

From: [Smith, Randy](#)
To: [Cetnar, Ashley \(OSUMC\)](#); [Li, Lang \(OSUMC\)](#); [Machiraju, Raghu](#); [Oghumu, Steve \(OSUMC\)](#)
Cc: [Williams, Valarie](#); [Smith, Randy](#); [Griffiths, Rob](#); [Miriti, Maria](#); [Reed, Katie](#); [Duffy, Lisa](#); [Hunt, Ryan](#); [Bittner, Brandi](#); [Lemon, Jason](#); [Matyas, Cory](#); [Metzler, Sandra](#); [Tomasko, David](#); [Shanker, Balasubramaniam](#); [Gold, Jennifer \(OSUMC\)](#); [Moore, Amy \(OSUMC\)](#); [Hammond, Ivy](#); [Watson, Sara](#); [Schoon, Eric](#); [Talbot, Ann](#); [Warren, Adam](#); [Eveland, Jessica](#)
Subject: Proposal to establish a Master of Science in Artificial Intelligence in Medicine
Date: Friday, October 23, 2026 4:20:51 PM
Attachments: [image001.png](#)

Ashley, Lang, Raghu, and Steve:

The proposal from the College of Engineering and the College of Medicine to establish an online Master of Science in Artificial Intelligence in Medicine was approved by the Council on Academic Affairs at its meeting on October 21, 2026. Thank you for attending the meeting to respond to questions/comments.

The proposal will now be sent to the University Senate with a request to be included for action at the Senate meeting on **November 19, 2026**. The Chair of the Council will present the proposal, but we will need you or a designee to attend to respond to detailed questions. Prior to that it will need discussion at the Faculty Council on **November 5, 2026**, and the Senate Steering Committee on **November 6, 2026**. I will provide you with details as I receive them.

If approved by the Senate, the proposal will be sent to the Board of Trustees for action at its meeting on **December 3, 2026**. If approved by the Board, the Graduate School will work with you on the approval process with the Ohio Department of Higher Education.

Once fully approved, the Office of the University Registrar will work with you on any implementation issues.

Please keep a copy of this message for your file on the proposal and I will do the same for the file in the Office of Academic Affairs.

If you have any questions please contact the Chair of the Council, Professor Valarie Williams(.1415), or me.

I wish you success with this important program development.

Randy



W. Randy Smith, Ph.D.

Vice Provost for Academic Programs

Office of Academic Affairs

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TO: Randy Smith, Vice Provost for Academic Programs

FROM: Graduate School Curriculum Services

DATE: September 24, 2026

RE: Proposal to establish a Master of Science in Artificial Intelligence in Medicine in the College Engineering and College of Medicine

The College of Engineering and College of Medicine is proposing to establish a Master of Science in Artificial Intelligence in Medicine

The proposal was received by the Graduate School on April 17, 2026. The combined GS/CAA subcommittee first reviewed the proposal on June 1, 2026, and asked for additional clarification and finalized the MOU from Ohio State Online. The additional clarification and MOU were received on 9/22/2026. With additional clarification and a finalized MOU, GS/CAA supports its review by the Council on Academic Affairs.



Memo

To: Randy Smith, Vice Provost for Academic Programs, Office of Academic Affairs
From: Cory Matyas, Assistant Dean for Curriculum and Assessment
Date: April 22, 2026
Re: New Master of Science in Artificial Intelligence in Medicine

Please find the attached proposal to establish a new, fully online Master of Science in Artificial Intelligence in Medicine (MS-AIM), jointly developed by the College of Engineering and the College of Medicine. The proposal seeks approval for an interdisciplinary, umbrella, multi-track graduate program focused on preparing professionals to apply artificial intelligence responsibly and effectively in healthcare domains including digital health, pathology, and precision oncology.

The program proposes to take effect in Autumn 2027.

The Engineering College Committee on Academic Affairs met on April 22, 2026, reviewed the proposal, and voted unanimously to approve it. A college-level record of support for this proposal has been formally established.





To: Dr. Randy Smith, Vice Provost for
Academic Programs

Date: April 20, 2026

Dear Dr. Smith,

I am writing on behalf of the departments of **Biomedical Informatics (BMI)**, **Pathology (PATH)**, and **Radiation Oncology (RadOnc)** in the **College of Medicine (COM)**, and the department of **Computer Science and Engineering (CSE)** in the **College of Engineering (COE)** to submit the attached proposal to the Council on Academic Affairs (CAA) for review and further consideration. We seek approval for a new, fully online, **Master of Science** degree program in **Artificial Intelligence in Medicine (MS-AIM)**.

The program has been developed in coordination with the **Office of Professional and Distance Education Programs (PDEP)** located within the College of Engineering and in alignment with Ohio State Online (OSO) financial and delivery models respectively. The proposed program responds directly to the widening gap between advances in Artificial Intelligence and the availability of a workforce capable of safely applying these technologies in various healthcare settings. A defining feature of the MS-AIM program is its **umbrella, multi-track design**, which integrates a shared AI core with domain-specific specializations in **Digital Health (BMI)**, **Pathology (PATH)** and **Precision Oncology (RadOnc)**. These areas represent high-impact domains where workforce shortages are deeply felt.

The MS-AIM program addresses this need through a **strongly blended, fully integrated design**, in which AI and clinical domains are co-developed across curriculum, instruction, and governance thereby facilitating the preparation of **bilingual** professionals who can bridge AI development with clinical and informatics-driven deployment. Please find the following attachments:

1. **Proposal Document** - Detailed description of the proposed degree program following the guidelines set by the Graduate School and the Office of Academic Affairs.
2. **Financial Impact Statement** - Analysis of the expected outcomes, benefits, and costs conducted by the Chief Financial Officers of the two colleges.
3. **Supporting Documents** - Additional relevant materials as listed in the guidelines.

All principal stakeholders will be available for further discussion or to answer any questions that may arise during the review process. Thank you for your time and consideration.

Sincerely,

Raghu Machiraju

On behalf of Profs. Arora, Chakravarti, Li, and Parwani

Raghu Machiraju, Ph.D.

Professor, Biomedical Informatics, Computer Science and Engineering, and Pathology

Associate Chair for Growth, Computer Science and Engineering

Co-PI, NSF ICICLE AI Institute, icicle.ai

Assistant Director for Operations, AI^(X) Hub @ Ohio State

Visiting Professor, Koita Center for Digital Health, Indian Institute of Technology – Bombay

Previous and Founding Director, Translational Data Analytics Institute

August 5, 2026

Re: Suggested Minor Revisions

Dear Cory,

Good afternoon! We hope that you are doing well.

We are reaching out to let you know that on **6/1/2026** the combined Graduate School – Council on Academic Affairs (GS/CAA) reviewed the proposal from the **College of Engineering** and the **College of Medicine** to **Establish a New MS in Artificial Intelligence in Medicine (MS-AIM)**. GS/CAA supports this new program being reviewed at CAA with the suggested minor revisions:

1. Information regarding the distribution of credit hours contains some inconsistencies.
 1. Please clarify if the credit hours are distributed over 5 semesters rather than 4
 2. Please explain why students are suggested to take 6 or 7 credit hours during the 2nd to 4th semester when full time is 8 credit hours.
2. Be sure that admission requirements are clearly stated.

We also need an MOU from OSOnline. Please let us know if you choose to revise the proposal. Once we have this information and the MOU, we will forward the package to CAA.

Please let us know if you have any questions. Thanks!

Graduate School Curriculum Services

Maria and TJ

Responses:

Thank you for these helpful comments. We have revised the proposal to address each point as follows.

1. **Clarification of the program duration.** We carefully reviewed the proposal to ensure consistency throughout the document. All references now indicate that the standard program of study is a **5-semester completion pathway**, with an alternative extended pathway of up to 10 semesters for part-time students and working professionals. References to a 4-semester pathway have been removed to eliminate ambiguity.
2. **Clarification of the semester credit-hour distribution.** We expanded **Section III.2.1 (Program of Study)** to explicitly explain the rationale for the credit-hour distribution. The revised text states that the MS-AIM program requires **34 credit hours** for all specializations and is intentionally designed as a **5-semester completion model** that accommodates part-time students and working professionals while allowing accelerated completion for students who choose to take heavier course loads. Accordingly, students may enroll in fewer than the standard full-time load of 8 credit hours during intermediate semesters. This clarification explains why the suggested course sequence includes 6–7 credit hours during Semesters 2–4 while still satisfying all degree requirements.
3. **Clarification of admission requirements.** We added a new section, **II.2.6 Admissions Requirement**, that explicitly defines the expected academic preparation for applicants. The section specifies two primary entry pathways: (i) applicants with computational backgrounds

(e.g., computer science, engineering, mathematics, statistics, physics, and related quantitative disciplines) and (ii) applicants with biomedical backgrounds (e.g., biology, biomedical sciences, biotechnology, chemistry, neuroscience, and health sciences). It also clarifies expectations regarding programming preparation, prerequisite coursework where appropriate, and the holistic admissions review process. These additions make the admission requirements explicit while preserving the program's dual-entry philosophy for students from both computational and biomedical disciplines.

Please let us know if you have any further questions. Thank you.

MASTER OF SCIENCE IN ARTIFICIAL INTELLIGENCE IN MEDICINE

I.1 Prologue

This proposal is submitted jointly by the College of Engineering and the College of Medicine to establish the Master of Science in Artificial Intelligence in Medicine (MS-AIM). The proposal has been reviewed and approved at the department and college levels within participating units, including Computer Science and Engineering, Biomedical Informatics, Pathology, and Radiation Oncology. Letters of concurrence from participating units and collaborating programs are included as attachments. These letters confirm support for the curriculum, faculty participation, and resource commitments necessary for successful program implementation. The program will be delivered in coordination with Ohio State Online, with a Memorandum of Understanding (MOU) defining operational and financial responsibilities. The cover image was rendered in Ghibli style by OpenAI's ChatGPT.

I. 2. Executive Summary, Concurrence(s), Unit Approvals

I.2.1 Executive Summary

This proposal seeks approval to establish a new graduate degree program: the Master of Science in Artificial Intelligence in Medicine (MS-AIM) at The Ohio State University. The program is a jointly administered initiative between the College of Engineering and the College of Medicine designed to address a critical and rapidly growing workforce need at the intersection of artificial intelligence and healthcare. The program has also been developed in coordination with the **Office of Professional and Distance Education Programs** (PDEP) located within the College of Engineering and in alignment with Ohio State Online (OSO) financial and delivery models respectively.

The proposed program responds directly to the widening gap between advances in artificial intelligence and the availability of a workforce capable of safely and effectively applying these technologies in healthcare settings. While demand for AI expertise is increasing across all sectors, healthcare presents uniquely complex challenges, including regulatory constraints, heterogeneous and high-dimensional data, and the need for clinically valid, interpretable, and equitable decision-making tools. Existing educational pathways do not adequately prepare graduates to operate across both technical and clinical domains, resulting in a shortage of professionals who can translate AI innovation into real-world practice.

A defining feature of the MS-AIM program is its **umbrella, multi-track design**, which is intentionally aligned with the structure of workforce demand in AI-enabled healthcare. The program integrates a shared artificial intelligence core with domain-specific specializations in Biomedical Informatics (including digital health), Pathology and Precision Oncology. These areas represent high-impact domains where workforce shortages—driven by aging populations, increasing disease burden, and the rapid digitization of health systems—are placing significant strain on healthcare delivery.

The MS-AIM program addresses this need through a **strongly blended, fully integrated design**, in which artificial intelligence and clinical domains are co-developed across curriculum, instruction, and governance. Unlike many existing programs that offer only partial or sequential integration, this approach ensures that students build technical depth and domain expertise in parallel. The program supports the development of **bilingual** professionals who can bridge AI development with clinical and informatics-driven deployment—an increasingly critical capability across health systems, biomedical research, and digital health industries.

The program will be delivered as a **fully asynchronous online degree through Ohio State Online**, enabling broad access for both full-time students and working professionals while supporting scalable workforce development across Ohio and beyond. The curriculum includes a shared AI core, domain

specializations, and a culminating capstone experience co-mentored by faculty from Engineering and Medicine. The program builds on Ohio State's institutional strengths and investments, including the AI^(X) Hub, advanced computing infrastructure, and the Data and Model Commons.

The MS-AIM program aligns with institutional priorities in artificial intelligence, interdisciplinary education, and healthcare innovation, and directly supports state and national workforce development goals in high-demand technology and health sectors. Upon approval, the program is expected to launch in Fall 2027 with an initial controlled enrollment and a scalable growth model designed to meet increasing demand. By combining an umbrella, multi-track structure with a strongly blended curriculum and fully online delivery, the program positions Ohio State as a national leader in preparing the next generation of professionals in AI-driven healthcare.

I.2.b Approvals

The proposed Master of Science in Artificial Intelligence in Medicine (MS-AIM) program has undergone review at the appropriate academic and administrative levels within participating units. Letters of concurrence from participating units and collaborating programs confirm support for the curriculum, faculty participation, and resource commitments necessary for successful program implementation. Additionally, letters from the academic deans of the two participating colleges verify that the proposal has been reviewed and approved at the college level in accordance with university procedures. We do not anticipate any substantial overlap in scope with other units within the University.

2.c Cover letters

All letters of support and approval letters are attached in **Supplementary Material**.

II. Introductory Material

II.1. New MS Program from Existing Doctoral Program: N/A

II. 2. The Proposed Program

II. 2.1. Full Name

The Master of Science in Artificial Intelligence in Medicine (MS-AIM) is a program characterized by its computational rigor, quantitative methods, and commitment to scientific inquiry. It focuses on the seamless integration of AI, biomedical data science, and clinical expertise to develop and deploy advanced systems within healthcare. By training students at the intersection of machine learning and clinical decision-making, the program bridges the gap between technical AI development and real-world implementation in fields like pathology and oncology.

II. 2.2. Required Semester Hours

The program will require **34 semester credit hours** for completion, depending on the track selected and elective coursework.

II.2.3. Duration

The typical time to completion will be **5 semesters for full-time students**, or **10 semesters for part-time students or working professionals**. The program is designed to support both accelerated and flexible pathways.

II.2.4. Launch Date

The proposed initial implementation date for the program is **Autumn Semester 2027**.

II.2.5. Audience

The primary target audience for the MS-AIM program includes full-time and part-time students, ranging from traditional college-age graduates in computer science, engineering, or data science to working adults and professionals in healthcare, biotechnology, and digital health industries. The program also serves clinicians and biomedical professionals seeking advanced AI training, as well as medical residents and trainees looking to pivot into interdisciplinary careers at the intersection of artificial intelligence and medicine.

II.2.6 Admissions Requirement

Applicants with a computational background are expected to hold a bachelor's degree in Computer Science, Computer Engineering, Data Science, Statistics, Mathematics, Physics, Electrical Engineering, Biomedical Engineering, or a closely related quantitative discipline. Prior programming experience is expected. Exposure to biology, medicine, biotechnology, clinical environments, or biomedical research is desirable but not required.

Applicants with a biomedical background are expected to hold a bachelor's degree in Biology, Biochemistry, Biotechnology, Biomedical Sciences, Chemical Sciences, Neuroscience, Health Sciences, or a closely related discipline. Prior programming experience is strongly recommended but is not required. Students without sufficient computational preparation will complete the program's prerequisite programming coursework before progressing into the AI core.

The admissions committee will evaluate applicants holistically, considering prior academic preparation, quantitative aptitude, programming experience, professional experience, and evidence of potential to succeed in an interdisciplinary program at the intersection of artificial intelligence and medicine.

II.3. Delivery

The MS-AIM degree will be offered 100% as a **distance-learning graduate program** (online), with all coursework delivered through **Ohio State Online (OSO)**. The program is designed with an **asynchronous-first instructional model**, supplemented by optional sessions for discussion, collaboration, and engagement with faculty and peers.

II.4. Cohort

Students in the MS-AIM program begin as a cohort for foundational core courses and orientation but transition to a more flexible, self-paced model for electives, specializations, and the capstone. This structure accommodates those following the **5-semester** and or the **10-semester** regimen allowing them to progress based on their professional interests and prior experience rather than following a strict lockstep sequence. Academic advising ensures that every student maintains a coherent path toward graduation.

II.5. Enrollment

Enrollment in the MS-AIM program will be managed through a cohort-based model with controlled growth. The anticipated initial size will be **40–60 students per year**. The program is open to both domestic and international students.

II. 6 Uniqueness of MS-AIM

The proposed program is an entry level graduate program. In this section, the uniqueness of the program is described.

II. 6.1 Uniqueness from Related Undergraduate Programs

The MS-AIM program is conceptually and qualitatively distinct from undergraduate programs in computer science, data science, or biomedical engineering. While undergraduate curricula prioritize foundational algorithmic skills and general-purpose programming, MS-AIM shifts the focus toward the specialized application of advanced AI within complex biological and clinical frameworks. Qualitatively, the program moves beyond introductory machine learning to explore high-level methodologies such as multimodal deep learning and probabilistic modeling.

It bridges the gap between theory and practice by requiring students to integrate clinical knowledge directly with computational methods, a level of interdisciplinary synthesis rarely addressed in undergraduate education. Furthermore, the program emphasizes the translational aspects of AI, focusing on real-world deployment, regulatory constraints, and the ethical implications of healthcare decision-making. By engaging with high-dimensional, sensitive medical data, students gain a professional depth that prepares them for specialized leadership roles in the biomedical workforce, distinguishing the program from the more generalized preparatory nature of a bachelor's degree.

II. 6.2 Theoretical Foundations of the Proposed Program

The MS-AIM program integrates the theoretical foundations of artificial intelligence with the specialized methods of inquiry inherent to the biomedical and clinical sciences. Students develop a robust grounding in core areas such as statistical learning theory, and probabilistic modeling. These frameworks represent the discipline's primary ways of knowing, allowing students to systematically quantify uncertainty and derive causal inferences from complex observational data.

Beyond computational methods, the curriculum emphasizes domain-specific theoretical frameworks, such as biological systems modeling and clinical reasoning under uncertainty. This approach ensures that students understand the discipline's unique challenges, including data heterogeneity and the socio-technical biases present in healthcare datasets. By mastering these methods of inquiry, students learn to move beyond model development to a deeper understanding of how AI systems behave in complex environments. They are trained to critically evaluate model performance through a lens of clinical validity, ensuring that their theoretical knowledge translates into meaningful and responsible deployment in real-world biomedical settings.

II. 6.3 Relevance to Professional Settings

The MS-AIM program places a central emphasis on professional decision-making by training students to integrate AI model outputs into complex clinical workflows. Rather than treating AI as a standalone tool, the curriculum teaches critical analysis by requiring students to evaluate models against operational constraints and evidence-based practice. This ensures that graduates can interpret technical data through

the lens of clinical reasoning, effectively bridging the gap between algorithmic predictions and actionable professional insights.

Furthermore, the program develops critical problem-solving skills by addressing real-world deployment challenges such as algorithmic bias, fairness, and system robustness. Through a hands-on capstone experience, students apply these analytical frameworks to clinically relevant problems, making informed decisions on model selection and validation. This rigorous approach ensures that their solutions are not only technically sound but also strategically viable and ethically responsible within professional healthcare environments.

II. 6.4 Broader Impact

The MS-AIM program curriculum is specifically structured to cultivate the high-level professional expertise required in modern medicine by bridging the gap between technical AI proficiency and clinical application. Students achieve professional competence through a rigorous examination of AI-driven decision-making, where they learn to identify and mitigate critical issues such as algorithmic bias and hallucination. The curriculum further ensures mastery of industry-standard protocols for data governance, privacy, and security, alongside the practical challenges of systems integration. By synthesizing technical skills with a deep understanding of the ethical and societal implications of AI, the program ensures graduates possess the comprehensive specialized knowledge necessary to lead and innovate responsibly within the evolving healthcare ecosystem.

II. 6.5 Competency Upskilling in AI

The MS-AIM curriculum is strategically engineered to bridge the gap between academic theory and professional expertise. Students develop professional competence by mastering the design and training of sophisticated machine learning and deep learning models tailored for complex, multimodal biomedical data—including imaging, genomics, and electronic health records. By building scalable data pipelines and rigorous evaluation frameworks, the program ensures students possess the technical infrastructure skills required in high-stakes clinical environments. To reach the expected level of professional expertise, the program employs a dual-entry structure that harmonizes diverse backgrounds. Computing-focused students are immersed in clinical and biomedical nuances, while domain-trained professionals acquire advanced computational rigor. This pedagogical approach ensures that all graduates achieve a consistent, high-level proficiency in translating AI models into deployable applications, directly addressing the interdisciplinary demands of the modern healthcare workforce.

II.6.6. Accreditation

At present, there is no specific accreditation body governing graduate programs in artificial intelligence in medicine. However, the MS-AIM program is designed in alignment with: (i) Established standards in **computer science and engineering education**; (ii) Best practices in **biomedical informatics and clinical and translational research**; and (iii) **Institutional guidelines for graduate education** at The Ohio State University. The program will continuously monitor developments in accreditation and professional standards in AI and healthcare to ensure ongoing alignment with emerging expectations.

II.7. Engendering Inquiry

The MS-AIM program prepares students to conduct significant applied research and discover new knowledge through a focus on advanced inquiry. This preparation centers on the capstone project, where students develop practical AI solutions for complex healthcare challenges by formulating research

problems and validating their models with real-world datasets. These experiences equip graduates for leadership in industry, academic research, and doctoral study.

III. Curricular Material

III. 1 Curriculum Details

III. 1.1 Program Requirements

To earn the Master of Science in Artificial Intelligence in Medicine (MS-AIM), students must typically complete:

- A shared core curriculum incl. Seminar and Capstone - 7 credits
- An AI core from CSE - 9 credits
- A domain specialization core - 9-10 credits
- Electives, one each from CSE and specialization - 6 credits
- Prerequisite course in programming - 2-3 credits

Students complete one of three specializations, which will appear on the transcript:

1. Artificial Intelligence in Digital Health (AIDH) — BMI
2. Artificial Intelligence in Pathology (AIP) — PATH
3. Artificial Intelligence in Precision Oncology (AIPO) — RadOnc

A comparative view of the three specializations is provided by **Table III.2**. Students must complete a minimum of **34 credit hours**, for all three specializations. All students are expected to:

- Demonstrate proficiency in **machine learning and AI methods**.
- Apply these methods to **domain-specific biomedical or clinical problems**.
- Successfully complete a **capstone project integrating AI and domain knowledge**.

Please find curricular tables in **Appendix A** and short syllabi in **Appendix B**. Learning outcomes are listed in **Section V.8**. As mentioned earlier, the program is fully-online and all **courses will be classified as DL, 100% Online**.

III. 2 Experimental Learning

The MS-AIM program requires completion of a capstone project (4 credit hours) as the culminating, integrated learning experience for the degree. The capstone is designed to synthesize knowledge acquired across the program's artificial intelligence core and domain-specific coursework, and to demonstrate students' ability to apply this knowledge in real-world healthcare and biomedical contexts.

The capstone course will be co-taught by faculty from the College of Engineering (CSE) and the relevant domain unit (Biomedical Informatics, Pathology, or Radiation Oncology, depending on the student's track). Instructional responsibility is shared across units, reflecting the program's integrated design and ensuring that students receive both technical and domain-specific guidance.

During the capstone experience, students work on applied, project-based problems grounded in clinically or operationally relevant settings. Projects require students to formulate problem statements, work with real or realistic biomedical datasets, develop and evaluate AI-based solutions, and consider issues related to deployment, validation, and clinical applicability. Emphasis is placed on producing solutions that are both technically rigorous and operationally feasible within healthcare environments.

The capstone serves as the program’s primary integrative assessment, evaluating students’ mastery of core competencies in machine learning, data systems, and domain-specific applications, as well as their ability to translate AI methods into practice. Successful completion of the capstone demonstrates readiness for advanced professional roles in industry, healthcare systems, and biomedical research, as well as for further graduate study. **The capstone course primarily facilitates experiential learning and facilitates the blending of AI with one of the three domains.**

III. 2.1. Program of Study (5-Semester Pathway — Standard Option)

To reiterate, the MS-AIM program requires **34 credit hours** for all specializations. The program is designed to support a **5-semester completion model** for part-time or working professionals, with flexibility for acceleration (see **Table III.1**). *It is for this reason, MS-AIM also allows credit enrollment for less than the full-time requirement of 8 credit hours.* In **Table III.2** the three specializations are compared on several fronts.

Table III.1: Program of Study - 5-semester Completion (typical)		
Semester	Coursework	Credits
1	Programming for Specialization; Course on AI in Specialization; Ethics in AI (CSE)	8-9
2	Specialization Course 1; Survey of AI	6
3	Specialization Course 2; Survey of AI; Foundations of Applied AI	6
4	Specialization Course 3; Elective Course 1	6-7
5	Capstone Design Course; Elective Course2	7

III. 2.2. Alternative Pathways

The program is designed to accommodate diverse student needs through flexible progression options. In addition to the standard 5-semester completion model, students may elect an extended pathway that allows completion over up to 10 semesters. Regardless of pathway, all students complete the same curriculum requirements and a culminating capstone experience.

The MS-AIM program is also designed to accommodate two primary student populations through a flexible dual-entry model. Students with strong computing backgrounds focus on advanced artificial intelligence methods and their application within clinical and biomedical domains, with minimal need for introductory coursework. In contrast, clinically trained or computationally less experienced students begin with foundational instruction in programming and AI before progressing into domain-specific applications.

This structured yet flexible approach broadens access to the program while ensuring that all students achieve a consistent level of technical and applied proficiency. It also differentiates the MS-AIM program from peer offerings by supporting multiple entry pathways within a single, integrated curriculum.

Table III.2: A Summary Comparison across the three MS-AIM Specializations			
Feature	Digital Health (AIDH)	Precision Oncology (AIPO)	Pathology (AIP)
Total Credits	34	34	34
CSE AI Core	9	9	9
Prerequisites	Programming for Biomedical Informatics (3)	Programming for Precision Oncology (2)	Programming for Digital Pathology (2)
Shared Core	Capstone: AI/ML in Digital Health	Capstone Design: Design of AI-Based Clinical Decision Support Systems	Capstone: Design of AI-based Clinical Decision Support Systems
Domain Core Courses	Medical Imaging; Analytics for Electronic Health Records (EHR); Natural Language Processing (NLP) for Biomedical Informatics.	AI in Radiation Oncology; AI in Radiation Biology; Fundamentals of Oncology.	Pathology Informatics; Digital Pathology; Fundamentals of Oncology.
Electives	ML & Stat. Pattern Recog.; Comp. Vision for HCI; Found. of Speech & Lang. Proc.; Intro to Neural Nets; Intro to Data Viz.; Intro to HP Deep Learning; Intro to Bioinformatics; Methods in Biomed. Informatics & Data Sci.; Public Health Informatics; Health Analytics; Clinical Informatics; Appl. ML for Bioinformatics	ML & Stat. Pattern Recog.; Comp. Vision for HCI; Found. of Speech & Lang. Proc.; Intro to Neural Nets; Intro to Data Viz.; Intro to HP Deep Learning; Rad. Treatment Tech.,Rad. Safety & Protection, Diagnostic Imaging; Cross-Sect. Anatomy	ML & Stat. Pattern Recog.; Comp. Vision for HCI; Found. of Speech & Lang. Proc.; Intro to Neural Nets; Intro to Data Viz.; Intro to HP Deep Learning; Intro to Anat. Pathology; Adv. Tech. for Comp. Pathology; Pathology Seminar Series; Immunology Seminar Series
Career Outcomes	Clinical AI engineer; Digital health product analyst; EHR/NLP AI specialist; Imaging-AI developer	Oncology AI scientist; Radiation oncology ML engineer; Treatment-response AI modeler; Precision oncology data scientist.	Computational pathology scientist; AI algorithm developer; Digital pathology workflow lead; Lab-IT/R&D roles.
Best for Who Wants...	EHR + imaging + omics + NLP + clinical workflows	Treatment optimization, radiation oncology, imaging & multiomics integration.	Imaging, Diagnostics, pathology-specific AI.

IV. Program Implementation

IV.1. Institutional Planning

IV. 1.1. Physical Facilities

The MS-AIM program will leverage a combination of existing institutional resources and targeted new investments to support instruction, research, and applied training.

IV. 1. 1. 1 Physical Facilities and Infrastructure

The MS-AIM program will leverage existing institutional resources, including instructional space within the College of Engineering and the College of Medicine, as well as dedicated collaborative and project-based learning environments associated with the AI^(X) Hub. The program will also utilize secure access environments for clinical and biomedical datasets to support applied learning, research, and capstone activities.

IV. 1. 1. 2 Resources

In addition, students will have access to advanced computational infrastructure through the Ohio Supercomputer Center (OSC) and Ohio State's AI^(X) Hub, including high-performance computing resources, GPU-enabled environments, and cloud-based platforms for large-scale data processing and machine learning. These resources provide the necessary computational capacity to support training, model development, and experimentation with complex, multimodal biomedical data.

Currently, the Department of Pathology manages over 5 million whole slide images, representing over 450,000 patients, which are used by OSU pathologists for diagnosis, consultation, education, and research. Similarly, Radiation Oncology has access to numerous images which it is striving to make available for research and educational purposes. OSU's College of Medicine is engaged at large in creating a de-identified electronic medical record data called LifeScale which will also allow for the creation of synthetic data. Lastly, the AI^(X) Hub is working to stand up a model and data commons which allow the campus community to share data and AI models. Collectively, these facilities and infrastructure ensure that the program can deliver a rigorous, scalable, and practice-oriented educational experience aligned with the technical and operational demands of AI-enabled healthcare.

IV. 1. 1. 3 Impact on Existing Resources

The program has been designed to leverage existing course offerings and faculty expertise, minimizing duplication and maximizing efficient use of institutional resources. It utilizes scalable cloud-based and shared computational infrastructure, reducing reliance on physical laboratory space while supporting advanced AI development and data-intensive applications. The program also aligns with and builds upon ongoing institutional investments in artificial intelligence infrastructure. As a result, the impact on existing facilities is expected to be manageable, with future growth accommodated through scalable computational resources and coordinated planning across participating units.

IV. 1.1.2. Staffing and Support

The program will be supported by faculty from Computer Science and Engineering, Biomedical Informatics, Pathology, and Oncology, reflecting its interdisciplinary foundation. Instructional design and delivery will be supported through Ohio State Online, while technical staff will provide support for computational infrastructure and data systems. The Director and Staff of the Professional and Distance

Education Programs (PDEP) office in the College of Engineering and one staff member from the College of Medicine will be responsible for the overall administration of the AIM degree and day-to-day operations. As enrollment grows, select additions of administrative, instructional or clinical faculty may be pursued to support program expansion.

IV. 1.2 Evidence of Market Demand

Extensive market analysis conducted by Ohio State Online (**Appendix F**) indicates strong and rapidly accelerating demand for graduate-level education at the intersection of artificial intelligence and healthcare. Over the past five years, completions in AI-related master's programs have increased by approximately 278%, with the number of institutions offering such programs growing by 188%. Related fields, including medical informatics, have also expanded significantly, reflecting sustained interest among both computing graduates seeking healthcare applications and clinicians seeking advanced computational training.

This demand is driven by a broader transformation in healthcare delivery. The rapid growth of biomedical data—including imaging, electronic health records, and multimodal datasets—combined with persistent workforce shortages in key clinical domains, has made artificial intelligence an essential component of modern healthcare systems. At the same time, a critical gap remains between AI development and real-world clinical deployment, creating demand for professionals who can translate models into operational, clinically valid systems.

Importantly, this demand is inherently multi-domain, spanning areas such as digital health, biomedical informatics, computational pathology, and oncology, each with distinct technical and clinical requirements. As a result, workforce needs cannot be met through single-discipline or loosely integrated programs. The MS-AIM program directly responds to this structure through its **umbrella, multi-track design** and **strongly blended curriculum**, which combine shared AI foundations with domain-specific expertise to prepare “bilingual” professionals capable of bridging development and deployment.

Demand is further reinforced by the rapid expansion of online graduate education, with online completions accounting for approximately 38% of AI programs and 70% of medical informatics programs. This reflects the need to upskill a distributed workforce, supporting the program's design as a fully online, scalable offering. Enrollment projections align with these trends, with an initial cohort of **40–60 students** and anticipated growth to **150–200 students within three to five years**. These projections have been incorporated into faculty planning, infrastructure development, and course delivery to ensure sustainable growth while maintaining program quality.

IV. 1.2.1 Rationale for MS-AIM: The Case for a Strong Curricular Blend of AI and a Domain

The Master of Science in Artificial Intelligence in Medicine (MS-AIM) is designed to address a critical workforce gap at the intersection of artificial intelligence and healthcare. Rapid advances in AI have outpaced the availability of professionals capable of safely and effectively deploying these technologies in clinical and biomedical settings. Existing educational pathways typically produce graduates with strength in either computing or healthcare, but not the integrated expertise required to translate innovation into practice.

This gap is reinforced by the structure of current academic offerings. Most programs fall along a spectrum of weak to moderate blends, where AI and healthcare are only loosely integrated through electives or capstone experiences. Even leading programs that achieve stronger integration are typically delivered in in-person or hybrid formats, limiting accessibility and scalability. At the same time, workforce demand is not uniform, but inherently multi-domain, spanning areas such as biomedical informatics, computational pathology, and oncology—each requiring distinct combinations of technical, data, and clinical knowledge.

The MS-AIM program responds directly to these limitations through an **umbrella, multi-track design** combined with a **strongly blended, fully integrated curriculum**. A shared AI core is paired with domain-specific specializations, enabling students to develop both rigorous computational foundations and specialized expertise aligned with real-world healthcare applications. Unlike loosely interdisciplinary models, the program integrates artificial intelligence and medicine across curriculum, instruction, and governance, including co-taught courses and a jointly administered structure. This approach supports the development of “bilingual” professionals who can bridge AI development with clinical deployment.

The program further advances the field by extending this strongly blended model into a **fully online, scalable format**, expanding access to working professionals while maintaining depth and rigor. Its emphasis on translational AI—focusing on implementation, validation, and deployment in real-world environments—ensures alignment with evolving workforce needs.

By combining an umbrella structure, deep interdisciplinary integration, and online delivery at scale, the MS-AIM program represents a distinctive and forward-looking approach to graduate education, positioning Ohio State to lead in preparing the next generation of AI-enabled healthcare professionals.

IV. 1.2.1.1 Student Demand

Demand for graduate training in artificial intelligence in medicine is driven by multiple, converging forces across education, industry, and healthcare systems. Rapid growth in AI degree completions—up approximately 278% over the past five years—reflects substantial and sustained student demand, particularly among computer science graduates seeking domain application and clinicians seeking advanced computational training. At the same time, interdisciplinary AI+X programs consistently demonstrate strong enrollment performance, indicating a clear market preference for integrated, cross-domain education.

More importantly, this demand extends beyond student interest to reflect a structural workforce need. Healthcare systems are increasingly dependent on AI to manage large-scale, complex biomedical data, yet face a shortage of professionals capable of translating AI models into clinically deployable solutions. This has created growing demand for bilingual professionals who can operate across both technical and clinical domains—a workforce segment that remains significantly undersupplied due to the limited availability of integrated training programs.

IV. 1.2.1.2 Institutional Need

The proposed MS-AIM program aligns closely with Ohio State’s strategic priorities in AI fluency, interdisciplinary graduate education, and healthcare innovation. The market analysis highlights that leading institutions are increasingly positioning AI+X programs as **joint, cross-college initiatives**, reflecting the importance of integrating technical and domain expertise. The program builds on Ohio State’s existing strengths in engineering, medicine, and data science, while leveraging institutional investments in AI infrastructure and online delivery.

IV. 1.2.3 Societal Demand

To reiterate, the increasing integration of artificial intelligence into healthcare delivery is driving a significant need for professionals who can develop, evaluate, and deploy AI systems in real-world settings. Industry demand is shifting from algorithm development to **translational AI**, emphasizing the ability to move models from research environments into operational clinical workflows.

At the same time, there is growing recognition of the importance of **ethical, equitable, and responsible AI**, particularly in healthcare contexts where bias and data limitations can have significant consequences. Leading programs now treat health equity and AI ethics as core competencies, reflecting the need for a

workforce capable of addressing both technical and societal challenges. The MS-AIM program directly responds to this demand by preparing graduates who can bridge technical development with clinical, operational, and ethical considerations.

IV. 1.2.1.4 Scope

The demand for professionals trained in AI-enabled healthcare spans local, regional, national, and international contexts. At the state level, Ohio's healthcare systems are increasingly adopting data-driven technologies, creating a need for a workforce capable of integrating AI into clinical and operational environments. Regionally and nationally, academic medical centers, healthcare systems, and industry partners—including biotechnology, pharmaceuticals, and health technology companies—require professionals who can manage complex biomedical data and deploy AI solutions at scale. Globally, the rapid growth of AI applications in healthcare, combined with workforce shortages in key clinical and analytical roles, underscores the international relevance of such training. The convergence of these trends demonstrates that demand for graduates of the MS-AIM program is broad and sustained across multiple sectors and geographic regions.

IV. 1.2.3 Statewide Alternatives

While Ohio institutions offer graduate programs in computer science, data science, and biomedical engineering, **no existing program integrates artificial intelligence, clinical medicine, and real-world healthcare deployment in a unified, graduate-level curriculum.** The MS-AIM program directly fills this gap through its joint leadership between the College of Engineering and the College of Medicine, its domain-specific specializations in Biomedical Informatics, Pathology, and Oncology, and its integrated, co-taught instructional model culminating in an applied capstone experience. This structure is not incremental—it represents a fundamentally different approach to training the AI-enabled healthcare workforce.

The absence of comparable programs is clear. Case Western Reserve University's Master's in Biomedical Informatics, while related, does not place a strong emphasis on artificial intelligence in digital health, nor does it achieve the same level of integration between computational and clinical domains. Other programs in the state, including Kent State's Master's in Artificial Intelligence and the University of Cincinnati's Master of Engineering, remain discipline-bound and do not prepare graduates to translate AI technologies into clinical environments.

The gap is most acute in high-impact areas such as computational pathology and oncology. Despite rapid advances in digital pathology, no graduate-level program currently provides comprehensive training in AI-driven computational pathology that integrates machine learning, computer vision, and clinical application. Similarly, in oncology—and particularly in radiation oncology—healthcare systems are increasingly dependent on AI for imaging analysis, treatment planning, and precision medicine, yet there is a clear absence of graduate programs preparing professionals to operate at this intersection. These are not emerging needs; they are immediate constraints on the adoption and effective use of AI in healthcare delivery.

The MS-AIM program directly addresses these unmet needs by producing graduates who can move beyond model development to implementation, validation, and deployment in real-world settings. By combining deep technical training with domain-specific expertise and a translational focus, the program establishes a new standard for interdisciplinary graduate education in this space. As such, it represents not only a first-of-its-kind offering in Ohio but a necessary and timely response to a clearly defined gap in workforce preparation at the state and national levels.

IV. 3 Suitability of Location

Ohio State is uniquely positioned to lead in this space through the combined strength of its academic medical center, nationally recognized engineering programs, and sustained institutional investment in artificial intelligence. Established expertise in AI and machine learning within Computer Science and Engineering, coupled with a large, integrated academic medical center and existing collaborations across Pathology, Biomedical Informatics, and Radiation Oncology, enables a level of interdisciplinary integration and scale that is difficult to replicate. These strengths are further reinforced by university-wide initiatives such as the AI(X) Hub, which support coordinated, cross-disciplinary innovation in artificial intelligence.

The Department of Computer Science and Engineering (CSE) at The Ohio State University, together with university-level AI institutes, provides a strong and scalable foundation for the proposed program. CSE comprises a large and highly productive faculty with expertise spanning machine learning, computer vision, natural language processing, data systems, high-performance computing, and trustworthy AI, supported by a robust research enterprise and comprehensive undergraduate and graduate programs. These strengths are complemented by major NSF-supported initiatives, including two AI Institutes. Further, the department has spearheaded several novel programs in AI and data analytics at both the undergraduate and graduate level.

Since 2017, the Department of Biomedical Informatics (BMI) has made sustained investments in AI for Digital Health, building a faculty of fourteen members with active research expertise in the area. BMI's research spans multi-omics data integration, systems biology and pharmacology, drug development, imaging informatics, diagnosis and prognosis, clinical decision-making, and implementation science. In parallel, the department has developed strong capabilities in electronic medical record (EMR) data integration, acquisition, computing infrastructure, governance, and regulatory compliance. Supported by established master's and PhD programs in biomedical informatics, BMI provides a robust ecosystem for advancing research, education, and workforce development in AI-driven digital health.

The Department of Pathology is a national leader in digital and computational pathology, managing over 5 million whole slide images from more than 450,000 patients. These resources support clinical care, education, and research, and provide a strong foundation for training in AI-driven imaging. With over 100 faculty spanning multiple subspecialties and a robust research portfolio in artificial intelligence, cancer biology, infectious disease, and immunology, the department offers deep domain expertise and translational capacity. Its comprehensive educational infrastructure and active graduate mentorship further strengthen this ecosystem.

Similarly, Ohio State's capabilities in oncology—particularly within radiation oncology at the The Ohio State University Comprehensive Cancer Center—provide a powerful, data-rich foundation for the proposed program. Advanced treatment infrastructure—including multiple LINACs supporting IMRT, VMAT, SBRT, and image-guided radiation therapy, along with emerging proton and FLASH modalities—generates high-dimensional, longitudinal datasets spanning multimodal imaging, treatment plans, dose distributions, and clinical outcomes. This integrated ecosystem supports precision treatment planning, adaptive therapy, and translational research, providing a strong environment for training in AI-driven oncology. The program is further strengthened by an interdisciplinary faculty across radiation physics, medical imaging, cancer biology, and computational sciences, supported by a robust educational and mentorship infrastructure.

Together, these assets position Ohio State to deliver a program that is not only academically rigorous but also deeply connected to real-world clinical environments, enabling students to engage with the data, systems, and challenges that define contemporary AI-enabled healthcare. Launching the MS-AIM program at this time allows Ohio State to establish early leadership in a rapidly expanding academic and workforce domain.

IV. 4 Inter-Institutional Collaboration

The program is well positioned to benefit from a range of strategic partnerships that will enhance both educational quality and workforce relevance. These include established collaborations with healthcare systems and growing engagement with industry partners such as GE Healthcare and Siemens, supporting applied learning, data access, and real-world problem contexts.

In addition, Ohio State's strong clinical affiliations create opportunities for expanded collaboration. While formal inter-institutional arrangements have not yet been finalized, there is clear potential to engage partners such as Nationwide Children's Hospital and its Research Institute, with whom Ohio State maintains close ties. Additional opportunities may include collaboration with leading regional institutions such as the Cleveland Clinic and the University of Cincinnati Medical Center.

Collectively, these partnerships position the program to remain closely aligned with evolving clinical, research, and industry needs, while creating pathways for future growth and collaboration.

IV.5 Growth and Sustainability

The program is designed for controlled and sustainable growth. Initial enrollment will be intentionally managed to ensure program quality, appropriate faculty-to-student ratios, and effective use of instructional and computational resources. As demand increases, the program will scale through its fully online delivery model, allowing for expansion that remains aligned with available faculty capacity, infrastructure, and student support services.

Long-term sustainability is supported through a combination of tuition revenue, shared institutional infrastructure, and cross-unit faculty participation. This integrated model enables efficient resource utilization while maintaining academic rigor and program quality as enrollment grows.

IV. 7. Institutional Staffing, faculty, and student support

IV. 7.1 Programmatic Support

The program will be supported by core faculty from Computer Science and Engineering, Biomedical Informatics, Pathology, and Oncology, reflecting its interdisciplinary design. Faculty will contribute across multiple roles, including instruction, capstone supervision, and ongoing curriculum development.

The interdisciplinary structure ensures sufficient faculty coverage across all domains while enabling efficient use of existing expertise and resources. This model supports both program quality and scalability without requiring substantial new investment at launch.

Initial implementation will rely primarily on existing faculty capacity. As enrollment grows, strategic faculty hires may be pursued to support expansion, maintain appropriate instructional capacity, and further strengthen domain-specific offerings.

Students in the MS-AIM program will receive structured academic advising to support appropriate course sequencing, alignment of coursework with capstone preparation, and timely progress toward degree completion. Advising will ensure that students build a coherent academic pathway tailored to their background and professional goals.

The curriculum is intentionally sequenced to support progressive learning. Foundational AI coursework precedes advanced applications, while domain-specific courses are designed to build in depth and complexity, culminating in integrated capstone experiences. This structure ensures that students are adequately prepared at each stage of the program and able to successfully synthesize technical and domain knowledge in applied settings.

IV.7.2. Administrative Arrangements

The AIM degree will be administered by the College of Engineering through the Professional and Distance Education Programs Office. The AIM Graduate Studies Committee will be established to coordinate the program's operations. *a) Graduate Studies Committee (GSC)* The AIM Faculty Co-Directors will act as co-chairs of the AIM-GSC. The AIM-GSC will consist of the following voting members: the AIM Faculty Co-Directors; one representative from the Department of Pathology; one representative from the Department of Radiation Oncology; and representative from the Department of Biomedical Informatics; The AIM-GSC will include the PDEP Director and one staff from College of Medicine as two non-voting members. *AIM Operations:* As mentioned earlier, the Director and Staff of PDEP and one staff member from the College of Medicine will be responsible for the overall administration of the AIM degree and day-to-day operations.

IV.7.3. Faculty Qualifications

The MS-AIM program will be supported by a highly qualified, interdisciplinary faculty drawn from both the College of Engineering and the College of Medicine, including the Departments of Computer Science and Engineering, Biomedical Informatics, Pathology, and Radiation Oncology. This integrated faculty structure ensures a balanced combination of technical depth and clinical relevance.

Participating faculty bring expertise spanning artificial intelligence and machine learning, biomedical informatics and health data systems, computational pathology and medical imaging, and oncology and clinical decision-making. Together, these areas form the intellectual foundation of the program and support its translational focus.

The program is supported by a diverse mix of faculty roles. Tenure-track faculty provide leadership in research and theoretical foundations, clinical faculty contribute domain expertise and real-world application perspectives, and teaching and professional faculty support high-quality course delivery and program scalability. Collectively, the faculty demonstrate strong records of externally funded research—including support from NIH, NSF, and industry partnerships—along with publications in leading venues across AI, biomedical informatics, and clinical research. They also bring substantial experience in interdisciplinary collaboration and graduate education.

Faculty contributions to the program include delivery of core AI instruction (primarily through CSE-led courses), development and teaching of domain-specific coursework across Biomedical Informatics, Pathology, and Oncology specializations, and co-mentorship of capstone projects that integrate technical and clinical perspectives.

At program launch, the MS-AIM will primarily leverage existing faculty capacity. As enrollment grows, additional instructional and clinical faculty appointments are anticipated to ensure continued program quality and scalability. A faculty matrix aligned with the CCGS Proposal Template is included as an embedded table in this proposal. Two-page curriculum vitae for participating faculty are provided in **Appendix D**.

IV.7.4 Faculty Matrix

Faculty qualifications for all four units are included in **Appendix C**.

IV. 8. Learning Objectives and Assessment Plan

IV. 8. 1 Program, AI Core, and Specialization Learning Objectives

Students enrolled in the program will learn both the AI/ML data analysis and programming, and their applications to individual biomedical research and data fields. By completion of one of the three specializations, the Master's students will be expected to be familiar with the fundamental methods of AI and be able to apply these methods to biomedical datasets. Learning outcomes of the entire program are listed in **Table IV.1**, while the learning outcomes of CSE and specialization curricula are listed in **Table IV.2** and **Table IV.3** respectively.

Table IV.1: Learning Outcomes of MS-AIM Program	
Outcome	Learning Outcome
P.1	Formulate and evaluate biomedical and clinical questions by understanding how data are generated, structured, and used across research and healthcare contexts.
P.2	Design, implement, and optimize AI/ML models for analyzing complex and multimodal data, applying appropriate computational methodologies.
P.3	Critically evaluate model performance, robustness, and limitations, and communicate findings effectively to interdisciplinary audiences.
P.4	Translate AI/ML solutions into real-world settings by integrating considerations of clinical workflows, data systems, scalability, and operational constraints.
P.5	Apply principles of responsible and ethical AI, including fairness, bias mitigation, privacy, and regulatory awareness in biomedical and healthcare applications.
P.6	Collaborate effectively in interdisciplinary teams to develop, evaluate, and deploy AI-driven solutions in biomedical and clinical environments.

Table IV.2: Learning Outcomes of CSE Curricula	
Outcome	Learning Outcome
C.1	Understand the foundations of artificial intelligence, including the distinctions between human and computational models of intelligence, and explain AI/ML models for data and image processing along with their underlying mathematical principles.
C.2	Process and analyze complex datasets, including large-scale and clinical data, by training, evaluating, and interpreting AI/ML models using appropriate programming tools and frameworks.
C.3	Apply, develop, and critically evaluate AI/ML models for data and image analytics, while identifying, interpreting, and incorporating relevant methods and evidence from the research literature.

Table IV.3: Specialization— AIDH: S1-S3, AIOI: S4-S6, AIP: S7-S9	
Outcome	Learning Outcome
S.1	Formulate and evaluate scientific questions in biomedical domains by understanding how data are generated, collected, annotated, and used across research and clinical contexts.
S.2	Select, apply, and optimize appropriate AI/ML models to analyze multi-modal biomedical data and address domain-specific scientific and clinical problems.
S.3	Critically evaluate model performance and limitations, and effectively communicate findings and insights within biomedical, clinical, and interdisciplinary contexts.
S.4	Evaluate the role of AI/ML in emerging cancer therapies including its impact for efficiency, clinical decision support, and patient centered care.
S.5	Critically assess the clinical readiness, generalizability, and bias of AI/ML models used in therapy.
S.6	Analyze AI models for clinical applications in oncology including image segmentation, radiation response for tissues, and clinical workflows.
S.7	Apply principles of biomedical informatics to clinical pathology and laboratory medicine, including the generation, curation, and management of histopathological imaging and patient data.
S.8	Develop and validate AI-based diagnostic methods for clinical use, incorporating rigorous statistical practices and evaluation frameworks appropriate for healthcare settings.
S.9	Integrate clinical data, imaging, and patient cohort information to support evidence-based decision-making and the translation of AI methods into real-world diagnostic workflows.

Through course projects and the capstone, the students will be familiar with critical thinking that enables them to appropriately identify questions and design methodologies to address those questions, realize implementations, and systematically evaluate and analyze the results of the design. They will also master both oral and written presentations to audiences with varied backgrounds. Given the extended immersion in industry, the students will have the opportunity to constantly hone and enhance their skill sets. Thus, the enrolled students will be able to quickly adapt to a dynamic landscape.

The students will work closely with instructors and program coordinator to make sure their learning goals will be clear from the beginning and satisfied at program completion. The program will work with the

students early to emphasize what they are expected to know, and the mindset, skills, and technical knowledge they should acquire from this program.

IV. 8. 2 Assessment Plan (Program-Level)

Assessment of program learning objectives will be conducted using a **multi-method, program-level evaluation strategy**, coordinated with guidance from the **Michael V. Drake Institute for Teaching and Learning (DITL)**.

IV. 8. 2.1 Program Assessment

Program objectives will be assessed using indirect and direct measures. Program assessment will focus across three main areas:

- **Expected learning outcomes (ELOs)**- Assessment of the program's achievement of the ELOs across the CSE core and specializations.
- **Program design and delivery**- Monitoring the effectiveness of the blended core, specialization pathways, experiential learning, and integration of concurrent professional experience with the curriculum
- **Student experience, engagement, and post-graduation outcomes**- Monitoring of retention, academic performance, co-op experiences and career readiness.

Assessment activities will occur annually and be reviewed by the program's Faculty Director(s) and a joint oversight committee representing, at minimum, and respective committees in the College of Engineering, and College of Medicine.

IV. 8.2.2 Program level metrics

Based on availability, the following data will be collected and analyzed to improve the quality of the program:

- Number of applications to program annually
- Program admissions (% admitted, % matriculated)
- Student retention rates
- Cumulative student GPAs
- Time to degree
- Graduation rates
- Co-op placement rates and employer distribution
- Career placement and average starting salaries
- Student surveys (discussed below)
- Student evaluations of instruction (SEI)
- Alumni surveys to determine applicable employment and use of degree.

IV. 8. 2.3 Direct measures of student learning-

- **Course embedded assessments**- Instructors will use rubrics aligned to the program's expected learning outcomes to assess program (P.1-P.6), core (C.1-C3) and specialization (S.1-S.9) outcomes. Artifacts may include prototypes, reports, code repositories, and more. Please see **Appendix D** for the learning outcomes mapping to courses.
- **Project and capstone evaluation**- The capstone course will have rubric-based assessment, evaluating the following:
 - Application of interdisciplinary methods

- Team collaboration and project leadership
- Data-driven decision-making
- Communication across audiences
- Integration of relevant AI tools

IV. 8. 2.4 Indirect measures of learning and program quality

- **Student surveys:** Annual surveys will gather data on:
 - Perceived mastery of interdisciplinary skills
 - Confidence in applying computer science and clinical concepts
 - Experience with team-based learning
 - Satisfaction with advising, course availability, and workload balance
- **Student evaluations of instruction (SEI)**
- **Exit survey-** Graduating students will complete an exit survey addressing:
 - Overall program satisfaction
 - Preparation for industry roles
 - Quality of experiential learning
 - Suggestions for program improvement
 - Post-graduation work placement
- **Alumni survey (1- and 3-years post-graduation)-** will assess:
 - Employment outcomes
 - Relevance of skills acquired
 - Advancement in desired career path
 - Long-term value of experiential learning
- **Continuous improvement process-** Assessment findings will be reviewed annually and shared with the participating colleges. The review cycle will include:
 - Data collection (each academic year)
 - Committee review and interpretation
 - Action planning based on results
 - Implementation and monitoring

V. Supplementary Material

V. 1 Completed Fiscal Impact Statement Form

V.2 MOU between College of Engineering and College of Medicine



Memorandum of Understanding

Between the College of Medicine and the College of Engineering
regarding development and structure of joint on-line graduate programs

The College of Medicine and College of Engineering desire to establish an agreement on how to structure, support, and administer joint on-line graduate programs (degree and certificate) typically at the Master's level.

The Colleges individually agree to the following structural elements:

- Joint programs will be structured in such a way as to highlight the partnership of engineering and medicine to the benefit of both colleges proportionally.
 - For programs in AI and CS the College of Engineering needs an umbrella approach to make it fiscally viable.
- All programs shall be led by co-directors appointed individually by each College.
- The term of the Co-directors will be 2 years with the possibility of renewal.
- Each college shall arrange for appropriate compensation for their appointed Co-director. At the time of this MOU, such compensation shall be \$5,000 per year and may increase to \$10,000 once total program enrollment reaches 25 students. Should enrollment decrease below 25 students compensation will decrease accordingly. Enrollment will be determined annually on the 15th day of the launch term.
- The Co-Directors shall be responsible for the aspects of program administration outlined in Appendix A to this MOU. They shall jointly determine the individual distribution of tasks.
- Any program shall agree to report into and be overseen by one of the Office of Curriculum and Scholarship (COM) or Office of Professional and Distance Education (COE) as appropriate to the topic of the program.
- All programs will be developed within the Ohio State Online (OSO) financial model and the Business and Finance Officer from each college will approve distribution of revenues that accrue to the Colleges. The program shall interact with OSO via the college office overseeing the program.
- All proposals brought forth shall articulate clearly all the following elements:
 - Proposed co-directors and criteria for how they will be selected and evaluated annually
 - A plan for compensating the time of faculty participants to develop the program
 - Membership of a curriculum committee to monitor and assess learning outcomes from the program and bring forth modifications as needed.
 - Agreement from the unit leaders of all participating faculty agreeing to the mechanism for compensating their faculty member(s).
 - Agreement from the unit leaders agreeing to offering each course in the program in the appropriate delivery mode and format – 100% online and asynchronous
 - Dispute resolution process
 - Program lifecycle and viability metrics including submission of a program budget utilizing the university distance education budget model, and any college distance education budget models
- Each college has the ability to propose sunseting and/or no longer participating in the program if it no longer meets the expectations of its college around student enrollment or another reason. A one-year notice must be given prior to disengagement, and a plan to teach out students must be provided.
- Each college must agree on a program launch date, one that allows enough time for the university, the college and Ohio State Online to properly set the program up for success.



THE OHIO STATE UNIVERSITY

This MOU shall be in effect December 1, 2025 and reviewed for renewal in Autumn of 2028. Changes to the terms may be negotiated among the signatories at any time.

__ALL SIGNATURES WILL BE COLLECTED IN DOCUSIGN__

Caroll R Bradford, Dean
College of Medicine

Bryan Pyles, Assoc Vice Pres Finance
College of Medicine

Ayanna Howard, Dean
College of Engineering

Bobby Srivastava, Chief Administrative Officer
College of Engineering



Appendix A

Program Director Responsibilities

1. Proposal development and the curricular approval process within each respective college
2. Create a course development schedule for OSO (updated semesterly)
3. Manage course offering schedule (updated semesterly)
4. Be fluent in online program delivery or willingness to become fluent so that you can coach and support faculty teaching in the program (course expectations - async, COE/COM Carmen template, etc)
5. Oversee assessment and evaluation of student outcomes and communicate results and plans to the University
6. Evaluate transfer credits when applicable
7. Direct program admissions process
8. Meet regularly (minimum of once a semester) with COE PDEP/COM team (review course development schedule, review course offering schedule, review enrollment, leads and application numbers)
9. Assisting instructors with online course delivery.
10. Performing or delegating periodic curriculum evaluations to determine if there are courses that need revisions or elimination, and if new courses should be added.
11. Overseeing curricular revision requests through approval process at College Committee on Academic Affairs, Graduate School, and Council on Academic Affairs.

Graduate Studies Program Chair responsibilities will include:

- Reviewing qualifications of potential students and applicants to make sure they have an appropriate academic background and work experience for the program.
- Reviewing applications of students with cGPA below 3.0 and make admissions decisions, help with petitioning Grad School for regular or probationary admission.
- Serving as advisor and mentor to low cGPA admits and provide mentoring plan when requested by Grad School.
- Serving as advisor and mentor to students placed on probation by Grad School because of low cGPA. Work with students to develop a plan to raise GPA to 3.0 and above.
- Providing advice to students and instructors when a conflict arises between them in a course. Serving as mediator, if requested.



Appendix B

College-specific fiscal approaches to on-line programs (if desired by business officers)

V.3 Letters of Support and Approvals - COE-DEAN, COM-DEAN, CSE-CHAIR, BMI-CHAIR, PATH-CHAIR, RADONC-CHAIR, CSE-GSC, BMI-GSC, PATH-GSC, RADONC-GSC

[GSC: Graduate Studies Chair]



April 10, 2026

Dr. W. Randy Smith
Vice Provost for Academic Programs
The Ohio State University

122 Hitchcock Hall
2070 Neil Ave
Columbus, OH 43210

614-247-6548

tomasko.1@osu.edu

Dear Vice Provost Smith:

I am pleased to endorse the proposed new online Master of Science in Artificial Intelligence in Medicine program in partnership with the College of Medicine. I have worked closely with Interim Vice for Education Alex Grieco to establish a framework for collaboration on on-line programs between our two colleges and this proposal is the first fruit of that effort.

This program will train students at the intersection of machine learning and artificial intelligence, biomedical and clinical data systems, and translational and clinical decision-making environments. In doing so, the program addresses a critical gap in current graduate education by preparing students to bridge the divide between AI system development and real-world clinical implementation. In addition, the online nature of the program will attract new postbaccalaureate students as well as working professionals which serves to broaden the appeal.

Please do not hesitate to contact me if I can provide further information in support of this proposal.

Sincerely,

David L Tomasko
Associate Dean for Academic Programs and Student Services
Professor of Chemical and Biomolecular Engineering



THE OHIO STATE UNIVERSITY
COLLEGE OF MEDICINE

Jennifer Gold, MD, FAAP
College of Medicine

Vice Dean for Education

320 Hamilton Hall
1645 Neil Avenue
Columbus, OH 43210

614-688-3104 Work
Jennifer.Gold@osumc.edu

April 14, 2026

W. Randy Smith, Ph.D.
Vice Provost for Academic Programs
The Ohio State University

Dear Dr. Smith:

As Vice Dean for Education of the College of Medicine, I fully endorse the proposed new online Master of Science in Artificial Intelligence in Medicine program in partnership with the College of Engineering.

This joint on-line degree program will serve a substantial need for students trained in the connection of AI system development and clinical application. This new program will also serve to broaden our ability to develop and maintain workforce ready professionals in the expanding fields of AI, medicine, and engineering. In addition, the fully on-line nature of this program will serve to maximize enrollment.

Please do not hesitate to contact me if I can provide further information in support of this proposal.

Sincerely,

Jennifer Gold, MD, FAAP
Vice Dean for Education, College of Medicine
Professor and Chair, Department of Biomedical Education and Anatomy
Harry C. and Mary Elizabeth Powelson Professor of Medicine
College of Medicine



Department of Computer Science and Engineering

395 Dreese Labs
2015 Neil Avenue
Columbus, OH 43210

614-292-5813 Phone
614-292-2911 Fax

Cse.osu.edu

April 17, 2026

Attn: Vice Provost W. Randy Smith
Council on Academic Affairs
Office of Academic Affairs
University Square South
15 E. 15th Ave
Columbus, OH 43201

Dear Vice Provost Smith and Members of the Council on Academic Affairs:

I am writing to express my strong support for the proposal to establish a new Master of Science degree program in Artificial Intelligence in Medicine (MS-AIM). As Chair of the Department of Computer Science and Engineering, I view this program as a strategically important addition to the university's academic offerings, addressing a critical and growing workforce demand at the intersection of artificial intelligence and healthcare.

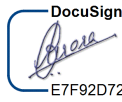
The MS-AIM program responds directly to rapid advancements in artificial intelligence and the increasing need for professionals with specialized training to apply these technologies responsibly and effectively in medical and healthcare settings. By integrating established strengths in computer science and medicine, the proposed program offers an interdisciplinary, applied curriculum that complements existing university offerings and remains distinct in scope and focus.

Designed as a fully asynchronous, online degree, the program expands access for working professionals and full-time students and supports Ohio's efforts to provide flexible, high-value educational pathways in high-demand fields. The MS-AIM program is well positioned to prepare graduates for roles that promote innovation, economic competitiveness, and improved health outcomes, while aligning closely with institutional priorities in artificial intelligence and interdisciplinary collaboration, as well as state and national workforce development goals.

The Department of Computer Science and Engineering fully endorses this proposal and looks forward to collaborating with the College of Medicine and the Office of Professional and Distance Education Programs to ensure the program's successful launch and long-term growth.

Thank you for your consideration.

Sincerely,

DocuSigned by:

E7F92D72F2F8454...

Anish Arora
Professor and Chair
Department of Computer Science and Engineering
The Ohio State University



THE OHIO STATE UNIVERSITY

Department of Biomedical Informatics
College of Medicine

Lang Li, PhD,
Professor and Chair

250 Lincoln Tower
1800 Cannon Drive
Columbus, OH 43210

614-292-4778 Phone
614-688-6600 Fax

April 14, 2026

Dr. W. Randy Smith
Vice Provost for Academic Programs
The Ohio State University

Subject: Supporting Letter for AI in Medicine Online Master Program

Dear Vice Provost Smith,

I want to express my strongest support for this AI in Medicine Online Master Program between College of Medicine and College of Engineering.

The future of professional workforce development in medicine heavily relies on AI and its applications to basic science and clinical science. Department of Biomedical Informatics has established strong graduate training programs in biomedical data, computational biology and clinical informatics, and their applications to basic science and clinical science. The AI in Digital Health track of this AI in Medicine Online Master Program will fit into the special training needs in AI and Medicine. I am very excited about this new online training program.

I am looking forward to working with colleagues from College of Engineering and developing and implementing this new online master program.

Sincerely,

Lang Li
Professor and Chair
Department of Biomedical Informatics
College of Medicine
The Ohio State University

April 20th, 2026

Re: Letter of Support for the MS in Artificial Intelligence in Medicine (MS-AIM)

Dear Members of the Council on Academic Affairs,

I am writing to express my strong support for the proposed Master of Science in Artificial Intelligence in Medicine (MS-AIM) program at The Ohio State University.

This program represents a strategically important, multidisciplinary effort that aligns with institutional priorities at the intersection of artificial intelligence, data science, and clinical care. The integration of a shared AI core with domain-specific tracks—including Biomedical Informatics and Computational Pathology—appropriately reflects the evolving demands of an AI-enabled healthcare workforce.

From the perspective of Radiation Oncology, artificial intelligence is increasingly central to advances in imaging, treatment planning, and precision oncology. The development of a workforce trained at this interface is essential to sustaining innovation, improving clinical outcomes, and maintaining national leadership in cancer care and research.

The Department of Radiation Oncology fully supports this initiative and is committed to contributing through faculty participation, interdisciplinary collaboration, and academic engagement as appropriate.

I respectfully recommend approval of this program.

Sincerely,

Arnab Chakravarti

Arnab Chakravarti, MD, FASTRO, FACRO, FRSM
Chair and Professor, Department of Radiation Oncology
The Ohio State University

April 15, 2026

Dr. W. Randy Smith
Vice Provost for Academic Programs
The Ohio State University

Dear Vice Provost Smith:

We are writing to request the Council on Academic Affairs' approval for a new online Master of Science degree program in **Artificial Intelligence in Medicine (MS-AIM)**. This multidisciplinary program will be administered jointly by the Department of Computer Science and Engineering (CSE), College of Engineering, and the Departments of Pathology (PATH), Biomedical Informatics (BMI), and Radiation Oncology (RadOnc), College of Medicine.

A defining feature of the MS-AIM program is its umbrella, multi-track design, which is intentionally aligned with the structure of workforce demand in AI-enabled healthcare. The program integrates a shared artificial intelligence core with domain-specific tracks in Biomedical Informatics (including digital health), Computational Pathology and Precision Oncology. These areas represent high-impact domains where workforce shortages—driven by aging populations, increasing disease burden, and the rapid digitization of health systems—are placing significant strain on healthcare delivery.

We respectfully request that the Council on Academic Affairs (CAA) approve the establishment of the professional Master's degree program in Artificial Intelligence in Medicine. The proposal documents the curriculum, resource allocations, faculty involvement, and program governance. With the CCA's approval, we can move forward with the next necessary steps of the approval process and begin program development and enrollment efforts at the earliest opportunity.

We have copied all interested parties from our originating units to ensure a coordinated approach across our departments. Thank you for your time and consideration. We look forward to the opportunity to further Ohio State University's commitment to innovation and leadership in the intersection of artificial intelligence and health.

Sincerely,



Anil Parwani, M.D., Ph.D., M.B.A.

Professor of Pathology and Biomedical Informatics
Chair of Pathology
Wexner Medical Center - Department of Pathology
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www.cse.osu.edu

April 17, 2025

To whom it may concern,

The Computer Science and Engineering (CSE) Graduate Studies Committee convened and discussed the program proposal titled "Master of Science in Artificial Intelligence in Digital Health" in its October 7, 2024 meeting. After minor revisions, the revised proposal was conditionally approved in the November 4, 2024 meeting pending further input by all faculty. The proposal was circulated to all faculty for additional comments on November 14, 2024. No additional comments or objections were received. The CSE Graduate Studies Committee determined that the proposal meets curricular standards in the December 2, 2024 meeting.

Please let me know if you have any further questions.

Sincerely,

Spyros Blanas

Associate Professor and Graduate Studies Chair
Department of Computer Science and Engineering
The Ohio State University



THE OHIO STATE UNIVERSITY

Department of Biomedical Informatics
College of Medicine

Ping Zhang, PhD
Vice Chair of Education

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Ping.Zhang@osumc.edu
medicine.osu.edu/bmi

April 17, 2026

W. Randy Smith, Ph.D.
Vice Provost for Academic Programs
Office of Academic Affairs
University Square South 15 E. 15th
Avenue Columbus, OH 43201

Dear Dr. Smith,

The Department of Biomedical Informatics (BMI) of the College of Medicine in partnership with other basic science departments and with the Department of Computer Science and Engineering (CSE) in the College of Engineering would like to propose a fully online Master of Artificial Intelligence in Medicine degree program. The growing demand for AI and machine learning (ML) in healthcare and life sciences, along with the increasing integration of AI into digital health, has created a significant need for professionals well-versed in these disciplines. This program aims to educate and train students and working professionals in AI for medicine. The curriculum combines both didactic and experiential components to equip students with the essential skills for the workforce. Multiple tracks are designed to meet the industry demands and align with participants' interests and backgrounds. Students will learn the basics of programming, tenets of AI and ML, data analysis, ethics, and the application of biomedical data in translational settings.

The Department of Biomedical Informatics is a leader in digital health higher education in the state and across the country. We believe this new degree program will allow us to help the next generation of healthcare professionals and researchers to prepare for the technical challenges in the constantly changing world of AI/ML. We are confident that this new program will make a stronger and more attractive Department of Biomedical Informatics at Ohio State.

Furthermore, this proposed curriculum and program structure have been thoroughly reviewed and officially approved by the BMI Education Committee. We stand united in our commitment to the academic rigor of this initiative and its potential to significantly elevate our educational offerings.

Sincerely,

Ping Zhang
Associate Professor and Vice Chair of Education
Department of Biomedical Informatics
The Ohio State University

Anil Parwani, M.D., Ph.D., M.B.A.

Donald A. Senhauser Chair, Department of Pathology
Chief of Pathology Services for the Health System
Distinguished Professor of Pathology and Biomedical Informatics
Wexner Medical Center - Department of Pathology
The Ohio State University
E409 Doan Hall, 410 West 10th Ave,
Columbus, OH, 43210

04/17/2026

Dear Dr. Parwani,

APPROVAL OF MASTER OF SCIENCE IN ARTIFICIAL INTELLIGENCE IN MEDICINE (MS-AIM) PROPOSAL DOCUMENT

I am writing in my capacity as Chair of the Graduate Education Committee to formally confirm that the Education Committee has reviewed the Master of Science in Artificial Intelligence in Medicine (MS-AIM) approval document, as well as the course syllabi that will comprise the proposed curriculum for the Artificial Intelligence in Pathology (AIP) specialization.

The committee conducted a thorough review of the proposal, including the program objectives, curriculum structure, and individual course content. Based on this review, the Education Committee finds that the proposed curriculum is academically sound, aligns with departmental and institutional educational standards, and appropriately supports the training objectives of the MS-AIM Program, AIP Specialization.

Accordingly, the Education Committee has formally reviewed and approved the proposed Artificial Intelligence in Pathology (AIP) specialization curriculum and supports its incorporation into the Master of Science in Artificial Intelligence in Medicine (MS-AIM) Program.

Please feel free to contact me if additional information or clarification is required.

Sincerely,

**Steve Oghumu, PhD**

Chair, Graduate Education Committee
Department of Pathology, College of Medicine
248 Evans Hall, 520 King Ave., Columbus, OH 43201
Phone: (614) 685-7556
Email: oghumu.1@osu.edu

The James



THE OHIO STATE UNIVERSITY
WEXNER MEDICAL CENTER

Ashley Cetnar, PhD, DABR
Medical Physicist – Associate Professor

Department of Radiation Oncology
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04/20/2026

Re: Letter of Support for the MS in Artificial Intelligence in Medicine (MS-AIM)

Dear Members of the Council on Academic Affairs,

On behalf of the Graduate Studies Committee in the Department of Radiation Oncology, I am writing to express our strong support for the proposal to establish a new online Master of Science degree program in Artificial Intelligence in Medicine (MS-AIM). In particular, we support the development of the Precision Oncology track and the associated coursework proposed within this program.

The integration of artificial intelligence into medical practice represents a critical and timely advancement in modern healthcare. This program is well positioned to meet a growing workforce need by preparing highly qualified professionals who can lead innovation at the intersection of data science, artificial intelligence, and medicine. Graduates of the MS-AIM program will be uniquely equipped to translate advanced computational methods into meaningful clinical and translational impact, ultimately improving patient outcomes and advancing the field of medicine.

We are supportive of the overall structure and general course framework that has been proposed for the MS-AIM program. We recognize that, upon program approval, the committee will review more detailed proposals for new courses to be included in the curriculum. As these detailed course proposals are developed, we appreciate that additional information will be provided to ensure that course content can be fully supported by the department, aligning faculty expertise, and is consistent with our strategic plan for course development. This structured and intentional approach will help ensure that the curriculum is rigorous, sustainable, and well aligned with the needs of learners in this emerging field.

The Precision Oncology track aligns closely with our department's academic strengths and long-term goals, particularly in leveraging data-driven approaches to advance cancer research and personalized medicine. We view this program as an important opportunity to extend our educational mission to a broader, diverse audience of learners through a flexible online format, while maintaining high academic standards and relevance to clinical and translational practice.

In summary, we strongly support the establishment of the MS-AIM program and the inclusion of the Precision Oncology track within it. We believe this program will make a meaningful contribution to graduate education and will help train the next generation of leaders capable of driving innovation in artificial intelligence-enabled medicine.

Thank you for the opportunity to provide this letter of support. Please feel free to contact us if additional information is needed.

Sincerely,

Ashley Cetnar, PhD, MS, MPAL, DABR
Department of Radiation Oncology Graduate Studies Committee Chair
Associate Professor - Department of Radiation Oncology

VI. Appendices

VI.1 Appendix A

Courses are for each specialization and the short syllabi are listed herein.

VI.1.1 Specialization— Artificial Intelligence in Digital Health (AIDH)

Table A: Prerequisite Courses for AIDH (3 credits)			
Course Number	Course Title	Credit Hours	Required /Elective
BMI 5780	Programming for Biomedical Informatics	3	Required (exemptions allowed)

Table B: Core Courses for AIDH (7 credits)			
Course Number	Course Title	Credit Hours	Required /Elective
BMI 5551	Introduction AI/ML in Digital Health	3	Required
BMI 6YYY, CSE 69YY	Capstone Design: AI/ML in Digital Health	4	Required

Table C: Required Courses in CSE (9 credits)			
Course Number	Course Title	Credit Hours	Required /Elective
CSE 5194	Ethics in AI	3	Required
CSE 5052	Survey of Artificial Intelligence for Non-Majors	3	Required
CSE 6520	Foundations of Applied Artificial Intelligence for Non-Majors	3	Required

Table D: Required Courses in BMI (9 credits)			
Course Number	Course Title	Credit Hours	Required /Elective
BMI 5552	AI/ML Applications in Medical Imaging	3	Required
BMI 5553	Predictive Analytics in Electronic Health Records	3	Required
BMI 5554	Natural Language Processing in Biomedical Informatics	3	Required

Table E: Elective courses from CSE and BMI curricula (6 credits)			
Course Number	Course Title	Credit Hours	Required /Elective
CSE 5523	Machine Learning and Statistical Pattern Recognition	3	Elective
CSE 5524	Computer Vision for Human-Computer Interaction	3	Elective

CSE 5525	Foundations of Speech and Language Processing	3	Elective
CSE 5526	Introduction to Neural Networks	3	Elective
CSE 5544	Introduction to Data Visualization	3	Elective
CSE 5449	Introduction to High-Performance Deep Learning	3	Elective
BMI 5710	Introduction to Biomedical Informatics	3	Elective
BMI 5730	Introduction to Bioinformatics	3	Elective
BMI 5750	Methods in Biomedical Informatics and Data Science	3	Elective
BMI 5760	Public Health Informatics	3	Elective
BMI 5770	Health Analytics	3	Elective
BMI 7040	Clinical Informatics	3	Elective
BMI 7235	Applications of Machine Learning for Bioinformatics	3	Elective
Include courses from the other two specializations namely AIPO and AIP.			

COURSES TO BE FULLY DEVELOPED

Course	Course Title
CSE 5194	Ethics in Artificial Intelligence
BMI 6YYY, CSE69YY	Capstone Design: AI/ML in Digital Health

Total credits: 34

VI. 1.1.2 Specialization — Artificial Intelligence in Precision Oncology (AIPO)

Table A: Prerequisite Courses for AIPO (2 credits)			
Course Number	Course Title	Credit Hours	Required /Elective
RADONC 5XXX	Programming for Radiation Oncology	2	Required (exemptions allowed)

Table B: Core Courses for AIPO (7 credits)			
Course Number	Course Title	Credit Hours	Required /Elective
RADONC 5XXX	Artificial Intelligence in Modern and Emerging Therapies	3	Required
RADONC 6YYY, CSE 69YY	Capstone Design: Design of AI-Based Clinical Decision Support Systems	4	Required

Table C: Required Courses in CSE (9 credits)			
Course Number	Course Title	Credit Hours	Required /Elective
CSE 5194	Ethics in AI	3	Required

Table C: Required Courses in CSE (9 credits)			
CSE 5052	Survey of Artificial Intelligence for Non-Majors	3	Required
CSE 6520	Foundations of Applied Artificial Intelligence for Non-Majors (substitute elective for exemptions)	3	Required

Table D: Required Courses from RadOnc (10 credits)			
Course Number	Course Title	Credit Hours	Required /Elective
RADONC 5XXX	Artificial Intelligence in Radiation Oncology	3	Required
RADONC 5XXX	Artificial Intelligence in Radiation Biology	3	Required
PATHOL 6640	Fundamentals of Oncology	4	Required

Table E: Elective Courses from CSE and RadOnc Curricula (6)			
Course Number	Course Title	Credit Hours	Required /Elective
CSE 5523	Machine Learning and Statistical Pattern Recognition	3	Elective
CSE 5524	Computer Vision for Human-Computer Interaction	3	Elective
CSE 5525	Foundations of Speech and Language Processing	3	Elective
CSE 5526	Introduction to Neural Networks	3	Elective
CSE 5544	Introduction to Data Visualization	3	Elective
CSE 5449	Introduction to High-Performance Deep Learning	3	Elective
RADONC 5XXX	Radiation Treatment Technologies	3	Elective
RADONC 5XXX	Radiation Safety and Protection	3	Elective
RADIOLOG 5XXX	Diagnostic Imaging	3	Elective
RADSCI 5XXX	Cross Sectional Anatomy	3	Elective
Include courses from the other two specializations namely AIDH and AIP.			

Courses that need Development	
RADONC 5XXX	Programming for Radiation Oncology
RADONC 5XXX	Artificial Intelligence in Modern and Emerging Therapies

RADONC 5XXX	Artificial Intelligence in Radiation Oncology
RADONC 5XXX	Artificial Intelligence in Radiation Biology
RADONC 5XXX	Radiation Treatment Technologies
RADONC 5XXX	Radiation Safety and Protection
RADONC 5XXX	Diagnostic Imaging
RADSCI 5XXX	Cross Sectional Anatomy
RADONC 6YYY, CSE 69YY	Capstone Design: Design of AI-Based Clinical Decision Support Systems

Total Credits: 34

VI. 1.1.3 Specialization — Artificial Intelligence in Pathology (AIP)

Table A: Prerequisite Course(s) for AIP (2 credits)			
Course Number	Course Title	Credit Hours	Required /Elective
PATHOL 5XXX	Programming for Digital Pathology	2	Required (with exceptions)

Table B: Core Courses for AIP (7 credits)			
Course Number	Course Title	Credit Hours	Required /Elective
PATHOL 5224	Computational Pathology in Practice	3	Required
PATH 6YYY, CSE 69YY	Capstone Design: Design of AI-based Diagnostic Systems	4	Required

Table C: Required Courses in CSE (9 credits)			
Course Number	Course Title	Credit Hours	Required /Elective
CSE 5194	Ethics in AI	3	Required
CSE 5052	Survey of Artificial Intelligence for Non-Majors	3	Required
CSE 6520	Foundations of Applied Artificial Intelligence for Non-Majors	3	Required

Table D: Required Courses in PATH (10 credits)			
Course Number	Course Title	Credit Hours	Required /Elective
PATHOL 5211	Digital Pathology	4	Required
PATHOL 5217	Introduction to Pathology Informatics	2	Required
PATHOL 6640	Fundamentals of Oncology	4	Required

Table E: Elective Courses from CSE and PATH Curricula (6 credits)			
Course Number	Course Title	Credit Hours	Required /Elective
CSE 5523	Machine Learning and Statistical Pattern Recognition	3	Elective
CSE 5524	Computer Vision for Human-Computer Interaction	3	Elective
CSE 5525	Foundations of Speech and Language Processing	3	Elective
CSE 5526	Introduction to Neural Networks	3	Elective
CSE 5544	Introduction to Data Visualization	3	Elective
CSE 5449	Introduction to High-Performance Deep Learning	3	Elective
PATHOL 5200	Introduction to Anatomical Pathology	2	Elective
PATHXXX	Advanced Techniques for Computational Pathology	3	Elective
PATHOL 6XXX	Pathology Seminar Series	3	Elective
PATHOL 8850	Immunology Seminar Series	1	Elective
Include courses from other two specializations namely, AIDH, AIPO.			

Total credits: 34

Courses to be Fully Developed	
PATHOL 5XXX	Programming for Digital Pathology
PATHOL 5211	Digital pathology
PATHOL 5217	Introduction to Pathology Informatics
PATHOL 5224	Computational Pathology in Practice
PATHOL 6XXX	Pathology Seminar Series
PATHXXX	Advanced Techniques for Computational Pathology
PATH 6YYY, CSE 69XX	Capstone Design: Design of AI-based Diagnostic Systems

VI.2 Appendix B

VI.2.1 Short Syllabi for Biomedical Informatics Courses

Course 1

Course Title: Programming for Biomedical Informatics

Course Number: BMI 5780

Number of Credits: 3

Course Description: This course will offer the foundational and working knowledge, skills, and tools for programming for Biomedical informatics. Biomedical informatics is a field that leverages complex and heterogeneous data. Working with these data requires knowledge of multiple programming languages and software in order to take advantage of existing tools and eventually build new tools. This course will focus on python, High-Performance Computing, and GitHub, as these are commonly used in Biomedical Informatics. This course will cover elementary Python programming (e.g., python syntax, environment, libraries) with which students should be able to write and run basic python programs. This course will also cover foundational data structures that are useful in Biomedical Informatics research (e.g., graphs, trees, matrices) and corresponding concepts and algorithms over the data structures (e.g., graph flow, tree traversal, matrix operations). With these data structures and algorithms, students should be able to implement many popular methods from scratch. In addition to data structures and algorithms, the course will discuss basic data analytics methods (e.g., classification, regression) and their implementations in popular python libraries for Biomedical Informatics applications. This course will also cover other useful content including basic commands and operations in Linux systems, the access and use of High-Performance Computing (HPC) systems, use of GitHub for open-sourced code sharing and version control, formal documentation, etc. This course will offer working knowledge and practice opportunities of popular Python tools, packages, and systems such as scikit-learn and Pytorch, and programming skills using Pytorch. Out of this course, the students should acquire necessary programming knowledge and skills, and be ready to program in Python and implement popular data analysis methods that can be used in Biomedical informatics research.

Prerequisites: The students should have undergrad level knowledge of linear algebra. The student should have taken introductory courses on programming. The students are expected to have knowledge in at least one programming language (not necessarily Python). Knowledge on data analysis and machine learning is preferred.

Course 2

Course Title: Predictive Analytics in Electronic Health Records

Course Number: BMI 5553

Number of Credits: 3

Course Description: Electronic health records (EHRs) provide massive, longitudinal data on thousands or even millions of patients, including demographics, laboratory results, diagnosis codes, prescriptions, and physician notes. As EHR databases are becoming more standardized and integrated across multiple hospital systems, they are gaining increasing attention from the informatics community as a resource to be mined, for example, to assess quality of patient care, develop early prediction models for disease, and define disease phenotypes.

Prerequisites: The students are encouraged to first take BMI 5780 Programming for Biomedical Informatics, which covers some basic knowledge of machine learning and Python programming. It is very

helpful if students already have these knowledge and skills. The course will provide some introduction sessions to ML/AI algorithms, and related Python packages to EHR data analytics.

Course 3

Course Title: AI/ML application in medical imaging

Course Number: BMI 5552

Number of Credits: 3

Course Description: AI has increasingly been used for a variety of complex segmentation and classification problems in medical imaging. These methods have shown great promise over traditional image processing methods, but still require image pre-processing and a rigorous post-validation approach required for medical imaging processing applications. This course will be centered around the development of an image processing workflow that will walk the student through each step of a medical image processing AI example. This includes acquiring the data, preparing it for analysis, pre-processing the data for use in a Convolutional Neural Network (CNN), performing the segmentation and/or classification, and interpreting and presenting the results. Key concepts of basic medical imaging processing and their applications, along with medical imaging AI techniques, will be presented. This course will use basic open- source medical imaging software packages such as ITK, NiftyNet and Pytorch. After completion of this course, students should have introductory knowledge of how AI can be used in medical image processing applications.

Prerequisites: Students are encouraged to have previously taken BMI 5780 Programming for Biomedical Informatics which covers some basic knowledge of machine learning and Python programming. The course will provide introductory material on basic image processing analysis and the use of AI algorithms as they pertain to medical imaging applications.

Course 4

Course Title: Survey of AI/ML in Digital Health

Course Number: BMI 5551

Number of Credits: 3

Course Description: The purpose of this course, AI/ML Overview in Digital Health is to introduce the concepts of AI/ML to enrollees. It will cover some introductions to EHR predictive analytics, clinical NLP, bioinformatics, and biomedical imaging. Students will apply ML/AI tools, analyze biomedical data, and answer biomedical research questions using the data and ML/AI tools.

Prerequisites: Students should have a familiarity with basic machine learning methods and have experience in python programming such as that provided in BMI 5780 Python programming.

Course 5

Course Title: Natural language processing in biomedical research

Course Number: BMI 5554

Number of Credits: 3

Course Description: This course introduces trainees to the natural language processing and text mining on biomedical data, including clinical notes from electronic medical records and biomedical literature. Examples of major topics to be discussed in this class include: 1) gold standard annotations in biomedical literature and clinical notes; 2) Text classifications for biomedical related topics including but not limited to diseases, drugs, genes, adverse events, biological experiments, and clinical studies. 3) Entity recognitions for biomedical related entities, including but not limited to diseases, drugs, genes, adverse events, biological experiments, and

clinical studies. (4) Relationship extractions for biomedical related causal/association/co-occurrence relations among diseases, drugs, genes, adverse events, animal models, and clinical studies. (5) Implementing machine learning and deep learning algorithms for various NLP tasks using Python.

Prerequisites: Students should have a familiarity with basic machine learning methods and have experience in python programming such as that provided in BMI 5780 Python programming.

Course 6

Course Title: Methods in Biomedical Informatics and Data Science

Course Number: BMI 5750

Number of Credits: 3

Course Description: This course provides training in practical biomedical informatics, study design, statistical analysis, and computational techniques related to biomedical research. The course will provide applied primers covering foundational biomedical informatics and quantitative science methods employed in the design, conduct, and analysis of basic science, clinical, and translational research programs. This survey course is intended to enable individuals to critically select such methods and evaluate their results as part of both the design of new projects as well as the review of results available in the public domain (e.g., literature, public data sets, etc.). The course will include hands-on experience with the R software environment and to the use of R packages that can be applied to these kinds of problems.

Prerequisites: Students should have undergraduate training in calculus and algebra. Some programming skills are encouraged, but not required.

Course 7

Course Title: Applications of Machine Learning for Bioinformatics

Course Number: BMI 7235

Number of Credits: 3

Course Description: This course will teach students the primary machine learning algorithms used in bioinformatics. We will cover the theoretical underpinnings of the methodology along with an explanation of how to use practical implementations (in R and Python) in order to apply the methods to real bioinformatics data sets. An important goal of the course is to introduce students to more advanced algorithms that are not covered in other classes in BMI. Examples include modern regression techniques (including ridge regression, LASSO, and elastic nets), deep learning (using TensorFlow), non-linear dimension reduction (including t-SNE and UMAP), directed and undirected graphical models, and association rules. By the end of the course, students will have had practice applying all of these methods to actual data sets. The course will include hands-on experience with the R and Python software environment and to the use of R packages that can be applied to these kinds of problems.

Prerequisites: Students should have a broad overview of the field of bioinformatics, such as that provided in BMI 5730 (Introduction to Bioinformatics). Students should have a basic familiarity with statistical methods, such as those presented in BMI 5750 (Methods in Biomedical Informatics and Data Science). Students should have an intermediate knowledge of the R statistical software environment, such as that presented in BMI 7030 (Analysis of Transcriptomics Data) or should be willing to learn that material on their own. The course will include a very brief review of this material. Much of the material can be obtained from this mini course: <https://www.edx.org/course/introduction-r-data-science-microsoft-dat204x-7>.

Course 8

Course Title: Introduction to Biomedical Informatics

Course Number: BMI 5710

Number of Credits: 3

Course Description: The goal of this course is to introduce trainees to the basic definitions, theories, and methods that serve as the foundations for the broad field of Biomedical Informatics (BMI). In this context, we will define BMI as: "the field that is concerned with the optimal use of information, often aided by the use of technology and people, to improve individual health, health care, public health, and biomedical research". Examples of major topics to be discussed in this class include: 1) the definition of BMI and its sub-disciplines; 2) the design and use of clinical information systems; 3) biomedical data management; 4) syntactic and semantic processing of heterogeneous data, information, and knowledge resources; 5) the role of informatics in supporting clinical, translational, and population-level research; and 6) future directions for the field of BMI.

Prerequisites: While there are no strict requirements, a successful student should have basic knowledge of computer science principles, statistical analysis methods, and biomedical terminology. However, primers for statistical analysis methods, and biomedicine and clinical medicine, will be provided in modules 8 and 4, respectively.

Course 9

Course Title: Introduction to Bioinformatics

Course Number: BMI 5730

Number of Credits: 3

Course Description: This course introduces students to basic topics of bioinformatics, including sequence analyses, genomics, transcriptomics, proteomics, and associated databases. This course is designed to introduce future biologists and physicians to bioinformatics database searching, tools usage and result evaluation. Upon completion of the course, students should be more comfortable working with the vast amounts of genomics, proteomics, and biomedical data and bioinformatics tools that will be relevant to their work in the coming decades. Familiarity or background in molecular biology and computer science is recommended.

Prerequisites: While there are no strict requirements, a successful student should have basic knowledge of computer science principles, statistical analysis methods and molecular biology. Review sessions for statistical analysis methods and molecular biology will be provided in class.

Course 10

Course Title: Public Health Informatics

Course Number: BMI 5760

Number of Credits: 3

Course Description: The goal of this course is to introduce students to the emerging and interdisciplinary field of Public Health Informatics. Informatics is an integral part of the foundations and success of public health initiatives and policies and is utilized in a unique and critical way to enhance public health goals. This course will examine the wide use and scope of informatics in the field of public health and allow students to focus on the core competencies of public health informatics, and really examine how informatics and public health are vital to each other. The fundamental public health theories of environmental health, health behavior and health promotion, and epidemiology will be discussed in the context of how informatics can be applied to these areas to enhance their experiences, methods, and tools

and ultimately achieve their goals. Other topics will include the use of GIS in enhancing epidemiological surveillance, informatics use in disaster relief efforts, informatics use in public safety and hospital communications, and the use of health information exchanges for public health purposes.

Prerequisites: While there are no strict requirements, a successful student should have a basic understanding of biomedical informatics and clinical research informatics principles, methods, and tools.

Course 11

Course Title: Health Analytics

Course Number: BMI 5770

Number of Credits: 3

Course Description: This online course is a hands-on exploration that walks students through theory and practice of exploring how data can be leveraged to facilitate discovery. The course offers an introduction to the emerging field of Health Analytics - the use of health-related data to improve the lives of people, processes, and organizations. In this course, we will explore the data ecosystem, wrestle with the challenge of moving from that data to meaningful questions, explore how we frame answers to questions using available tools and then practice presenting that data in meaningful ways.

Prerequisites: None

Course 12

Course Title: Clinical Informatics

Course Number: BMI 7040

Number of Credits: 3

Course Description: The course provides training in the theories, methods, and application of clinical informatics. Clinical Informatics is the field concerned with the use of data and information technology applied to the delivery of healthcare services. Clinical informatics has a wide array of healthcare delivery application areas in the clinical domain, including, pharmacy, nursing, and patient care operational areas. While there are no prerequisite course requirements, a familiarity with United States healthcare delivery and medical terminology is strongly encouraged.

Prerequisites: None

Course 13

Course Title: Survey of AL/ML in Digital Health

Course Number: BMI 5551

Number of Credits: 3

Course Description: Students will interact with ML/AI technologies to create novel innovations in biomedical and clinical research and healthcare.

Prerequisites: The students are encouraged to first take BMI 5780 Programming for Biomedical Informatics, which covers some basic knowledge of machine learning and Python programming. It is very helpful if students already have these knowledge and skills. The course will provide some introduction sessions to ML/AI algorithms, and related Python packages to EHR data analytics.

VI.2.2 Short Syllabi for CSE courses

Course 1

Course Title: Fairness, Bias, and Ethics in AI

Course Number: CSE 5194(pilot)

Number of Credits: 3

Course Description: Science of fairness in machine learning, sources and measures of the unfairness arising from ML algorithms, and interventions to mitigate unfairness issues.

Prerequisites: Junior, senior, graduate standing, or permission of instructor.

Course 2

Course Title: Statistical Machine Learning and Pattern Recognition

Course Number: CSE 5523

Number of Credits: 3

Course Description: Introduction to basic concepts of machine learning and statistical pattern recognition; techniques for classification, clustering and data representation and their theoretical analysis.

Prerequisites: Junior, senior, graduate standing, or permission of instructor.

Course 3

Course Title: Computer Vision for Human-Computer Interaction

Course Number: CSE 5524

Number of Credits: 3

Course Description: Computer vision algorithms for use in human-computer interactive systems; image formation, image features, segmentation, shape analysis, object tracking, motion calculation, and applications.

Prerequisites: Junior, senior, graduate standing, or permission of instructor.

Course 4

Course Title: Foundations of Speech and Language Processing

Course Number: CSE 5525

Number of Credits: 3

Course Description: Fundamentals of natural language processing, automatic speech recognition and speech synthesis; lab projects concentrating on building systems to process written and/or spoken language.

Prerequisites: Junior, senior, graduate standing, or permission of instructor.

Course 5

Course Title: Introduction to Neural Networks

Course Number: CSE 5526

Number of Credits: 3

Course Description: Survey of fundamental methods and techniques of neural networks; single- and multi-layer perceptrons; radial-basis function networks; support vector machines; recurrent networks; supervised and unsupervised learning.

Prerequisites: Junior, senior, graduate standing, or permission of instructor.

Course 6

Course Number: CSE 5449

Course Title: Introduction to High Performance Deep Learning

Number of Credits: 3

Course Description: Discussion of popular methods deep neural networks (DNNs) and deep learning (DL) frameworks including Tensorflow, Pytorch, MXNet, Caffe, and Chainer; survey of applications in image recognition, speech processing, textual analysis, medical imaging, materials science, and autonomous vehicular systems; discussion of scale-up and scale-out approaches.

Prerequisites: Junior, senior, graduate standing, or permission of instructor.

Course 7

Course Title: Survey of Artificial Intelligence for Majors

Course Number: CSE 5052

Number of Credits: 3

Course Description: Survey of the basic concepts and techniques in artificial intelligence, including problem solving, knowledge representation, and machine learning.

Prerequisites: 1211, 1221, 1222, 1223, or 2221, or Grad standing

Course 8

Course Title: Foundations of Applied Artificial Intelligence for Non-Majors (substitute elective for exemptions)

Course Number: CSE 6520

Number of Credits: 3

Course Description: Introduction to computer programming, to problem solving techniques using computer programs, and to the mathematical foundations of Artificial Intelligence. Specifically geared towards graduate students from non-Computer Science backgrounds with examples drawn from Artificial Intelligence.

Prerequisites: Not open to students enrolled in CSE major.

Course 9

Course Title: Introduction to Data Visualization

Course Number: CSE 5544

Number of Credits: 3

Course Description: Principles and methods for visualizing data from measurements and calculations in physical and life sciences, and transactional and social disciplines; information visualization; scientific visualization.

Prerequisites: CSE5361, Stat 3301, CSE3541, or CSE5541.

Course 10

Course Title: Capstone Design: AI/ML in Digital Health

Course Number: BMI6YYY, CSE69YY (NEW)

Number of Credits: 4

Course Description: This course will provide experiential learning for students involving in-depth investigation, experimentation, and the discovery of new knowledge in the field. The capstone project will be multi-disciplinary combining AI and Digital Health.

Prerequisites: CSE core course, Specialization core courses

VI.2.3 Short Syllabi for Radiation Oncology Courses

Course 1

Course Title: Artificial Intelligence in Modern and Emerging Therapies

Course Number: RADONC 5XXX (NEW)

Number of Credits: 3

Course Description: This course explores the application of artificial intelligence across modern and emerging therapeutic approaches, emphasizing innovation in disease treatment, personalization, and clinical decision-making. Students will explore how AI methods are used to enhance novel therapies, adaptive treatment strategies, and precision medicine across oncology and related clinical domains. The course highlights real-world use cases such as AI-enabled therapy selection, response prediction, and workflow optimization, while addressing ethical, regulatory, and safety considerations associated with deploying AI in our evolving therapeutic landscapes.

Prerequisites: None

Course 2

Course Title: Artificial Intelligence in Radiation Oncology

Course Number: RADONC 5XXX (NEW)

Number of Credits: 3

Course Description: **Course Title:** Artificial Intelligence in Radiation Oncology

Course Description: This course examines the application of artificial intelligence across the clinical and technical domains of radiation oncology, focusing on how machine learning and deep learning methods are used to optimize, automate, and personalize the radiation therapy workflow. Learners will explore AI applications in treatment outcome prediction, automatic treatment planning, target volume and organ-at-risk segmentation, image-guided adaptive radiotherapy, and quality assurance. Emphasis is placed on integrating clinical, imaging, and dosimetric data with modern AI frameworks to support evidence-based, efficient, and individualized cancer treatment.

Prerequisites: None

Course 3

Course Title: Artificial Intelligence in Radiation Biology

Course Number: RADONC 5XXX (NEW)

Number of Credits: 3

Course Description: This course examines the intersection of artificial intelligence and radiation biology, focusing on how data-driven and computational methods are used to model, predict, and interpret

biological responses to radiation. Learners will explore AI applications in radiobiological modeling, radiosensitivity and resistance analysis, normal tissue toxicity prediction, and radiogenomics. Emphasis is placed on integrating biological mechanisms with machine learning and systems-level data to support biologically informed and personalized radiation therapy.

Prerequisites: None

Course 4

Course Title: Programming for Radiation Oncology

Course Number: RADONC 5XXX (NEW)

Number of Credits: 2

Course Description: This course introduces foundational programming skills for radiation oncology applications, with an emphasis on Python, Jupyter Notebooks, and high-performance computing environments. Students will learn core programming concepts (syntax, data structures, and environments) and gain hands-on experience working with biomedical data, including tabular and imaging modalities. The course also introduces key tools and practices such as commonly used Python libraries (e.g., NumPy, pandas, scikit-learn), basic data structures and algorithms, Linux/HPC workflows, and version control using GitHub. Through practical, domain-relevant examples, students will develop the skills to acquire, process, analyze, and visualize data, and build a foundation for implementing data-driven methods in biomedical informatics.

Prerequisites: None

Course 5

Course Title: Capstone Design: Design of AI-Based Clinical Decision Support Systems

Course Number: RADONC 5XXX (NEW)

Number of Credits: 3

Course Description: This capstone course integrates the technical, clinical, and regulatory knowledge acquired throughout the program into a team-based design experience focused on the development of AI-driven clinical decision support systems (CDSS). Working in interdisciplinary teams, students conceive, design, prototype, and evaluate an original CDSS addressing a real-world clinical problem across domains such as diagnostic imaging, risk stratification, or care pathway optimization.

The course spans the full development lifecycle, from clinical needs assessment and data curation through validation methodology, human factors design, and regulatory considerations including FDA AI/ML guidance, bias mitigation, and explainability. Final deliverables include a functional prototype, a comprehensive design document, a clinical validation plan, and a formal presentation to a panel of faculty, clinicians, and industry reviewers.

Prerequisites: Completion of core program coursework in machine learning for healthcare, clinical informatics, and biomedical data science, or instructor consent.

Course 5

Course Title: Radiation Treatment Technologies

Course Number: RADONC 5XXX (NEW)

Number of Credits: 3

Course Description: This course provides a foundational overview of radiation treatment technologies for students entering AI-focused graduate study without prior experience in radiation oncology. Learners will be introduced to the clinical goals of radiation therapy, basic radiation physics, and the major

treatment modalities used in modern cancer care, including external beam radiotherapy, intensity-modulated radiation therapy (IMRT), image-guided radiotherapy (IGRT), stereotactic treatments, proton therapy, and brachytherapy. The course emphasizes how medical imaging, treatment planning, delivery systems, and quality assurance workflows generate complex data suitable for computational analysis. Clinical terminology, care pathways, and safety considerations are presented at a conceptual level to enable effective collaboration with clinicians and researchers. By the end of the course, students will have the domain context needed to understand, develop, and evaluate AI methods applied to radiation treatment planning, delivery, and outcomes analysis.

Prerequisites: None

Course 6

Course Title: Radiation Safety and Protection

Course Number: RADONC 5XXX (NEW)

Number of Credits: 3

Course Description: This course introduces the fundamental principles of radiation safety and protection for graduate students without prior training in radiation oncology or medical physics. Students will learn core concepts of radiation biology, dose and risk, and the mechanisms by which ionizing radiation interacts with human tissue and the environment. The course includes regulatory frameworks, safety standards, and professional roles governing the safe use of radiation in medicine, with emphasis on occupational, patient, and public protection. Key topics include radiation units and measurements, exposure pathways, shielding and monitoring, ALARA (As Low As Reasonably Achievable) principles, and safety considerations across diagnostic and therapeutic applications. The course also highlights how radiation safety data can inform AI-driven risk assessment, workflow optimization, and decision support. By the end of the course, students will have the foundational knowledge needed to responsibly engage in AI research and development involving radiation-based technologies.

Prerequisites: None

Course 7

Course Title: Diagnostic Imaging

Course Number: RADIOLG 5XXX (NEW)

Number of Credits: 3

Course Description: This course provides a high-level introduction to diagnostic imaging for students who do not have a clinical or imaging background. It surveys the major imaging modalities used in modern healthcare. Topics include introduction to radiography, computed tomography (CT), magnetic resonance imaging (MRI), ultrasound, and nuclear medicine with emphasis on the clinical questions each modality addresses. Students will learn basic imaging physics, image formation concepts, contrast mechanisms, and common artifacts at a conceptual level. The course also introduces standard imaging data formats, annotations, and workflows, along with considerations of image quality, dose, and safety. Throughout the course, connections are made between diagnostic imaging and AI applications such as image reconstruction, segmentation, detection, and decision support. By the end of the course, students will have the domain knowledge needed to meaningfully engage with imaging datasets and collaborate with clinicians in AI-driven diagnostic research and development.

Prerequisites: None

Course 8

Course Title: Cross Sectional Anatomy

Course Number: RADSCI 5XXX (NEW)

Number of Credits: 3

Course Description: This course introduces the principles of cross-sectional anatomy for using axial, sagittal, and coronal perspectives, students will learn to identify major organs, vascular structures, bones, and soft tissues as they appear on CT, MRI, and other tomographic imaging modalities. Emphasis is placed on spatial relationships, anatomical variability, and clinically relevant landmarks. The course integrates anatomy with imaging context, highlighting how structures appear across modalities and how anatomy underpins tasks such as segmentation, registration, and disease localization. By the end of the course, students will have the anatomical literacy needed to interpret cross-sectional medical images and to develop and evaluate AI methods applied to imaging, radiation therapy, and image-guided interventions.

Prerequisites: ANATOMY 2300 or Permission of Instructor

VI.2.4 Short Syllabi for Pathology Courses

Course 1

Course Title: Digital Pathology

Course Number: PATHOL 5211

Number of Credits: 4

Course Description This is a graduate level course consisting of lectures/seminars, covering various subjects and recent advances in digital pathology. Reading will be from primary sources in current scientific literature.

Prerequisites: None

Course 2

Course Title: Introduction to Pathology Informatics

Course Number: PATHOL 5217

Number of Credits: 2

Course Description: This course provides a comprehensive overview of pathology informatics, emphasizing the integration of technology and data science into pathology practice. Students will explore the principles and practical applications of informatics in laboratory management, diagnostics, and research. Topics include laboratory information systems (LIS), data standards and interoperability, informatics-driven quality management, and the role of informatics in precision medicine. The course prepares students for further study in specialized areas such as digital pathology and artificial intelligence while equipping them with foundational knowledge to navigate the rapidly evolving field of pathology informatics

Prerequisites: None

Course 3

Course Title: Computational Pathology in Practice

Course Number: PATHOL 5224

Number of Credits: 3

Course Description: This graduate-level course consists of a series of lectures focused on the various subjects and recent advances in computational pathology. The curriculum includes detailed readings from current scientific literature, with lectures designed to foster a deep understanding and encourage critical evaluation of the topics covered. This course aims to provide students with a thorough insight into the state-of-the-art research and practical applications within the field of computational pathology, emphasizing both foundational theories and innovative approaches.

Prerequisites: None

Course 4

Course Title: Immunology Seminar Series

Course Number: PATHOL 8850

Number of Credits: 1

Course Description: This is a graduate level course consisting of lectures/seminars, covering various subjects and recent advances in Immunology, Infection, and Immuno-Oncology.

Prerequisites: None

Course 5

Course Title: Fundamentals of Oncology

Course Number: PATHOL 6640

Number of Credits: 4

Course Description: This is a graduate level course consisting of lectures/seminars, covering various subjects and recent advances in oncology. Reading will be from primary sources in current scientific literature. Seminars will be interactive and encourage critical evaluation of the reading assignments

Prerequisites: None

Course 6

Course Title: Advanced Techniques for Computational Pathology

Course Number: PATHOL 5XXX (NEW)

Number of Credits: 3

Course Description: This graduate-level course provides an in-depth exploration of advanced topics in computational pathology. Through a combination of lectures, hands-on assignments, and detailed readings from current scientific literature, students will gain expertise in cutting-edge technologies and methodologies in the field. The curriculum emphasizes practical applications, advanced machine learning techniques, and the integration of pathology with emerging modalities such as spatial transcriptomics and digital twins. By critically evaluating state-of-the-art research and real-world case studies, students will develop the skills to design, implement, and evaluate innovative computational pathology solutions, preparing them to contribute to the future of pathology research and practice.

Prerequisites: None

Course 7

Course Title: Introduction to Anatomic Pathology

Course Number: PATHOL 5200

Number of Credits: 2

Course Description: This is a graduate level course consisting of laboratory observation, microscope observation, and discussions, covering various areas in Anatomic Pathology, meant to prepare the student to better understand what is needed in digital pathology.

Prerequisites: None

Course 8

Course Title: Capstone Design: Design of AI-based Diagnostic Systems

Course Number: PATH 6YYY, CSE 69YY (NEW)

Number of Credits: 4

Prerequisites: Graduate standing, or permission of instructor.

Course Description: Capstone design project; conceptual and technical design; theory and practice of pathology informatics systems; teamwork, written and oral communication skills.

Course 9

Course Title: Programming for Pathology

Course Number: PATH 5XXX (NEW)

Number of Credits: 2

Course Description: This course introduces foundational programming skills for pathology applications, with an emphasis on Python, Jupyter Notebooks, and high-performance computing environments. Students will learn core programming concepts (syntax, data structures, and environments) and gain hands-on experience working with biomedical data, including whole-slide imaging, histopathology data, and tabular clinical datasets. The course also introduces key tools and practices such as commonly used Python libraries (e.g., NumPy, pandas, scikit-learn, OpenCV), basic data structures and algorithms, Linux/HPC workflows, and version control using GitHub. Through practical, pathology-relevant examples, students will develop the skills to acquire, process, analyze, and visualize data, and build a foundation for implementing data-driven methods in computational pathology and biomedical informatics.

Prerequisites: None

VI.3 Appendix C

Faculty matrices for all four entities are listed below.

Biomedical Informatics (BMI)					
Name	Rank	Full-Time (FT) or Part-Time (PT)	Instructor Qualification		Courses taught
			Credentials	Years	
Yuan Xue	Assistant Professor	FT	PhD. Information Sciences and Technology, The Pennsylvania State University, 2021	3	BMI 5780: Programming for Biomedical Informatics
Dongjun Chung	Associate Professor	FT	PhD. Biostatistics, University of Wisconsin, 2005	20	BMI 7235: Machine Learning in Bioinformatics
Xia Ning	Professors	FT	PhD. Computer Science and Engineering, University of Minnesota, 2012	10	BMI 5551: Introduction AI/ML in Digital Health
Qin Ma	Professor	FT	PhD. Operational Research and Bioinformatics, University of Georgia, 2010	14	BMI 6YYY: Capstone Design: AI/ML in Digital Health
Courtney Hebert	Associate Professor	FT	MD. Medicine, The Ohio State University, 2005	11	BMI 6YYY: Capstone Design: AI/ML in Digital Health
Kimberly Powell	Associate Professor	FT	PhD. Biomedical Engineering, The Ohio State University, 1992	16	BMI 5552: AI/ML Applications in Medical Imaging
Ping Zhang	Associate Professor	FT	PhD. Computer Science, Temple University, 2013	5	BMI 5553: Predictive Analytics in Electronic Health Records
Amy Hite	Assistant Professor	FT	PhD, Biology, The Ohio State University, 2008	4	BMI 5730: Introduction to Bioinformatics
Lang Li	Professor	FT	PhD. Biostatistics, University of Michigan, 2001	25	BMI 5554: Natural Language Processing in Biomedical Informatics
Computer Science and Engineering (CSE)					
Raghu Machiraju	Professor	FT	Ph.D., Computer and Information Science, Ohio State University, 1996	30	CSE 59YY Capstone Courses for all three specializations
Bryan Weaver	Senior Lecturer	FT	Ph.D., Philosophy, Ohio State University, 2012	12	CSE 5194 (pilot): Ethics in AI
Mohammad Mahdi Khalili	Assistant Professor	FT	Ph.D., Electrical Engineering and Computer Science, University of Michigan, 2020	4	CSE 5052: Survey of Artificial Intelligence for Non-Majors

Proposal for a Masters degree in AI In Medicine (MS-AIM), Apr 20, 2026

Ali AlilooeeDolatabad	Senior Lecturer	FT	Ph.D., Mathematics, Dalhousie University, 2015	9	CSE 6520: Foundations of Applied Artificial Intelligence for Non-Majors
Jim Davis	Professor	FT	Ph.D., Computer Science, Massachusetts Institute of Technology, 2000	24	CSE 5524: Computer Vision for Human-Computer Interaction
Huan Sun	Associate Professor	FT	Ph.D., Computer Science, University of California-Santa Barbara, 2015	6	CSE 5525: Foundations of Speech and Language Processing
Deliang Wang	Professor	FT	Ph.D., Computer Science, University of Southern California, 1991	33	CSE 5526: Introduction to Neural Networks
Hanqi Guo	Associate Professor	FT	Ph.D., Computer Science, Peking University, 2014	7	CSE 5544: Introduction to Data Visualization
Hari Subramoni	Assistant Professor	FT	Ph.D., Computer Information Science	5	CSE 5449: Introduction to High-Performance Deep Learning

Pathology (PATH)					
Zaibo Li	Professor – Clinical – Pathology	FT	PhD. Pathology, University of Rochester, 2002; MD, Beijing Medical University, 1995	19	PATHOL 5XXX: Digital Pathology; PATH 6YYY, Capstone Design: AI-based Diagnostic Systems
Swati Satturwar	Assistant Professor – Clinical – Pathology	FT	MD, Indira Gandhi Medical College, India, 2003	4	PATHOL 5XXX: Digital Pathology; PATHOL 6XXX: Computational Pathology Seminar Series
Giovanni Lujan	Associate Professor – Clinical – Pathology	FT	MD, University of El Salvador, 2004	22	PATHOL 5XXX: Introduction to Pathology Informatics
Steve Oghumu	Associate Professor – Pathology	FT	PhD, Ohio State University, 2010	13	PATHOL 6640: Fundamentals of Oncology; PATHOL 8850: Immunology Seminar Series
Anna Vilgelm	Assistant Professor – Pathology	FT	PhD, Engelhardt Institute of Molecular Biology, Russian Academy of Sciences, and Vanderbilt University Medical Center. 2011	10	PATHOL 6640: Fundamentals of Oncology; PATHOL 5200 Introduction to Anatomical Pathology

Proposal for a Masters degree in AI In Medicine (MS-AIM), Apr 20, 2026

Khalid Niazi	Associate Professor – Pathology	FT	PhD, Uppsala University, 2011	18	PATHOL 5XXX: Computational Pathology in Practice; PATHXXX Advanced Techniques for Computational Pathology
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Radiation Oncology					
Arnab Chakravarti	Professor	FT	MD, University of Virginia, 1995	31	RADONC 5XXX: Radiation Treatment Technologies
Nilendu Gupta	Professor	FT	Ph.D, The Ohio State University, 1995	31	RADONC 5XXX: Diagnostic Imaging
Ashley Cetnar	Associate Professor	FT	PhD, The Ohio State University, 2020	6	RADONC 5XXX: Radiation Safety and Protection
Dominic DiCostanzo	Assistant Professor	FT	PhD, The Ohio State University, 2023	3	RADONC 6YYY, CSE 69YY, Capstone Design: Design of AI-based Diagnostic Systems
Ahmet Ayan	Professor	FT	PhD, University of Iowa, 2004	22	RADONC 6YYY, CSE 69YY, Capstone Design: Design of AI-based Diagnostic Systems
Sun Jun Ma	Assistant Professor	FT	MD, SUNY Buffalo, 2018	8	RADSCIXXXX: Cross Sectional Anatomy
Jany Chan	Research Scientist	FT	PhD, Cornell University	6	RADONC 5XXXProgramming for Radiation Oncology
Simeng Zhu	Assistant Professor	FT	MD, University of Florida, 2018	8	RADONC 5XXX: Artificial Intelligence in Modern and Emerging Therapies
Aline Becker	Research Scientist	FT	MD, Federal University of Para, Brazil, 2001 PhD, Cancer Hospital, Barretos, Brazil , 2015	25	RADONC 5XXX: Artificial Intelligence in Radiation Biology

VI. 4 Appendix D

CVs of all participating faculty are included in the following pages.

Courtney Hebert, M.D., M.S.
220 S Lincoln Tower
1800 Cannon Drive
Columbus, OH 43210
614-688-6549 Office
courtney.hebert@osumc.edu

Last updated: 2/19/2025

Current Position(s)

Associate Professor, College of Medicine, Department of Biomedical Informatics
Division Director, Clinical Informatics and Implementation Science, Department of Biomedical Informatics Physician,
Department of Internal Medicine, Division of Infectious Diseases
Division Director, Learning Health Systems Science, Department of Biomedical Education and Anatomy
Director of Informatics, Applied Health Systems Science for the Lead.Serve.Inspire Curriculum
Co-Chair Research Stakeholder Group
Co-Chair WIMS Advocacy Subcommittee
Associate Program Director, Clinical Informatics Fellowship
The Ohio State University College of Medicine
Columbus, Ohio

Education

National Library of Medicine Fellow, in the Clinical and Translational Informatics Training Program	2012-13
Advanced Fellowship in Infectious Diseases, Health Care Epidemiology, IL	2010-11 University of Chicago,
Fellowship, Infectious Diseases, University of Chicago, IL	2008-10
Residency, Internal Medicine, University of Chicago, IL	2005-08
M.D., (magna cum laude), The Ohio State University, Columbus, OH	2001-05
B.A. in Theology, minor in Biology (cum laude) Georgetown University, Washington, D.C.	1997-01

Academic Appointments

2013 - 2014 Instructor, The Ohio State University, Infectious Diseases.
2013 - 2014 Instructor, The Ohio State University, Biomedical Informatics.
2012 - 2013 Clinical Assistant Professor, The Ohio State University, Infectious Diseases.
2011 - 2013 Postdoctoral Research Fellow, The Ohio State University, College of Medicine.
2014-present Physician, Infectious Diseases, The Ohio State University
2022-present Associate Professor, Biomedical Informatics, The Ohio State University

Selected Honors and Awards

Buckeye Shining Star Award, presented at WIMS Annual Meeting	2024
Department of Biomedical Informatics Award for Excellence in Faculty Teaching	2024
Department of Biomedical Informatics Faculty Award for Excellence in Diversity, Equity and Inclusion Enhancement	2021
Inducted into the Hall of FAME for my work as a committee member in the Faculty, Advancement, Mentoring and Engagement's (FAME's) Clinical Scholarship Committee	2019
College of Medicine Faculty Achievement Award	2015

Residency Honors:

Recognized for excellence in teaching by 3 rd year Pritzker school of medicine students in the spring quarter of 2006	2006-08
<i>Henry Pilger Jenkins Resident Teaching Award</i> Nomination	

Medical School Honors:

Magna Cum Laude Graduate	
Glasgow-Rubin Achievement Citation presented by the American Medical Women's Association to women medical students graduating as top scholars in their class.	2005
Member of Alpha Omega Alpha 2005-	
Phi Kappa Phi Honor Society 2004	

Certification and Licensure

Internal Medicine, American Board of Internal Medicine	2008, 2018
Infectious Disease, American Board of Internal Medicine	2012
Clinical Informatics, American Board of Preventive Medicine	2014
Illinois State Medical License (inactive)	2008-11
Ohio State Medical License (active)	2011-present

Professional Development

Selected Peer-Reviewed Publications

- Schubert C, Bruce E, Karl J, Nahikian-Nelms M, Pennyman N, Rizer M, Vrontos E, Hebert C. Implementing a Novel Interprofessional Clinical Informatics Curriculum. *Comput Inform Nurs*. 2022 Jun 1;40(6):411-418. PMID: [35213472](#); PMCID: PMC9172881.
- Motiwala, T., Zhang, P., Gregory, M., Fareed, N., Ning, X., Coombes, K., Kokanos, G., & Hebert, C. (2022). Review of applied health informatics courses in a multidisciplinary biomedical informatics department. *Learning Health Systems*. <https://doi.org/10.1002/lrh2.10336>
- Bright, T. J., Williams, K. S., Rajamani, S., Tiase, V. L., Senathirajah, Y., Hebert, C., & McCoy, A. B. (2021). Making the case for workforce diversity in biomedical informatics to help achieve equity-centered care: a look at the AMIA First Look Program. *Journal of the American Medical Informatics Association*, 29(1), 171–175. PMID: [34963144](#).
- Hebert C, Ridgway J, Vekhter B, Brown EC, Weber SG, Robicsek A. 2012. "Demonstration of the weighted-incidence syndromic combination antibiogram: an empiric prescribing decision aid." *Infect Control Hosp Epidemiol*. Apr;33(4):381-8. PubMed PMID: [22418634](#).
- Dewart CM, Gao Y, Rahman P, Mbodj A, Hade EM, Stevenson K, Hebert CL. Penicillin allergy and association with ciprofloxacin coverage in community-onset urinary tract infection. *Infect Control Hosp Epidemiol*. 2018 Sep;39(9):1127-1128. Epub 2018 Jul 23. PubMed PMID: [30033886](#).
- Rahman P, Hebert C, Nandi A. ICARUS: minimizing human effort in iterative data completion. *Proceedings of the VLDB Endowment*. 2018 Sep 1;11(13):2263-76. PMCID: [PMC6553872](#)
- Hebert C, Gao Y, Rahman P, Dewart C, Lustberg M, Pancholi P, Stevenson K, Shah N, Hade E. Prediction of antibiotic susceptibility for urinary tract infections in a hospital setting. *Antimicrob Agents Chemother*. 2020 Jun 23;64(7):e02236-19. PMID: [32312778](#)

Selected Grants and Contract Awards

R25LM014223 (PI: Hebert, Zhang)

9/15/2022-8/31/2027

NLM

OSU Summer Internship Program in Biomedical Informatics and Data Science

Goal: To encourage and support students, underrepresented in biomedical informatics and data science, through an interdisciplinary summer internship program.

R01HS027200 (PI: Hebert)

AHRQ

09/30/2019-08/31/2024

GeoHAI: A novel geographic tool for Hospital Acquired Infection visualization and assessment

Goal: The objective of this research is to develop a hospital-acquired infection assessment tool, which incorporates geographic data on the hospital and patient-level data from the electronic health record system, and is useful for hospital infection preventionists in better identifying clusters of hospital-acquired infections.

R01 AI116875 (PI: Hebert)

NIAID

05/01/2015-04/30/2020

Automation and Multi-Site Validation of a Personalized Empiric Antibiotic Advisor

Goal: This study developed an automated tool within the electronic health records to guide antibiotic choice by using microbiology data from the hospital and clinical information from the patient.

AYSE ODABAS, PhD

Ayse.Odabas@osumc.edu

PROFESSIONAL EXPERIENCE

Biomedical Information Specialist 2023 - current

Assistant Professor-Practice 2023 - current

The Ohio State University, Center for Biostatistics(CFB), and Department of Biomedical Informatics(BMI)

- Performs data consultation and analysis for a variety of PCORnet projects and academic feasibility studies, supports study design for grant proposals
- Helps manage the PCORI Common Data Model(CDM), its regulatory and legal requirements, and the IRB process
- Builds and runs queries, generates reports, presents results, utilizing SQL, SAS, Python, Excel, JIRA, AWS, Globus, Microsoft Azure and Databricks, Tableau
- Epic Clarity, Caboodle certified, with intricate knowledge of OSU PCORI CDM data extracted from EHR/Clarity/Caboodle DB
- Collaborates with data analytics teams from PaTH/PCORnet sites across the country
- Supports other members of the data analytics and biostatistics teams in access to and interpretation of EHR data housed in OSU PCORI CDM, Clarity/Caboodle DBs
- Co-teaches BMI 5780 - *Introduction to Biomedical Programming for BMI*
- Conducts skills workshops on Jupyter Lab and Notebooks, Python basics, NumPy, Pandas for BMI Summer Internship. Co-creates an inaugural Data Science Bootcamp for high school students within CFB
- Prepares, records, and teaches an accessible asynchronous online course in Carmen Canvas for Python Programming with Biomedical focus

Software Architect, Engineer, Team Lead 1997 – 2003

Lucent Technologies Columbus, OH

- Led a team of 3-4 software engineers through feature design, implementation, and testing of various wireless telecommunication systems projects
- Coordinated project tasking and reporting across multiple interdisciplinary engineering teams in different locations within the US and abroad

Teaching Faculty 1995 – 1997

The Ohio State University, Department of Computer and Information Science

- Taught Principles of Programming Languages and Introduction to Artificial Intelligence to 60+ undergraduate juniors and seniors per academic year
- Taught a section of, and supervised a team of up to 10 teaching associates for Computer-Assisted Problem Solving, an introductory programming course for 100+ undergraduates
- Developed lesson plans, graded assignments, and held weekly office hours for students

Graduate Research Assistant and Post-Doctoral Researcher 1990 – 1995

The Ohio State University, Division of Medical Informatics, Lab for Knowledge-based Medical Systems

- Completed PhD research with adviser Prof. Jack W. Smith, MD PhD. Designed and implemented a computational model of skill and concept acquisition in the domain of liver disease and liver biopsy interpretation

Graduate Teaching Assistant 1989 – 1990

The Ohio State University, Department of Computer and Information Science

- Taught a section of Computer-Assisted Problem Solving for 20+ undergraduate students per term

EDUCATION

Ph.D. in Computer and Information Science, The Ohio State University 1995

M.S. in Computer and Information Science, The Ohio State University 1989

B.S. in Computer Engineering, Bogazici University, Istanbul, Turkey 1987

Ping Zhang
The Ohio State University
1800 Cannon Drive, Columbus, OH 43210
zhang.10631@osu.edu 614-293-9286 <https://cse.osu.edu/people/zhang.10631>

A. Research Interests

I am broadly interested in **data mining**, **machine learning**, and their applications to real-world problems, especially in **biomedical informatics** and **computational medicine**.

B. Education

B.S., 2004	Computer Science	Huazhong University of Science & Technology	Wuhan, China
M.S., 2007	Computer Science	Huazhong University of Science & Technology	Wuhan, China
Ph.D., 2013	Computer Science	Temple University	Philadelphia, PA

C. Appointments

2023 – present	Associate Professor, Department of Biomedical Informatics and Department of Computer Science and Engineering, The Ohio State University, Columbus, OH
2019 – 2023	Assistant Professor, Department of Biomedical Informatics and Department of Computer Science and Engineering, The Ohio State University, Columbus, OH
2013 – 2018	Research Staff Member and Master Inventor, IBM T.J. Watson Research Center, Yorktown Heights, NY
2012	Research Intern, Siemens Corporate Research, Princeton, NJ
2011 – 2012	Research Intern, GlaxoSmithKline, King of Prussia, PA

D. Selected Honors and Awards

2022	NSF CAREER Award
2021	Best Paper Candidate, IEEE International Conference on Data Mining (ICDM)
2021	Award for Excellence in Mentoring, The Ohio State University (OSU)
2020 – present	Fellow of the American Medical Informatics Association (AMIA)
2018	IBM Master Inventor Award
2018	IBM Outstanding Technical Achievement Award for Cognitive-driven Chronic Disease Management Solution Suite
2016	IBM Outstanding Technical Achievement Award for Patient Similarity Analytics

E. Selected Peer-Reviewed Publications

Five publications most closely related to the proposed project

1. Yin C, Liu R, Zhang D, **Zhang P**. Identifying sepsis subphenotypes via time-aware multi-modal auto-encoder. In *Proceedings of the 26th ACM SIGKDD International Conference on Knowledge Discovery & Data Mining (KDD)*, pages 862–872, 2020.
2. Zhang D, Yin C, Hunold KM, Jiang X, Caterino JM, **Zhang P**. An interpretable deep-learning model for early prediction of sepsis in the emergency department. *Patterns*, 2(2):100196, 2021.
3. Li R, Yin C, Yang S, Qian B, **Zhang P**. Marrying medical domain knowledge with deep learning on electronic health records: a deep visual analytics approach. *Journal of Medical Internet Research (JMIR)*, 22(9):e20645, 2020. (Featured on AMIA 2021 Year-in-Review)
4. Yin C, Liu R, Caterino J, **Zhang P**. Deconfounding actor-critic network with policy adaptation for dynamic treatment regimes. In *Proceedings of the 28th ACM SIGKDD Conference on Knowledge Discovery & Data Mining (KDD)*, pages 2316–2326, 2022.
5. Pham T, Yin C, Mehta L, Zhang X, **Zhang P**. Cardiac complication risk profiling for cancer survivors via multi-view multi-task learning. In *Proceedings of the 21st IEEE International Conference on Data Mining (ICDM)*, pages 499–508, 2021.

Five other significant publications

1. Liu R, Wei L, **Zhang P**. A deep learning framework for drug repurposing via emulating clinical trials on real-world patient data. *Nature Machine Intelligence*, 3(1):68–75, 2021. (Top 1% attention score of all research outputs ever tracked by Altmetric)
2. Pham TH, Qiu Y, Zeng J, Xie L, **Zhang P**. A deep learning framework for high-throughput mechanism-driven phenotype compound screening and its application to COVID-19 drug repurposing. *Nature Machine Intelligence*, 3(3):247–257, 2021.
3. Guan Y, Li H, Yi D, Zhang D, Yin C, Li K, **Zhang P**. A survival model generalized to regression learning algorithms. *Nature Computational Science*, 1(6):433–440, 2021.
4. Gao Y, Fokoue A, Luo H, Iyengar A, Dey S, **Zhang P**. Interpretable drug target prediction using deep neural representation. In *Proceedings of the 2018 International Joint Conference on Artificial Intelligence (IJCAI)*, pages 3371–3377, 2018.
5. Yin C, Moroi S, **Zhang P**. Predicting age-related macular degeneration progression with contrastive attention and time-aware LSTM. In *Proceedings of the 28th ACM SIGKDD Conference on Knowledge Discovery & Data Mining (KDD)*, pages 4402–4412, 2022.

F. Selected Grants

1. **CAREER: Developing actionable methods for observational health data**, NSF IIS. PI. 04/01/2022–03/31/2027. Amount of Awards: \$556,828
2. **A statistical network pharmacology approach for early detection of adverse drug events**, NIH NIGMS R01. PI, with co-PI Pengyue Zhang. 09/15/2021–08/31/2024. Amount of Award: \$1,172,134
3. **SenSE: Multimodal biosensors and data driven methods for explainable analytics for a proactive approach to heart failure care**, NSF CBET. Co-PI, with PI Emre Ertin. 10/01/2020–09/30/2023. Amount of Award: \$750,000
4. **OSU summer internship program in biomedical informatics and data science**, NIH NLM R25. Co-PI, with PI Courtney Hebert. 09/15/2022–08/31/2027. Amount of Award: \$628,344

G. Synergistic Activities

1. **Industry experience:** At IBM, lead the research and development of big data analytics for clinical decision support. Contribute to AI products such as Watson for Drug Discovery and Watson for Patient Safety. Deploy IBM research solutions to health facilities such as Beijing Anzhen Hospital and Beijing Tiantan Hospital. File 28 patent applications (19 of them are granted as patents), and win an IBM Master Inventor Award in 2018.
2. **Academic experience:** At OSU, lead Artificial Intelligence in Medicine (AIMed) Lab. Contribute AI tools for clinical decision support at the OSU Wexner Medical Center for heart attack, and at Nationwide Children's Hospital for pediatric trauma. Win an NSF CAREER Award in 2022.
3. **Teaching:** Regularly teach "Introduction to Data Mining" (CSE 5243), a mixed undergraduate & graduate-level core class for computer science and data science majors across campus. Create a new class "AI in Medicine" (CSE 6539) for CSE and BMI graduate students. Create a new class "Trustworthy Data Science" (CSE 6249) for CSE graduate students.
4. **Conference organizer:** KDD 2018 (media and publicity co-chair), KDD 2019 (media and publicity co-chair), SDM 2020 (local chair), SDM 2023 (workshop co-chair)
5. **Journal editorial board:** Associate Editor for *BMC Digital Health*, *BMC Medical Informatics and Decision Making*, and *Journal of Healthcare Informatics Research*.
6. **Reviewer:** 2 books, >30 scientific journals (e.g., *Nature Communication*, *Nature Methods*, *Nature Medicine*, *Lancet Digital Health*, *Nature Machine Intelligence*, *Machine Learning*, *IEEE Transactions on Pattern Analysis and Machine Intelligence*), >50 academic conferences (e.g., ICML, NeurIPS, ICLR, KDD, IJCAI, AAAI, AMIA).

Yuan Xue

ASSISTANT PROFESSOR · THE OHIO STATE UNIVERSITY

340D Lincoln Tower, 1800 Cannon Drive, Columbus, OH 43210, USA

✉ yuan.xue@osumc.edu | 🌐 yuan-xue.com | 🎓 Google Scholar

Research Interests

My research interests encompass computer vision and deep learning, with a particular emphasis on biomedical image analysis through the application of generative models and data-efficient learning. I have a strong background in interdisciplinary research, leveraging deep learning techniques to drive innovation across various domains. My recent focus has shifted towards the development of foundation models and the exploration of multi-modal learning, particularly in the realm of vision-language interaction with multi-modal large language models. I am passionate about harnessing the transformative power of AI to revolutionize both clinical and scientific medicine. Looking ahead, I am driven by the goal of transforming pioneering AI research into novel diagnostic and prognostic tools, thereby shaping the future of clinical medicine in uncharted ways.

Education

The Pennsylvania State University, University Park

University Park, PA, USA

Ph.D. IN INFORMATION SCIENCES AND TECHNOLOGY (IST)

Aug. 2018 - May 2021

- Develop and apply computer vision and machine learning techniques, especially deep learning algorithms, in vision and medical image analysis tasks. Actively participate in interdisciplinary research including Bioengineering, Mineral Engineering, Materials Science, and Architecture.
- Dissertation Title: Deep Generative Models for Medical Images and Beyond.
Advisor: Prof. Sharon X. Huang

Lehigh University

Bethlehem, PA, USA

M.S. IN COMPUTER SCIENCE (CS)

Sept. 2015 - Aug. 2018

- Deep Learning for Medical Image Analysis
Advisor: Prof. Sharon X. Huang

Huazhong University of Science and Technology (HUST)

Wuhan, Hubei, China

B.S. IN ELECTRONIC ENGINEERING (EE)

Sept. 2011 - Jun. 2015

- Multi-Armed Bandit algorithms for optimized resource allocation in wireless communication.
Advisor: Prof. Pan Zhou

Professional Experience

Department of Biomedical Informatics

The Ohio State University

ASSISTANT PROFESSOR

July 2023 - present

- Medical Imaging Informatics and Artificial Intelligence

Image Analysis and Communications Lab (IACL)

Johns Hopkins University

POSTDOCTORAL FELLOW

Aug. 2021 - July 2023

- Investigate Brain MRI preprocessing steps including MR image harmonization, missing contrast synthesis, registration, super resolution, and the quality assurance of processed images. Also manage and contribute to research projects such as thalamus nuclei segmentation, ventricle segmentation, meningeal layers surface reconstruction, and volumetric analysis.

Principal Investigator: Prof. Jerry L. Prince

Honors & Awards

- Spotlight of CVM Journal 2022
- Best Paper Award MICCAI DALI 2022
- MEDIA Best Paper Award Runner Up 2020

• Best Presentation Award	MICCAI 2019
• Outstanding Thesis	HUST, 2015
• Excellent Undergrad Student	HUST, 2015

Professional Services

Organizer for Workshops

• Program Chair and organizer of the MICCAI Workshop on Advancing Data Solutions in Medical Imaging AI (ADSMI)	2024
• Program Chair and organizer of the 3rd MICCAI Workshop on Data Augmentation, Labeling, and Imperfections (DALI)	2023
• Program Co-Chair and co-organizer of the 2nd MICCAI Workshop on Data Augmentation, Labeling, and Imperfections (DALI)	2022
• Editorial Chair and co-organizer of the 1st MICCAI Workshop on Data Augmentation, Labeling, and Imperfections (DALI)	2021

Editor for Journals

• Computerized Medical Imaging and Graphics	Guest Editor
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Area Chair for International Conferences

• International Conference on Medical Image Computing and Computer-Assisted Intervention (MICCAI)	2024
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Reviewer for Journals

- IJCV, CVIU, TMI, Medical Image Analysis, TNNLS, Neurocomputing, JBHI, IEEE Access, TWC, etc.

Reviewer for International Conferences

- CVPR, ECCV, ICCV, ICML, ICLR, NeurIPS, AAAI, MICCAI, etc.

Invited Talks & Presentations

• “Advancing Healthcare through Generative AI: Theory and Practice,”	Stony Brook University, February 2024
• “The Emergence of Generative AI: Theory and Practice,”	Amazon, January 2024
• “Advancing Healthcare through Generative AI: Theory and Practice,”	Ohio State University, January 2024
• “Generalizable Learning in Medical Image Analysis,”	National Library of Medicine, July 2023
• “Generalizable Learning in Medical Image Analysis,”	University of Kentucky, April 2023
• “Generalizable Learning in Medical Image Analysis,”	Ohio State University, March 2023
• “Deep Generative Models for Medical Images and Beyond,”	Du’Shu Forum/The 2nd Youth Academic Forum, November 2022
• “Bi-directional Synthesis of Pre- and Post-contrast MRI via Guided Feature Disentanglement,”	MICCAI SASHIMI, Singapore, September 2022
• “Medical Image Segmentation and Synthetic Augmentation,”	University of Wisconsin-Madison, April 2021
• “Deep Generative Models for Medical Images and Beyond,”	Johns Hopkins University, April 2021
• “Deep Generative Models for Medical Images and Beyond,”	University of Chicago, April 2021
• “Improved Disease Classification in Chest X-Rays with Transferred Features from Report Generation,”	IPMI, HKUST, June 2019
• “SegAN: Adversarial Network with Multi-scale L1 Loss for Medical Image Segmentation,”	National Library of Medicine, September 2017

Lang Li

Department of Biomedical Informatics
College of Medicine
The Ohio State University
Columbus, OH 43210

A. Professional Preparation

B.A., 1992 Wuhan University of Technology
M.A., 1996 University of New Mexico
Ph.D., 2001 University of Michigan

B. Appointments

1994-1995 Teaching Assistant, Department of Mathematics & Statistics, University of New Mexico
1996 Teaching Assistant, Department of Biostatistics, University of Michigan, MI
1999 Summer Intern, Clinical Pharmacology Department, AIZA Corporation, Clinical Pharmacology Department, Mountain View, CA
1997-2001 Research Assistant, Comprehensive Cancer Center, University of Michigan, MI
2001 Assistant Professor of the Department of Medicine, Indiana University, Indianapolis, IN
2001 Adjunct Assistant Professor of the Department of Public Health, Indiana University, IN
2001 Adjunct Scientist of the Regenstrief Institute, IN
2001 Adjunct Assistant Professor of the Clinical Pharmacology, IN
2007-2010 Associate Professor of the Department of Medicine, Indiana University, IN
2007 Director of Bioinformatics Core, School of Medicine, Indiana University, IN
2010 Associate Professor of the Department of Medical and Molecular Genetics, IN
2011 Associate Director of the Center for Computational Biology and Bioinformatics, IN
2011 Associate Director of the Indiana Institute of Personalized Medicine, IN
2013 Interim Director of Center for Computational Biology and Bioinformatics, IN
2014 Director of Center for Computational Biology and Bioinformatics, Indiana University, IN
2014 Professor of Medical and Molecular Genetics, Indiana University, IN
2017 Professor and Chair of Department of Biomedical Informatics, The Ohio State University, OH

C. Products

Five products most closely related to the proposed project

1. **Li L**, Yu M., Chin R., Lucksiri A., Flockhart D., and Hall S. Drug-drug interaction prediction: A Bayesian meta-analysis approach. *Statistics in Medicine*, 2007, 26, 3700 - 3721.
2. Goswami CP, Cheng L, Alexander PS, Singal A, and **Li L**. A New drug combinatory effect prediction algorithm on the cancer cell based on gene expression and dose-response curve. *CPT: pharmacometrics & systems pharmacology*. 2015, 4(2):80-90.
3. Duke J., Han X., Wang Z., Overhage M., Subhadarshini A., Karnik SD, Rocha L.M., Li X., Strother M., Flockhart D., Quinney SK, and **Li L**. Literature based drug interaction discovery and its validation in the electronic medical record system. *PLoS Computational Biology*, 2012, 8(8):e1002614.
4. Bansal M, Yang J, Karan C, **Li L**, and NCI-DREAM consortium. Predictive activity of drug combinations through crowdsourcing. *Nature Biotechnology*, 2014, 32:1213-22.
5. Li J, Huo Y, Wu X, Liu E, Zeng Z, Tian Z, Fan, K, Stover D, Cheng L, and **Li L**. Essentiality and transcriptome-enriched pathway scores predict drug-combination synergy. *Biology*, 2020, 9(9), 278. <https://doi.org/10.3390/biology9090278>.

Five other significant products

1. Wang Z, Kim S, Quinney SK, Guo Y, Hall SD, Rocha LM, and **Li L**. Literature mining on pharmacokinetics numerical data: a feasibility study. *Journal of Biomedical Informatics*, 2009, 42: 725-735.
2. Shen C, Huang Y, Liu Y, Wang G, Zhao Y, Wang Z, Teng M, Wang Y, Flockhart DA, Skaar TC, Yan P, Nephew KP, Huang TH, **Li L**. A modulated empirical Bayes model for identifying topological and temporal estrogen receptor a regulatory networks in breast cancer. *BMC Systems Biology*. 2011 May 9; 5:67.
3. Wu HY, Karnik SD, Subhadarshini A, Wang Z, Philips S, Han X, Chiang C, Liu L, Boustani M, Rocha LM, Flockhart D, Quinney SK, and **Li L**. An Integrated Pharmacokinetics Ontology and Corpus for Text Mining. *BMC Bioinformatics*, 2013, 14:35.
4. Chiang CW, Zhang P, Wang X, Wang L, Zhang S, Ning X, Shen L, Quinney SK, **Li L**. Translational high-dimensional drug interaction discovery and validation using health record databases and pharmacokinetics models. *Clinical Pharmacology and Therapeutics*, 2018 Feb; 103(2):287-295.
5. Wu HY, Shendre A, Zhang S, Zhang P, Wang L, Zeruesenay D, Rocha LM, Shatkay H, Quinney SK, Ning X and **Li L**. Translational knowledge discovery between drug interaction and pharmacogenetics. *Clinical Pharmacology and Therapeutics*, 2020 Apr; 107(4): 886-902.

D. Synergistic Activities

Conference Organization: International Conference on Intelligent Biology and Medicine 2012-2020 (Steering Committee).

Grant Reviewer: NIH Study Sections (BCHI standing member, ZCA1 SRLB-V, ZGM1 BBCB, ZRG1 BST-T, ZHL1 CSR-H).

Reviewers: >20 scientific journals (e.g., *Nature Method*, *Nature Biotechnology*, *Bioinformatics*, *Biostatistics*, *Biometrics*, *PLoS Computational Biology*, *BMC Bioinformatics*, *Clinical Pharmacology and Therapeutics*, *Pharmacometrics and System Pharmacology*, and etc.).

E. Collaborators and Other Affiliations

Collaborators and Co-Editors

Collaborators: Li Shen (IU), Yunlong Liu (IU), Jamie Renbarger (IU), Bryan P. Schneider (IU), Todd Skaar (IU), Sara K. Quinney (IU), Luis Rocha (IU), Donglin Zeng (UNC), Sean Hennessy (UPenn), Hagit Shatkay (U. of Delaware).

Co-Editors: I am an Associate Editor of *Pharmacometrics and System Pharmacology* and *IEEE Computational Biology and Bioinformatics*.

Thesis Advisor, Postgraduate-Scholar Sponsor, Undergraduate Research Advisor

Post-doc fellows: Seongho Kim, Sara K. Quinney (female), Lijun Cheng (female), Weidan Cao (female), Aditi Shendre (female), Xue Wu (female), and Lei Wang

Ph.D. Students: Jihao Zhou (U of Mich), Zhiping Wang (IU), Xu Han (IU), Chien-Wei Chiang (IU), Hengyi Wu (IU), Pengyue Zhang (IU), Aida Yazdanparast (IU), Enze Liu (IU), Yang Huo (IU), Zitu Munstair (OSU), Yuxi Zhu (OSU), Shan Tang (OSU), Kunjie Fan (OSU), Birkan Gokbag (OSU) and Shuai Shao (OSU).

IDENTIFYING INFORMATION:

NAME: Guo, Hanqi

POSITION TITLE: Associate Professor

PRIMARY ORGANIZATION AND LOCATION: The Ohio State University, Department of Computer Science and Engineering, Columbus, Ohio, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
Argonne National Laboratory, Lemont, Illinois, United States	Postdoctoral Fellow	07/2014 - 07/2017	Mathematics and Computer Science
Peking University, Beijing, Not Applicable, N/A, China	PHD	07/2014	Computer Science
Beijing University of Posts and Telecommunications, Beijing, Not Applicable, N/A, China	BS	07/2009	Mathematics and Applied Mathematics

Appointments and Positions

2022 - present	Associate Professor, The Ohio State University, Department of Computer Science and Engineering, Columbus, Ohio, United States
2022 - present	Joint Appointment, Argonne National Laboratory, Mathematics and Computer Science Division, Lemont, Illinois, United States
2021 - 2022	Computer Scientist, Argonne National Laboratory, Mathematics and Computer Science Division, Lemont, Illinois, United States
2019 - 2022	Scientist At-Large, University of Chicago, Consortium for Advanced Science and Engineering, Chicago, Illinois, United States
2017 - 2022	Fellow, Northwestern University, Northwestern University Argonne National Laboratory Institute for Science and Engineering, Evanston, Illinois, United States
2017 - 2021	Assistant Computer Scientist, Argonne National Laboratory, Mathematics and Computer Science Division, Lemont, Illinois, United States

Products**Products Most Closely Related to the Proposed Project**

1. Wurster S, Xiong T, Shen H, Guo H, Peterka T. Adaptively Placed Multi-Grid Scene Representation Networks for Large-Scale Data Visualization. IEEE Transactions on Visualization and Computer Graphics. 2024; 30(1):965-974. Available from: <https://ieeexplore.ieee.org/document/10297599/> DOI: 10.1109/TVCG.2023.3327194
2. Wurster S, Guo H, Shen H, Peterka T, Xu J. Deep Hierarchical Super Resolution for Scientific Data. IEEE Transactions on Visualization and Computer Graphics. 2023 December; 29(12):5483-5495. Available from: <https://ieeexplore.ieee.org/document/9920542/> DOI: 10.1109/TVCG.2022.3214420
3. Zhang Y, Guo H, Shang L, Wang D, Peterka T. A Multi-Branch Decoder Network Approach to

Adaptive Temporal Data Selection and Reconstruction for Big Scientific Simulation Data. IEEE Transactions on Big Data. 2022 December 1; 8(6):1637-1649. Available from: <https://ieeexplore.ieee.org/document/9464670/> DOI: 10.1109/TBDATA.2021.3092174

4. Shi N, Xu J, Wurster S, Guo H, Woodring J, Van Roekel L, Shen H. GNN-Surrogate: A Hierarchical and Adaptive Graph Neural Network for Parameter Space Exploration of Unstructured-Mesh Ocean Simulations. IEEE Transactions on Visualization and Computer Graphics. 2022; :1-1. Available from: <https://ieeexplore.ieee.org/document/9751203/> DOI: 10.1109/TVCG.2022.3165345
5. Shi N, Xu J, Li H, Guo H, Woodring J, Shen H. VDL-Surrogate: A View-Dependent Latent-based Model for Parameter Space Exploration of Ensemble Simulations. IEEE Transactions on Visualization and Computer Graphics. 2022; :1-11. Available from: <https://ieeexplore.ieee.org/document/9904429/> DOI: 10.1109/TVCG.2022.3209413

Other Significant Products, Whether or Not Related to the Proposed Project

1. Yan L, Guo H, Peterka T, Wang B, Wang J. TROPHY: A Topologically Robust Physics-Informed Tracking Framework for Tropical Cyclones. IEEE Transactions on Visualization and Computer Graphics. 2023; :1-11. Available from: <https://ieeexplore.ieee.org/document/10309869/> DOI: 10.1109/TVCG.2023.3326905
2. Hanqi Guo, Ningyu Mao, Xiaoru Yuan. WYSIWYG (What You See is What You Get) Volume Visualization. IEEE Transactions on Visualization and Computer Graphics. 2011 December; 17(12):2106-2114. Available from: <http://ieeexplore.ieee.org/document/6064975/> DOI: 10.1109/TVCG.2011.261
3. Guo H, He W, Seo S, Shen H, Constantinescu E, Liu C, Peterka T. Extreme-Scale Stochastic Particle Tracing for Uncertain Unsteady Flow Visualization and Analysis. IEEE Transactions on Visualization and Computer Graphics. 2019; 25(9):2710-2724. Available from: <https://ieeexplore.ieee.org/document/8419325/> DOI: 10.1109/TVCG.2018.2856772
4. Zhang J, Guo H, Hong F, Yuan X, Peterka T. Dynamic Load Balancing Based on Constrained K-D Tree Decomposition for Parallel Particle Tracing. IEEE Transactions on Visualization and Computer Graphics. 2018; 24(1):954-963. Available from: <http://ieeexplore.ieee.org/document/8017633/> DOI: 10.1109/TVCG.2017.2744059
5. Xu J, Guo H, Shen H, Raj M, Wurster S, Peterka T. Reinforcement Learning for Load-Balanced Parallel Particle Tracing. IEEE Transactions on Visualization and Computer Graphics. 2023; 29(6):3052-3066. Available from: <https://ieeexplore.ieee.org/document/9706326/> DOI: 10.1109/TVCG.2022.3148745

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not limited to current, pending, and other support (both foreign and domestic) as defined in 42 U.S.C. § 6605.

I also certify that, at the time of submission, I am not a party to a malign foreign talent recruitment program.

Misrepresentations and/or omissions may be subject to prosecution and liability pursuant to, but not

limited to, 18 U.S.C. §§ 287, 1001, 1031 and 31 U.S.C. §§ 3729-3733 and 3802.

Certified by Guo, Hanqi in SciENcv on 2024-09-18 23:57:38

IDENTIFYING INFORMATION:

NAME: Machiraju, Raghu K

ORCID iD: <https://orcid.org/0000-0002-8101-8119>

POSITION TITLE: Professor

PRIMARY ORGANIZATION AND LOCATION: The Ohio State University, Computer Science and Engineering, Bioinformatics, Pathology, Columbus, Ohio, United States**Professional Preparation:**

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
The Ohio State University, Columbus, Ohio, US	PhD	08/1996	Computer and Information Science
Indian Institute of Science, Bangalore, Karnataka, India	MENG	05/1984	Computer Science and Automation
University of Delhi, New Delhi, Not Applicable, N/A, India	BENG	06/1982	Electrical Engineering

Appointments and Positions

2000 - present Professor, The Ohio State University, Computer Science and Engineering, Bioinformatics, Pathology, Columbus, Ohio, United States

2024 - 2026 Visiting Professor, Indian Institute of Technology - Bombay, Mumbai, Maharashtra, India

1996 - 1999 Assistant Professor, Mississippi State University, NSF Engineering Research Center on Computational Field Simulation, Starkville, Mississippi, United States

Products**Products Most Closely Related to the Proposed Project**

1. Aljuhani A, Casulekha I, Chan J, Liebner D, Machiraju R. Uncertainty Aware Sampling Framework of Weak-Label Learning for Histology Image Classification. International Conference on Medical Image Computing and Computer-Assisted Intervention. pp. 366-376; 2022 September 15; Singapore.
2. Kulkarni C, Chan J, Fosler-Lussier E, Machiraju R. Learning Latent Structures for Cross Action Phrase Relations in Wet Lab. 59th Annual Meeting of the Association for Computational Linguistics and the 11th International Joint Conference on Natural Language Processing. pp. 6737-6750; 2021 August 17.
3. Jain A, Awan A, Aljuhani A, Hashmi J, Anthony Q, Subramoni H, Panda D, Machiraju R, Parwani A. GEMS: GPU-Enabled Memory-Aware Model-Parallelism System for Distributed DNN Training. SC20: International Conference for High Performance Computing, Networking, Storage and Analysis; 2020 December 10.
4. Janoos F, Singh S, Machiraju R, Wells WM, Mórocz IA. State-space models of mental processes from fMRI. Inf Process Med Imaging. 2011;22:588-99. PubMed Central PMCID: [PMC4011193](https://pubmed.ncbi.nlm.nih.gov/PMC4011193/).

5. Karageorgos GM, Cho S, McDonough E, Chadwick C, Ghose S, Owens J, Jung KJ, Machiraju R, West R, Brooks JD, Mallick P, Ginty F. Deep learning-based automated pipeline for blood vessel detection and distribution analysis in multiplexed prostate cancer images. *Front Bioinform.* 2023;3:1296667. PubMed Central PMCID: [PMC10844485](#).

Other Significant Products, Whether or Not Related to the Proposed Project

1. Ji X, Shen HW, Ritter A, Machiraju R, Yen PY. Visual Exploration of Neural Document Embedding in Information Retrieval: Semantics and Feature Selection. *IEEE Trans Vis Comput Graph.* 2019 Jun;25(6):2181-2192. PubMed PMID: [30892213](#).
2. Kaewprag P, Newton C, Vermillion B, Hyun S, Huang K, Machiraju R. Predictive models for pressure ulcers from intensive care unit electronic health records using Bayesian networks. *BMC Med Inform Decis Mak.* 2017 Jul 5;17(Suppl 2):65. PubMed Central PMCID: [PMC5506589](#).
3. Li Q, Zachmann G, Feng D, Huang K, Machiraju R. 2013 IEEE Scientific Visualization Contest winner: Observing genomics and phenotypical patterns in the developing mouse brain. *IEEE Comput Graph Appl.* 2014 Sep-Oct;34(5):88-97. PubMed PMID: [25379583](#).
4. Dey V, Machiraju R, Ning X. Improving Compound Activity Classification via Deep Transfer and Representation Learning. *ACS Omega.* 2022 Mar 22;7(11):9465-9483. PubMed Central PMCID: [PMC8945064](#).
5. Eicher T, Spencer KD, Siddiqui JK, Machiraju R, Mathé EA. IntLIM 2.0: identifying multi-omic relationships dependent on discrete or continuous phenotypic measurements. *Bioinform Adv.* 2023;3(1):vbad009. PubMed Central PMCID: [PMC10010601](#).

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not limited to current, pending, and other support (both foreign and domestic) as defined in 42 U.S.C. § 6605.

I also certify that, at the time of submission, I am not a party to a malign foreign talent recruitment program.

Misrepresentations and/or omissions may be subject to prosecution and liability pursuant to, but not limited to, 18 U.S.C. §§ 287, 1001, 1031 and 31 U.S.C. §§ 3729-3733 and 3802.

Certified by Machiraju, Raghu K in SciENcv on 2024-06-19 14:03:25

IDENTIFYING INFORMATION:**NAME:** Ning, Xia**POSITION TITLE:** Professor**PRIMARY ORGANIZATION AND LOCATION:** Biomedical Informatics, Computer Science and Engineering, The Ohio State University, Columbus, Ohio, United States**Professional Preparation:**

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
The Ohio State University, Columbus, Ohio, United States	MBA	08/2024	Business Administration
University of Minnesota, Twin Cities, Minneapolis, Minnesota, United States	PHD	06/2012	Computer Science & Engineering
University of Minnesota, Twin Cities, Minneapolis, Minnesota, United States	MS	07/2009	Computer Science & Engineering
University of Minnesota, Twin Cities, Minneapolis, Minnesota, United States	MS	04/2009	Statistics
Zhijiang University, Hangzhou, Zhejiang, China	BS	06/2005	Computer Science

Appointments and Positions

2023 - present Professor, Biomedical Informatics, Computer Science and Engineering, The Ohio State University, Columbus, Ohio, United States

2024 - present Professor (courtesy), Division of Medicinal Chemistry and Pharmacognosy, College of Pharmacy, The Ohio State University, Columbus, Ohio, United States

2022 - present Associate Director of Biomedical Informatics, Center for Translational Science Institute (CTSI), The Ohio State University, Columbus, Ohio, United States

2022 - present Division Chief on AI in Digital Health, Biomedical Informatics Department, The Ohio State University, Columbus, Ohio, United States

2020 - 2023 Associate Professor, Biomedical Informatics, Computer Science and Engineering, The Ohio State University, Columbus, Ohio, United States

2020 - 2023 Co-Director, Computational Health and Life Sciences Community of Practice, Translational Data Analytics Institute (TDAI), The Ohio State University, Columbus, Ohio, United States

2018 - 2020 Assistant Professor, Biomedical Informatics, Computer Science and Engineering, The Ohio State University, Columbus, Ohio, United States

2014 - 2018 Assistant Professor, Computer and Information Science, Indiana University - Purdue University Indianapolis, Indianapolis, Indiana, United States

2012 - 2014 Research Staff Member, Autonomic Management Department, NEC Labs America, Princeton, New Jersey, United States

Products

Products Most Closely Related to the Proposed Project

1. Chen Z, Min MR, Parthasarathy S, Ning X. A Deep Generative Model for Molecule Optimization via One Fragment Modification. Nat Mach Intell. 2021 Dec;3(12):1040-1049. PubMed Central PMCID: [PMC8856604](#).
2. Chen Z, Ayinde OR, Fuchs JR, Sun H, Ning X. G(2)Retro as a two-step graph generative models for retrosynthesis prediction. Commun Chem. 2023 May 30;6(1):102. PubMed Central PMCID: [PMC10229662](#).
3. Chen Z, Zhang B, Guo H, Emani P, Clancy T, Jiang C, Gerstein M, Ning X, Cheng C, Min MR. Binding peptide generation for MHC Class I proteins with deep reinforcement learning. Bioinformatics. 2023 Feb 3;39(2) PubMed Central PMCID: [PMC9907221](#).
4. Lawrence PJ, Ning X. Improving MHC class I antigen-processing predictions using representation learning and cleavage site-specific kernels. Cell Rep Methods. 2022 Sep 19;2(9):100293. PubMed Central PMCID: [PMC9499997](#).
5. Yu B, Baker FN., Chen Z, Ning X, Sun H. LlaSMol: Advancing Large Language Models for Chemistry with a Large-Scale, Comprehensive, High-Quality Instruction Tuning Dataset. Conference on Language Modeling. 2024 October.

Other Significant Products, Whether or Not Related to the Proposed Project

1. Ioannidis VN, Song X, Manchanda S, Li M, Pan X, Zheng D, Ning X, Zeng X, Karypis G. DRKG -- drug repurposing knowledge graph for COVID-19. <https://github.com/gnn4dr/DRKG/blob/master/DRKG%20Drug%20Repurposing%20Knowledg> 2020.
2. Lawrence PJ, Burns B, Ning X. Enhancing drug and cell line representations via contrastive learning for improved anti-cancer drug prioritization. NPJ Precis Oncol. 2024 May 18;8(1):106. PubMed Central PMCID: [PMC11102516](#).
3. Chen Z, Min M, Guo H, Chen C, Clancy T, Ning X. T-Cell Receptor Optimization with Reinforcement Learning and Mutation Policies for Precision Immunotherapy. International Conference on Research in Computational Molecular Biology. 2023.
4. Chen Z, Peng B, Ioannidis VN. A knowledge graph for clinical trials – CTKG. Scientific Reports. 2022 February; 12(1):4724.
5. Chen Z, Min MR, Ning X. Ranking-Based Convolutional Neural Network Models for Peptide-MHC Class I Binding Prediction. Front Mol Biosci. 2021;8:634836. PubMed Central PMCID: [PMC8165219](#).

NSF BIOGRAPHICAL SKETCH

NAME: Wang, DeLiang

POSITION TITLE & INSTITUTION: Professor, Ohio State University

(a) PROFESSIONAL PREPARATION

INSTITUTION	LOCATION	MAJOR / AREA OF STUDY	DEGREE (if applicable)	YEAR YYYY
Peking University	Beijing, Beijing	Computer Science	BS	1983
Peking University	Beijing, Beijing	Computer Science	MS	1986
University of Southern California	Los Angeles, CA	Computer Science	PHD	1991

(b) APPOINTMENTS

2001 - present Professor, Ohio State University, Department of Computer Science & Engineering and Center for Cognitive and Brain Sciences, Columbus, OH

2007 - present Chief Scientist, Elevox, Shenzhen

2015 - 2019 Visiting Professor, Northwestern Polytechnical University, Center of Intelligent Acoustics and Immersive Communications, Xi'an

2014 - 2014 Visiting Scholar, Starkey Hearing Technologies, Eden Prairie, MN

2006 - 2007 Visiting Scholar, Oticon, Copenhagen

1998 - 1999 Visiting Scholar, Harvard University, Department of Psychology, Cambridge, MA

1997 - 2001 Associate Professor, Ohio State University, Ohio State University, Columbus, OH

1995 - 1995 Visiting Research Fellow, University of Sheffield, Department of Computer Science, Sheffield

1991 - 1997 Assistant Professor, Ohio State University, Ohio State University, Columbus, OH

1988 - 1991 Research Assistant, University of Southern California, Department of Computer Science, Los Angeles, CA

(c) PRODUCTS

Products Most Closely Related to the Proposed Project

1. Wang Z, Wang P, Wang D. Complex spectral mapping for single- and multi-channel speech enhancement and robust ASR. IEEE/ACM Transactions on Audio, Speech, and Language Processing. 2020; 28:1778-1787.
2. Wang Z, Wang D. Deep learning based target cancellation for speech dereverberation. IEEE/ACM Transactions on Audio, Speech, and Language Processing. 2020; 28:941-950.
3. Liu Y, Wang D. Divide and conquer: A deep CASA approach to talker-independent monaural speaker separation. IEEE/ACM Transactions on Audio, Speech, and Language Processing. 2019; 27:2092-2102.
4. Wang Z, Zhang X, Wang D. Robust speaker localization guided by deep learning-based time-frequency masking. IEEE/ACM Transactions on Audio, Speech, and Language Processing. 2019; 27:178-188.
5. Williamson D, Wang Y, Wang D. Complex ratio masking for monaural speech separation. IEEE/ACM Transactions on Audio, Speech, and Language Processing. 2016; 24:483-492.

Other Significant Products, Whether or Not Related to the Proposed Project

1. Chen J, Wang D. Supervised speech separation based on deep learning: An overview. *IEEE/ACM Transactions on Audio, Speech, and Language Processing*. 2018; 26:1702-1726.
2. Wang D. Deep learning reinvents the hearing aid. *IEEE Spectrum*. 2017; (March):32-37.
3. Computational Auditory Scene Analysis: Principles, Algorithms, and Applications. Wang D, Brown G, editors. Hoboken NJ: Wiley & IEEE Press; 2006.
4. Wang Y, Wang D. Cocktail party processing via structured prediction. *Proceedings of NIPS*; 2012. pp. 224-232.
5. Wang Y, Narayanan A, Wang D. On training targets for supervised speech separation. *IEEE/ACM Transactions on Audio, Speech, and Language Processing*. 2014; 22:1849-1858.

(d) SYNERGISTIC ACTIVITIES

1. **Curriculum development.** The PI introduced two permanent courses to the OSU curriculum: *Proseminar in Cognitive Science* and *Introduction to Neural Networks*. The first one is truly interdisciplinary, cross-listed in computer science & engineering, industrial engineering, linguistics, philosophy, psychology, and speech & hearing. The second one is a cornerstone of OSU's AI curriculum and a very popular class, serving both graduate and undergraduate students.
2. **Study of computational auditory scene analysis.** The PI led the development of computational auditory scene analysis (CASA), which aims to solve the cocktail party problem (speech segregation) based on auditory scene analysis principles. The 2006 book on CASA listed above is the definitive reference in the field, which helped to establish CASA as a mainstream approach to sound separation.
3. **Introduction of the ideal mask concept.** Based on auditory masking effects, the PI's lab originated the notion of the ideal binary mask (IBM), and later the ideal ratio mask (IRM) and complex ideal ratio mask (cIRM). These ideal masks become standard computational objectives in speech and audio processing, and are widely used as training targets in supervised sound separation. Wang et al.'s 2014 paper listed above on training targets received the 2019 IEEE Signal Processing Society Best Paper Award.
4. **Deep neural networks for speech segregation and intelligibility improvement for hearing-impaired listeners.** The PI's lab was the first to introduce deep neural networks to supervised sound separation. The use of deep learning for ideal mask estimation demonstrated, for the first time, substantial speech intelligibility improvements for listeners with hearing loss. This achievement, widely regarded as a breakthrough, was featured in a cover story in *IEEE Spectrum* in its March 2017 issue.
5. **Selected professional services and recognition**
 - Co-Editor-in-Chief, *Neural Networks*
 - Organized/Co-organized a number of conferences/workshops, including the NSF *Perspectives on Speech Separation Workshop* (2003) and *International Conference on Neural Information Processing* (2006)
 - Recipient of the University Distinguished Scholar Award from OSU (2014), the Helmholtz Award from the International Neural Network Society (2008), and the Office of Naval Research Young Investigator Award (1996)

IDENTIFYING INFORMATION:

NAME: Subramoni, Hari

POSITION TITLE: Assistant Professor

PRIMARY ORGANIZATION AND LOCATION: The Ohio State University, Columbus, Ohio, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
The Ohio State University, Columbus, Ohio, USA	PHD	08/2013	Computer Science and Engineering
University College of Engineering, Trivandrum, Not Applicable, N/A, India	BENG	04/2004	Computer Science and Engineering

Appointments and Positions

2022 - present	Assistant Professor, The Ohio State University, Columbus, Ohio, United States
2015 - 2022	Research Scientist, The Ohio State University, Columbus, Ohio, United States
2013 - 2015	Senior Research Associate, The Ohio State University, Columbus, Ohio, United States
2011 - 2011	Research Intern, Lawrence Livermore National Laboratory, Livermore, California, United States
2009 - 2010	Research Intern, IBM TJ Watson Research Center, Ossining, New York, United States
2008 - 2013	Graduate Research Assistant, The Ohio State University, Columbus, Ohio, United States
2006 - 2007	Member Technical Staff, Force10 Networks, Chennai, Not Applicable, N/A, India
2004 - 2006	Software Engineer, ISoftTech-Sasken Solutions, Chennai, Not Applicable, N/A, India

Products**Products Most Closely Related to the Proposed Project**

1. Panda D, Subramoni H, Chu C, Bayatpour M. The MVAPICH project: Transforming research into high-performance MPI library for HPC community. Journal of Computational Science. 2021 May; 52:101208-. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S1877750320305093> DOI: 10.1016/j.jocs.2020.101208
2. Zhou Q, Kousha P, Anthony Q, Shafie Khorassani K, Shafi A, Subramoni H, Panda D. Accelerating MPI All-to-All Communication with Online Compression on Modern GPU Clusters. Lecture Notes in Computer Science [Internet] Cham: Springer International Publishing; 2022. Chapter Chapter 13-25p. Available from: https://link.springer.com/10.1007/978-3-031-07312-0_1 DOI: 10.1007/978-3-031-07312-0_1

3. Zhou Q, Chu C, Kumar N, Kousha P, Ghazimirsaeed S, Subramoni H, Panda D. Designing High-Performance MPI Libraries with On-the-fly Compression for Modern GPU Clusters. 2021 IEEE International Parallel and Distributed Processing Symposium (IPDPS). 2021 IEEE International Parallel and Distributed Processing Symposium (IPDPS); ; Portland, OR, USA. IEEE; c2021. Available from: <https://ieeexplore.ieee.org/document/9460453/> DOI: 10.1109/IPDPS49936.2021.00053
4. Kousha P, Jain A, Kolli A, Sainath P, Subramoni H, Shafi A, Panda D. “Hey CAI” - Conversational AI Enabled User Interface for HPC Tools. Lecture Notes in Computer Science [Internet] Cham: Springer International Publishing; 2022. Chapter Chapter 587-108p. Available from: https://link.springer.com/10.1007/978-3-031-07312-0_5 DOI: 10.1007/978-3-031-07312-0_5
5. Kousha P, Sankarapandian Dayala Ganesh Ram K, Kedia M, Subramoni H, Jain A, Shafi A, Panda D, Dockendorf T, Na H, Tomko K. INAM: Cross-stack Profiling and Analysis of Communication in MPI-based Applications. Practice and Experience in Advanced Research Computing. PEARC '21: Practice and Experience in Advanced Research Computing; 18 0 21; Boston MA USA. New York, NY, USA: ACM; c2021. Available from: <https://dl.acm.org/doi/10.1145/3437359.3465582> DOI: 10.1145/3437359.3465582

Other Significant Products, Whether or Not Related to the Proposed Project

1. H. Subramoni, S. Chakraborty, D. K. Panda. Designing Dynamic and Adaptive MPI Point-to-point Communication Protocols for Efficient Overlap of Computation and Communication. International Supercomputing Conference (ISC '17); 2017 ne; c2017.
2. H. Subramoni, S. Potluri, K. Kandalla, B. Barth, J. Vienne, J. Keasler, K. Tomko, K. Schulz, A. Moody, D. K. Panda. Design of a Scalable InfiniBand Topology Service to Enable Network-Topology-Aware Placement of Processes. Proceedings of the International Conference for High Performance Computing, Networking, Storage and Analysis (SC); 2012; c2012.
3. Kousha P, Sankarapandian Dayala Ganesh Ram K, Subramoni H, Panda D, Na H, Dockendorf T, Tomko K. Accelerated Real-time Network Monitoring and Profiling at Scale using OSU INAM. Practice and Experience in Advanced Research Computing. PEARC '20: Practice and Experience in Advanced Research Computing; 26 0 20; Portland OR USA. New York, NY, USA: ACM; c2020. Available from: <https://dl.acm.org/doi/10.1145/3311790.3396672> DOI: 10.1145/3311790.3396672
4. Kousha P, Ramesh B, Kandadi Suresh K, Chu C, Jain A, Sarkauskas N, Subramoni H, Panda D. Designing a Profiling and Visualization Tool for Scalable and In-depth Analysis of High-Performance GPU Clusters. 2019 IEEE 26th International Conference on High Performance Computing, Data, and Analytics (HiPC). 2019 IEEE 26th International Conference on High Performance Computing, Data, and Analytics (HiPC); ; Hyderabad, India. IEEE; c2019. Available from: <https://ieeexplore.ieee.org/document/8990500/> DOI: 10.1109/HiPC.2019.00022
5. S. Chakraborty, H. Subramoni, D. P, a. Contention Aware Kernel-Assisted MPI Collectives for Multi/Many-core Systems. 2017 IEEE International Conference on Cluster Computing; 2017 pt; c2017.

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not limited to current, pending, and other support (both foreign and domestic) as defined in 42 U.S.C. § 6605.

I also certify that, at the time of submission, I am not a party to a malign foreign talent recruitment program.

Misrepresentations and/or omissions may be subject to prosecution and liability pursuant to, but not limited to, 18 U.S.C. §§ 287, 1001, 1031 and 31 U.S.C. §§ 3729-3733 and 3802.

Certified by Subramoni, Hari in SciENCv on 2025-02-04 10:41:21

Kimerly A. Powell, Ph.D.
220 Lincoln Tower, 1800 Cannon Dr., Columbus, Oh 43210
Ph: (614) 366-2252 Fax: 614-688-6600
E-mail: kimerly.powell@osumc.edu

EDUCATION

- 1992 The Ohio State University, Columbus, Ohio
Ph.D., Biomedical Engineering
- 1987 The Ohio State University, Columbus, Ohio
M.S., Biomedical Engineering
- 1982 The Ohio State University, Columbus, Ohio
B.S., Chemical Engineering

ACADEMIC EXPERIENCE

- 2022-present Associate Professor,
Department of Biomedical Informatics
The Ohio State University
- 2008-2022 Assistant Professor,
Department of Biomedical Informatics
The Ohio State University
- 1997-2005 Assistant Staff,
Department of Biomedical Engineering and Division of Radiology
Cleveland Clinic Foundation
Cleveland, Ohio

PUBLICATIONS

The total citations of my publications over the course of my career have been 4726 with an h-index of 39 and i10-index of 63 as of 02/15/2021.

1. Kaul VF, Brannan Z, Keith J, Hittle B, Riggs W, Hiss M, Varadarajan V, Zhan K, **Powell K**, Wiet GJ, Adunka OF. Post-operative evaluation of computed tomography imaging following cochlear implantation. Am J Otolaryngol. 2024 Jan-Feb;45(1):104081. doi: 10.1016/j.amjoto.2023.104081. Epub 2023 Oct 4. PMID: 37820391.

2. Andersen SAW, Hittle B, Värendh M, Lee J, Varadarajan V, **Powell KA**, Wiet GJ. Further Validity Evidence for Patient-Specific Virtual Reality Temporal Bone Surgical Simulation. *Laryngoscope*. 2023 Aug 31. doi: 10.1002/lary.31016
3. **Powell KA**, Bohrer LR, Stone NE, Hittle B, Anfinson KR, Luangphakdy V, Muschler G, Mullins RF, Stone EM, Tucker BA. Automated human induced pluripotent stem cell colony segmentation for use in cell culture automation applications. *SLAS Technol*. 2023 Jul 15:S2472-6303(23)00047-X. doi: 10.1016/j.slast.2023.07.004
4. Bohrer LR, Stone NE, Mullin NK, Voigt AP, Anfinson KR, Fick JL, Luangphakdy V, Hittle B, **Powell K**, Muschler GF, Mullins RF, Stone EM, Tucker BA. Automating iPSC generation to enable autologous photoreceptor cell replacement therapy. *J Transl Med*. 2023 Feb 28;21(1):161. doi: 10.1186/s12967-023-03966-2.
5. Andersen SAW, Hittle B, Keith JP, **Powell KA**, Wiet GJ. Pipeline for Automated Processing of Clinical Cone-Beam Computed Tomography for Patient-Specific Temporal Bone Simulation: Validation and Clinical Feasibility. *Otol Neurotol*. 2023 Feb 1;44(2):e88-e94. doi: 10.1097/MAO.0000000000003771.
6. Andersen SAW, Keith JP, Hittle B, Riggs WJ, Adunka O, Wiet GJ, **Powell, KA**. Automated Calculation of Cochlear Implant Electrode Insertion Parameters in Clinical Cone-Beam CT. *Otol Neurotol*. 2022, Feb;1;43(2):199-205, doi: 10.1097/MAO.0000000000003432.
7. **Powell, KA**; Wiet, GJ; Hittle, B; Oswald; GI; Keith, JP; Stredney, D; Andersen, SA (2021) *Atlas-Based Segmentation of Cochlear MicroStructures in Cone Beam CT*. International Journal of Computer Assisted Radiology and Surgery, 2021 Mar;16(3):363-373, doi: 10.1007/s11548-020-02304-x.
8. Zhang, X.; **Powell, K.**; Li, L. (2020). Breast cancer stem cells: Biomarkers, identification and isolation methods, regulating mechanisms, cellular origin, and beyond. *Cancers*, 12 (12), 1-28. doi:10.3390/cancers12123765
9. Andersen, S.A.W.; Varadarajan, V.V.; Moberly, A.C.; Hittle, B.; **Powell, K.A.**; Wiet, G.J. (2021). Patient-specific Virtual Temporal Bone Simulation Based on Clinical Cone-beam Computed Tomography. *Laryngoscope*, doi:10.1002/lary.29542
10. Andersen, S.A.W.; Bergman ,M. ; Keith, J.P.; **Powell, K.A.**; Hittle ,B.; Malhotra, P.; Wiet, G.J. (2020). *Segmentation of Temporal Bone Anatomy for Patient-Specific Virtual Reality Simulation*. *Ann Otol Rhinol Laryngol online ahead of print* doi: 10.1177/0003489420970217
11. Geisler, J.A.; Spehar, J.M.; Steck, S.A.; Bratasz, A.; Shakya, R.; **Powell, K.**; Sizemore, G.M. (2020). *Modeling Brain Metastases Through Intracranial Injection and Magnetic Resonance Imaging*. *J Vis Exp*. 2020 Jun 7;(160). doi: 10.3791/61272. <https://pubmed.ncbi.nlm.nih.gov/32568247/>
12. Mantripragada, V.P.; Luangphakdy, V.; Hittle, B.; **Powell, K.**; Muschler, G.F. (2020). Automated in-process characterization and selection of cell-clones for quality and efficient cell manufacturing. *Cytotechnology*, 72 (5), 615-627. doi:10.1007/s10616-020-00403-w

Bryan R. Weaver

bryanrweaver@gmail.com

+11 (0) 660-998-2661

Areas of Specialization

Ethics, Normativity, Conceptual Engineering, the Philosophy of Technology (including Artificial Intelligence), Pragmatism, the Philosophy of Language, the Philosophies of Love and Sex, the Philosophy of Science, and the History of Philosophy.

Academic Background

Senior Lecturer in Computer Science and Engineering at the Ohio State University: 2019-present.

Lecturer in Computer Science and Engineering at the Ohio State University: 2018.

Senior Lecturer in Philosophy at the Ohio State University: 2013-2017.

Visiting Scholar in Philosophy at the University of Missouri: 2012-2013.

Visiting Scholar in Philosophy at the University of North Carolina at Chapel Hill: 2008-2009, 2010-2012.

Ph.D. in Philosophy from the University of Reading, UK: 2005–2012.

Publications

Reasons in the Normative Realm (with Kevin Scharp), under contract with Oxford University Press.

“A Defense of QUD Contextualism about Reasons” (with Kevin Scharp), *Inquiry: An Interdisciplinary Journal of Philosophy*, 2023.

“The Ethics of Geography-Military Relations: A Reply to Our Interlocutors” (with Joel Wainwright), *Annals of the American Association of Geographers*, 2022.

“A Critical Commentary on the AAG Geography and Military Study Committee Report” (with Joel Wainwright), *Annals of the American Association of Geographers*, 2021.

Semantics for Reasons (with Kevin Scharp), Oxford University Press, 2019.

“Marriage and the Norm of Monogamy” (with Fiona Woollard), *The Monist*, 91 (3), July 2008, pp. 515-532.

Fellowships, Grants, Scholarships, Etc.

Grant Award from Battelle Engineering, Technology, and Human Affairs (BETHA), the Ohio State University, 2016-2017.

Conferences, Presentations, Workshops, Etc.

“The Ethics of Artificial Intelligence”, the National Institutes of Health (NIH)-Funded Training Grant in Molecular Biophysics, the Ohio State University, Columbus, Ohio, December 11, 2024.

“The Ethics of Artificial Intelligence”, the Ohio State University Retirees Association (OSURA), the Ohio State University, Columbus, Ohio, September 18, 2024.

“Substantive Algorithmic Fairness”, Commentary on the Distinguished Lecture on Big Data, Law, and Policy for the Ohio State University Program on Data and Governance, the Ohio State University, Columbus, Ohio, April 1, 2024.

“Can Ethical Theory Be Useful in Developing Technology for Social Justice?”, College of Engineering, the Ohio State University, Columbus, Ohio, April 9, 2022.

“Fake News, Conceptual Engineering, and Weaponized Concepts”, Arché Philosophical Research Centre, St. Andrews University, St. Andrews, Scotland, November 20, 2018.

Teaching

The Ethics of Artificial Intelligence, the Ohio State University, Spring 2025.

Design and Professional Practice 1 and 2, the Ohio State University, regular guest lecturer in ethics, Autumn 2017-present.

Population Medicine, the Ohio State University, guest lecturer in ethics, Autumn 2023.

Social, Ethical, and Professional Issues in Computing, the Ohio State University, Spring 2018-present.

Computing Ethics and Effective Presentation, the Ohio State University, Autumn 2016, Spring 2017.

Introduction to Engineering Ethics, the Ohio State University, Autumn 2013-Spring 2016, Autumn 2017.

Service

Diversity and Inclusion Committee Member in the Department of Computer Science and Engineering, the Ohio State University, 2021-present.

Founding advisor of the student group “Applied Ethics and Technology at the Ohio State”, 2021-present.

Affiliated Faculty Member of the Translational Data Analytics Institute (TDAI) at the Ohio State University, 2021-present.

Steering Committee Member of the Center for Ethics and Human Values (CEHV) at the Ohio State University, 2019-present.

Conference organizer, Generative Artificial Intelligence and the Alignment Problem, the Ohio State Center for Ethics and Human Values (CEHV), April 5, 2024.

Conference organizer, Fake News: Causes, Effects, Solutions, the Ohio State Center for Ethics and Human Values (CEHV), Autumn 2018.

Faculty sponsor for the Richard J. and Martha D. Denman Undergraduate Research Forum, the Ohio State University, Spring 2017.

Qin Ma, Ph.D.

PROFESSIONAL EXPERIENCE

- 2023- Professor
Department of Biomedical Informatics (BMI), College of Medicine,
The Ohio State University
- 2023- Co-director of the Computational Health and Life Sciences CoP
Translational Data Analytics Institute (TDAI)
The Ohio State University
- 2022- Division Chief of Bioinformatics and Computational Biology (DBCBC)
Department of Biomedical Informatics, College of Medicine,
The Ohio State University
- 2022- Leader of the Immuno-Oncology Informatics Group (IOIG)
Pelotonia Institute for Immuno-Oncology (PIIO)
The Ohio State University

EDUCATION

- 2011-2014 Postdoc Computational Systems Biology
University of Georgia (Supervisor: Prof. Ying Xu)
- 2005-2010 Ph.D. Operational Research and Bioinformatics
University of Georgia (Supervisor: Prof. Ying Xu, 2008-2010)
Shandong University (Supervisor: Prof. Guojun Li, 2005-2008)
- 2001-2005 B.S. Applied Mathematics and Algorithm Design
Shandong University, Awarded with first-class honors

RESEARCH INTERESTS

Deep learning and single-cell studies have been making waves in the science and technology communities. Deep learning offers a broad range of methods that can be used to investigate diverse data- and hypothesis-driven questions in single-cell biology. The highly heterogeneous nature of single-cell and spatial omics data can be analyzed across a wide range of research topics by deep-learning modeling and optimization in a hypothesis-free manner. Recently, the applications of foundation models showcased significant promise for new insights discovery in single-cell biology. My lab focuses on developing cutting-edge deep-learning methods for single-cell and spatial omics data, aiming to discover underlying mechanisms (e.g., gene regulation, cell-cell interactions, and cellular senescence) in diverse biological systems and complex diseases.

SELECTED PUBLICATIONS

- a. Wang, X., Duan, M., Li, J., Ma, A., Xin, G., Xu, D., Li, Z., and **Ma, Q.**^{\$}. MarsGT: Multi-omics analysis for rare population inference using single-cell graph transformer. *Nat Commun* 15, 338 (2024). PMID: 38184630 PMCID: PMC10771517.
- b. Ma A, Xin G, **Ma Q**^{*}. The use of single-cell multi-omics in immuno-oncology. *Nat Commun*. 2022 May 18;13(1):2728. doi: 10.1038/s41467-022-30549-4. PMID: 35585090; PMCID: PMC9117235.
- c. Ma, A., Wang, X., Li, J., Wang, C., Xiao, T., Liu, Y., Cheng, H., Wang, J., Li, Y., Chang, Y., Li, J., Wang, D., Jiang, Y., Su, L., Xin, G., Gu, S., Li, Z., Liu, B., Xu, D., and **Ma, Q.**^{\$}. Single-cell biological network inference using a heterogeneous graph transformer. *Nat Commun*. 2023.14(1): p.964. PMID: 36810839 PMCID: PMC9944243.
- d. Wang, J., Ma, A., Chang, Y., Gong, J., Jiang, Y., Qi, R., Wang, C., Fu, H., **Ma, Q.**^{\$}, and Xu, D.^{\$}. scGNN is a novel graph neural network framework for single-cell RNA-Seq analyses. *Nat Commun*. 2021 Mar 25;12(1):1882. PMID: 33767197; PMCID: PMC7994447.
- e. Chen J, Wang X, Ma A, Wang QE, Liu B, Li L, Xu D, **Ma Q**^{*}. Deep transfer learning of cancer drug responses by integrating bulk and single-cell RNA-seq data. *Nat Commun*. 2022 Oct 30;13(1):6494. doi: 10.1038/s41467-022-34277-7. PMID: 36310235; PMCID: PMC9618578.

SELECTED GRANTS

R01GM152585

Ma (MPI: Chung and Ma)

09/01/2024-08/31/2029

Statistical power analysis framework for multi-sample and cross-platform spatial omics experiments.

R01DK138504

Ma (MPI: Wang, Ma, Eadon)

07/01/2023 – 06/30/2028

SCH: Graph-based spatial transcriptomics computational methods in kidney diseases

R21HG012482

Ma (MPI: Chung and Ma)

06/01/2022 – 05/31/2025

Statistical Power Calculation Framework for Spatially Resolved Transcriptomics Experiments.

P01CA267108

Ma (Data Science Core PI)

04/01/2023-03/31/2028

Sex, Chromosomes, and Immunity in Bladder Cancer

P01AI177687

Ma (Data Science Core PI)

06/01/2023-05/31/2028

Multi-Omics Analysis of Broadly Neutralizing Antibodies and Therapeutic Vaccination

U54AG075931

Ma (Data Analysis Core PI)

09/30/2021-09/30/2026

TriState SenNET (Lung and Heart) Tissue Map and Atlas consortium

SYNERGISTIC ACTIVITIES

1. Editor-in-Chief of Computational Biology and Chemistry, Associate Editor of BMC Genomics; Editorial Board members of Scientific Reports, Computational and Structural Biotechnology Journal, Briefings in Bioinformatics.
2. Conference chair of the International Conference on Intelligent Biology and Medicine (ICIBM) in 2025; Program Committee Chairs of the IEEE MedAI conference in 2024; Member of International Society for Computational Biology, Association for Clinical and Translational Science, Pelotonia Institute for Immuno-Oncology, and International Association for Intelligent Biology and Medicine.
3. Speak at the Joint Statistical Meetings (2023-2024) on the topic “graph representation learning of single-cell omics data”; keynote speaker at the 21st Asia Pacific Bioinformatics Conference (2023); keynote talk for a webcast on single-cell multi-omics methods organized by *Nature Reviews Molecular Cell Biology* and *Nature Communications* (2023)
4. (i) Mentored four postdocs, Yuzhou Chang (Now joint postdoc Harvard/OSU); Yang Li (now an assistant professor in Beijing, China), and Anjun Ma (now an assistant professor at OSU) and Adam McDermaid (Now as Principal Data Scientist - Optum); (ii) ~40 graduate research assistants; (iii) three MSs at SDSU; (iv) six undergraduates (USs); (v) to research scientists and 7 specialists in Biostatistics and Bioinformatics (vi) two NSF-funded Research Experience for Undergraduates students; (vii) 9 junior faculty members - Distinguished Faculty Mentor Award from the Biomedical Science Graduate Program (BSGP) at OSU (2024)

Amy Webb Hite
The Ohio State University
1800 Cannon Drive, Columbus, OH 43210
amy.hite@osumc.edu

A. Research Interests

I am broadly interested in bioinformatics relating to the analysis of ‘omics data. I am interested in creating reusable workflows and code for bioinformatics applications

B. Education

	Biosystems and		
B.S., 2004	Agricultural Engineering	University of Kentucky	Lexington, KY
Ph.D., 2012	Biomedical Engineering	University of North Carolina	Chapel Hill, NC

C. Appointments

2023 – present	Clinical Assistant Faculty, Biomedical Informatics, Ohio State University, Columbus, OH
2016 – 2022	Research Scientist, Bioinformatics Shared Resource Biomedical Informatics, Ohio State University, Columbus, OH
2011 – 2016	Postdoctoral Researcher, Pharmacogenomics and Biomedical Informatics, Ohio State University, Columbus, OH

D. Selected Honors and Awards

E. Selected Peer-Reviewed Publications

Five publications most closely related to the proposed project

1. Gadepalli VS, Ozer HG, Yilmaz AS, Pietrzak M, **Webb A**. BISR-RNAseq: an efficient and scalable RNAseq analysis workflow with interactive report generation. *BMC Bioinformatics*. 2019 Dec 20;20(Suppl 24):670. doi: 10.1186/s12859-019-3251-1. PubMed PMID: 31861980; PubMed Central PMCID: PMC6923898.
2. Harrigan ME, Filous AR, Vadala CP, **Webb A**, Pietrzak M, Sahenk Z, Prüss H, Reiser PJ, Popovich PG, Arnold WD, Schwab JM. Lesion level-dependent systemic muscle wasting after spinal cord injury is mediated by glucocorticoid signaling in mice. *Sci Transl Med*. 2023 Dec 20;15(727):eadh2156. doi: 10.1126/scitranslmed.adh2156. Epub 2023 Dec 20. PubMed PMID: 38117902.
3. Jerome AD, Sas AR, Wang Y, Hammond LA, Wen J, Atkinson JR, **Webb A**, Liu T, Segal BM. Cytokine polarized, alternatively activated bone marrow neutrophils drive axon regeneration. *Nat Immunol*. 2024 Jun;25(6):957-968. doi: 10.1038/s41590-024-01836-7. Epub 2024 May 29. PubMed PMID: 38811815.
4. Sebastian NT, **Webb A**, Shilo K, Robb R, Xu-Welliver M, Haglund K, Brownstein J, DeNicola GM, Shen C, Williams TM. A PI3K gene expression signature predicts for recurrence in early-stage non-small cell lung cancer treated with stereotactic body radiation therapy. *Cancer*. 2023 Dec 15;129(24):3971-3977. doi: 10.1002/cncr.34983. Epub 2023 Aug 10. PubMed PMID: 37560930
5. Wolfe AR, Wald P, **Webb A**, Sebastian N, Walston S, Robb R, Chen W, Vedaie M, Dillhoff M, Frankel WL, Kwon W, Jang JY, Williams TM. A microRNA-based signature predicts local-regional failure and overall survival after pancreatic cancer resection. *Oncotarget*. 2020 Mar 10;11(10):913-923. doi: 10.18632/oncotarget.27496. eCollection 2020 Mar 10. PubMed PMID: 32206188; PubMed Central PMCID: PMC7075466.

Five other significant publications

1. Eltobgy MM, Zani A, Kenney AD, Estfanous S, Kim E, Badr A, Carafice C, Daily K, Whitham O, Pietrzak M, **Webb A**, Kawahara J, Eddy AC, Denz P, Lu M, Kc M, Peebles ME, Li J, Zhu J, Que J, Robinson R, Rosas Mejia O, Rayner RE, Hall-Stoodley L, Seveau S, Gavrilin MA, Zhang X, Thomas J, Kohlmeier JE, Suthar MS, Oltz E, Tedeschi A, Robledo-Avila FH, Partida-Sanchez S, Hemann EA, Abdelrazik E, Forero A, Nimjee SM, Boyaka PN, Cormet-Boyaka E, Yount JS, Amer AO. Caspase-4/11 exacerbates disease severity in SARS-CoV-2 infection by promoting inflammation and immunothrombosis. *Proc Natl Acad Sci U S A*. 2022 May 24;119(21):e2202012119. doi: 10.1073/pnas.2202012119. Epub 2022 May 19. PubMed PMID: 35588457; PubMed Central PMCID: PMC9173818.

2. Graham RT, Bell EH, **Webb A**, Zhao Y, Timmers C, Fleming JL, Sells BE, Robison NJ, Palmer JD, Finlay JL, Chakravarti A. Pediatric Gliosarcoma With and Without Neurofibromatosis Type 1: A Whole-exome Comparison of 2 Patients. *J Pediatr Hematol Oncol*. 2021 Nov 1;43(8):e1201-e1204. doi: 10.1097/MPH.0000000000002020. PubMed PMID: 33235140.
3. Kalyanasundaram A, Li N, Gardner ML, Artiga EJ, Hansen BJ, **Webb A**, Freitas MA, Pietrzak M, Whitson BA, Mokadam NA, Janssen PML, Mohler PJ, Fedorov VV. Fibroblast-Specific Proteotranscriptomes Reveal Distinct Fibrotic Signatures of Human Sinoatrial Node in Nonfailing and Failing Hearts. *Circulation*. 2021 Jul 13;144(2):126-143. doi: 10.1161/CIRCULATIONAHA.120.051583. Epub 2021 Apr 20. PubMed PMID: 33874740; PubMed Central PMCID: PMC8277727.
4. Talbert EE, Cuitiño MC, Ladner KJ, Rajasekera PV, Siebert M, Shakya R, Leone GW, Ostrowski MC, Paleo B, Weisleder N, Reiser PJ, **Webb A**, Timmers CD, Eiferman DS, Evans DC, Dillhoff ME, Schmidt CR, Guttridge DC. Modeling Human Cancer-induced Cachexia. *Cell Rep*. 2019 Aug 6;28(6):1612-1622.e4. doi: 10.1016/j.celrep.2019.07.016. PubMed PMID: 31390573; PubMed Central PMCID: PMC6733019.
5. Chhibber A, French CE, Yee SW, Gamazon ER, Theusch E, Qin X, **Webb A**, Papp AC, Wang A, Simmons CQ, Konkashbaev A, Chaudhry AS, Mitchel K, Stryke D, Ferrin TE, Weiss ST, Kroetz DL, Sadee W, Nickerson DA, Krauss RM, George AL, Schuetz EG, Medina MW, Cox NJ, Scherer SE, Giacomini KM, Brenner SE. Transcriptomic variation of pharmacogenes in multiple human tissues and lymphoblastoid cell lines. *Pharmacogenomics J*. 2017 Mar;17(2):137-145. doi: 10.1038/tpj.2015.93. Epub 2016 Feb 9. PubMed PMID: 26856248; PubMed Central PMCID: PMC4980276.

F. Selected Grants

1. **Genetic determinants of survival and drug response using whole genome sequencing**, United Therapeutics Corporation. Co-PI. 11/18/2022 - 05/18/2025. Amount of Awards: \$67,211
2. **Role of the non-canonical Inflammasome in SARS-CoV-2-mediated pathology and coagulopathy**, NIH/NIAID. Bioinformatics. 04/10/2024 - 03/31/2029. Amount of Award: \$16,823,243. FTE 10%
3. **Consequences of brain injury on glia-neuron dynamics, neuropathology and neuropsychiatric illness**, DOD, Bioinformatics. 09/30/2023 - 09/29/2027. Amount of Award: \$7,700,740, FTE 12%

G. Synergistic Activities

1. **Academic experience:** Extensive experience in NGS analysis for many different types of 'omics data including genomics, transcriptomics, CHIPseq/ATACseq, etc. Collaborate with Bioinformatics Shared Resource to connect with PIs across the university providing analysis and education
2. **Teaching:** Regularly teach BMI 5710 Intro to BMI and BMI 5730 Intro to Bioinformatics. Worked with a course designer to improve the online presentation of both courses. Supervise sessions of these courses taught by others.
3. **Volunteering:** Educating others about bioinformatics through BISR workshops for the Comprehensive Cancer Center, high school student summer program, and a day long workshop for the Neuroscience department
4. **Department service:** Participate in BMI Educational Committee and review MS/MPH student applications.

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. **DO NOT EXCEED FIVE PAGES.**

NAME: **Swati Satturwar**

eRA COMMONS USER NAME (credential, e.g., agency login): **SWATI_SATTURWAR_OSU**

POSITION TITLE: **Assistant Professor of Pathology**

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE (if applicable)	Completion Date MM/YYYY	FIELD OF STUDY
Indira Gandhi Medical College (Nagpur, India)	MD	12/2003	Medicine
Grant Medical College (Mumbai, India)		07/2010	Pathology Residency
University of Toronto (Toronto, Canada)		03/2015	Prostate Cancer Research Fellowship
East Carolina University (Greenville, NC)		06/2019	Pathology Residency
University of Pittsburgh (Pittsburgh, PA)		06/2020	Cytopathology Fellowship
University of Pittsburgh (Pittsburgh, PA)		06/2021	Genitourinary Pathology Fellowship

A. Personal Statement

I am associate director of digital pathology shared resource and an assistant professor in the Anatomic Pathology division and a faculty member of the division of Genitourinary Pathology, Cytopathology, Bone and Soft tissue Pathology and Digital Pathology at The Ohio State University. I am a board-certified anatomic and clinical pathologist. I completed genitourinary pathology and cytopathology fellowships at the University of Pittsburgh Medical Center and a research fellowship at Toronto General Hospital, Canada. My research interests include understanding pathologic basis of carcinogenesis, exploring novel biomarkers for prostate, kidney, bladder & testicular neoplasms, non-exfoliative cytology, bone and soft tissue neoplasms, exploring innovative applications of digital pathology. During my fellowships I worked on biomarkers for prostate adenocarcinomas and renal neoplasms. I have collaborated with multiple investigators and participated in digital pathology and AI application-based studies for genitourinary tumors and soft tissue sarcomas. Ongoing research projects include development of risk stratification model for soft tissue sarcomas using whole slide images and molecular data. Exploring potential of AI for prediction of immunotherapy response for different tumor types and NIH funded sex bias studies for bladder cancer. I have the expertise to evaluate bladder carcinomas and apply digital pathology knowledge needed for this research project.

B. Positions, Scientific Appointments, and Honors

2021-present Assistant Professor, Division of Pathology, The Ohio State University, Columbus, OH
2022-present Associated director, Digital Pathology Shared Resources, The Ohio State University

Honors

2001 Honors in Pathology

2017 The Most Outstanding Resident in Anatomic Pathology, Robert L West Award

2021 Best Abstract award
 2021 Poster of distinction award
 2021 Association of Pathology Informatics travel award
 2021 Pathology trainee research advancement award
 2023 Ace my Pathology: Outstanding Author Award
 2024 Buckeye Early Career Shining Star Award
 2024 AI app development Appathon competition winner
 2024 Anatomic Pathology teaching award

C. Contributions to Science

Dr Satturwar's complete list of publications is available at this link:

<https://pubmed.ncbi.nlm.nih.gov/?term=SWATI%20SATTURWAR>

1. Digital Pathology and Artificial intelligence-based studies - Application: My recent work explored the utility of the novel technologies such as digital imaging and artificial intelligence for diagnosis, prognosis and quantification of biomarkers.

- [1] **Swati Satturwar**, Anil V. Parwani. Artificial Intelligence-Enabled Prostate Cancer Diagnosis and Prognosis: Current State and Future Implications. *Adv Anat Pathol*. 2024 Mar 1; 31(2): 136-144. PMID: 38179884.
- [2] Nada Shaker, Rulong Shen, Abberly Lott-Limbach, **Swati Satturwar**, Peter Kobalka, Saman Ahmadian, Shaoli Sun, Wei Chen, Giovanni Lujan, Ashwini Esnakula, Anil Parwani, Zaibo Li. Automated imaging analysis of Ki-67 immunohistochemistry on whole slide images of cell blocks from pancreatic neuroendocrine neoplasms. *Journal of American Society of Cytopathology*. May-Jun 2024; 13(3): 205-212. PMID: 38433072.
- [3] Chen W, Ziebell J, Arole V, Parkinson B, Yu L, Dai H, Frankel WL, Yearsley M, Esnakula A, Sun S, Gamble D, Vazzano J, Mishra M, Schoenfield L, Kneile J, Reuss S, Schumacher M, **Satturwar S**, Li Z, Parwani A, Lujan G. Comparing Accuracy of Helicobacter pylori Identification Using Traditional Hematoxylin and Eosin (H&E)-stained Glass Slides with Digital Whole Slide Imaging. *Lab Invest*. 2024 Jan; 104(1): 100262. PMID: 37839639.
- [4] **Swati Satturwar**, Joshua Pantanowitz, Christopher Manko, Lindsey Seigh, Sara E Monaco, Liron Pantanowitz. Ki-67 Proliferation Index in Neuroendocrine Tumors: Can Augmented Reality Microscopy with Image Analysis Improve Scoring? *Cancer Cytopathology*. 2020 Aug; 128(8): 535-544. PMID: 32401429.

2. Digital Pathology and Artificial intelligence-based studies - Technology: My recent work explored the utility of the novel technologies such as digital imaging and artificial intelligence for diagnosis, prognosis and quantification of biomarkers.

- [1] Shaker N, Shilo K, Esnakula AK, Shafi S, Challa B, Patel A, Kellough DA, Hammond S, Javaid S, **Satturwar S**, Yearsley MM, Li Z, Limbach AL, Lujan G, Parwani AV. Comparison of four different displays for identification of select pathologic features extracted from whole slide images of surgical pathology cases. *Pathol Res Pract*. 2023 Nov; 251: 154843. PMID: 37826873.
- [2] Ankush Patel, Nada Shaker, David A Kellough, Savannah Erck, Erin Palermi, Zaibo Li, Giovanni Lujan, **Swati Satturwar**, Anil V Parwani. Types and Frequency of Whole Slide Imaging Scan Failures in a Clinical High Through-Put Digital Pathology Scanning Laboratory. *J Pathol Inform*. 2022 Jun; 13: 100112. PMID: 36268081.
- [3] Saba Shafi, David A Kellough, Giovanni Lujan, **Swati Satturwar**, Anil V Parwani, Zaibo Li. Integrating and validating automated digital imaging analysis of estrogen receptor immunohistochemistry in a fully digital workflow for clinical use. *J Pathol Inform*. 2022 Jun; 13: 100122. PMID: 36268080.
- [4] **Swati Satturwar**, Liron Pantanowitz. Pathology Outlines: Pathology Informatics: Topic: Augmented Reality Microscopy. Published online June 25, 2020.

BIOGRAPHICAL SKETCH

NAME: Oghumu, Steve Onyeka

eRA COMMONS USER NAME: OGHUMU01

POSITION TITLE: Associate Professor

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE	END DATE	FIELD OF STUDY
Ahmadu Bello University	BS	01/2002	Microbiology
Ohio State University, Columbus, OHIO	MS	08/2007	Immunology/Molecular Biology
Ohio State University, Columbus, OHIO	PHD	06/2010	Immunology
Ohio State University, Columbus, OHIO	NIH training grant	11/2014	Immuno-oncology/Oral biology

A. Personal Statement

I am an Associate Professor in the Department of Pathology, College of Medicine and a member of The Ohio State University Comprehensive Cancer Center. My research program is aimed at understanding the cellular and molecular mechanisms of head and neck carcinogenesis and advancing the development and application of compounds for head and neck cancer chemoprevention and treatment. I have over 10 years of experience in the characterization of cellular and molecular mechanisms of solid tumor development. I am an expert in immunology, cellular and molecular biology as well as in the generation of genetically modified mouse models. As part of my post-doctoral experience, I received intensive training in oral biology through a highly competitive National Institute of Dental and Craniofacial Research (NIDCR) sponsored T32 training grant (T32DE14320). I was awarded a 5-year National Cancer Institute (NCI) funded Mentored Research Scientist Career Development Award (K01CA207599) which examines the mechanisms of oral cancer inhibition by bioactive phytochemicals in black raspberries, and a 4-year American Cancer Society (ACS) Research Scholar Grant (RSG-19-079-01-TBG), which investigates the effect of macrophage migration inhibitory factor on immune cells of the oral tumor microenvironment. I have also published several high impact peer reviewed manuscripts on oncogenic pathways and inhibitors of carcinogenesis.

Throughout my career, I have cherished the opportunity to provide mentoring to undergraduate, graduate, professional and post-doctoral trainees, and I consider this a valuable academic contribution to next generation of students as we face the unique challenges of the future. As a beneficiary of diversity training through the NCI diversity supplement program (U01 CA188250-02S1), I am committed to enhancing the diversity in biomedical research as well as to the responsible conduct of research.

Ongoing and recently completed projects that I would like to highlight include:

R01DE033906 – NIH/NIDCR

Oghumu (PI)

09/04/2024 – 05/31/2029

Defining the role of the oral glucocorticoid system in oral carcinogenesis and its modulation for improved treatment outcomes

K01CA207599 – NIH/NCI

Oghumu (PI)

09/01/2017 – 08/31/2023

Mechanisms of Oral Cancer Inhibition by Bioactive Phytochemicals in Black Raspberries

RSG-19-079-01-TBG - American Cancer Society (ACS)

Oghumu (PI)

07/01/2019 – 12/31/2024

Mechanisms of MIF in Oral Cancer: Applications for Prevention and Treatment

Citations:

1. Nedungadi D, Ryan N, Anderson K, Lamenza FF, Jordanides PP, Swingler MJ, Rakotondraibe L, **Riedl KM, Iwenofu H, Oghumu S**. Modulation of the oral glucocorticoid system during black raspberry mediated oral cancer chemoprevention. *Carcinogenesis*. 2021 Dec 9;bgab118. doi: 10.1093/carcin/bgab118. Online ahead of print. PMID: 34888650.
2. Ryan N, Anderson K, Volpedo G, Hamza O, Varikuti S, Satoskar AR, **Oghumu S**. STAT1 inhibits T cell exhaustion and myeloid derived suppressor cell accumulation to promote anti-tumor immune responses in head and neck squamous cell carcinoma. *Int J Cancer*. 2019 Nov 10. PMID: 31709529. PubMed Central PMCID: PMC7366342
3. Knobloch TJ, Ryan NM, Bruschweiler-Li L, Wang C, Bernier MC, Somogyi A, Yan PS, Cooperstone JL, **Mo X, Bruschweiler RP, Weghorst CM, Oghumu S**. Metabolic Regulation of Glycolysis and AMP Activated Protein Kinase Pathways during Black Raspberry-Mediated Oral Cancer Chemoprevention. *Metabolites*. 2019 Jul 11;9(7). PMCID: PMC6680978.
4. **Oghumu S**, Casto BC, Ahn-Jarvis J, Weghorst LC, Maloney J, Geuy P, Horvath KZ, Bollinger CE, Warner BM, Summersgill KF, Weghorst CM, Knobloch TJ. Inhibition of Pro-inflammatory and Anti-apoptotic Biomarkers during Experimental Oral Cancer Chemoprevention by Dietary Black Raspberries. *Front Immunol*. 2017;8:1325. PMCID: PMC5660285.

B. Positions, Scientific Appointments, and Honors

Positions and Scientific Appointments

2023 - Present	Associate Professor, College of Medicine, Ohio State University Wexner Medical Center
2018 - 2023	Assistant Professor, College of Medicine, Ohio State University Wexner Medical Center
2016 - Present	Member, American Association of Cancer Research
2015 - 2017	Research Scientist, College of Public Health, Ohio State University
2012 - Present	Member, American Association of Immunologists
2012 - 2015	Member, American Association for Dental Research
2012 - 2016	Member, American Association for the Advancement of Science
2011 - 2014	Postdoctoral Fellow, College of Dentistry, Ohio State University
2008 - 2010	Member, American Society of Microbiologists

Honors

2019	Department of Pathology FASTPATH Future Leader Award, Ohio State University Wexner Medical Center
2019	American Cancer Society Research Scholar, American Cancer Society, United States
2018	NIH/NCI Certificate of Achievement Presentation Award, National Institutes of Health, United States
2017	NIH/NCI Certificate of Excellence Meritorious Poster Presentation Award, National Institutes of Health, United States
2011 - 2014	NIH/NIDCR T32 Fellowship Award, National Institutes of Health, Bethesda, United States
2003	Ohio State University Graduate School Fellowship Award, Ohio State University
2000 - 2001	Arthur Andersen Honors List Award for Scholastic Achievement in Nigerian Universities, Arthur Andersen Consulting Group

Complete List of Published Work in My Bibliography:

<https://www.ncbi.nlm.nih.gov/myncbi/steve.oghumu.1/bibliography/public/>

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. **DO NOT EXCEED FIVE PAGES.**

NAME: Li, Zaibo

eRA COMMONS USER NAME (credential, e.g., agency login): LZAIBO

POSITION TITLE: Professor of Pathology

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE (if applicable)	Completion Date MM/YYYY	FIELD OF STUDY
Peking University	MD	07/1995	Medicine
Peking University People's Hospital	Residency	07/1997	Orthopedic Surgery
University of Rochester	Ph.D	10/2002	Pathology
University of Rochester	Postdoctoral	12/2005	Biomedical Genetics
University of Rochester	MBA	05/2009	Medical Management
University of Pittsburgh	Residency	06/2012	Pathology
University of Pittsburgh	Fellowship	06/2013	Cytopathology
University of Pittsburgh	Fellowship	06/2014	Breast/GYN Pathology

A. Personal Statement

I have the expertise, leadership, training, expertise and motivation necessary to successfully carry out the proposed research project. I have a broad background in molecular biology, pathology and clinical medicine with specific training and expertise in breast cancer and gynecologic/ovarian cancer research, and digital pathology research. My research in breast cancer and gynecologic field includes cancer prognostic/predictive marker testing and high-risk lesions. In addition, I have a strong biomedical research background with a PhD and postdoctoral research experience. During my research years, I had received several prestigious and highly competitive national scientific awards, including the Scholar-in-Training award from AACR, the Wilmot Cancer Research Fellowship award, and a New Investigator Award grant, and also published multiple scientific articles in several prestigious journals. During my pathology practice, I have been actively seeking and pursuing multiple research projects and have published multiple pathology related research articles and presented multiple abstracts at national meeting. As a result of these previous experiences, I have developed the ability to collaborate with other clinicians/researchers and to construct a realistic research plan, timeline, and budget.

Ongoing Research Support

IBEX sponsored clinical trial

Reader study comparing pathologists' performance on HER2 scoring when supported by the Galen Breast HER2 application versus manual scoring in breast cancer specimens

Funding agency: IBEX

IRB Number: 2023X0207

Dates of funding: 01/01/2024 – 12/31/2025

Role: PI

% effort: 5%

Fund: 81,446\$

Patient Care Innovation Award

Implementation of artificial intelligence algorithms in clinical pathology practice

Funding agency: The Ohio State University

Dates of funding: 07/01/2022 – 06/30/2025

Role: PI

% effort: 5%

Fund: 314,884\$

Investigator-initiated Research Award of Department of Defense (DOD) Grant (PI: Wang)

Targeting translesion synthesis to overcome PARP inhibitor resistance in ovarian cancer

Funding agency: Department of Defense

Dates of funding: 04/01/2021 – 03/31/2025

Role: Co-I

% effort: 0.24 Calendar

Fund: 600,000\$

1R01CA231857 (MPI: Ramaswamy/Ganju) 03/06/2019 – 03/31/2024 0.12 calendar

NIH

Addressing cancer disparity through defining the molecular link between breast feeding and triple negative breast cancer

Role: Co-I

% effort: 1%

Fund: \$349,041

Title: Clinical Validation Protocol for Test of non-Inferiority of Primary Diagnosis by WSI using Hamamatsu NanoZoomer S360MD Digital Slide Scanner System Compared to Conventional Determination by Light Microscopy (Primary Diagnosis) (PI: Parwani)

Funding source: Hamamatsu Photonics K.K.

Dates of funding: 2/18/2019-2/28/2023

Total award dollars: \$445,000

Grant/Contract #: HCT-P001

Percent effort: 2%

Role: Co-I

Title: Clinical Validation Protocol for Feature Detection Precision by WSI using Hamamatsu NanoZoomer S360MD Digital Slide Scanner System (PI: Parwani)

Funding source: Hamamatsu Photonics K.K.

Dates of funding: 2/7/2019-2/28-2023

Total award dollars: \$50,000

Grant/Contract #: HCT-P002

Percent effort: NA

Role: Co-I

B. Positions, Scientific Appointments, and Honors

Positions and Employment

2023-present Professor, Department of Pathology, Ohio State University, Columbus, OH

2023-current Endowed University Pathology Services Professorship, Ohio State University, Columbus, OH

2019-2023 Associate Professor, Department of Pathology, Ohio State University, Columbus, OH

2014-2019 Assistant Professor, Department of Pathology, Ohio State University, Columbus, OH

2006-2008 Research Assistant Professor, Department of Biomedical Genetics, University of Rochester, Rochester, NY

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. **DO NOT EXCEED FIVE PAGES.**

NAME: Niazi, Muhammad Khalid Khan, Ph.D.

eRA COMMONS USER NAME (credential, e.g., agency login): MNIAZI

POSITION TITLE: Associate Professor of Pathology and Biomedical Engineering

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE (if applicable)	Completion Date MM/YYYY	FIELD OF STUDY
IIU, Islamabad	B.Sc. (Hons)	12/2001	Computer Science
IIU, Islamabad	MS	12/2004	Digital Image Processing
Uppsala University, Uppsala, Sweden	Ph.D.	10/2011	Medical Image Processing
The Ohio State University, Columbus, Ohio	Postdoctoral training	03/2015	Digital Pathology, Imaging Informatics

A. Personal Statement

I am one of the instructors for Master Masters program in Digital and Computational Pathology. Currently, I work as an associate professor of Pathology and Biomedical Engineering at the Ohio State University, where I am responsible for developing image analysis methods, algorithms, and systems for biomedicine. My unique educational training and professional experience enable me to conduct collaborative and meaningful research with academic institutions, industry, and the business sector. Over the years, I have developed novel digital image analysis methods that enable computers to solve intriguing clinical and research problems that directly or indirectly impact clinical care. Unlike conventional methods, these approaches are inspired by neurophysiology, sociology, nature, and physics.

I have been actively involved in graduate education since 2008, teaching a variety of courses at both the Master's and PhD levels. Since 2018, I have also been supervising PhD students and postdoctoral researchers, guiding them in their academic and research endeavors. As an active researcher in the fields of artificial intelligence and computational pathology, my teaching and mentorship are deeply informed by cutting-edge advancements and practical applications in these areas. This expertise will be crucial for the success of the Masters of Digital and Computational Pathology Program, as I aim to equip students with the skills and knowledge needed to excel in this rapidly evolving field. My commitment to mentorship and education ensures that the next generation of scientists and scholars is well-prepared to tackle the challenges and opportunities in digital and computational pathology.

Ongoing and recently completed projects that I would like to highlight include:

R01CA276301

Niazi (PI)

Jul 1, 2023 - Jun 30, 2028

An ensemble deep learning model for tumor bud detection and risk stratification in colorectal carcinoma.

R01DC020715

Gurcan (PI), Role: Co-I

05/05/2023 – 04/30/2028

Computer-assisted diagnosis of ear pathologies by combining digital otoscopy with complementary data using machine learning

R21 CA273665

Gurcan (PI), Role: Co-I

04/01/23-03/31/25

Efficient and cost-effective breast cancer risk stratification using whole slide histopathology images

Role: Co-Investigator

R21 EB029493

Niazi (PI)

04/01/21-12/31/24

Development of quantitative tools to predict patients with difficult intubation to minimize treatment related complications

R01 1R01HL177046-01

04/01/2026-03/31/2031

Hachem (PI), Role: Co-I

Incorporating Donor Lung CT Images into Machine Learning Models to Predict Sever Primary Graft Dysfunction after Lung Transplantation

B. Positions, Scientific Appointments, and Honors

Positions and Scientific Appointments

2024-Present	Associate Professor of Pathology, The Ohio State University, Columbus, OH, USA
2024- 2024	Associate Professor, Center for Artificial Intelligence Research, Department of Internal Medicine, Wake Forest School of Medicine, Winston-Salem, NC, USA
2018-2024	Assistant Professor, Center for Artificial Intelligence Research, Department of Internal Medicine, Wake Forest School of Medicine, Winston-Salem, NC, USA
2016-2017	Research Scientist, Department of Biomedical Informatics, The Ohio State University, Columbus, Ohio, USA
2015-2016	Senior Research Associate, Department of Biomedical Informatics, The Ohio State University, Columbus, Ohio, USA
2012-2015	Postdoctoral Researcher, Department of Biomedical Informatics, The Ohio State University, Columbus, Ohio, USA
2007-2011	Researcher and PhD student, Centre for Image Analysis, Uppsala University, Uppsala, Sweden
2007-2009	Lecturer and Lab In Charge, Centre for Image Analysis, Uppsala University, Uppsala, Sweden
2007-2011	Researcher and PhD student, Centre for Image Analysis, Uppsala University, Uppsala, Sweden

Honors

2021	Trailblazer Award, NIBIB, NIH
2019	Travel Award for best poster, Wake Forest School of Medicine, Winston-Salem, USA
2018	Best poster award, American Urology Association, San Francisco, USA
2018	Travel Award for best poster, Wake Forest School of Medicine, Winston-Salem, USA
2011	Best Poster Award at 38th Annual Conf of the European Teratology Society, Barcelona, Spain
2009	Vetenskapsrådet (VR) grant for research studies in biomedical Image analysis, Sweden
2008	Best Paper Award, Lecture Notes in Artificial Intelligence, Leipzig, Germany

C. Contributions to Science

Complete List of Published Work in My Bibliography

<https://www.ncbi.nlm.nih.gov/myncbi/muhammad%20khalid%20khan.niazi.1/bibliography/public/>

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. **DO NOT EXCEED FIVE PAGES.**

NAME: **Esnakula, Ashwini Kumar**

eRA COMMONS USER NAME (credential, e.g., agency login): **ESNAKULA**

POSITION TITLE: **Clinical Associate Professor of Pathology**

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE (if applicable)	Completion Date MM/YYYY	FIELD OF STUDY
Kasturba Medical College, Manipal University, Mangalore, Karnataka, India	MBBS	03/2006	Medicine
Georgetown University, Lombardi Cancer Center, Washington, DC	MS	05/2007	Tumor biology
Howard University Hospital, Washington, DC	Residency	06/2013	Anatomic and Clinical Pathology
Washington University School of Medicine/ Barnes Jewish Hospital, St. Louis, MO	Fellowship	06/2014	Selective Surgical Pathology
Cleveland Clinic, Cleveland, OH	Fellowship	06/2015	Gastrointestinal, Hepatic, and Pancreaticobiliary Pathology

A. Personal Statement

I am a board-certified surgical pathologist with clinical interest and expertise in Gastrointestinal and gynecologic pathology, and laboratory management. Currently, I am a Clinical Associate Professor at The Ohio State University Medical Center, Department of Pathology, with a primary appointment in the Division of Anatomic Pathology. My clinical practice includes diagnosing various gastrointestinal and gynecologic tract pathologies and providing clinicians with meaningful prognostic information that guides clinical management.

I have collaborated on clinical and translational research activities in oncologic pathology throughout my career. I have focused on applying immunohistochemistry and molecular techniques to investigate the pathogenesis of pre-neoplastic and neoplastic processes. My academic focus is on gastrointestinal/liver and gynecologic pathology, specifically pancreatic neoplasms, medications/agents-induced GI/liver injury, and endometrial cancers.

B. Positions, Scientific Appointments, and Honors

07/2024- present Medical Director of Immunohistochemistry, Department of Pathology, The Ohio State University Wexner Medical Center, Columbus, OH, USA.

07/1/2023 Program Director, Gastrointestinal/Liver Pathology Fellowship, Department of Pathology, The Ohio State University Wexner Medical Center, Columbus, OH, USA

04/2023- Present CLIA/CAP laboratory director, Ackerman Anatomic Pathology Laboratory, Department of Pathology, The Ohio State University Wexner Medical Center, Columbus, OH, USA.

07/2021- present Medical Director of Histology, Department of Pathology, The Ohio State University Wexner Medical Center, Columbus, OH, USA.

08/2020- present Clinical Associate Professor, Department of Pathology, The Ohio State University Wexner Medical Center, Columbus, OH, USA.

07/2020-08/2020 Clinical Associate Professor, Department of Pathology, Immunology and Laboratory Medicine, University of Florida College of Medicine, Gainesville, FL, USA.

07/2019- 08/2020 Unit Director, Gynecologic Pathology, Departments of Pathology, Immunology and Laboratory Medicine, University of Florida College of Medicine, Gainesville, FL, USA.

07/2017- 05/2020 Director Gross Room, Department of Pathology, Immunology and Laboratory Medicine, University of Florida College of Medicine, Gainesville, FL, USA.

07/2015-06/2020 Clinical Assistant Professor, Department of Pathology, Immunology and Laboratory Medicine, University of Florida College of Medicine, Gainesville, FL, USA.

Honors

2022 Anatomic Pathology Faculty Teacher of the Year: The Ohio State University Wexner Medical Center, Department of Pathology, Columbus, OH, USA.

2017 Exemplary Teacher Award- University of Florida College of Medicine, Gainesville, FL, USA

C. Contributions to Science

My research involves the histopathologic, immunohistochemical, and molecular characterization of various common and uncommon neoplasms of the female reproductive and gastrointestinal tract. Some selected publications are listed below.

1. Haight PJ, **Esnakula A**, Riedinger CJ, Suarez AA, Gillespie J, Patton A, Chassen A, Cohn DE, Cosgrove CM. Molecular characterization of mixed-histology endometrial carcinoma provides prognostic and therapeutic value over morphologic findings. NPJ Precis Oncol. 2025 Feb 8;9(1):41. doi: 10.1038/s41698-025-00803-1.
2. Liu Y, **Esnakula AK**, Jain S, Lin J, Panarelli N, Pyatibrat S, Karamchandani DM. Spectra of well-differentiated neuroendocrine lesions in the extrahepatic biliary system: a case series. Histopathology. 2024 Sep 12. doi: 10.1111/his.15316.
3. Challa B, **Esnakula AK**. Histologic manifestations of ocrelizumab-associated intestinal and hepatic injury in patients with multiple sclerosis. Histopathology. 2024 Apr;84(5):765-775. doi: 10.1111/his.15120. Epub 2023 Dec 19.
4. Riedinger CJ, **Esnakula A**, Haight PJ, Suarez AA, Chen W, Gillespie J, Villacres A, Chassen A, Cohn DE, Goodfellow PJ, Cosgrove CM. Reply to "Mismatch repair and microsatellite instability-Recommendation for an optimal test strategy". Cancer. 2024 May 1;130(9):1713-1714. doi: 10.1002/cncr.35257.
5. Manne A, Yu L, Hart PA, Tsung A, **Esnakula A**. Differential Expression and Diagnostic Value of MUC5AC Glycoforms in Pancreatic Ductal Adenocarcinoma. Cancers (Basel). 2023 Oct 2;15(19):4832. doi: 10.3390/cancers15194832.

Complete list of published work:

<https://pubmed.ncbi.nlm.nih.gov/?term=ESNAKULA&sort=date>

CURRICULUM VITAE
BONNIE SUE PRICE WHITAKER

1253 Saling Drive
 Columbus, Ohio 43229
 Cell (614) 313-0484
 Work (614) 293-8418

EDUCATION

7/77-5/78 University of Kentucky
 Lexington, Kentucky
 General courses

8/74-7/76 Jennie Stuart Memorial Hospital Laboratory School
 Hopkinsville, Kentucky
 Laboratory Technology
 12 months classroom/12 months internship

6/74-12/74 Hopkinsville Community College
 Hopkinsville, Kentucky
 General courses

8/69-5/74 Caldwell County High School
 Princeton, Kentucky
 College Preparatory Track

WORK EXPERIENCE

12/10-CURRENT Ohio State University Medical Center
 Department of Pathology
 Division of Anatomic Pathology
 N305B Doan Hall
 410 W. 10th Ave.
 Columbus, OH 43210
 Anatomic Pathology Operations Director

5/08-11/10 Ohio State University Medical Center
 Department of Pathology
 Division of Anatomic Pathology
 N308B Doan Hall
 410 W. 10th Ave.
 Columbus, OH 43210
 Clinical Histology Laboratory Manager

2/04-4/08 Brown & Associates Medical Laboratories
 8076 El Rio
 Houston, TX 77054
 Laboratory Manager

11/03-4/08 Ancillary Pathways
 7000 SW 62nd Avenue
 Suite PH-C
 Miami, FL 33143
 Consultant
 Provided training for laboratories requiring
 training and/or troubleshooting in IHC and/or ISH on a
 contract basis

6/97-2/04 University of Texas Houston-- Health Science Center
 Medical School
 Department of Pathology
 Houston, TX 77030

2/96-5/97 Technical Director, Histology Laboratory
Ventana Medical Systems, Inc.
3865 North Business Center Drive
Tucson, AZ 85705
Account Executive
sales and customer service for immunohistochemistry equipment
and reagents

10/93-2/96 BioTek Solutions, Inc.
120 B Cremona Drive
Santa Barbara, California 93117
Staff Scientist
Provided IHC training and technical support to customers
Sales Representative

7/91-10/93 Texoma Pathology Associates
1115 Memorial Drive
Denison, Texas 75020
Manager, histology laboratory
Methods development/research technical specialist

10/85-6/91 Emory University Hospital
Department of Anatomic Pathology
Atlanta, Georgia
Pathologist's Assistant (uncertified) 4+ years
Technical Specialist 1+ year

3/85-10/87 Scottish Rite Children's Hospital
Atlanta, Georgia
Medical Technologist, Clinical Laboratory

11/82-5/84 James B. Haggin Memorial Hospital
Harrodsburg, Kentucky
Medical Technologist, Clinical Laboratory

5/77-5/81 International Clinical Laboratories
Lexington, Kentucky
Medical Technologist, Good Samaritan Hospital

1/75-5/77 Caldwell County War Memorial Hospital
Princeton, Kentucky
Medical Technologist, Clinical Laboratory

CERTIFICATION

MT(HEW)

Public Health Service, Bureau of Quality Assurance
#2830005, October, 1976, Technologist

HT(ASCP)

August, 1992

ID# 03200128MHT

HT-14953

IHC Qualification (QIHC)

November, 1995

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. DO NOT EXCEED FIVE PAGES.

NAME: Madar, Ashley Joy Cetnar

eRA COMMONS USER NAME (credential, e.g., agency login): A_CETNAR

POSITION TITLE: Vice-Chair, Education Council

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE (if applicable)	END DATE MM/YYYY	FIELD OF STUDY
Grove City College	BS	05/2011	Applied Physics
Vanderbilt University	MS	05/2013	Medical Physics
University of Louisville	OTH	06/2015	Residency
The Ohio State University	PHD	12/2020	Education: Teaching and Learning
The Ohio State University	MPA	12/2024	Masters of Public Administration and Leadership

A. Personal Statement

I am a professional problem-solver who is passionate about bringing out the best in others. I am trained as both a clinical medical physicist and expert in teaching and learning. Within the clinic, I strive to provide excellent patient care as my role as a medical physicist by solving problems, applying science and technology, upholding quality and safety, and promoting innovation for new ways of treating patients. As an educator, I am passionate about helping others learn and grow as both individuals and within a team. Within this program, I propose combining science and education to integrate many of the skills I have honed throughout my career. I have a background in the science of radiation oncology through my graduate work, residency, and clinical work within medical physics. I look forward to being able to contribute my unique background with a PhD in Teaching and Learning to direct this proposal to develop an AI curriculum applied in medicine.

1. Cetnar AJ. Implementing team science in undergraduate medical physics research. J Appl Clin Med Phys. 2025 Jul;26(7):e70169. PubMed Central PMCID: PMC12257336.
2. Cetnar AJ, Woollard J, Ding L. Assessment of a medical physics educational program for science teachers. J Appl Clin Med Phys. 2025 May;26(5):e70087. PubMed Central PMCID: PMC12059288.
3. Cetnar AJ, Besemer A, Bry V, Buckey CR, Burmeister J, Rodrigues A, Schubert L, Speidel M, Sutlief S, Yu AS. Introduction to concept inventories for medical physics education. J Appl Clin Med Phys. 2023 Oct;24(10):e14130. PubMed Central PMCID: PMC10562015.
4. Cetnar AJ. Model for implementation of a modern journal club in medical physics residency programs. J Appl Clin Med Phys. 2021 Jun;22(6):253-261. PubMed Central PMCID: PMC8200434.

B. Positions, Scientific Appointments and Honors**Positions and Scientific Appointments**

2025 -	Vice-Chair, Education Council, American Association of Physicists in Medicine
2024 -	Associate Professor, Ohio State University
2024 -	Chair, Radiation Oncology Medical Physics Education Subcommittee, American Association of Physicists in Medicine
2022 - 2023	College of Medicine Annual Education Symposium Steering Committee, Ohio State University
2022 - 2023	Program Director, Workshop on Improving the Teaching and Mentoring of Medical Physics Virtual Conference, American Association of Physicists in Medicine
2021 -	Chair, Committee on Medical Physicists as Educators, American Association of Physicists in Medicine
2021 - 2024	Assistant Professor, Ohio State University
2020 - 2022	Board of Directors, American Association of Physicists in Medicine

2020 - 2021	Program Director, Accelerating Women and Minority Physics Specialty Meeting, American Association of Physicists in Medicine
2019 - 2019	President, Ohio River Valley Chapter of AAPM
2018 -	Board of Editors, Journal of Applied Clinical Medical Physics
2015 - 2021	Medical Physicist, Ohio State University

Honors

2024	Karen Doppke Award for Women in Medical Physics, Division of Physics in the Department of Radiation Oncology at Massachusetts General Hospital and Harvard Medical School
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C. Contribution to Science

1. I have contributed to national efforts in medical physics education through curriculum development, leadership training, and equity-focused initiatives. As a co-author of the AAPM/ASTRO 2023 Core Physics Curriculum and AAPM Report No. 365, I helped establish standardized competencies and updated academic program recommendations for graduate and residency training. I also lead the development of the Medical Physics Leadership Academy Journal Club, fostering a national community of emerging leaders, and explored bias mitigation strategies in residency admissions through blinded application research for our medical physics residents. These collaborative projects have advanced educational quality, professional development, and inclusivity across the field.
 - a. Cetnar AJ, Hall K, Hirata EY, Wang D, Collins CE, Barreto IL, Edward SS, Kapadia A, Wells MC, Wilson JM, Xu Y, Johnson JL. Medical Physics Leadership Academy Journal Club (Leadership Club) program: Two-year review in building a community of leaders. J Appl Clin Med Phys. 2023 Nov;24(11):e14164. PubMed Central PMCID: PMC10647985.
 - b. Studenski MT, Cetnar A, Derosiers CM, Dooley S, Gagneur JD, Galavis PE, Kainz KK, Lamichhane N, Sandwall PA, Shen J, Tien CJ, Wang D, Wang IZ, Warkentin HK, McAvoy S. The AAPM/ASTRO 2023 Core Physics Curriculum for Radiation Oncology Residents. Int J Radiat Oncol Biol Phys. 2024 Feb 1;118(2):325-329. PubMed PMID: 37689369.
 - c. Cetnar AJ, DiCostanzo DJ, Weldon M, Swanson AE, Mathews J, Gupta N. Blinding of Residency Applications in Medical Physics: Promises and Pitfalls. Adv Radiat Oncol. 2023 Jul-Aug;8(4):101242. PubMed Central PMCID: PMC10209683.
 - d. Burmeister JW, Busse NC, Cetnar AJ, Howell RR, Jeraj R, Jones AK, King SH, Matthews KL 2nd, Montemayor VJ, Newhauser W, Rodrigues AE, Samei E, Turkington TV, Gronberg MP, Loughery B, Roth AR, Joiner MC, Jackson EF, Naine PA, Kim LH. Academic program recommendations for graduate degrees in medical physics: AAPM Report No. 365 (Revision of Report No. 197). J Appl Clin Med Phys. 2022 Oct;23(10):e13792. PubMed Central PMCID: PMC9588271.
2. I have actively mentored undergraduate students and residents in collaborative research projects that address clinical challenges in radiation oncology and medical physics. These efforts have led to peer-reviewed publications exploring failure modes and effects analyses in brachytherapy and a clinical trial for whole lung irradiation, as well as innovations in intrafraction motion review for spine stereotactic body radiation therapy. Through these projects, I have supported researchers in developing technical expertise, contributing to quality improvement in patient care, and advancing the field through rigorous scientific inquiry.
 - a. Holtman AL, DiCostanzo DJ, Zimmerman CA, Graeper G, Woollard J, Christ DF, Cetnar AJ. Comparison of failure modes and effects analyses and time for brachytherapy ring and tandem applicator digitization between manual and solid applicator source placement methods. J Appl Clin Med Phys. 2024 May;25(5):e14336. PubMed Central PMCID: PMC11087182.
 - b. Swanson AE, DiCostanzo DJ, Gupta N, Hintenlang K, Chakravarti A, Cetnar AJ. Multi-phase failure modes and effects analysis for low dose bilateral whole lung irradiation of COVID-19 positive patients requiring respiratory ventilation. J Appl Clin Med Phys. 2024 Apr;25(4):e14261. PubMed Central PMCID: PMC11005974.
 - c. Jank EA, Cetnar AJ. Exploring the Use of Contour-Based Intrafraction Motion Review for Spine Stereotactic Body Radiation Therapy Treatments. Adv Radiat Oncol. 2024 Feb;9(2):101351. PubMed Central PMCID: PMC10885588.

- d. Graeper G, Cetnar A, Ayan AS, Weldon M. Interpretation of intrafraction motion review data and method for verification. J Appl Clin Med Phys. 2021 Nov;22(11):196-202. PubMed Central PMCID: PMC8598153.
- 3. I have led and contributed to clinically driven research projects that deepen our understanding of radiation oncology physics and improve patient care. My work includes commissioning ultra-high dose rate electron beams for FLASH therapy, developing optimization tools for dose delivery, implementing triggered imaging techniques for spine stereotactic radiotherapy, and evaluating the longevity of key linear accelerator components. These investigations address real-time clinical challenges and have been shared broadly through peer-reviewed publications and presentations to advance practice within the medical physics community.
 - a. Cetnar AJ, Jain S, Gupta N, Chakravarti A. Technical note: Commissioning of a linear accelerator producing ultra-high dose rate electrons. Med Phys. 2024 Feb;51(2):1415-1420. PubMed PMID: 38159300.
 - b. Jain S, Cetnar A, Woollard J, Gupta N, Blakaj D, Chakravarti A, Ayan AS. Pulse parameter optimizer: an efficient tool for achieving prescribed dose and dose rate with electron FLASH platforms. Phys Med Biol. 2023 Sep 22;68(19) PubMed PMID: 37735967.
 - c. Cetnar AJ, Degnan M, Pichler J, Jain S, Morelli S, Thomas E, Elder JB, Scharschmidt TJ, Palmer JD, Blakaj DM. Implementation of triggered kilovoltage imaging for stereotactic radiotherapy of the spine for patients with spinal fixation hardware. Phys Imaging Radiat Oncol. 2023 Jan;25:100422. PubMed Central PMCID: PMC9978845.
 - d. Cetnar AJ, DiCostanzo DJ. The lifetime of a linac monitor unit ion chamber. J Appl Clin Med Phys. 2021 Dec;22(12):108-114. PubMed Central PMCID: PMC8664141.

Aline Paixao Becker, M.D., M.S., Ph.D.

Translational Scientist | Neuropathology and Molecular Pathology

Aline.Becker@osumc.edu

I am a Research Scientist formally trained in anatomic pathology at the University of Sao Paulo (Brazil), with extensive experience in neuropathology and translational research. My background in neuropathology and molecular pathology, associated with a large experience working with multidisciplinary teams has provided me experience in grant writing and in the full process of discovery and validation of prognostic and/or predictive biomarkers of adult glioma. Before moving to the USA, I worked for 10 years as Board-certified surgical pathologist specialized in neuropathology, including brain & spine tumors, neurodegenerative diseases, and autopsy. I also served as Professor of Pathology for 2nd-4th year medical students and preceptor to medical residents in Anatomic Pathology in my home country. I am currently enrolled in the Master of Translational Data Analytics program at The Ohio State University.

Experience

2021 – Current

Research Scientist at the Ohio State University

- Translational Scientist with research focus on adult gliomas, prognostic and predictive biomarkers, tumor heterogeneity and response to treatment
- Development of multimodal (multi-omics, radiomics, and pathomics) data integration methods in collaboration with the College of Engineering
- Scientific writing: leading role in multidisciplinary teams for grant applications (NIH, NSF, and internal CCTS grant) and co-authorship in multiple high-impact factor manuscripts published in Cancers, Brain Pathology, JAMA Oncology, Journal of Clinical Oncology, and Cell Reports Medicine
- Support and mentorship to junior researchers and international Medical Residents

2015 – 2021

Senior Research Associate at the Ohio State University

- Histopathological analyses and support for molecular pathology analyses of clinical and *in vivo* studies
- Management of formalin-fixed, paraffin embedded (FFPE) tissue, including storage; analysis and area selection from glass slides; planning, and building of tissue microarrays (TMAs) in semi-automated platform
- Development of de-identification system for samples and generation of the clinical database of cases available at the laboratory
- Scientific writing: collaborated in multiple DoD and NIH (R01, U19, U54, and UH2/UH3) applications
- Co-edited the book "Precision Molecular Pathology of Glioblastoma" - <https://doi.org/10.1007/978-3-030-69170-7>
- Multiple manuscripts in collaboration with national and international authors, including publications in Oncogene, Molecular Cancer Research, Scientific Reports, and Journal of Neuropathology & Experimental Neurology

2004 – 2015

Board-Certified Pathologist at University of Sao Paulo and Barretos Cancer Hospital (Brazil)

- Provided Pathology reports in general surgical pathology, Neuropathology, and soft tissue and bone pathology
- Brain cut sessions for gross pathology description, histopathology reports, and coordination of Neuropathology-Radiology-Neurosurgery weekly rounds
- Mentorship to Medical Residents in Anatomic Pathology

Aline Paixao Becker, M.D., M.S., Ph.D.

Translational Scientist | Neuropathology and Molecular Pathology

Aline.Becker@osumc.edu

2006 – 2009; 2011 – 2013

Professor of Pathology at University of Ribeirao Preto (UNAERP) (Brazil)

- Experience in active learning methodology (Problem-Based Learning)
- Development of didactic materials for study guidance
- Mentored several students into Medical Residency in Anatomic Pathology

Education

2025 – present

The Ohio State University

Master in Translational Data Analytics (Predicted graduation: Spring/2027).

2022

Washington University in St. Louis School of Medicine

E4B 1 program in innovation and entrepreneurship

2015

Institute for Research in Immunology and Cancer (IRIC) – University of Montreal, Canada.

Summer School in Systems Biology (Functional genomics)

2012 – 2015

Fundacao Pio XII, Barretos Cancer Hospital, Barretos (Brazil)

Ph.D. in Oncology

Title: Evaluation of MAPK pathway in the oncogenesis of pilocytic astrocytoma (PMID: 26083571, PMID: 26083571, PMID: 26083571)

Mentors: Rui Manuel Reis, PhD and Cristovam Scapulatempo Neto, MD, PhD

2005 – 2008

University of Sao Paulo (Brazil)

Master's in science – Medicine

Title: Pilocytic astrocytomas: Clinic-pathologic study with evaluation of cellular proliferation, expression of Galectin-3, vascular density and neuronal differentiation (PMID: 19823847, PMID: 20711594)

Mentors: Ricardo de Oliveira, MD, PhD and Luciano Neder, MD, PhD

2002 – 2005

University of Sao Paulo (Brazil)

Medical Residency in Anatomic Pathology

1995 – 2001

Federal University of Para (Brazil)

Medical School

Aline Paixao Becker, M.D., M.S., Ph.D.

Translational Scientist | Neuropathology and Molecular Pathology

Aline.Becker@osumc.edu

Skills

- Portuguese: Native language; English: Fluent; Spanish: High intermediate (B2 level of CEFR)
- Cooperation in multidisciplinary teams
- Leading role in collaborations between OSU and Siemens Healthineers for molecular-radiomics integration
- Advanced scientific and grant writing
- Advanced knowledge of SPSS software for statistics
- Advanced knowledge of Excel
- Advanced knowledge of PowerPoint for oral presentation and posters
- Advanced use of IHIS, software for clinical review of patients' files
- Advanced use of pathology image viewers and digital pathology analysis software (Phillips viewer, ImageScope, OlyVIA, QuPath)
- Intermediate knowledge of R, Python, and SQL languages applied to data visualization and biostatistical analyses (in progress)
- Intermediate knowledge of Qlucore software for multi-omics analysis
- Intermediate wet lab skills in cell culture, Western Blot, DNA and RNA purification from FFPE tissue
- Self-petition to Permanent Residence (Green Card) category EB1A
- Naturalized as Citizen of the United States of America

List of publications

<https://scholar.google.com/citations?user=E1NX5ewAAAAJ&hl=fr>

<https://www.ncbi.nlm.nih.gov/myncbi/aline.becker.1/bibliography/public/>

<https://orcid.org/0000-0002-8695-810X>

<https://www.webofscience.com/wos/author/record/AAD-2209-2021>

NAME: Dominic J DiCostanzo

POSITION TITLE & INSTITUTION: Medical Physicist and Dosimetry Manager, The Ohio State University

A. PROFESSIONAL PREPARATION - (see [PAPPG Chapter II.C.2.f.\(i\)\(a\)](#))

INSTITUTION	LOCATION	MAJOR/AREA OF STUDY	DEGREE (if applicable)	YEAR (YYYY)
Saint Vincent College	Latrobe, PA	Physics	BS	2008
Vanderbilt University	Nashville, TN	Medical Physics	MS	2010
Health Quest Medical Systems	Poughkeepsie, NY	Clinical Residency	Certificate	2012
The Ohio State University	Columbus, OH	Health and Rehabilitation Sciences	PhD	2023

B. APPOINTMENTS - (see [PAPPG Chapter II.C.2.f.\(i\)\(b\)](#))

From - To	Position Title, Organization and Location
2023 - Present	Assistant Professor, Executive Administrative Director, The Ohio State University Proton Center, Columbus, OH
2016 - 2023	Medical Physicist and Dosimetry Manager, The Ohio State University Wexner Medical Center, Columbus, OH
2012 - 2016	Medical Physicist, The Ohio State University Wexner Medical Center, Columbus, OH
2011 - 2012	Chief Medical Physics Resident, Health Quest Medical Systems, Poughkeepsie, NY
2010 - 2011	Medical Physics Resident, Health Quest Medical Systems, Poughkeepsie, NY

C. PRODUCTS - (see [PAPPG Chapter II.C.2.f.\(i\)\(c\)](#)) Products Most Closely Related to the Proposed Project

- Bazan, J. G., E. Healy, S. Beyer, K. Kuhn, D. DiCostanzo, T. L. Smith, S. Jhavar and J. R. White (2020). "Clinical Effectiveness of an Adaptive Treatment Planning Algorithm for Intensity Modulated Radiation Therapy Versus 3D Conformal Radiation Therapy for Node-Positive Breast Cancer Patients Undergoing Regional Nodal Irradiation/Postmastectomy Radiation Therapy." *Int J Radiat Oncol Biol Phys* 108(5): 1159-1171.
- DiCostanzo DJ, Patterson ES. Using Incident Reports to Advance Patient Safety and System Resilience in Radiation Oncology Treatment Planning. In *Proceedings of the International Symposium on Human Factors and Ergonomics in Health Care 2021 Jul* (Vol. 10, No. 1, pp. 286-290). Sage CA: Los Angeles, CA: SAGE Publications.
- Hansen, C. J., D. DiCostanzo, R. J. Mumaw and E. S. Patterson (2020). "Healthcare and Aviation: Perspectives on Alerts, Machine Learning, and Future Directions." *Proceedings of the International Symposium on Human Factors and Ergonomics in Health Care* 9(1): 113-115.
- Rice, A., I. Zoller, K. Kocos, D. Weller, D. DiCostanzo, A. Hunzeker and N. Lenards (2019). "The implementation of RapidPlan in predicting deep inspiration breath-hold candidates with left-sided breast cancer." *Medical Dosimetry* 44(3): 210-218.
- Sebastian, N. T., C. Glenn, R. Hughes, R. Raval, J. Chu, D. DiCostanzo, E. H. Bell, J. Grecula, A. Arnett, H. Gondal, J. McGregor, J. B. Elder, R. Lonser, A. Chakravarti, D. Trifiletti, P. D. Brown, M. Chan and J. D. Palmer (2020). "Linear accelerator-based radiosurgery is associated with lower incidence of radionecrosis compared with gamma knife for treatment of multiple brain metastases." *Radiotherapy and Oncology* 147: 136-143.

Other Significant Products, Whether or Not Related to the Proposed Project

- Cetnar, A. and D. DiCostanzo (2018). "Which Fiducials Were Placed? The Challenge of Identifying Gold Seeds Vs. Calypso Beacons Using Imaging Alone Before Treatment." Medical Physics 45(6): E273-E273.
- Christ, D., D. DiCostanzo, A. Ayan, J. Woollard and N. Gupta (2017). "Evaluation of a Novel Multi-Criteria Optimization Algorithm in a Commercially Available Treatment Planning System." Medical Physics 44(6): 2903-2903.
- DiCostanzo, D., A. Ayan, J. Woollard and N. Gupta (2017). "Use of Eclipse Scripting API to Ensure Plan Integrity for Patient Specific Quality Assurance." Medical Physics 44(6).
- DiCostanzo, D., A. Ayan, J. Woollard and N. Gupta (2016). "Prediction of TrueBeam Hardware Issues Using Trajectory Log Analysis." Medical Physics 43(6): 3375-3375.

D. SYNERGISTIC ACTIVITIES - (see [PAPPG Chapter II.C.2.f\(i\)\(d\)](#))

- DiCostanzo, D., S. Thompson, J. Woollard, N. Gupta and A. Ayan (2015). "An Electronic Whiteboard Platform to Manage Treatment Planning Process." Medical Physics 42(6): 3572-3572.
- Gupta, N., A. Ayan, D. DiCostanzo, M. Carlson and J. Woollard (2018). "Development of a Robust Linac QA Program for Multiple Beams Matched and Dosimetrically Equivalent TrueBeams." Medical Physics 45(6): E610-E610.
- Lead developer of institutional DICOM processing pipeline to convert data into consumable data types for machine learning applications.
- Involved in the American Association of Physicists in Medicine professional organization: Member of AAPM Professional Council, Chair of Clinical Practice Committee, Member of Ethics Committee

Sung Jun Ma

Local: 723 Terra Ct, Worthington, OH 43085
Cell: (765) 586-1270
E-mail: SungJun.Ma@osumc.edu

Employment

- 08/2023-Current Assistant Professor
Department of Radiation Oncology
The Ohio State Comprehensive Cancer Center
The James Cancer Hospital and Solove Research Institute
Columbus, OH
- 08/2023-Current Adjunct Research Assistant Professor
Department of Radiation Medicine
Roswell Park Comprehensive Cancer Center
Buffalo, NY

Education

- 07/2019-06/2023 Residency, Radiation Oncology
Roswell Park Comprehensive Cancer Center
Buffalo, NY
- 07/2018-06/2019 Internship, Preliminary Medicine
Northwell Health, North Shore University Hospital
Manhasset, NY
- 07/2014-06/2018 M.D. with Research Honors
Jacobs School of Medicine and Biomedical Sciences
University at Buffalo, The State University of New York
Buffalo, NY
- 07/2008-06/2012 B.S., Applied Mathematics
Purdue University
West Lafayette, IN

Select Peer-Reviewed Publications

1. Singh AK*, **Ma S**...Farrugia MK, Yu H. Development and external validation of integrated machine learning-based prognostic model in oropharyngeal head and neck cancer using the systemic inflammatory response index. *Cancers (Basel)*. 2025;17(23):3820.
*Contributed equally.
2. **Ma S**, Yu H, Khan M, et al. Defining the optimal threshold and prognostic utility of pre-treatment hemoglobin level as a biomarker for survival outcomes in head and neck cancer patients receiving chemoradiation. *Oral Oncol*. 2022;133:106054.
3. **Ma S**, Yu H, Khan M, et al. Evaluation of optimal threshold of neutrophil-lymphocyte ratio and its association with survival outcomes among patients with head and neck cancer. *JAMA Netw Open*. 2022;5(4):e227567.
4. Yu H, **Ma S**, Farrugia M, et al. Machine learning incorporating host factors for predicting survival in head and neck squamous cell carcinoma patients. *Cancers (Basel)*. 2021;13(18).

Select Book Chapters

1. Virk J, Zhu S, Sim A, **Ma S**. Recent trends of artificial intelligence in radiation oncology: A narrative review of prospective studies. *Appl Radiat Oncol*. 2025;14(3):1-13.
2. Zhu S*, **Ma S***, Farag A, et al. Artificial Intelligence, Machine Learning and Big Data in Radiation Oncology. *Hematol Oncol Clin North Am*. 2025;39(2):453-469. *Contributed Equally.

Select Research Funding

- 04/2025-06/2026 The Ohio State University Comprehensive Cancer Center
The Arthur G. James Cancer Hospital and Richard J. Solove Research Institute
Department of Radiation Oncology Seed Grant
AWD-119460
Feasibility Study to Develop and Validate Deep Learning-Based Multimodal Biomarker for Patients with p16-Negative Head and Neck Cancer Treated with Upfront Surgical Resection
Aim is to develop a machine learning model to risk stratify the patients with p16-negative head and neck cancer after upfront surgery based on clinical variables and whole slide images
Amount: \$15,000
Role: PI (co-PI: Simeng Zhu, Abberly Lott Limbach; Mentor: Dukagjin Blakaj)
- 04/2023-03/2024 Roswell Park Comprehensive Cancer Center
Clinical Research Investigator-Initiated Studies Program (CRI-ISP)
(No Number Assigned)
Intensive Symptom Surveillance Guided by Machine Learning-Directed Risk Stratification (INSIGHT)
Aims are to (1) evaluate the efficacy of intensive symptom evaluation during and after radiation versus usual care on reducing acute care visits among patients with head and neck cancer undergoing radiation and (2) prospectively validate our machine learning model in identifying high-risk patients
Amount: \$45,527
Role: PI (Mentor and Nominal PI: Anurag K. Singh)

Select Conference Abstracts

1. Sadek Y, Sun J, Zhu Y...**Ma S**, Zhu S. (2026). Whole slide imaging-based prediction of immunohistochemistry markers and surgical pathological features. American Society of Clinical Oncology (ASCO) Annual Meeting.
2. Sun J, Sadek Y, Zhu Y...**Ma S**, Zhu S. (2026). Multimodal AI prediction of head and neck cancer treatment outcomes with whole slide imaging. American Society of Clinical Oncology (ASCO) Annual Meeting.
3. **Ma S**, Matott LS, DeLeon R, et al. (2021). Prospective pilot study of radiation dermatitis among patients with breast cancer evaluated using deep machine learning. American Radium Society (ARS) Annual Meeting, Virtual.

Skills

R software for survival and competing risk analysis, propensity score matching, and restricted cubic spline modeling. Working knowledge of mlr3 package for data preprocessing, supervised learning model development and evaluation, and model interpretability.

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. DO NOT EXCEED FIVE PAGES.

NAME: Gupta, Nilendu

eRA COMMONS USER NAME (credential, e.g., agency login): NGUPTA06

POSITION TITLE: Vice Chair of Medical Physics, Department of Radiation Oncology

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE (if applicable)	END DATE MM/YYYY	FIELD OF STUDY
Indian Institute of Technology, Kharagpur	BS	05/1987	Instrumentation/Electrical Engineering
The Ohio State University, Columbus, OH	MS	12/1990	Biomedical Engineering/Medical Physics
The Ohio State University, Columbus, OH	PHD	08/1995	Biomedical Engineering/Medical Physics

A. Personal Statement

As an academic Medical Physicist my current research interests are in the development of radiation measurement systems in biology and medicine and in the simulation and modeling of radiation doses through radiation transport to better characterize normal tissue tolerance to different radiation fields. I support investigators in the department with various dosimetry needs, which include QC analyses and commissioning of irradiators including those used for research. I currently lead the FLASH radiotherapy physics efforts within the department. I am Physics PI for NRG Oncology/NSABP B-51/RTOG 1304, which is a Phase III Breast Cancer radiotherapy trial, and the physics PI for a multi-institution trail on Low-Dose Radiotherapy for patients with SARS-COV-2 Pneumonia, funded by Varian Medical Systems. With my training background in nuclear physics and research experience in mixed neutron photon field dosimetry experience, as well as my experimental background in Nuclear Reactor and particle accelerator beams,

As a leader of our Medical Physics and Dosimetry program and the owner of our Oncology Information System and Treatment Planning System, I lead the use of AI techniques within our clinical implementation strategy.

Leadership roles in Education, Research and Training: As Director of the Radiation Physics Residency Program and Vice Chair and Chief Medical Physicist, I provide training to Physics residents and take leading role in QC, maintenance and clinical commission of various instruments and linear accelerators in the Department of Radiation Oncology. I hold a co-appointment with Nuclear Engineering department and I am member in the oversight board of OSU-Nuclear Reactor. I have led various clinical training programs and schools that have been developed by the department for professional and peer training, and have had leadership roles in planning and directing national symposia, evaluating training programs and training and certification of medical physicists. I serve internationally on the Board of the Commission on Accreditation of Medical Physics Education Programs (CAMPEP), perform residency program accreditation reviews for CAMPEP, and serve on the American Board of Radiology as an oral examiner for certification of Medical Physicists. I am also a member of the International Council of the American Association of Physicists in Medicine (AAPM) charged with creating a framework of education and training for our peers globally, and am a committee chair for one of the committees (Global Data and Information Exchange Committee) of the AAPM.

B. Positions, Scientific Appointments and Honors**Positions and Scientific Appointments**

2023 -	Vice Chair of Medical Physics, Department of Radiation Oncology, The Ohio State University, Columbus, OH
2019 -	Professor of Radiation Oncology, The Ohio State University, Dept of Radiation Oncology, Columbus, OH
2007 -	Chief of Medical Physics, Department of Radiation Oncology, The Ohio State University, Columbus, OH

- 2003 - Director, Medical Physics Residency Training Program, Dept of Radiation Oncology, The Ohio State University, Columbus, OH
- 1998 - 2012 Assistant Professor of Radiation Oncology, OHIO STATE UNIVERSITY
- 1995 - 2019 Associate Professor, OHIO STATE UNIVERSITY
- 1995 - 1998 Research Specialist, OHIO STATE UNIVERSITY

Honors

- 2019 Volunteer Service Award, American Board of Radiology
- 2018 Fellow, American Association of Physicists in Medicine

C. Contribution to Science

1. **Radiation biology and RBE calculation.** My interest and work in mixed neutron photon field dosimetry in support of our Neutron capture therapy project has led to some early work in developing methodologies to characterize the clinical RBE's for epithermal and thermal neutrons and validate them by measurements. We developed some early models to relate neutron LET to clinical RBE's, developed measurement techniques for mixed neutron/photon paired ion chamber and TLD dosimetry, and computational work to correlate small animal and human trials.
 - a. Racke FK, Baird M, Barth RF, Huo T, Yang W, Gupta N, Weldon M, Rutledge H. Unique in vitro and in vivo thrombopoietic activities of ingenol 3,20 dibenzoate, a Ca(++)-independent protein kinase C isoform agonist. PLoS One. 2012;7(12):e51059. PubMed Central PMCID: PMC3528756.
 - b. Woollard JE, Blue TE, Gupta N, Gahbauer RA. Development and calculation of an energy dependent normal brain tissue neutron RBE for evaluating neutron fields for BNCT. Health Phys. 2001 Jun;80(6):583-9. PubMed PMID: 11388728.
 - c. Blue TE, Woollard JE, Gupta N, Greskovich JF Jr. An expression for the RBE of neutrons as a function of neutron energy. Phys Med Biol. 1995 May;40(5):757-67. PubMed PMID: 7652006.
 - d. Blue T, Gupta N, Woollard J. A calculation of the energy dependence of the RBE of neutrons. Physics in Medicine and Biology. 1993; 38(12):1693-1712. Available from: <https://www.scopus.com/inward/record.uri?eid=2-s2.0-0027724092&doi=10.1088%2f0031-9155%2f38%2f12%2f002&partnerID=40&md5=bdb3bce76d5c3fa180a9be6edffaeb57> DOI: 10.1088/0031-9155/38/12/002
2. **Boron Neutron Capture therapy.** I have been an integral part of the Boron Neutron Capture Therapy (BNCT) program at Ohio State. Our group developed one of the earliest designs of an accelerator based epithermal neutron source for clinical implementation of BNCT. My contribution was to complete design and fabrication of a filter system to optimize the neutron spectrum for testing a prototype system and I performed a series of experiments using a proton accelerator and accelerator produced neutrons using the OSU Van de Graaff facility and the Ohio University accelerator lab. I developed measurement methods and dosimetry techniques to characterize the beam and performed mixed field dose calculations for patient images to evaluate the beam quality. This prototype was used by several students in our group for further studies and experiments.
 - a. Barth RF, Gupta N, Kawabata S. Evaluation of sodium borocaptate (BSH) and boronophenylalanine (BPA) as boron delivery agents for neutron capture therapy (NCT) of cancer: an update and a guide for the future clinical evaluation of new boron delivery agents for NCT. Cancer Commun (Lond). 2024 Aug;44(8):893-909. PubMed Central PMCID: PMC11337926.
 - b. Woollard JE, Albertson BJ, Reed MK, Blue TE, Capala J, Gupta N, Gahbauer RA. A comparison of neutron beams for BNCT based on in-phantom neutron field assessment parameters. Med Phys. 2001 Feb;28(2):184-93. PubMed PMID: 11243342.
 - c. Woollard J, Blue T, Gupta N, Gahbauer R. Evaluation of moderator assemblies for use in an accelerator-based neutron source for boron neutron capture therapy. Nuclear Technology. 1998; 123(3):320-333. Available from: <https://www.scopus.com/inward/record.uri?eid=2-s2.0-0032167276&partnerID=40&md5=c4a1517b0c613bf129ecfc625c4cc34e>

- d. Gahbauer R, Gupta N, Blue T, Goodman J, Barth R, Grecula J, Soloway AH, Sauerwein W, Wambersie A. Boron neutron capture therapy: principles and potential. *Recent Results Cancer Res.* 1998;150:183-209. PubMed PMID: 9670292.
3. **Clinical Dosimetry and Radiation therapy planning.** In my role as a clinical medical physicist in a clinical radiotherapy department, I have been involved in developing multiple studies in conventional photon beam radiotherapy planning and dosimetry methods and intercomparison studies. I have developed expertise in a wide array of measurement methods and dose calculation techniques to improve understanding of radiotherapy treatment efficacy and characterize normal tissue doses.
 - a. Cetnar AJ, Jain S, Gupta N, Chakravarti A. Technical note: Commissioning of a linear accelerator producing ultra-high dose rate electrons. *Med Phys.* 2024 Feb;51(2):1415-1420. PubMed PMID: 38159300.
 - b. Cuitiño MC, Fleming JL, Jain S, Cetnar A, Ayan AS, Woollard J, Manring H, Meng W, McElroy JP, Blakaj DM, Gupta N, Chakravarti A. Comparison of Gonadal Toxicity of Single-Fraction Ultra-High Dose Rate and Conventional Radiation in Mice. *Adv Radiat Oncol.* 2023 Jul-Aug;8(4):101201. PubMed Central PMCID: PMC10050676.
 - c. Bazan J, DiCostanzo D, Kuhn K, Majithia L, Quick A, Gupta N, White J. Likelihood of unacceptable normal tissue doses in breast cancer patients undergoing regional nodal irradiation in routine clinical practice. *Pract Radiat Oncol.* 2017 May-Jun;7(3):154-160. PubMed PMID: 28094211.
 - d. Rong Y, Jia J, Sun J, Gupta N. WE-E-BRB-08: Establishing Comprehensive Quality Assurance Program for Volumetric Modulated Arc Therapy — Clinical Study Using Control Point Analysis Software. *Medical Physics.* 2012; 39(6):3957. Available from: <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85024820988&doi=10.1118%2f1.4736150&partnerID=40&md5=a6185dac46c97d705632fe3de2b6d73>
d DOI: 10.1118/1.4736150
 4. **Drug delivery optimization for improved radiotherapy response.** As an offshoot of my interest and work on binary therapies like BNCT, I have collaborated in several projects that have evaluated the efficacy of different drug delivery pathways in conjunction with conventional radiotherapy, altered fractionation schemes and evaluated these in small animal models. I have helped design experiments involving combination therapies involving radiotherapy, designed and fabricated novel animal irradiation and in-vitro experimental techniques and systems, performed assessment and measurement of doses delivered towards completing various studies.
 - a. Barth RF, Yang W, Huo T, Riley KJ, Binns PJ, Grecula JC, Gupta N, Rousseau J, Elleaume H. Comparison of intracerebral delivery of carboplatin and photon irradiation with an optimized regimen for boron neutron capture therapy of the F98 rat glioma. *Appl Radiat Isot.* 2011 Dec;69(12):1813-6. PubMed PMID: 21493080.
 - b. Yang W, Huo T, Barth RF, Gupta N, Weldon M, Grecula JC, Ross BD, Hoff BA, Chou TC, Rousseau J, Elleaume H. Convection enhanced delivery of carboplatin in combination with radiotherapy for the treatment of brain tumors. *J Neurooncol.* 2011 Feb;101(3):379-90. PubMed Central PMCID: PMC4492111.
 - c. Bratasz A, Pandian RP, Deng Y, Petryakov S, Grecula JC, Gupta N, Kuppusamy P. In vivo imaging of changes in tumor oxygenation during growth and after treatment. *Magn Reson Med.* 2007 May;57(5):950-9. PubMed Central PMCID: PMC2206209.
 - d. Barth RF, Grecula JC, Yang W, Rotaru JH, Nawrocky M, Gupta N, Albertson BJ, Ferketich AK, Moeschberger ML, Coderre JA, Rofstad EK. Combination of boron neutron capture therapy and external beam radiotherapy for brain tumors. *Int J Radiat Oncol Biol Phys.* 2004 Jan 1;58(1):267-77. PubMed PMID: 14697448.

Complete List of Published Work in My Bibliography:

<https://www.ncbi.nlm.nih.gov/myncbi/nilendu.gupta.1/bibliography/public/>

BIOGRAPHICAL SKETCH

NAME: SIMENG ZHU

eRA COMMONS USER NAME (credential, e.g., agency login): simeng_zhu

POSITION TITLE: CLINICAL ASSISTANT PROFESSOR

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE (if applicable)	Completion Date MM/YYYY	FIELD OF STUDY
Washington University in St. Louis St. Louis, MO	BA	05/2014	Physics
University of Florida College of Medicine Gainesville, FL	MD	05/2018	Medicine
Henry Ford Hospital Detroit, MI		06/2023	Radiation Oncology Residency

A. Personal Statement

I am a Clinical Assistant Professor at The Ohio State University James Cancer Center, specializing in central nervous system tumors and head and neck cancers. My current research focus is on using artificial intelligence (AI) technology to enhance patient outcomes and streamline clinical workflows. During my PGY-4 year of residency, I participated in the ASTRO-Varian Research Training Fellowship. In this role, I collaborated full-time with the Advanced AI and Applied Research teams at Varian Medical Systems, where we developed AI-based tools for radiation treatment planning. Our efforts have resulted in three patents and conference presentations, and we are currently preparing manuscripts for publication. I am also leading a research project as the Principal Investigator, supported by grants from the Radiation Oncology Institute and Google Cloud. Our team has created a multimodal deep learning model to predict treatment outcomes following radiation therapy for head and neck cancer.

My current funding support includes:

OSU Department of Radiation Oncology Department Seed Grant (\$15,000)

Role: Co-PI

Duration: 4/2025 – 6/2026

Project: Feasibility Study to Develop and Validate Deep Learning-Based Multimodal Biomarker for Patients with p16-Negative Head and Neck Cancer Treated with Upfront Surgical Resection

B. Positions, Scientific Appointments

2023- present Clinical Assistant Professor, Department of Radiation Oncology, The Ohio State University James Cancer Center

2018-2023 Resident Physician, Department of Radiation Oncology, Henry Ford Hospital, Detroit, MI

C. Contributions to Science

1. I have conducted several studies investigating the role of AI and image analysis in cancer care. These studies encompass applications such as tumor auto-segmentation using convolutional neural networks and human papillomavirus (HPV) status prediction in oropharyngeal cancer using quantitative CT image features.

- a. **Zhu S**, Dai Z, Ning W. Two-stage approach for segmenting gross tumor volume in head and neck cancer with CT and PET imaging. *HECKTOR 2020. Lecture Notes in Computer Science*. 2021; 12603: 22-27.
- b. **Zhu S**, Gilbert M, Chetty IJ, Siddiqui F. The 2021 landscape of FDA-approved artificial intelligence/machine learning-enabled medical devices. *International Journal of Medical Informatics*. 2022; 165: 104828. PMID: 35780651.
- c. Bagher-Ebadian H, **Zhu S**, Siddiqui F, Lu M, Movsas B, Chetty IJ. Technical note: On the development of an outcome-driven frequency filter for improving radiomics-based modeling of human papillomavirus (HPV) in patients with oropharyngeal squamous cell carcinomas. *Medical Physics*. 2021; 48(11): 7552-7562. PMID: 34390003.
- d. Xu L, **Zhu S**, Wen N. Deep reinforcement learning and its application in medical imaging and radiation therapy: a survey. *Physics in Medicine & Biology*. 2022; 67(22). PMID: 36270582.
- e. Zong W, Carver E, **Zhu S**, Schaff E, Chapman D, Lee J, Bagher Ebadian, H, Chetty IJ, Movsas B, Wen N, Alafif T, Zong Z. Prostate cancer malignancy detection and localization from mpMRI using auto-deep learning: one step closer to clinical utilization. *Scientific Reports*. 2022; 12(1). PMID: 36575209.
- f. Bagher-Ebadian H, Siddiqui F, Ghanem AI, **Zhu S**, Lu M, Movsas B, Chetty IJ. Radiomics outperforms clinical factors in characterizing human papilloma virus (HPV) for patients with oropharyngeal squamous cell carcinomas. *Biomedical Physics & Engineering Express*. 2022; 8(4). PMID: 34781181.
- g. Summerfield N, Morris E, Banerjee S, He Q, Ghanem AI, **Zhu S**, Zhao J, Dong M, Glide-Hurst Carri. Enhancing Precision in Cardiac Segmentation for MR-Guided Radiation Therapy through Deep Learning. *International Journal of Radiation Oncology Biology and Physics*. 2024; 120(3). PMID: 38797498.
- h. Oreiller V, Andrearczyk, Jreige M, Boughdad S, Elhalawani H, Castelli J, Vallieres M, **Zhu S**, et al. Head and Neck Tumor Segmentation in PET/CT: The HECKTOR Challenge. *Medical Image Analysis*. 2021. 77: 102336. PMID: 35016077.
- i. Court LE, Aggarwal A, Jhingran A, et al. Artificial Intelligence-Based Radiotherapy Contouring and Planning to Improve Global Access to Cancer Care. *Journal of Clinical Oncology Global Oncology*. 2024. (In Press). PMID: 38484191.

2. During clinical training, I worked with several mentors to investigate the treatment outcome and toxicity after radiation therapy for multiple disease sites. The research topics included novel concepts such as the role of proton therapy for vestibular schwannoma and the interaction between radiation therapy and immune checkpoint inhibitors.

- a. **Zhu S**, Hitchcock KE, Mendenhall WM. Radiation therapy for aneurysmal bone cysts. *American Journal of Clinical Oncology*. 2017; 40(6): 621-624. PMID: 26165419.
- b. **Zhu S**, Mendenhall WM. Postoperative adjuvant radiotherapy for cutaneous melanoma with perineural invasion: University of Florida experience. *Cancer Investigation*. 2018; 36 (7): 389-394. PMID: 30188744.
- c. **Zhu S**, Lightsey JL, Hoppe BS, Okunieff P, Gopalan P, Kaye F, Morris CG, Yeung AR. Stereotactic ablative body radiotherapy for primary non-small cell lung cancer: achieving local control with a lower biologically effective dose. *Cancer Investigation*. 2018; 36 (5): 289-295. PMID: 30040495.
- d. **Zhu S**, Rotondo RL, Mendenhall WM, Dagan R, Lewis D, Huh S, Knox G, Tavaniepour D, Sandhu S, Rutenberg MS. Long-term outcomes of fractionated stereotactic proton therapy for vestibular schwannoma: a case series. *International Journal of Particle Therapy*. 2018; 4 (4): 37-46. PMID: 31773014.
- e. **Zhu S**, Yang X, Xu K, Jeong J, Khan MK. High-resolution ultrasound-guided high-dose-rate (HDR) surface brachytherapy for basal cell carcinoma of the skin: a case report. *Advances in Radiation Oncology*. 2018; 3: 591-594. PMID: 30370359.
- f. **Zhu S**, Khalil R, Altairy O, Burmeister C, Dimitrova I, Elshaikh MA. Increased risk of recurrence in early-stage endometrial carcinoma after delays in adjuvant radiation treatment. *International Journal of Gynecological Cancer*. 2021; 31(1): 73-77. PMID: 33087415.

NIH BIOGRAPHICAL SKETCH COMMON FORM

Name: Chakravarti, MD, Arnab

Persistent Identifier (PID) of the Senior/Key Person: <https://orcid.org/0000-0002-5392-8721>

Position Title: Chair and Professor

Organization and Location: Arthur G. James Hospital/Richard J. Solove Research Institute/Ohio State University Comprehensive Cancer Center, Columbus, Ohio, United States

PROFESSIONAL PREPARATION

INSTITUTION AND LOCATION	DEGREE	Start Date	Completion Date	FIELD OF STUDY
University of Virginia, Charlottesville, Virginia, United States	Doctor of Medicine (MD)	01/1991	01/1995	Medicine
Duke University, Durham, North Carolina, United States	Bachelor of Arts (BA)	01/1988	01/1990	Pre-Med, Economics

Appointments and Positions

2009 - present	Chair and Professor, Arthur G. James Hospital/Richard J. Solove Research Institute/Ohio State University Comprehensive Cancer Center, Columbus, Ohio, United States
2009 - present	Chair and Professor, Arthur G. James Hospital/Richard J. Solove Research Institute/Ohio State University Comprehensive Cancer Center, Columbus, Ohio, United States
2023 - present	Chair, Board of Directors, International Society of Neuro-Radiation Biology, Tokyo, Not Applicable, N/A, Japan
2021 - present	Member, NCI Advisory Board of Scientific Counselors, Bethesda, Maryland, United States
2021 - present	Board of Directors, Ohio Neuro-Oncology Consortium, Columbus, Ohio, United States
2020 - present	Committee Member, European Organization for Research and Treatment of Cancer (EORTC), Brussels, Not Applicable, N/A, Belgium
2019 - present	Chair, Radiation Therapy Oncology Group (RTOG) Brain Tumor Translational Research Subcommittee, Philadelphia, Pennsylvania, United States
2017 - present	Klotz Family Chair in Cancer Research, Arthur G. James Hospital/Richard J. Solove Research Institute, Ohio State University Comprehensive Cancer Center, Columbus, Ohio, United States
2015 - 2017	Chair, Cancer Biomarker Study Section, National Institutes of Health, Bethesda, Maryland, United States
2013 - 2015	Chair, Scientific Program Committee, American College of Radiation Oncology, Fairfax, Virginia, United States
2009 - 2017	Max Morehouse Chair of Cancer Research, Arthur G. James Hospital/Richard J. Solove Research Institute, Ohio State University Comprehensive Cancer Center, Columbus, Ohio, United States
2009 - 2012	CEO, Ohio State University Physicians (OSUP), Radiation Oncology, LLC, Columbus, Ohio, United States
2005 - 2009	Director, Medical Student Education, Harvard Medical School Clerkship, Boston, Massachusetts, United States
2005 - 2009	Radiation Oncology Executive Committee Member, Harvard Medical School, Boston, Massachusetts, United States
2005 - 2009	Associate Professor of Radiation Oncology, Massachusetts General Hospital/Harvard Medical School, Boston, Massachusetts, United States
2002 - 2009	Director, Brian D. Silber Laboratory of Molecular and Cellular Radiation Neuro-Oncology, Massachusetts General Hospital, Boston, Massachusetts, United States
2002 - 2005	Assistant Professor of Radiation Oncology, Massachusetts General Hospital/Harvard Medical School, Boston, Massachusetts, United States
2000 - 2001	Instructor of Radiation Oncology, Massachusetts General Hospital/Harvard Medical School, Boston, Massachusetts, United States
2000 - 2001	Chief Resident, Dept. of Radiation Oncology, Massachusetts General Hospital/Harvard Medical School, Boston, Massachusetts, United States
1996 - 2000	Resident, Dept. of Radiation Oncology, Massachusetts General Hospital/Harvard Medical School, Boston, Massachusetts, United States

Products

Products Closely Related to the Proposed Project

1. Belanova R, Sprlakova-Pukova A, Standara M, Janu E, Koukalova R, Kristek J, Burkon P, Kolouskova I, Prochazka T, Pospisil P, Chakravarti A, Slampa P, Slaby O, Kazda T. In silico study of pseudoprogression in glioblastoma: collaboration of radiologists and radiation oncologists in the estimation of extent of high dose RT region. Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub. 2020 Sep;164(3):307-313. PubMed PMID: [31544900](#).
2. Barthel FP, Johnson KC, Varn FS, Moskalik AD, Tanner G, Kocakavuk E, Anderson KJ, Abiola O, Aldape K, Alfaro KD, Alpar D, Amin SB, Ashley DM, Bandopadhyay P, Barnholtz-Sloan JS, Beroukhi R, Bock C, Brastianos PK, Brat DJ, Brodbelt AR, Bruns AF, Bulsara KR, Chakrabarty A, Chakravarti A, Chuang JH, Claus EB, Cochran EJ, Connelly J, Costello JF, Finocchiaro G, Fletcher MN, French PJ, Gan HK, Gilbert MR, Gould PV, Grimmer MR, Iavarone A, Ismail A, Jenkinson MD, Khasraw M, Kim H, Kouwenhoven MCM, LaViolette PS, Li M, Lichter P, Ligon KL, Lowman AK, Malta TM, Mazor T, McDonald KL, Molinaro AM, Nam DH, Nayyar N, Ng HK, Ngan CY, Niclou SP, Niers JM, Noushmehr H, Noorbakhsh J, Ormond DR, Park CK, Poisson LM, Rabadan R, Radlwimmer B, Rao G, Reifemberger G, Sa JK, Schuster M, Shaw BL, Short SC, Smitt PAS, Sloan AE, Smits M, Suzuki H, Tabatabai G, Van Meir EG, Watts C, Weller M, Wesseling P, Westerman BA, Widhalm G, Woehrer A, Yung WKA, Zadeh G, Huse JT, De Groot JF, Stead LF, Verhaak RGW. Longitudinal molecular trajectories of diffuse glioma in adults. Nature. 2019 Dec;576(7785):112-120. PubMed Central PMCID: [PMC6897368](#).
3. Kwak S, Akbari H, Garcia JA, Mohan S, Dicker Y, Sako C, Matsumoto Y, Nasrallah MP, Shalaby M, O'Rourke DM, Shinohara RT, Liu F, Badve C, Barnholtz-Sloan JS, Sloan AE, Lee M, Jain R, Cepeda S, Chakravarti A, Palmer JD, Dicker AP, Shukla G, Flanders AE, Shi W, Woodworth GF, Davatzikos C. Predicting peritumoral glioblastoma infiltration and subsequent recurrence using deep-learning-based analysis of multi-parametric magnetic resonance imaging. J Med Imaging (Bellingham). 2024 Sep;11(5):054001. PubMed Central PMCID: [PMC11363410](#).
4. Corn BW, Moughan J, Knisely JP, Fox SW, Chakravarti A, Yung WK, Curran WJ Jr, Robins HI, Brachman DG, Henderson RH, Mehta MP, Movsas B. Prospective evaluation of quality of life and neurocognitive effects in patients with multiple brain metastases receiving whole-brain radiotherapy with or without thalidomide on Radiation Therapy Oncology Group (RTOG) trial 0118. Int J Radiat Oncol Biol Phys. 2008 May 1;71(1):71-8. PubMed PMID: [18164829](#).
5. Sizemore ST, Mohammad R, Sizemore GM, Newsheer S, Yu H, Ostrowski MC, Chakravarti A, Xia F. Synthetic Lethality of PARP Inhibition and Ionizing Radiation is p53-dependent. Mol Cancer Res. 2018 Jul;16(7):1092-1102. PubMed Central PMCID: [PMC6713455](#).

Other Significant Products Highlighting Contributions to Science

1. Gittleman H, Lim D, Kattan MW, Chakravarti A, Gilbert MR, Lassman AB, Lo SS, Machtay M, Sloan AE, Sulman EP, Tian D, Vogelbaum MA, Wang TJC, Penas-Prado M, Youssef E, Blumenthal DT, Zhang P, Mehta MP, Barnholtz-Sloan JS. An independently validated nomogram for individualized estimation of survival among patients with newly diagnosed glioblastoma: NRG Oncology RTOG 0525 and 0825. Neuro Oncol. 2017 May 1;19(5):669-677. PubMed Central PMCID: [PMC5464437](#).
2. Bell EH, Pugh SL, McElroy JP, Gilbert MR, Mehta M, Klimowicz AC, Magliocco A, Bredel M, Robe P, Grosu AL, Stupp R, Curran WJ Jr, Becker AP, Salavaggione AL, Barnholtz-Sloan JS, Aldape K, Blumenthal DT, Brown PD, Glass J, Souhami L, Lee RJ, Brachman D, Flickinger J, Won M, Chakravarti A. Molecular-Based Recursive Partitioning Analysis Model for Glioblastoma in the Temozolomide Era: A Correlative Analysis Based on NRG Oncology RTOG 0525. JAMA Oncol. 2017 Jun 1;3(6):784-792. PubMed Central PMCID: [PMC5464982](#).
3. Chakravarti A, Wang M, Robins HI, Lautenschlaeger T, Curran WJ, Brachman DG, Schultz CJ, Choucair A, Dolled-Filhart M, Christiansen J, Gustavson M, Molinaro A, Mischel P, Dicker AP, Bredel M, Mehta M. RTOG 0211: a phase 1/2 study of radiation therapy with concurrent gefitinib for newly diagnosed glioblastoma patients. Int J Radiat Oncol Biol Phys. 2013 Apr 1;85(5):1206-11. PubMed Central PMCID: [PMC4199329](#).
4. Buckner JC, Shaw EG, Pugh SL, Chakravarti A, Gilbert MR, Barger GR, Coons S, Ricci P, Bullard D, Brown PD, Stelzer K, Brachman D, Suh JH, Schultz CJ, Bahary JP, Fisher BJ, Kim H, Murtha AD, Bell EH, Won M, Mehta MP, Curran WJ Jr. Radiation plus Procarbazine, CCNU, and Vincristine in Low-Grade Glioma. N Engl J Med. 2016 Apr 7;374(14):1344-55. PubMed Central PMCID: [PMC5170873](#).
5. Cheng X, Geng F, Pan M, Wu X, Zhong Y, Wang C, Tian Z, Cheng C, Zhang R, Puduvalli V, Horbinski C, Mo X, Han X, Chakravarti A, Guo D. Targeting DGAT1 Ameliorates Glioblastoma by Increasing Fat Catabolism and Oxidative Stress. Cell Metab. 2020 Aug 4;32(2):229-242.e8. PubMed Central PMCID: [PMC7415721](#).

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not limited to information related to domestic and foreign appointments and positions.

I also certify that, at the time of submission, I am not a party to a malign foreign talent recruitment program.

Misrepresentations and/or omissions may be subject to prosecution and liability pursuant to, but not limited to, 18 U.S.C. §§ 287, 1001, 1031 and 31 U.S.C. §§ 3729-3733 and 3802.

Certified by Chakravarti, MD, Arnab in SciENcv on 2026-04-16 11:47:21

NIH BIOGRAPHICAL SKETCH SUPPLEMENT

Name: Chakravarti, MD, Arnab

Persistent Identifier (PID) of the Senior/Key Person: <https://orcid.org/0000-0002-5392-8721>

Position Title: Chair and Professor

Organization and Location: Arthur G. James Hospital/Richard J. Solove Research Institute/Ohio State University Comprehensive Cancer Center, Columbus, Ohio, United States

Personal Statement

I will serve as the Principal Investigator (PI) for the proposed Medical Scientist Training Program T32 grant. Currently, I serve as the Chair and Professor of Radiation Oncology at the Arthur G. James Hospital/Richard J. Solove Research Institute/Ohio State University Comprehensive Cancer Center, where I also hold the Klotz Family Chair of Cancer Research and serve as the Director of the Brain Tumor Program. Nationally, I serve on the NCI Advisory Board of Scientific Counselors to guide NCI leadership with strategic planning, decision-making, and resource allocation within the NCI. I am Chair of the Board of Directors of the International Society of Neuro-Radiation Biology; Board of Directors of the Ohio Neuro-Oncology Consortium; Chair of the Radiation Therapy and Oncology Group (RTOG) Brain Tumor Translational Research Subcommittee and Co-Chair of the RTOG Brain Tumor Committee. My leadership roles in these organizations have enabled me to lead translational research studies that currently define the standard-of-care for patients with CNS tumors. My research focuses on genomic, epigenomic, transcriptomic, and proteomic profiling that lead to validation of novel prognostic and predictive biomarkers and further development of personalized models for prediction of survival and treatment response (e.g. nomograms and recursive partitioning analysis).

I have received continuous federal funding since 1999 and served as PI on NIH K08, R01, RC2 Go-Grants, U10, ACA, and K12 awards. Most notably, I received funds from the Health and Human Affordable Care Grant, the largest grant ever awarded in Radiation Oncology. This sustained funding demonstrates my ability to produce high-impact, clinically significant research. I have trained over 3,000 students, graduate students, medical residents-fellows, and postdoctoral fellows. Many of my trainees have established successful academic careers at leading institutions in the U.S. and internationally. The primary objective in my laboratory is to develop personalized care strategies tailored to individual patients. Currently, there is a critical need to train the future generation in basic science. By capitalizing on my extensive experience in basic, translational, and clinical cancer research, I will serve as a mentor and provide laboratory space for training purposes. I am committed to promoting a safe and supportive research environment for all trainees, ensuring they receive training in rigorous and unbiased experimental design, methodology, analysis, interpretation, and reporting of results. Trainees will be guided to conduct biomedical research with increasing responsibility and independence. I will support their participation in activities that help identify and transition into careers aligned with their skills, interests, and values. Finally, I will ensure that trainees complete their degrees in a timely fashion with the skills, credentials, and experiences necessary for successful career transitions. My background uniquely positions me to lead this effort and foster an environment that promotes rigorous scientific inquiry and innovation. The successful implementation of this proposal will strengthen OSU's training program for both predoctoral and postdoctoral scholars and accelerate discoveries that advance cancer research.

Honors

2016	Lifetime Achievement Award, Society for Asian American Scientists in Cancer Research (AACR)
2015	America's Top Cancer Doctors, Newsweek Magazine
2015 - 2026	Press Ganey Award for Best Patient Satisfaction Score in Radiation Oncology, Press Ganey
2015 - 2026	Top 101 Physicians in the United States, World Wide Registry
2012	Fellow, American College of Radiation Oncology
2012 - 2017	Top 1% of All Physicians in USA, Castle-Connolly
2012 - 2017	Top 1% of Cancer Specialists in USA, Castle-Connolly
2011	Young Investigator Basic Science Award, American Society for Therapeutic Radiology and Oncology (ASTRO)
2011 - 2017	Best Doctors Award, Best Doctors, Inc
2011 - 2017	Top Doctors, Columbus Magazine
2010	Keynote Lecturer, European Society for Radiotherapy and Oncology (ESTRO)
2008	Lucien J. Rubinstein Memorial Award, American Brain Tumor Association (ABTA)

2004	Simon Kramer Award, Radiation Therapy Oncology Group (RTOG)
2001	Novartis Research Award, American Association for Cancer Research (AACR)
1990	Magna Cum Laude, Duke University

Contributions to Science

1. Patented Biomarker Panel to Identify Optimal Therapies for GBM Patients

I developed a patented biomarker panel that predicts which glioblastoma (GBM) patients may benefit—or may be harmed—from adding targeted therapies to radiation versus radiation alone. GBMs are among the most aggressive tumors, with median survival of ~12 months despite surgery, radiation, and chemotherapy. As national PI of RTOG 0211, I led a Phase I/II trial examining gefitinib with radiation for newly diagnosed GBM patients (Chakravarti, 2013, PMID: 23182702). Based on tumor tissues collected, my team dissected molecular pathways downstream of EGFR and developed a biomarker panel to predict benefit from gefitinib combined with radiation. In a subsequent NEJM publication, I co-led translational research identifying NFkB pathway as another mediator of resistance to anti-EGFR therapy (Bredel, 2011, PMID: 21323448). These findings inform patient selection for future trials and advance precision medicine in neuro-oncology.

2. Molecular Mechanisms of Radiation Resistance in Human Tumors

My research has provided critical insights into molecular mechanisms underlying radiation resistance and strategies to overcome it. I was among the first to report that deregulation of PI3K/AKT signaling confers radiation resistance in GBM, leading to early clinical trials combining radiotherapy with kinase inhibitors. My team also identified microRNA-based mechanisms of resistance and demonstrated that SET-driven suppression of PP2A sustains γ H2AX, maintaining glioma stem cell properties (Han, 2025, PMID: TBD; Cui, 2021, PMID: 32973101). These findings have opened new therapeutic avenues to sensitize tumors to radiation (Cheng, 2020, PMID: 32559414).

3. Mechanisms of Resistance to Anti-EGFR Therapy in GBM

EGFR signaling is markedly heightened in most GBMs due to amplification or activating mutations. In RTOG 0211, gefitinib was combined with radiation for newly diagnosed GBM patients (Chakravarti, 2013, PMID: 23182702). Although well tolerated, resistance emerged through IGFR-I signaling activating PI3K pathways (Chakravarti, 2002, PMID: 11782371). My team demonstrated that IGFR-I-activated PI3K signaling represents a novel mechanism of resistance to anti-EGFR therapy, informing rational combination strategies for future trials.

4. Programmatic Leadership in Advancing Personalized Radiation Oncology

As Chair of Radiation Oncology at OSU and Co-Chair of NRG Brain Tumor Committees, I have led national and international efforts to integrate molecular profiling into radiation oncology. I secured a \$100M federal grant to expand clinical and research infrastructure, enabling personalized care delivery models—the largest grant ever awarded in Radiation Oncology nationally. Additionally, I established an international training center to disseminate best practices globally, impacting underserved populations and advancing precision medicine worldwide (Buckner, 2016, PMID: 27050206; Bell, 2017, PMID: 28097324).

5. Summary of Research Impact

My research has advanced personalized care for malignant brain tumors and uncovered critical molecular mechanisms of radiation resistance. I have consistently published in high-impact journals (NEJM, JAMA, Cancer Cell, Cell Metab) and led NCI-funded cooperative group trials that define current standards of care. These contributions have shaped clinical practice, informed trial design, and improved patient outcomes globally (Gittleman, 2017, PMID: 28453749; Cheng, 2020, PMID: 32559414).

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not limited to information related to domestic and foreign appointments and positions.

I also certify that, at the time of submission, I am not a party to a malign foreign talent recruitment program.

Misrepresentations and/or omissions may be subject to prosecution and liability pursuant to, but not limited to, 18 U.S.C. §§ 287, 1001, 1031 and 31 U.S.C. §§ 3729-3733 and 3802.

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. DO NOT EXCEED FIVE PAGES.

NAME: Ayan, Ahmet Sedat

eRA COMMONS USER NAME (credential, e.g., agency login): AHMET_AYAN

POSITION TITLE: Professor-Clinical

EDUCATION/TRAINING (*Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.*)

INSTITUTION AND LOCATION	DEGREE (if applicable)	END DATE MM/YYYY	FIELD OF STUDY
Middle East Technical University, Ankara, Not Applicable, N/A	BS	07/1991	Physics
Middle East Technical University, Ankara, Not Applicable, N/A	MS	07/1996	Physics
University of Iowa, Iowa City, Iowa	PHD	05/2004	Physics
University of Iowa, Iowa City, Iowa	Postdoctoral Fellow	06/2005	Physics
University of Pennsylvania, Philadelphia, Pennsylvania	Postdoctoral Fellow	06/2009	Radiology
University of Pennsylvania, Philadelphia, Pennsylvania	Resident	07/2011	Therapeutic Medical Physics

A. Personal Statement

As Chief Physicist at The Ohio State University Proton Therapy Center, I am responsible for the clinical integrity, safety, and performance of proton therapy delivery within a complex, high-acuity oncology environment. My work focuses on ensuring that advanced technologies are implemented in a manner that is precise, reliable, and aligned with clinical standards of care. I led the acceptance and clinical commissioning of a pencil beam scanning proton therapy system (Varian ProBeam 360), including two gantries and a fixed beam treatment room, translating technical capabilities into a fully operational clinical program. A central component of my role is the development and oversight of systems that support safe and consistent care. I established a comprehensive proton therapy Quality Assurance program aligned with AAPM guidelines and regulatory requirements, and I have coordinated the creation of disease site-specific clinical guidelines and procedures. My responsibilities include oversight of treatment planning processes, evaluation of complex clinical scenarios, and collaboration with multidisciplinary teams to ensure that decisions are both technically sound and clinically appropriate. I also led the Imaging and Radiation Oncology Core (IROC) credentialing of our center, supporting participation in NIH-sponsored cooperative group clinical trials. My research interests include normal tissue toxicity modeling in radiotherapy, the use of image informatics to support clinical decision-making, quality assurance of linear accelerator imaging systems, ultra-high-dose-rate (FLASH) radiotherapy, and radiation detection. This work reflects a broader commitment to advancing radiation oncology through approaches that integrate technical rigor with clinical applicability. In this project, I bring clinical expertise in radiation oncology, grounding the work in real-world safety-critical workflows, clinical decision-making, and patient care priorities. My contribution focuses on ensuring that the proposed approaches align with established clinical practices, regulatory expectations, and the realities of care delivery in complex oncology settings. I provide a clinical and operational lens that supports the development of solutions that are safe, implementable, and directly relevant to patient care.

B. Positions, Scientific Appointments and Honors

Positions and Scientific Appointments

2025 -	Chief of Physics, The Ohio State University, James Outpatient Care, Proton Therapy Center , Columbus, Ohio
2024 -	Professor-Clinical, The Ohio State University, Department of Radiation Oncology, Columbus, Ohio
2022 - 2024	Chief of Proton Physics, The Ohio State University, Department of Radiation Oncology, Columbus, Ohio
2019 - 2024	Associate Professor-Clinical, The Ohio State University, Department of Radiation Oncology, Columbus, Ohio
2013 - 2019	Assistant Professor-Clinical, The Ohio State University, Department of Radiation Oncology, Columbus, Ohio
2011 - 2013	Radiation Physicist, The Ohio State University, Department of Radiation Oncology, Columbus, Ohio

Honors

1998 - 1999	Doctoral Research Scholarship, Scientific and Technical Research Council of Turkey (TUBITAK), Ankara, Turkey
1987 - 1991	Undergraduate Education Scholarship, GUDAS Foundation, Middle East Technical University, Ankara, Turkey
2008	Goertz-Nicholson Memorial Award, University of Iowa, Department of Physics and Astronomy, Iowa City, IA

C. Contribution to Science

1. a. Lee E, Faught AM, Lee HA, Batin E, Ayan A. Clinical commissioning of a novel compact multi-room pencil beam scanning proton therapy system. J Appl Clin Med Phys. 2026 Mar;27(3):e70538. PubMed PMID: 41833508.
b. Batin E, Faught A, Lee H, Ayan A. Modeling and Validation of a Proton Therapy Couch Top. Int J Part Ther. 2025 Sep;17:100753. PubMed Central PMCID: PMC12181023.
c. Busse NC, Al-Ghazi MSAL, Abi-Jaoudeh N, Alvarez D, Ayan AS, Chen E, Chuong MD, Dezarn WA, Enger SA, Graves SA, Hobbs RF, Jafari ME, Kim SP, Maughan NM, Polemi AM, Stickel JR. AAPM Medical Physics Practice Guideline 14.a: Yttrium-90 microsphere radioembolization. J Appl Clin Med Phys. 2024 Feb;25(2):e14157. PubMed Central PMCID: PMC10860558.
d. Upadhyay R, Ayan AS, Jain S, Klamer BG, Perlow HK, Zoller W, Blakaj DM, Beyer S, Grecula J, Arnett A, Thomas E, Chakravarti A, Raval RR, Palmer JD. Dose-Volume Tolerance of the Brain and Predictors of Radiation Necrosis After 3-Fraction Radiosurgery for Brain Metastases: A Large Single-Institutional Analysis. Int J Radiat Oncol Biol Phys. 2024 Jan 1;118(1):275-284. PubMed PMID: 37574170.
2. a. DiCostanzo DJ, Allen TT, Ayan AS, Quick A, Evans KD, Patterson ES. An assessment of skill erosion on high-dose rate brachytherapy treatment planning. J Appl Clin Med Phys. 2025 Oct;26(10):e70300. PubMed Central PMCID: PMC12521045.
b. Dibs K, Mageswaran P, Raval R, Thomas E, Gogineni E, Pan J, Klamer B, Ayan A, Bourekas E, Boulter D, Fetko N, Cochran E, Chakravarthy V, McGregor J, Tili E, Palmer J, Peters N, Lonser R, Elguindy A, Yap E, Soghrati S, Marras W, Grecula J, Chakravarti A, Elder J, Blakaj D. Expanded analysis of vertebral endplate disruption and its impact on vertebral compression fracture risk. Radiat Oncol. 2025 May 14;20(1):74. PubMed Central PMCID: PMC12076872.
c. Upadhyay R, Ayan AS, Jain S, Klamer BG, Perlow HK, Zoller W, Blakaj DM, Beyer S, Grecula J, Arnett A, Thomas E, Chakravarti A, Raval RR, Palmer JD. Dose-Volume Tolerance of the Brain and Predictors of Radiation Necrosis After 3-Fraction Radiosurgery for Brain Metastases: A Large

Single-Institutional Analysis. Int J Radiat Oncol Biol Phys. 2024 Jan 1;118(1):275-284. PubMed PMID: 37574170.

- d. Zou W, Zhang R, Schöler E, Taylor PA, Mascia AE, Diffenderfer ES, Zhao T, Ayan AS, Sharma M, Yu SJ, Lu W, Bosch WR, Tsien C, Surucu M, Pollard-Larkin JM, Schuemann J, Moros EG, Bazalova-Carter M, Gladstone DJ, Li H, Simone CB 2nd, Petersson K, Kry SF, Maity A, Loo BW Jr, Dong L, Maxim PG, Xiao Y, Buchsbaum JC. Framework for Quality Assurance of Ultrahigh Dose Rate Clinical Trials Investigating FLASH Effects and Current Technology Gaps. Int J Radiat Oncol Biol Phys. 2023 Aug 1;116(5):1202-1217. PubMed Central PMCID: PMC10526970.
3. ## Advancing Toxicity-Aware Proton Therapy and Normal Tissue Sparing Radiotherapy effectiveness is often limited by damage to surrounding normal tissues, particularly in complex or high-dose treatments. My work has focused on improving **normal tissue toxicity modeling and mitigation**, especially in proton therapy. Across multiple disease sites, including brain metastases and spine stereotactic radiotherapy, I contributed to studies demonstrating how dose distribution and fractionation influence toxicity risk. Notably, our multi-institutional and single-institution analyses identified predictors of brain dose tolerance and vertebral compression fracture risk, helping quantify clinically meaningful toxicity patterns. These findings support **more informed treatment planning and risk stratification**, enabling clinicians to better balance tumor control with patient safety. My role included **study design, dosimetric analysis, and interpretation of clinical implications**, working closely with multidisciplinary teams to translate technical findings into clinically actionable insights.
4. ## Development and Validation of Robust Proton Therapy Planning and Commissioning The safe clinical implementation of proton therapy requires rigorous commissioning and validation of complex systems. I contributed to foundational work in **commissioning, modeling, and robustness evaluation** of pencil beam scanning (PBS) systems. This includes work on: • Clinical commissioning of a multi-room Varian ProBeam 360 system • Modeling and validation of treatment components such as proton therapy couch tops • Development of methodologies to ensure accurate and reliable dose delivery These efforts helped establish **safe and reproducible clinical workflows**, supporting the broader adoption of advanced proton therapy technologies. My role involved **leading or contributing to commissioning efforts, validation studies, and technical modeling**, ensuring alignment with clinical and regulatory standards.
5. ## Motion Management, Image Informatics, and Treatment Accuracy Uncertainty from motion and imaging limitations remains a major challenge in radiotherapy. My work has addressed this through image informatics and motion characterization** to improve treatment precision. Key contributions include: • Quantification of intrafraction motion during postoperative spine stereotactic treatments • Development of machine learning pipelines to improve accessibility and usability of clinical data • Contributions to imaging system quality assurance and data-driven workflows These studies provide evidence and tools to better **account for motion and uncertainty**, improving targeting accuracy and reducing unintended dose to normal tissues. My role focused on **data pipeline development, motion analysis, and integration of imaging data into clinical decision-making frameworks**.

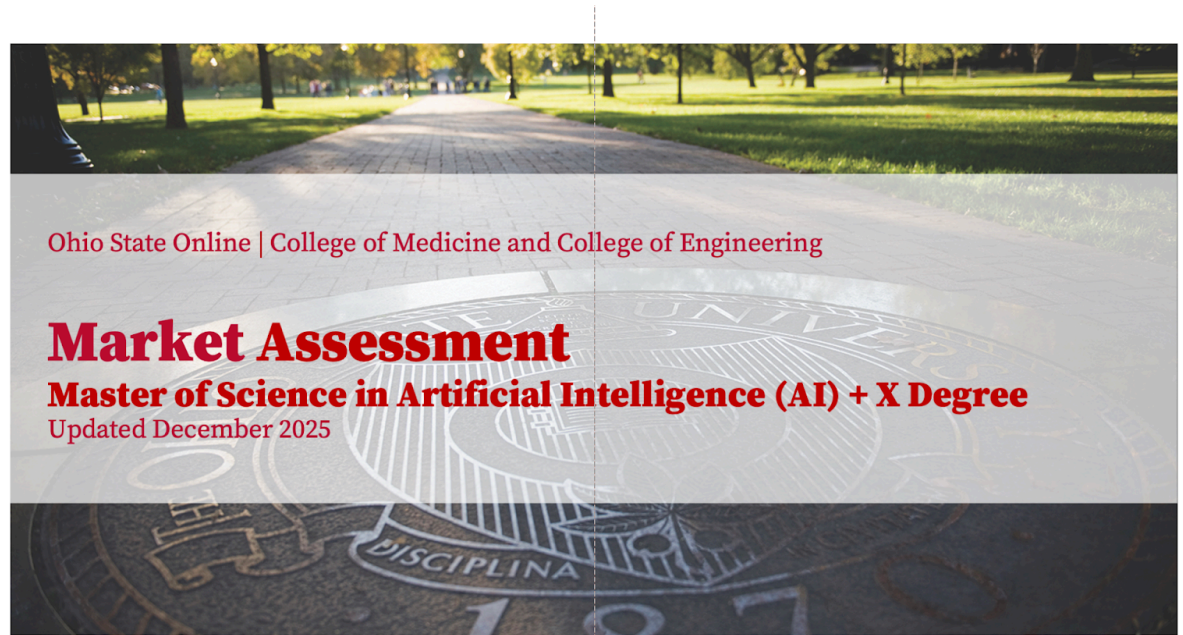
VI. 5 Appendix EMapping from Courses to Learning Outcomes.**Program Outcomes****0-nothing, 1- minor (1-2 hours), 2- (3-6 hours), 3 (7+ hours)**

Table VI.1: Mapping courses to learning outcomes as described in Section IV.8																		
Course Number	P.1	P.2	P.3	P.4	P.5	P.6	C.1	C.2	C.3	S.1	S.2	S.3	S.4	S.5	S.6	S.7	S.8	S.9
CSE 5194	1	0	0	1	3	0	1	0	2	1	1	1	1	1	1	1	1	1
CSE 5052	1	2	1	1	1	2	3	3	3	2	2	2	2	2	2	2	2	2
CSE 6520	1	3	1	1	1	2	3	3	3	2	2	2	2	2	2	2	2	2
BMI 6YYY, CSE 69YY [Capstone]	3	2	2	3	1	3	0	0	0	3	2	3	0	0	0	0	0	0
RADONC6YYY, CSE69YY [Capstone]	3	2	2	3	1	3	0	0	0	0	0	0	3	2	3	0	0	0
PATHOL 6YYY, CSE 69YY [Capstone]	3	2	2	3	1	3	0	0	0	0		0	0	0	0	3	2	3
BMI 5552	2	1	1	1	2	1	1	1	1	3	3	3	2	2	2	2	2	2
BMI 5553	2	1	1	1	2	1	1	1	1	3	3	3	2	1	1	1	1	1
BMI 5554	2	1	1	1	2	1	1	1	1	3	3	3	1	1	1	1	1	1
PATHOL 5211	1	1	1	2	0	1	0	0	0	0	0	0	0	0	0	2	2	2
PATHOL 5217	2	2	1	2	1	1	0	0	0	0	0	0	0	0	0	2	1	3
PATHOL 6640	2	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0
RADONC 5XXX - Treatment	2	1	2	2	1	1	1	1	1	0	0	0	3	1	3	0	0	0
RADONC 5XXX - RadOnc	2	2	1	2	1	1	1	1	1	0	0	0	2	2	3	0	0	0
RADONC 5XXX - RadBio	2	2	1	1	1	1	1	1	1	0	0	0	1	1	1	0	0	0

Note: Only core and capstone courses are included in the Table VI.1.

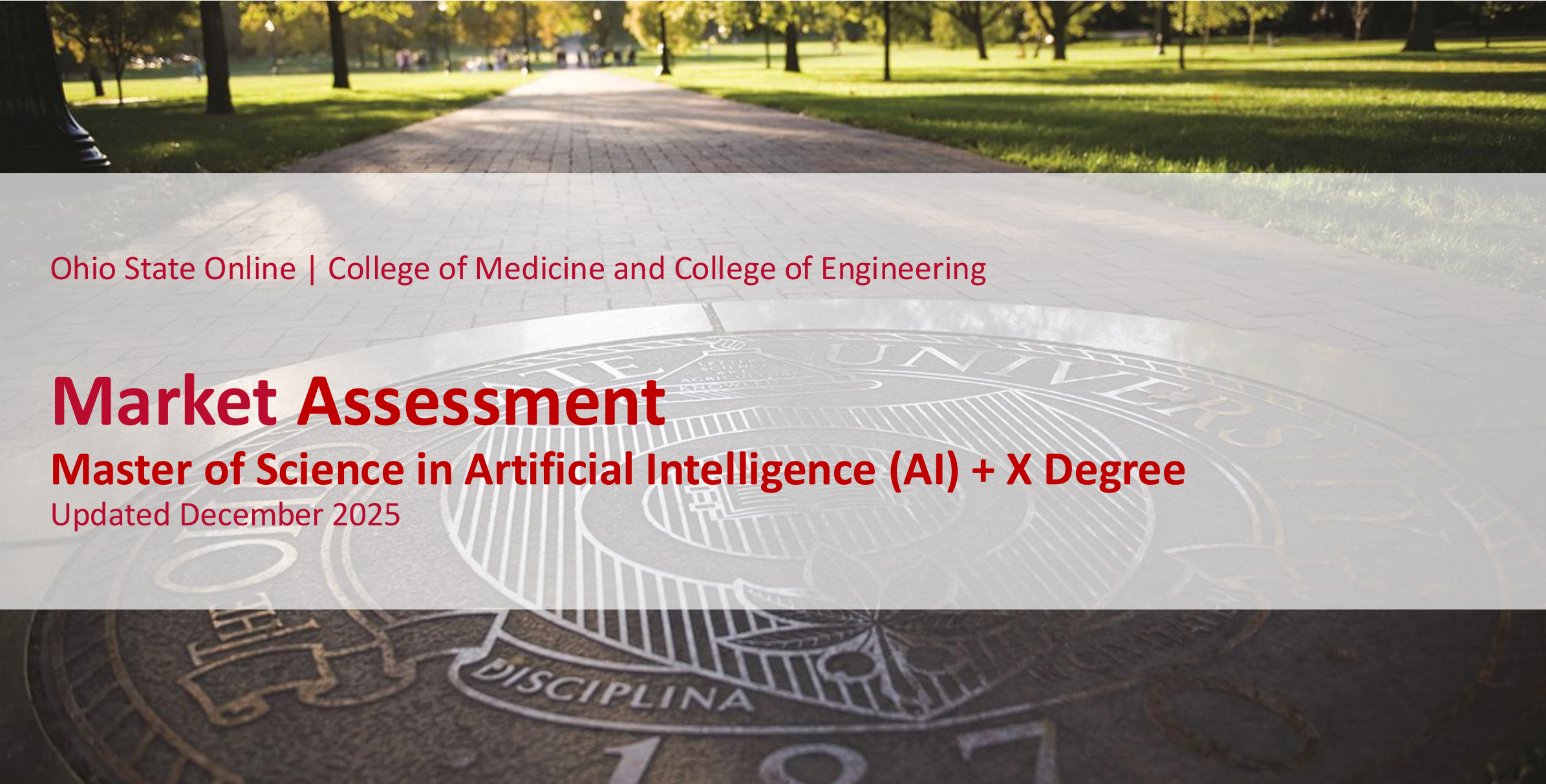
VI.5. Appendix F

Please find market research conducted by Ohio State Online herein.



THE OHIO STATE UNIVERSITY
ONLINE

Ohio State Online | Market Research



Ohio State Online | College of Medicine and College of Engineering

Market Assessment

Master of Science in Artificial Intelligence (AI) + X Degree

Updated December 2025



Contents

- I. Preface
- II. Degree Completion Trends
- III. Comparable Programs Analysis



Background

The College of Engineering is interested in a Master’s degree in AI + X Degree and wants to conduct a competitive cost analysis to understand the spectrum of costs in the market. There are 3 tiers of schools included in this analysis.

Tier	Institutions	Integration Summary
Tier 1 – True Blends	Stanford, Harvard Med, Michigan, Northwestern, UTHealth Houston, Univ of Washington, Univ of Alabama Birmingham, Georgetown (8)	More than 2 domain tracks (AI/ML + medicine). Joint governance across Medicine + CS/Info. Mixed cohorts of clinicians + computing pros.
Tier 2 – Moderate Blends	Columbia, Penn, Vanderbilt, Johns Hopkins (4)	Strong AI/DS cores applied to health contexts but limited formal tracks; rely on electives or capstones.
Tier 3 – Lower Blend	Univ of Louisville	Biostatistics/bioinformatics orientation; minimal AI specialization.

While these institutions provide valuable program benchmarks, they may not all represent Ohio State’s direct "prospect set“ with a similar online program. When evaluating this analysis, the primary cost comparisons for an online prospect should be weighted against similar peer institutions.

Building on previous research ([LINK](#)), this report provides an expanded market assessment for a Master’s in AI, offering a more comprehensive competitive set and a deeper analysis of program costs. This updated evaluation leverages 2024 IPEDS data alongside a review of publicly available information to benchmark institutional costs, program structures, and other key academic attributes.

Summary

Market Opportunity and Explosive Growth: The demand for AI-focused advanced degrees is growing at an "explosive pace".

- Degree completions in AI have surged 278% over the last five years, with the number of institutions offering these programs up 188%.
- While growing more slowly than AI, Medical Informatics has seen an 81% increase in completions.
- Online completions now account for 38% of the AI market (up from 20% just one year ago) and 70% of the Medical Informatics market, signaling a strong preference for distance learning.

Pricing and Program Structure: OSU has the opportunity to position itself as a high-value, high-quality alternative to expensive private institutions.

- OSU's standard online graduate engineering tuition (\$1,170/credit) aligns with public competitors like UT Health and UAB.
- With a quality program offering Ohio State is a strong value and highly accessible at a price point of ~\$35,000 for the degree, which is significantly lower than Tier 1 privates like Harvard (~\$101k) or Stanford (~\$69k/year).
- Most competitive programs require 27 to 32 credit hours. Adopting a 30-credit model would ensure the degree remains competitive and meets accreditation standards.

Strategic Competitive Positioning:

- Top-tier programs succeed by producing "bilingual" graduates—technical experts who understand clinical constraints and clinicians who can manage AI development. This cross-training is a primary differentiator between a generic CS degree and a high-value AI+X degree.
- Competitive positioning is driven by "Translational AI"—the ability to prove that algorithms can move from the lab to a live hospital/healthcare setting.
- Industry demand is shifting from "how to build AI" to "how to build equitable AI." Leading programs are treating Health Equity and AI Ethics not as electives, but as core competencies to mitigate diagnostic bias.

Degree Completion Trends

*Lightcast provides data on college enrollments and graduates, as reported in the National Center for Education Statistics (NCES) IPEDS dataset. This includes graduates by school, CIP code, award level and data on distance completions. **Completions data has been updated from previous report to reflect 2024 IPEDS data.***



Program Mapping Analysis

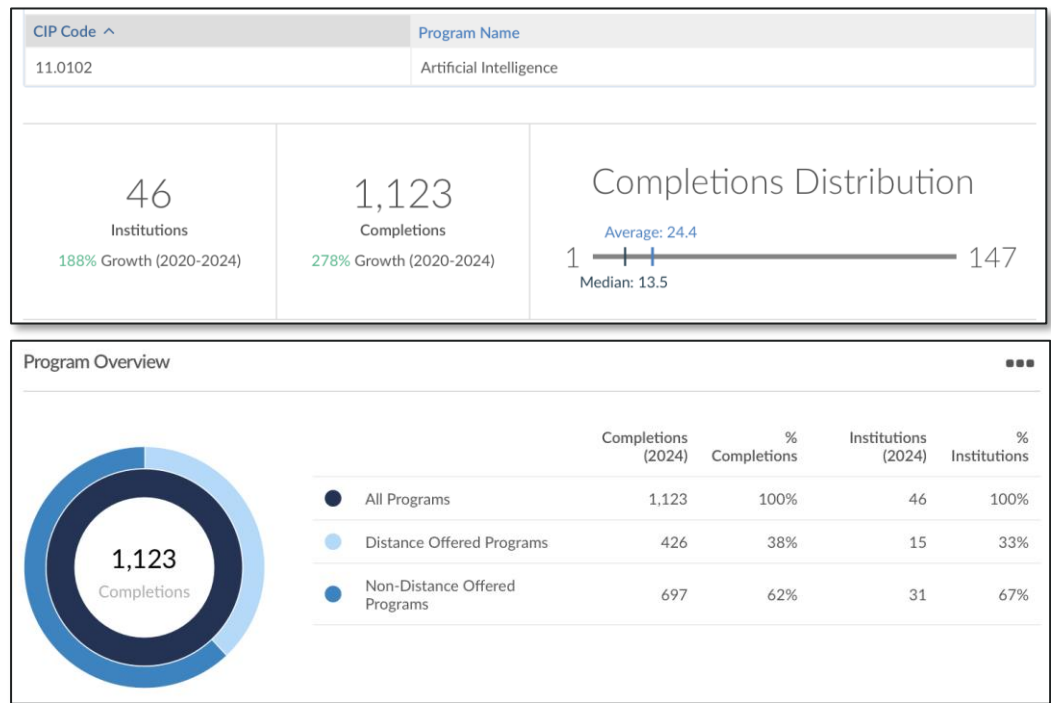
A review of CIP codes is generally conducted to ensure an analysis is inclusive of all degrees and programs. This involves a review of comparable programs and to the extent possible, identifies CIP codes associated with those programs. This determines the CIP codes to be included, which can be one or more pending the mapping structure. An explanation of CIP codes is in the Appendix.

CIP codes

This analysis showed **no** specific CIP code for Artificial Intelligence in Medicine, Health Care, Digital Health or Computational Pathology, so a general review for AI will be used to evaluate broad demand in AI master's degree programs. The CIP code used is: **11.0102, Artificial Intelligence**. There is also a CIP code for **Medical Informatics 51.2706** which is shown separately and was not included in the original report.

Degree Completion Trends – Master’s in AI

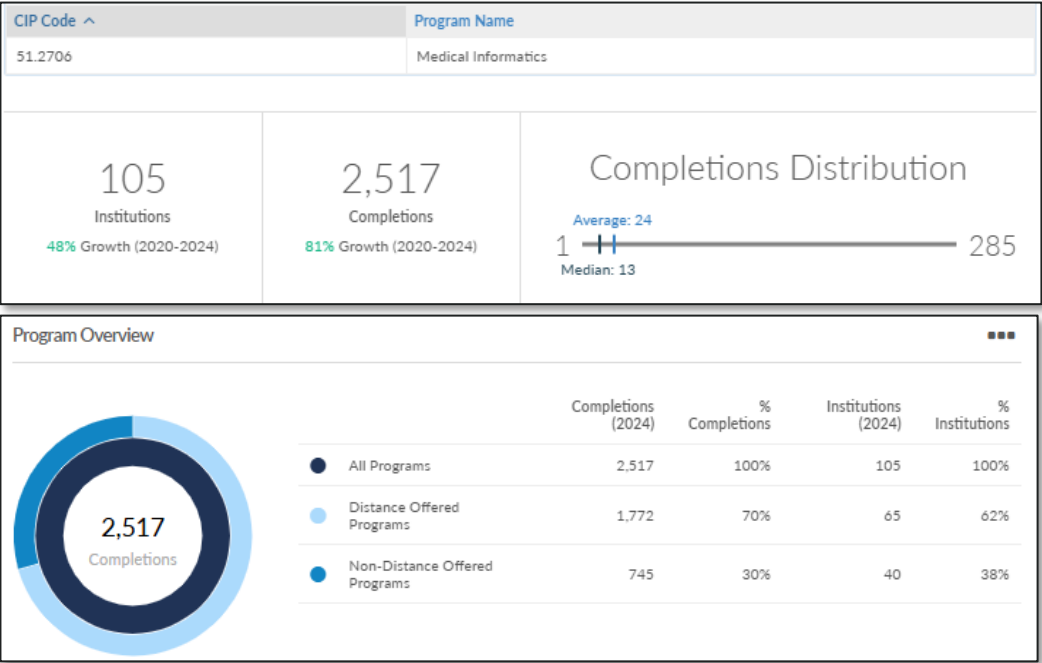
- As shown in the last report, student demand in AI continues at an explosive pace, the # of institutions up 188% in the past 5 years and completions up 278%. And this is understated to the current market as it is 2024 completions representing 2022 enrollments.
- Online degree completions are also growing substantially now making up 38% of the completions market, up from 20% 1 year ago.
- There is no doubt that AI degrees are growing and offer considerable opportunity for higher education institutions, including Ohio State.



Completions by Institution					
Institution	Master's Degree Completions (2024)	Growth % YOY (2024)	Market Share (2024)	IPEDS Tuition & Fees (2023)	Completions Trend (2020-2024)
Carnegie Mellon University	147	-17.4%	13.1%	\$49,450	
University of Pennsylvania	87	-11.2%	7.7%	\$46,034	
San Jose State University	69	32.7%	6.1%	\$9,426	
University of North Texas	69	-9.2%	6.1%	\$9,062	
Illinois Institute of Technology	68	70.0%	6.1%	\$33,810	
Northeastern University	58	5.5%	5.2%	\$28,100	
University of San Diego	50	42.9%	4.5%	\$29,328	
Johns Hopkins University	50	177.8%	4.5%	\$65,956	
University of Southern California	40	-11.1%	3.6%	\$68,128	
Boston University	38	72.7%	3.4%	\$64,712	

Degree Completion Trends – Master’s in Medical Informatics

- While Medical Informatics Master’s are not growing at the same rate as AI, they are still growing at a strong pace – 81% in completions and 48% in institutions.
- Medical Informatics is heavily concentrated in online completions which make up 70% of the market.
- Several competitors included in the analysis are in the top completion producing institutions: **UT Health Science Center, Michigan and Harvard.**
- Based on demand in the market, both AI and Medical Informatics are opportunity areas for a master’s degree.



Comparable Program Analysis



Comparable Programs Analysis

Cost of Comparable Programs

- Ohio State's standard online graduate engineering tuition (\$1,170 per credit hour) aligns with several competitors like UT Health Houston and UAB.
- By aligning this program with Ohio State's established graduate online tuition of ~\$35,000, the proposed MS in AI + X offers an elite program at an accessible price point. This allows OSU to remain a high-value alternative to Tier 1 private institutions—such as Harvard (~\$101k) or Stanford (~\$69k/year)—while being priced similarly to peers.
- Most competitive programs require 27 to 32 credit hours. Adopting a 30-credit model would keep the total degree cost competitive while meeting accreditation standards.

Institution	Degree Researched	Total Cost	Cost Per Credit Hour	Additional Fees	# of Credit Hours
Stanford University	MS in Biomedical Data Science	~69,663 per year	\$1,548 per unit	Not found	45 minimum
Harvard Medical School	Master's in Biomedical Informatics	~\$101,560	N/A - flat tuition	\$250 - Registration Fee \$1,800 - University Health Service Fee	64
University of Michigan	Master of Health Informatics	\$18,500 per term (Residents) \$30,632 per term (Out of State)	N/A - Charged by term	\$80 - Registration Fee	45
Northwestern University	MS in Health Informatics	\$63,132	\$5,131	\$130 - Technology Fee	12 Courses
UTHealth Houston	MS in Biomedical Informatics	\$18,900 (Texas Resident) \$42,663 (Out of State)	\$260 - Resident \$1,075 - Non Resident	\$275 - Technology Fee	39
University of Washington	MS in Biomedical & Health Informatics	\$20,253 (In State, per year) \$35,259 (Out of State, per year)	N/A	\$96 - Technology Fee	30
University of Alabama at Birmingham	MS in Artificial Intelligence in Medicine	~\$20,724 (In State) ~\$51,150 (Out of State)	\$628 In State \$1,550 Out of State	\$250 - Graduate Support Fee (Per course) \$125 - Professional Support Fee (Per semester)	33
Georgetown University	MS in Health Informatics & Data Science	~\$70,812 (1 year plan) ~\$75,870 (More than 1 year plan, per credit rate)	\$30,348 (per semester flat rate for 12 credits +) \$2,529 (per credit rate for less than 12 credits)	Could not find	30
Columbia University	MA in Biomedical Informatics	~\$81,000	\$2,700	Could not find	32
University of Pennsylvania	MBMI	~\$56,020	\$4,912	\$492 - General Fee per CU \$358 - Clinical Fee \$198 - Technology Fee per CU	10 courses
Vanderbilt University	MS in Applied Clinical Informatics	\$70,757	N/A - flat tuition	\$207 (1st year) \$138 (2nd year) - Student Services Fee \$390 (1st year) \$260 (2nd year) - Student Health Fee \$100 - Year 1 transcript fee	36
Johns Hopkins University	MS in Applied Health Sciences Informatics	\$71,712 (first year/\$70,972 second year) \$14,610 (per year if online, part-time student)	N/A	\$740 - Matriculation Fee	30
University of Louisville	MS in Biostatistics (Bioinformatics Track)	~\$28,050 (Resident, part-time) ~\$57,057 (Non resident, part-time) ~\$22,956 (Resident, full-time) ~\$46,662 (Non resident, full-time)	\$850 (Resident/less than 9 credit hours) \$1,729 (Non resident/less than 9 credit hours) \$7,652 (Resident/full-time student, per semester) \$15,554 (Non resident/full-time, per semester)	Could not find	33

*Cost estimations based on full-time, in state residents. All data pulled from publicly available data. Weblinks used in [Detailed Excel](#).



Admissions Requirements and Concentrations Offered

- **Varied Application Materials:** Most programs require standard documents such as official transcripts, letters of recommendation, resumes, and personal statements or statements of purpose.
- **Flexible Technical Prerequisites:** Some institutions have specific entry barriers, such as Georgetown requiring documentation of programming experience, while Vanderbilt does not require a computer science degree but recommends two years of relevant post-undergrad experience.
- **Specialization Options:** While many programs do not list specific concentrations, others offer tracks in areas like Clinical Informatics, Health Technology, Data Science, and Bioinformatics.

Institution	Admissions Requirements	Concentrations/Specializations
Stanford University	No GRE Required	N/A
Harvard Medical School	Minimum of a bachelor's degree from an accredited US or international institution.	N/A
University of Michigan	Transcripts, Three letters of recommendation, Three short answer essays, Resume, Personal Statement	N/A
Northwestern University	Statement of purpose, Resume, Two letters of recommendation, Official Transcripts	Three program specializations: Clinical Informatics, Health Technology, and Health Administration Informatics
UTHealth Houston	Baccalaureate or higher degree, Official transcripts, Resume Three letters of recommendation, Goal Statement	Research Track Applied Biomedical Informatics Track
University of Washington	Not posted	Data Science Specialization
University of Alabama at Birmingham	Not posted	Thesis Track Non-Thesis Track
Georgetown University	Bachelor's degree, Transcripts, Documentation of programming experience, Resume, Two letters of recommendation, Statement of purpose	N/A
Columbia University	Not posted	N/A
University of Pennsylvania	Unofficial transcripts, CV or resume, Personal Statement Two letters of recommendation	N/A
Vanderbilt University	No computer science degree is required, Two years of relevant post-undergrad experience is preferred, Standardized tests not required but recommended	N/A
Johns Hopkins University	Terminal degree in a relevant area of healthcare or bachelor's degree in a relevant area + 5 years of related work experience	N/A
University of Louisville	Two letters of recommendation, Transcripts, Statement of purpose	Standard Track Thesis Track Bioinformatics Track



Program Positioning and Student Targeting

- **Interdisciplinary Governance:** Success is marketed as a "tri-college" effort. For example, Michigan's program is a joint venture between the School of Information, Public Health, and the Medical School.
- **Targeting the "Bilingual" Professional:** Positioning focuses on creating "bilingual" graduates—clinicians who can code and engineers who understand clinical workflows.
- **Ethical & Equitable AI:** A recurring theme in program positioning (especially at Michigan and Harvard) is the focus on health equity and the ethical deployment of AI to ensure technology does not amplify existing biases.

Institution	Program Positioning	Student Target
Stanford University	The Biomedical Data Science Program is interdepartmental and offers instruction and research opportunities leading to MS and PhD degrees in Biomedical Data Science.	This degree is designed for individuals who wish to undertake an in-depth study of biomedical data science with research full-time.
Harvard Medical School	The Master of Medical Sciences (MMSc) in Biomedical Informatics program trains students to contribute to the rapidly evolving use of biomedical data for revolutionary advances in scientific inquiry and technological development.	This program is designed for students who want to develop data science skills in the context of medicine and biological science to improve human health.
University of Michigan	The University of Michigan Master of Health Informatics is an interdisciplinary program offered by the School of Information, the School of Public Health and the Medical School. This unique combination of disciplines offers students an unparalleled education that combines the practical and theoretical knowledge needed for a successful career in this burgeoning field.	The Master of Health Informatics is an especially attractive option for individuals who are interested in leadership roles in health management, consulting or systems implementation.
Northwestern University	The dynamic field of health informatics operates at the convergence of healthcare and information technology. The online master's in Health Informatics (MHI) program is offered in partnership with Northwestern University's Feinberg School of Medicine, a leader in the medical community. MHI students prepare for <u>emerging opportunities and roles</u> across the healthcare enterprise in classes <u>taught by thought leaders</u> in the informatics field.	Master's in Health Informatics students come from a range of backgrounds that are reflected in three distinct program specializations: Clinical Informatics, Health Technology Informatics, and Health Administration Informatics.
UTHealth Houston	McWilliams School of Biomedical Informatics at UTHealth Houston offers a Master's Degree in Biomedical Informatics with two tracks: the research track and the applied biomedical informatics track. Both tracks provide students with knowledge and skills to deliver innovative solutions to real-world problems in health information technology.	Did not explicitly state
University of Washington	The goal of our Master's degree program is to train the next generation of researchers and leaders to advance the science of Biomedical and Health Informatics. Our MS program is research-focused; students must complete a thesis that aims at solving a research problem in the science of biomedical and health informatics.	Did not explicitly state
University of Alabama at Birmingham	You can be at the forefront of the next leaders in medicine dedicated to understanding and strategically applying AI technology to enhance healthcare services across all levels, including administration, research, and clinical care. The MS in Artificial Intelligence in Medicine (AIM) examines the evolving intersection of data science, machine learning, and medicine, from the foundations of AI in healthcare to emerging trends.	Background in Medicine, Statistics, Computer Science, Mathematics & Biomedical Engineering/Engineering. Healthcare Professionals (with a programming background). Students should have proficiency with Python; programming is a requirement for success.
Georgetown University	The Georgetown University Master's in Health Informatics & Data Science is designed to help you develop core competencies in data science, health-related data, predictive analytics, machine learning (ML), artificial intelligence (AI) and other advanced technologies.	This program is aimed at health professionals, engineers, and math/science/computer science majors seeking to become practicing health data scientists and clinical informaticians.
Columbia University	The Free-Standing Master of Arts (MA) program prepares students for practical, hands-on careers in informatics. Graduates have gone on to work at hospitals, entered industry, or enrolled in PhD programs.	The program is appropriate for students from a wide range of backgrounds.
University of Pennsylvania	The Master of Clinical Informatics (MCI) program seeks to provide state-of-the-art graduate-level educational and training opportunities in clinical informatics, adhering to the best practices as established by national competency standards, to create the next generation of clinical informatics and practitioners.	Demonstrated experience with: The history, goals, methods and current challenges of the major health science fields; Professional experience in a clinical or clinical research environment; The U.S. healthcare system and Current healthcare challenges
Vanderbilt University	With flexible virtual classes, mentorship from nationally recognized faculty, and access to the largest biomedical informatics department in the world, Vanderbilt's MS-ACI is designed for a diverse range of healthcare professionals seeking to lead and innovate in clinical informatics.	For working professionals who are looking to advance their careers in the health care field.
Johns Hopkins University	Designed for those wanting to obtain practical competencies in biomedical informatics and data science. Using AMIA guidelines, we presume that the health sciences informatician should be capable of developing or leading innovative applications of information technology and information systems that address clinical or public health priorities.	Aimed towards students with relevant healthcare degrees and/or relevant work experience
University of Louisville	The Master of Science (MS) degree prepares students for careers as professional biostatisticians in industry, government or academia.	Bachelor's degrees in diverse fields, background coursework in calculus (particularly multivariable calculus)



Suggested Outcomes

- **Diverse Career Pathways:** Programs prepare graduates for a wide range of roles, including research leaders, clinical informatics practitioners, and consultants within healthcare organizations, pharma/biotech, and government agencies.
- **Emphasis on Emerging Tech:** Several institutions, such as Stanford and UAB, specifically highlight training in new algorithms and AI technologies, focusing on their critical analysis and ethical implications in medicine.
- **Focus on Health Equity:** The University of Michigan emphasizes training students to develop socio-technical interventions that address health inequities and ensure technology is deployed in an ethical, equitable manner.

Institution	Suggested Outcomes
Stanford University	Students receive training in investigating new approaches to conceptual modeling and developing new algorithms that address challenging problems in the biological sciences and clinical medicine.
Harvard Medical School	Through a rigorous combination of core coursework and a year-long full-time thesis research project, students will graduate with the computational, methodological, and data science skills to contribute to an ongoing revolution in biomedical discovery.
University of Michigan	Graduates of the program will be able and motivated to: -Build understanding of the resources and needs of a diversity of individuals, communities, organizations, and environments to ensure that information technology deployed to improve health and health equity will recognize and amplify existing strengths -Apply health informatics methods in ethical and equitable ways to understand and address health-related problems -Appropriately utilize theories of individual behavior, social science, health management and organizational change in the design and implementation of socio-technical interventions -Develop socio-technical interventions that fit to context for successful deployment in health settings -Implement and manage socio-technical innovations based on an understanding of the relevant history, prevailing culture, organizational context, and policies towards eliminating health inequities and promoting the health of all peoples -Evaluate socio-technical interventions to ascertain their overall, and heterogeneous, effects on healthcare, access to care, and health outcomes, always being mindful of the potential of interventions for perpetuating existing inequities -Communicate effectively regarding problems and solutions and work within teams and organizations to address health informatics-related problems collaboratively
Northwestern University	Graduates leave the program ready to leverage technology tools and data for more efficient, patient-centered healthcare delivery and improved population health, and apply essential skills such as organizational change leadership and project management.
UTHealth Houston	Both tracks provide students with knowledge and skills to deliver innovative solutions to real-world problems in health information technology.
University of Washington	Trained to be the next generation of researchers and leaders to advance the science of Biomedical and Health Informatics.
University of Alabama at Birmingham	Gain practical experience with real-world applications, receive training in the critical analysis of AI technologies, and explore the legal and ethical implications of AI in medicine. Through this graduate-level program, both current and future medical professionals can acquire in-demand skills that often lead to new opportunities in healthcare technology and innovation.
Georgetown University	By the end of the program, you will be prepared to successfully take on a wide range of opportunities in health care organizations and related industries, including health technology developers, device manufacturers, pharma/biotech, academic medical centers, and management consulting firms.
Columbia University	Graduates have gone on to work at hospitals, entered industry, or enrolled in PhD programs.
University of Pennsylvania	Our program's objectives are drawn from the key competencies identified by the American Medical Informatics Association's 2017 guidelines, which identify the skills and knowledge that informatics practitioners need to set themselves apart in a rapidly developing field.
Vanderbilt University	100% graduation rate through May 2025, 100% employment rate one year post graduation, 92% retention rate AY 2024-2025
Johns Hopkins University	Using AMIA guidelines, we presume that the health sciences informatician should be capable of developing or leading innovative applications of information technology and information systems that address clinical or public health priorities.
University of Louisville	Students receive state-of-the-art training in the latest statistical methodologies with focus on the design of research studies, modern statistical data analysis in health sciences research, and research in Biostatistical methodology. In addition, students are provided with tools with which to develop evidence-based clinical and healthcare policies and guidelines.



Memorandum of Understanding

Online Program

Between

Master of Science in Artificial Intelligence in Medicine
College of Engineering
College of Medicine
The Ohio State University

And

Ohio State Online
The Ohio State University

Purpose

The purpose of this Memorandum of Understanding (MOU) is to acknowledge that the **Master of Science in AI in Medicine** has met or exceeded the modality substantive change threshold—making the program an online (ONL) program or is a new online (ONL) program for the university and will meet the requirements for an online program in partnership with Ohio State Online.

Term of MOU

This MOU will become effective upon obtaining all necessary signatures and will remain in effect for the life of the program.

Services Provided for Program Launch

As an online (ONL) program this program will receive Ohio State Online support, such as market research, student acquisition of online (ONL) program students, ongoing online (ONL) program student support, online (ONL) program and course design and development, and state authorization and licensure research and disclosures (if applicable). The initial marketing and staffing support will depend on the funding request support agreed to in the funding MOU. Per OAA funding guidelines for new online programs, there will be a separate funding request (funding MOU) to support the start-up of these services until the revenue attribution is recognized via the Ohio State budget model. Without this funding, the program's launch will not be as strong or robust as desired.



Based on pre-approval planning conversations, this program may leverage the following Ohio State Online services:

Online Enrollment Services: Generating and finding quality prospective online (ONL) program students dependent on initial funding, selling prospective students on the online (ONL) program and Ohio State, helping re-enroll and retain online (ONL) program students each term to help them reach graduation, and supporting the college to achieve steady-state revenue streams.

Online Instruction Services: Reviewing and recommending evidence-based online (ONL) program curricular design to best meet and support the intended audience and enrollment goals; providing and encouraging online (ONL) program instructor professional learning opportunities; and partnering with instructors for initial online (ONL) program course design, development, and ongoing course updates.

Ohio State Online and college program relationship contacts listed below will have ongoing check-ins and strategy sessions to evolve online (ONL) program services and programs to achieve shared goals. Service activities will be aligned for the online (ONL) program during these meetings.

Table of Program Relationship Contacts

Units	College / Department / Campus	Ohio State Online
Organization Oversight	- Balasubramaniam Shanker, Dean, COE - Amy Moore, Dean, COM	Jason Lemon, Dean
Administrative Oversight	- Dave Tomasko, Associate Dean, COE - Sandra Metzler, Associate Dean, COE - Jennifer Gold, Vice Dean, COM	- John Muir, Director, OL&I - Brandi Bittner, AVP, OE
Program Oversight	- Raghu Machiraju, COE - Lang Li, COM	- John Muir, Director, OL&I - Brandi Bittner, AVP, OE
Course Oversight	- Nikki Herbert, COE PDEP - Steve Oghumu, COM - Ashley Cetnar, COM - Ping Zhang, COM - Rajiv Ramnath, COE	Assigned OSO program / course design director, assigned Instructional Designer
Student Support Oversight	Nikki Herbert, COE PDEP	Assigned Reenrollment Team
Marketing/Recruiting Oversight	Nikki Herbert, COE PDEP	Assigned Marketing Manager and Recruiting lead



Fiscal Oversight	- Bobby Srivastava, COE Chief Administration Officer - Bryan Pyles, COM Associate Vice President of Finance	Jon Rucker, Director, Online Financial Strategy and Analysis
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Signatories

By signing this MOU, all groups agree to be active partners and to abide by this agreement:

Program Director DocuSigned by:  9C490E4754FD489... DocuSigned by:  3149FC823BD3488...	Date: 08/12/2026 08/12/2026
Department Chair DocuSigned by:  E7F92D72F2F8454... DocuSigned by: Anil V Parwani 61156CD19B89142F...	Date: 08/13/2026 08/21/2026 08/17/2026
College Fiscal Officer Signed by: Bobby Srivastava 59EEBEEC7A8E404... DocuSigned by:  3B8D0B6B2DEC453... Signed by: Sandra A Metzler D499A5022B5349E...	Date: 08/25/2026 09/02/2026
Curricular Associate Dean DocuSigned by:  3B8D0B6B2DEC453... Signed by: Sandra A Metzler D499A5022B5349E...	Date: 09/07/2026 09/11/2026 09/11/2026
Dean DocuSigned by:  050EEF05CA7B4B4... Signed by:  CD08880548334F9...	Date: 09/11/2026 09/13/2026
Vice Provost and Dean of Online Learning DocuSigned by:  9C19184E034F41C...	Date: 09/13/2026



Online Program Attributes

Program Working Title:	Master of Science in Artificial Intelligence in Medicine
Anticipated CAA approval date for ONL modality:	SP 2026
Anticipated ODHE approval date for ONL modality:	AU 2027

Program level:	☐ Associate	☐ Undergraduate	☒ Graduate	☐ Professional
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Approval type:	☒ New program	☐ Change of delivery	☐ Certificate Type:	☐ Stackable	☐ Other
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If applicable, will the program continue to offer an on-ground version? (Note, notification to CAA and Ohio State Online will be necessary if an approved program modality is no longer offered.)	☐ Yes	☒ No
Percentage of courses offered online for this program?	100%	
If other, please explain:		

Anticipated term for first enrollment intake:	AU 2027
(Note, marketing and recruitment will begin about 6 months prior to first enrollment term.)	

Will this program have a differential fee structure?	☐ Yes	☒ No
If yes, please explain justification:		

Total credit hours for program:	34
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Does this program have mandatory onsite training components? (e.g., practicum, residency, or internship)	☐ Yes	☒ No
If yes, please explain:		

Does this program have any non-mandatory onsite training components? (e.g., orientation)	☐ Yes	☒ No
If yes, please explain:		

Has the funding MOU for this program been signed?	☐ Yes	☒ No
Funding level provided by the college:	☐ Full	☐ Partial
Launch funding accelerates enrollment growth and ROI. Without it, ramp-up slows and financial sustainability is uncertain.		



Online Program Courses

The online program course delivery strategy at launch is outlined in the table below.

Note: the information in the first row of the table is included only to provide an example of how the information should be formatted.

Course Code and Name	Current Delivery Mode(s)* (how course has been offered previously: in person, hybrid, distance learning, N/A - new course)	Core or Elective	Asynchronous or Synchronous or Both	First Term and Session (if applicable) this Course will be Offered as part of this Online Program	Other terms and sessions (if applicable) this course be offered (None, AU25, SP25, SU25)
BMI 5780: Programming for Biomedical Informatics	Distance Learning	Core	Asynchronous	AU27	AU and SP
BMI 5551: Introduction AI/ML in Digital Health	Distance Learning	Core	Asynchronous	AU27	AU
BMI 6YYY, CSE 69YY: Capstone Design: AI/ML in Digital Health	Distance Learning	Core	Asynchronous	SP28	SP
BMI 5552: AI/ML Applications in Medical Imaging	Distance Learning	Core	Asynchronous	SP28	SP
BMI 5553: Predictive Analytics in Electronic Health Records	Distance Learning	Core	Asynchronous	AU27	AU
BMI 5554: Natural Language Processing in Biomedical Informatics	Distance Learning	Core	Asynchronous	SP28	SP
BMI 5556: Human-Centered Design of AI in Healthcare	Distance Learning	Elective	Asynchronous	AU28	Every other AU
BMI 5557: Vision Language Models and Multimodal AI in Healthcare	Distance Learning	Elective	Asynchronous	SP29	Every other SP
BMI 5710: Introduction to Biomedical Informatics	Distance Learning	Elective	Asynchronous	AU27	AU
BMI 5730: Introduction to Bioinformatics	Distance Learning	Elective	Asynchronous	AU27	AU and SP
BMI 5750 Methods in Biomedical Informatics and Data Science	Distance Learning	Elective	Asynchronous	SU28	SU
BMI 5760: Public Health Informatics	Distance Learning	Elective	Asynchronous	AU27	AU
BMI 5770: Health Analytics	Distance Learning	Elective	Asynchronous	SP29	Every other SP



BMI 7040: Clinical Informatics	Distance Learning	Elective	Asynchronous	AU27	Every other AU
BMI 7235: Applications of Machine Learning for Bioinformatics	Distance Learning	Elective	Asynchronous	AU27	AU
CSE 5194: Ethics in AI	Distance Learning	Core	Asynchronous	AU27	AU and SP
CSE 5052: Survey of Artificial Intelligence for Non-Majors	Distance Learning	Core	Asynchronous	AU27	AU and SP
CSE 6520: Foundations of Applied Artificial Intelligence for Non-Majors	Distance Learning	Core	Asynchronous	AU27	AU and SP
CSE 5525: Foundations of Speech and Language Processing	Distance Learning	Elective	Asynchronous	AU28	AU
CSE 5526: Introduction to Neural Networks	Distance Learning	Elective	Asynchronous	SP28	SP
CSE 5544: Introduction to Data Visualization	Distance Learning	Elective	Asynchronous	SP28	SP
CSE 5449: Introduction to High Performance Deep Learning	Distance Learning	Elective	Asynchronous	SP28	SP
CSE 5523: Machine Learning and Statistical Pattern Recognition	Distance Learning	Elective	Asynchronous	SP28	SP
CSE 5524: Computer Vision for Human-Computer Interaction	Distance Learning	Elective	Asynchronous	AU28	AU
RADONC 5XXX: Programming for Radiation Oncology	Distance Learning	Core	Asynchronous	AU27	AU
RADONC 5XXX: Artificial Intelligence in Modern and Emerging Therapies	Distance Learning	Core	Asynchronous	SP28	SP
RADONC 6YYY, CSE 69YY: Capstone Design: Design of AI-Based Clinical Decision Support Systems	Distance Learning	Core	Asynchronous	SP29	SP
RADONC 5XXX: Artificial Intelligence in Radiation Oncology	Distance Learning	Core	Asynchronous	SU28	SU
RADONC 5XXX: Artificial Intelligence in Radiation Biology	Distance Learning	Core	Asynchronous	AU28	AU
RADONC 5XXX: Radiation Treatment Technologies	Distance Learning	Elective	Asynchronous	TBD	TBD
RADONC 5XXX: Radiation Safety and Protection	Distance Learning	Elective	Asynchronous	TBD	TBD



RADONC 5XXX: Diagnostic Imaging	Distance Learning	Elective	Asynchronous	TBD	TBD
RADSCI 5XXX: Cross Sectional Anatomy	Distance Learning	Elective	Asynchronous	TBD	TBD
PATHOL 5XXX: Computing Environments for Digital Pathology	Distance Learning	Core	Asynchronous	AU27	AU
PATHOL 5224: Computational Pathology in Practice	Distance Learning	Core	Asynchronous	SU28	SU
PATH 6YYY, CSE 69YY: Capstone Design: Design of AI-based Diagnostic Systems	Distance Learning	Core	Asynchronous	AU28	AU
PATHOL 5211: Digital Pathology	Distance Learning	Core	Asynchronous	SP28	SP
PATHOL 6640: Fundamentals of Oncology	Distance Learning	Core	Asynchronous	SP29	SP
PATHOL 5217: Introduction to Pathology Informatics	Distance Learning	Core	Asynchronous	SP28	SP
PATHOL 5200: Introduction to Anatomical Pathology	Distance Learning	Elective	Asynchronous	AU28	AU
PATH XXX: Advanced Techniques for Computational Pathology	Distance Learning	Elective	Asynchronous	SP29	Every other SP
PATHOL 6XXX: Updates in Pathology	Distance Learning	Elective	Asynchronous	SP29	SP
PATHOL 8850: Seminars in Pathology	Distance Learning	Elective	Asynchronous	AU28	AU



State Authorization

Ohio State Online will support necessary steps for state authorization approvals and notifications, and the program will abide by federal and state laws and disclosure requirements, for items selected yes.		
Will this program enroll students located outside Ohio?	☒ Yes	☐ No
Is this program designed to lead to professional licensure or certification in any state?	☐ Yes	☒ No
If yes, what is the name of the professional licensure or certification?		
If yes, is professional licensure or certification required to obtain employment/advancement in the field?	☐ Yes	☐ No
Will this program conduct on-ground supervised field experiences such as clinicals, practicums, student teaching or internships?	☐ Yes	☒ No



Certificate Of Completion

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Jonathan Mark Rucker

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Signer Events

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li.8958@osu.edu

Professor and Chair

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Signature

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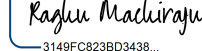
Raghu Machiraju

machiraju.1@osu.edu

The Ohio State University

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Anish Kumar Arora

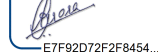
arora.9@osu.edu

Professor and Chair, Computer Sc & Engg

The Ohio State University

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Anil V Parwani

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Chair, Dept of Pathology

The Ohio State University

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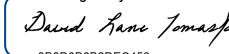
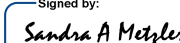
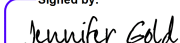
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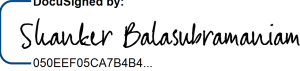
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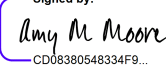
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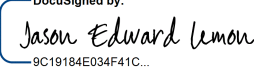
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Bryan Pyles pyles.133@osu.edu Assoc Vice President for Finance Medicine Security Level: Email, Account Authentication (None), Login with SSO Electronic Record and Signature Disclosure: Not Offered via DocuSign	DocuSigned by:  ABADB5331CEC4A4... Signature Adoption: Pre-selected Style Using IP Address: 140.254.70.165	Sent: 8/25/2026 2:45:30 PM Viewed: 8/25/2026 2:51:18 PM Signed: 9/2/2026 7:45:04 AM
David Lane Tomasko tomasko.1@osu.edu Associate Dean, Engineering The Ohio State University Security Level: Email, Account Authentication (None), Login with SSO Electronic Record and Signature Disclosure: Not Offered via DocuSign	DocuSigned by:  3B8D086B2DEC453... Signature Adoption: Pre-selected Style Using IP Address: 107.205.33.130	Sent: 9/2/2026 7:45:07 AM Viewed: 9/7/2026 3:08:28 PM Signed: 9/7/2026 3:12:59 PM
Sandra A Metzler metzler.136@osu.edu Professor of Practice The Ohio State University Security Level: Email, Account Authentication (None) Electronic Record and Signature Disclosure: Not Offered via DocuSign	Signed by:  D499A5022B5349E... Signature Adoption: Pre-selected Style Using IP Address: 174.105.44.67 Signed using mobile	Sent: 9/7/2026 3:13:03 PM Viewed: 9/11/2026 7:19:42 AM Signed: 9/11/2026 7:21:16 AM
Jennifer Gold gold.6@osu.edu Security Level: Email, Account Authentication (None), Login with SSO Electronic Record and Signature Disclosure: Not Offered via DocuSign	Signed by:  F0C434D8518B45B... Signature Adoption: Pre-selected Style Using IP Address: 209.249.45.115	Sent: 9/11/2026 7:21:19 AM Viewed: 9/11/2026 2:21:42 PM Signed: 9/11/2026 2:22:17 PM

Signer Events	Signature	Timestamp
Shanker Balasubramaniam shanker.32@osu.edu Professor and Chair Security Level: Email, Account Authentication (None), Login with SSO	DocuSigned by:  050EEF05CA7B4B4... Signature Adoption: Pre-selected Style Using IP Address: 164.107.161.23	Sent: 9/11/2026 2:22:20 PM Viewed: 9/11/2026 4:24:58 PM Signed: 9/11/2026 4:25:24 PM

Electronic Record and Signature Disclosure:
Not Offered via DocuSign

Amy M Moore moore.4380@osu.edu Interim Dean, COM The Ohio State University Security Level: Email, Account Authentication (None)	Signed by:  CD08380548334F9... Signature Adoption: Pre-selected Style Using IP Address: 104.231.145.48	Sent: 9/11/2026 4:25:27 PM Viewed: 9/13/2026 12:08:30 PM Signed: 9/13/2026 12:08:46 PM
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Electronic Record and Signature Disclosure:
Not Offered via DocuSign

Jason Edward Lemon lemon.297@osu.edu Vice Provost and Dean The Ohio State University Security Level: Email, Account Authentication (None), Login with SSO	DocuSigned by:  9C19184E034F41C... Signature Adoption: Pre-selected Style Using IP Address: 74.215.102.6	Sent: 9/13/2026 12:08:48 PM Viewed: 9/13/2026 12:16:40 PM Signed: 9/13/2026 12:17:10 PM
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Electronic Record and Signature Disclosure:
Not Offered via DocuSign

In Person Signer Events	Signature	Timestamp
Editor Delivery Events	Status	Timestamp
Agent Delivery Events	Status	Timestamp
Intermediary Delivery Events	Status	Timestamp
Certified Delivery Events	Status	Timestamp

Carbon Copy Events	Status	Timestamp
Jonathan Mark Rucker rucker.78@osu.edu Security Level: Email, Account Authentication (None) Electronic Record and Signature Disclosure: Not Offered via DocuSign	COPIED	Sent: 9/13/2026 12:17:13 PM Resent: 9/13/2026 12:17:30 PM
Brandi N Bittner bittner.102@osu.edu Security Level: Email, Account Authentication (None), Login with SSO Electronic Record and Signature Disclosure: Not Offered via DocuSign	COPIED	Sent: 9/13/2026 12:17:15 PM Viewed: 9/14/2026 9:29:32 AM
Erin R McLaughlin mclaughlin.556@osu.edu Security Level: Email, Account Authentication (None), Login with SSO Electronic Record and Signature Disclosure:	COPIED	Sent: 9/13/2026 12:17:16 PM Viewed: 9/14/2026 9:00:33 AM

Carbon Copy Events	Status	Timestamp
Not Offered via DocuSign		
John Muir muir.25@osu.edu The Ohio State University Security Level: Email, Account Authentication (None) Electronic Record and Signature Disclosure: Not Offered via DocuSign	COPIED	Sent: 9/13/2026 12:17:17 PM
Jacob Harris Bane bane.17@osu.edu The Ohio State University Security Level: Email, Account Authentication (None), Login with SSO Electronic Record and Signature Disclosure: Not Offered via DocuSign	COPIED	Sent: 9/13/2026 12:17:19 PM Viewed: 9/14/2026 9:20:10 AM
Kathryn Marie Reed reed.901@osu.edu The Ohio State University Security Level: Email, Account Authentication (None) Electronic Record and Signature Disclosure: Not Offered via DocuSign	COPIED	Sent: 9/13/2026 12:17:20 PM
Lisa N Delaney delaney.177@osu.edu The Ohio State University Security Level: Email, Account Authentication (None) Electronic Record and Signature Disclosure: Not Offered via DocuSign	COPIED	Sent: 9/13/2026 12:17:21 PM
Maria N. Miriti miriti.1@osu.edu X The Ohio State University Security Level: Email, Account Authentication (None), Login with SSO Electronic Record and Signature Disclosure: Not Offered via DocuSign	COPIED	Sent: 9/13/2026 12:17:23 PM Viewed: 9/23/2026 1:37:18 PM

Witness Events	Signature	Timestamp
Notary Events	Signature	Timestamp
Envelope Summary Events	Status	Timestamps
Envelope Sent	Hashed/Encrypted	8/12/2026 8:59:11 AM
Envelope Updated	Security Checked	8/18/2026 9:09:21 AM
Certified Delivered	Security Checked	9/13/2026 12:16:40 PM
Signing Complete	Security Checked	9/13/2026 12:17:10 PM
Completed	Security Checked	9/13/2026 12:17:23 PM
Payment Events	Status	Timestamps

From: [Martin, Andrew](#)
To: [Reed, Katie](#)
Subject: RE: Forwarding proposal: ENG-MED AI in Medicine
Date: Friday, October 9, 2026 8:00:36 AM
Attachments: [image001.png](#)
[image002.png](#)

Hi Katie
ASC provides concurrence for this proposal.
Best
Andrew



Andrew W. Martin

Associate Dean for Undergraduate Education
Professor of Sociology
114 University Hall, 230 North Oval Mall
Columbus, OH 43210
614-247-6641 Office
martin.1026@osu.edu

From: Reed, Katie <reed.901@osu.edu>
Sent: Thursday, October 1, 2026 1:09 PM
To: Martin, Andrew <martin.1026@osu.edu>
Subject: RE: Forwarding proposal: ENG-MED AI in Medicine

Hi Andrew,

Did you connect with Bernadette on this question?

Thanks,
Katie

From: Martin, Andrew <martin.1026@osu.edu>
Sent: Thursday, September 24, 2026 1:13 PM
To: Reed, Katie <reed.901@osu.edu>
Subject: RE: Forwarding proposal: ENG-MED AI in Medicine

I'm guessing we may want to have NMS chairs give concurrence; I'll double check with Bernadette



Andrew W. Martin

Associate Dean for Undergraduate Education
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114 University Hall, 230 North Oval Mall

Columbus, OH 43210
614-247-6641 Office
martin.1026@osu.edu

From: Reed, Katie <reed.901@osu.edu>
Sent: Thursday, September 24, 2026 12:59 PM
To: Martin, Andrew <martin.1026@osu.edu>
Subject: FW: Forwarding proposal: ENG-MED AI in Medicine

Andrew,

It does not look like this proposal received concurrence from the College of Arts and Sciences. Do you think it needs to be reviewed by ASC?

Thanks,
Katie

From: Kowalsky, Lisa <kowalsky.10@osu.edu>
Sent: Thursday, September 24, 2026 9:34 AM
To: Reed, Katie <reed.901@osu.edu>
Cc: Miriti, Maria <miriti.1@osu.edu>; Matyas, Cory <matyas.3@osu.edu>
Subject: Forwarding proposal: ENG-MED AI in Medicine

Dear Katie,

Please find attached a proposal from the College of Engineering and the College of Medicine to establish a Master of Science in Artificial Intelligence in Medicine. It was reviewed by GS/CAA and the resulting revision is supported for review at CAA. Please be aware the MOU is now established and at the very end of the file.

Please let me know if any questions or concerns arise.

Best,
Lisa



Lisa Clouser (Kowalsky)

The Ohio State University
Graduate School
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614-292-2267 Office

gradsch.osu.edu

Pronouns: she/her/hers