Artificial Intelligence in Medicine

The Graduate Certificate in AI in Medicine provides a unique credential that will help physicians, entrepreneurs, students, and scientists become knowledgeable about the growing and influential field of artificial intelligence in medicine. The certificate emphasizes the practical application and integration of artificial intelligence principles and tools to design and implement effective approaches for improving health of people through increased precision in predictive modeling, improved diagnostics and other advances.

Courses will apply toward the Masters of Healthcare Innovation. Certificates may be combined to obtain an Interdisciplinary Master's Degree.

Courses are held asynchronously with optional weekly synchronous sessions.

The Graduate Certificate in AI in Medicine is awarded by the University of Alabama at Birmingham Heersink School of Medicine.

Admission Requirements

Admission requirements include eligibility for admission to the UAB Graduate School. There is no GRE required. An admissions committee reviews applications and makes final decisions. Students may begin the program in the Fall or Spring semesters.

Required Coursework

Graduate Certificate Artificial Intelligence in Medicine

Requirements		Hours
HCI 611	Foundations of Artificial Intelligence in Medicine	3
HCI 612	Applications of Artificial Intelligence in Medicine	3
HCI 613	Leadership and Ethics for Artificial Intelligence in Medicine	3
HCI 614	Integration of Artificial Intelligence into Clinical Workflow	3
HI 620	Security and Privacy in Health Care	3
Total Hours		**15**

Masters in Artificial Intelligence in Medicine

Approved as of June 2024 for addition to Catalog for Heersink School of Medicine

Requirements		Hours
HCI 611	Foundations of Artificial Intelligence in Medicine	3
HI 620	Security and Privacy in Health Care	3
AIM 641	Technical Introductions to Deep Learning in Medicine	3
AIM 642	Artificial Intelligence for Medical Imaging	3
AIM 643	Artificial Intelligence for Biomedical Signals and Critical Care Systems	3
AIM 644	Reinforcement Learning for Clinical Decision Making	3
AIM 645	Advanced Natural Language Processing (NLP) in Medicine	3
HCI 614	Integration of Artificial Intelligence into Clinical Workflow	3
HCI 613	Leadership and Ethics for Artificial Intelligence in Medicine	3
AIM 699	Thesis Research	6
Optional Electives (Minimum of 2)		
AIM 646	Large Language Model (LLM) Development in Medicine	
AIM 647	Explainable AI in Medicine	
EE 638	Neural Time Series Data Analysis	
EE 626	Digital Image Processing	
CS 680	Matrix Algorithms for Data Science	
CS 616	Big Data Programming	
CS 675	Data Visualization	
Total Hours		**33**

AIM-Artificial Intel in Med Courses

AIM 600. Programming Essentials for AI in Medicine. 0 Hours.
This course is designed for students with no prior experience in Python programming. Students will learn about basic coding concepts to prepare for the transition into more specialized areas, such as deep learning, by building a solid programming foundation that supports further exploration of AI technologies in medicine. Students will complete this course once admitted to the MS in AI in Medicine program.

AIM 641. Technical Introductions to Deep Learning in Medicine. 3 Hours.
The technical aspects of deep learning in medicine will introduce students to machine learning and deep learning topics that are relevant to the application and development of those techniques in the healthcare domain. These techniques deal with the prediction of labels or real values for unseen objects, based on a set of previously encountered examples, or automated discovery of patterns and commonalities in data. Students will be first introduced to the fundamentals of machine learning and its application to ensure a correct and skillful use of available techniques. We will then focus on deep learning techniques, and how they can be applied in the medical field.
Prerequisites: HCI 611 [Min Grade: C](Can be taken Concurrently)

AIM 642. Artificial Intelligence for Medical Imaging. 3 Hours.
The course will cover the design and implementation of advanced AI-based diagnostics and patient monitoring strategies using medical images from various modalities. Students learn specific preprocessing pipelines for various types of medical images; implement AI-based diagnostics as a project using open-source medical image datasets; learn various development and transfer learning strategies of AI models for medical images.
Prerequisites: HCI 611 [Min Grade: C](Can be taken Concurrently)

AIM 643. Artificial Intelligence for Biomedical Signals and Critical Care Systems. 3 Hours.
This course educates learners about artificial intelligence and machine learning applications to various biomedical signals and perioperative time-series data. The course specifically provides a detailed instruction on how to develop AI systems for real-time time-series data from ICU and other critical care systems. The course presents challenges associated with processing biomedical signals from critical care systems and how AI can assist in improving patient monitoring strategies.
Prerequisites: HCI 611 [Min Grade: C](Can be taken Concurrently)

AIM 644. Reinforcement Learning for Clinical Decision Making. 3 Hours.
This course educates students to the components that make up a reinforcement learning problem and to the important concepts to focus on when trying to solve such a problem in the context of clinical decision making. Students learn what are the different properties of a reinforcement learning problem and what are the consequences of these properties with respect to solvability. They learn how to implement these techniques with focus to the clinical domain, and how supervised learning (and specifically deep learning) can be used to help reinforcement learning techniques tackle larger problems.
Prerequisites: HCI 611 [Min Grade: C](Can be taken Concurrently)

AIM 645. Advanced Natural Language Processing (NLP) in Medicine. 3 Hours.
This theoretical course provides the students with the skills and knowledge to understand and develop state-of-the-art solutions for natural language processing tasks in the field of medicine and healthcare. After a short introduction to traditional generative grammars and statistical approaches to NLP, the course will focus on transformers and variations on their architecture (including BERT and GPT), and about which models work best for which tasks, their capacities, limitations and how to optimize these for medical applications.
Prerequisites: HCI 611 [Min Grade: C](Can be taken Concurrently)

AIM 646. Large Language Model (LLM) Development in Medicine. 3 Hours.
This practical course provides the hands-on expertise. Large Language Model (LLM) concepts such as tokenization, text classification, and sentiment analysis to more advanced topics like fine-tuning large language models for domain-specific healthcare applications. Through a blend of lectures, hands-on assignments, and project work, students will gain a deep understanding of the capabilities and constraints of current LLM technologies. They will also delve into the ethical and regulatory considerations unique to deploying LLMs in a healthcare setting.
Prerequisites: HCI 611 [Min Grade: C](Can be taken Concurrently)

AIM 647. Explainable AI in Medicine. 3 Hours.
In this course, students learn to explain the difference between different explanation approaches (e.g., global versus local models) and to critically choose which are suitable to use based on underlying assumptions and relative advantages and limitations. Students learn to evaluate the quality and ethical consequences of approaches based on the techniques taught, the understandability of explanations, and demonstrate awareness of the ethical, normative, and social consequences of their applications.
Prerequisites: HCI 611 [Min Grade: C](Can be taken Concurrently)

AIM 690. Special Topics in Artificial Intelligence in Medicine. 1-3 Hour.
Rotating special topics course focusing on medical synergies with artificial intelligence.

AIM 699. Thesis Research. 1-6 Hour.
Independent research culminating in master's thesis in AI in Medicine.

AIM 701. AI in Medicine Graduate Seminar. 1 Hour.
The AI in Medicine Monthly Seminar Series brings together leading experts at the forefront of artificial intelligence and healthcare to share their insights, breakthroughs, and visions for the future. Modeled after grand rounds, each session features an invited speaker who presents their work in applying AI to pressing clinical challenges, spanning medical imaging, digital pathology, genomics, electronic health records, clinical trials, and healthcare delivery. The series provides a platform for clinicians, data scientists, and researchers to engage in cross-disciplinary dialogue, examine real-world applications, and consider the ethical, regulatory, and translational dimensions of AI in medicine. Attendees will gain exposure to cutting-edge research, innovative tools, and case studies highlighting how AI is shaping diagnostics, prognostics, and personalized care.

HCI-Healthcare Innovation Courses

HCI 611. Foundations of Artificial Intelligence in Medicine. 3 Hours.
This course introduces students to the fundamentals needed for implementing Artificial Intelligence (AI) in clinical settings. Introduction to AI, Introduction to Healthcare System and Clinical data and Introduction to tools and techniques used in AI.

HCI 612. Applications of Artificial Intelligence in Medicine. 3 Hours.
This course introduces students to Applications of AI in medicine, Machine Learning- Applications of AI to EHR data, Deep Learning- Applications of AI to Medical Imaging data, and Natural Language Processing- Applications of AI to Clinical Documentation.
Prerequisites: HCI 611 [Min Grade: C](Can be taken Concurrently) or HCI 611 [Min Grade: C](Can be taken Concurrently)

HCI 613. Leadership and Ethics for Artificial Intelligence in Medicine. 3 Hours.
This course introduces students to leadership, ethical and strategic skills, responsible AI, AI strategy, people, organization, and implementation of AI in medicine.
Prerequisites: HCI 611 [Min Grade: C](Can be taken Concurrently) or HCI 611 [Min Grade: C](Can be taken Concurrently)

HCI 614. Integration of Artificial Intelligence into Clinical Workflow. 3 Hours.
This course introduces students to strategies and processes for integrating AI into existing clinical workflows. Using AI for Medical Diagnosis, Using AI for Medical Prognosis, and Using AI for Medical Treatment.
Prerequisites: HCI 611 [Min Grade: C](Can be taken Concurrently) or HCI 611 [Min Grade: C](Can be taken Concurrently)

HCI 641. Foundations of Digital Health. 3 Hours.
This course introduces students to the basic concepts needed for implementing digital health solutions in health care. Digital Health Concepts and Key Components, Digital Health Technologies, and Digitally Enabled Care Models.

HCI 642. Leadership & Ethics for Digital Health. 3 Hours.
This course introduces students to leadership, ethical and strategic skills for digital health. Business and Commercialization Strategies, Ethics, Digital Health Technology Assessment.
Prerequisites: HCI 641 [Min Grade: C](Can be taken Concurrently) or HCI 641 [Min Grade: C](Can be taken Concurrently)

HCI 643. Special Topics for Digital Health. 3 Hours.
This course introduces students to special topics in digital health including blockchain in health care, mixed reality in health care and data science for digital health.

HCI 644. Health Care Innovation and Management. 3 Hours.
This course introduces students to the concepts of healthcare innovation and builds knowledge of managing healthcare innovations, fostering an innovative culture in healthcare settings, and assessing and prioritizing innovation from a strategic perspective.

HCI 645. The Organization of Healthcare Innovation. 3 Hours.
This course exposes students to organizational theories and practice related innovation. The course specifically builds knowledge and skills in analyzing the healthcare innovation case using organizational theories, as well as evaluating possibilities and limitations of organizational theories in encouraging and sustaining innovation.

HCI 646. Business Skills for Healthcare Innovation. 3 Hours.
This course provides in-depth knowledge and skills in the financial aspects of healthcare innovation, analyzing healthcare markets and marketing and considerations for start-ups and social enterprises in healthcare.

HCI 647. Healthcare Innovation Metrics and Assessment. 3 Hours.
This course builds student knowledge and skills in economic approaches to health care evaluations, health technology assessment, cost-benefit analysis, and application of health economic approaches to analyze healthcare innovations.

HCI 648. New Technologies and Healthcare. 3 Hours.
This course develops student knowledge of emerging technologies in healthcare including but not limited to digital health innovations, AI and Robotics, Internet of Things and Biosensors.

HCI 649. Design Thinking in Healthcare. 3 Hours.
Design Thinking and Innovation will teach you how to leverage fundamental design thinking principles and innovate problem solving tools to address business challenges and build products, strategies, teams and environments for optimal use and performance.

HCI 650. Making New Healthcare Markets. 3 Hours.
This course focuses on how to identify and capitalize upon marketplace design opportunities. Defines markets and marketplaces and describes the basic functions of each. Discusses attributes (e.g., heterogeneity of participants' preferences and asymmetry in available information) that determine whether and how marketplaces create value. Explains common causes of market failure; presents a framework for designing marketplaces in response. Discusses tactics for building trust and liquidity when launching new market places as well as challenges encountered as marketplaces mature (e.g. congestion and disintermediation).

HCI 680. Special Topics in Healthcare Innovation. 1-3 Hour.
Rotating special topics course focusing on healthcare innovation topics.

HCI 685. Healthcare Innovation Practicum I. 3 Hours.
This course consists of a group project and of classes addressing issues typically encountered in health care innovation projects in companies, start-up or in the health care provider organizations. Examples of these issues are concerned with innovation design, needs analysis, development of value propositions, markets and pricing of medical products, or issues in organizational implementation of innovation. Students focus on a specific innovation challenge in a specific company or health provider organization (typically a hospital). The project carries out fieldwork in its host organization to obtain the most fruitful problem statement, to collect data and to present and discuss solutions.

HCI 686. Healthcare Innovation Practicum II. 3 Hours.
This course consists of a project addressing issues typically encountered in health care innovation projects in companies, start-up or in the health care provider organizations. Examples of these issues are concerned with innovation design, needs analysis, development of value propositions, markets and pricing of medical products or issues in organizational implementation of innovation. Students focus on a specific innovation challenge in a specific company or health provider organization. The students carry out field work in its host organization to obtain the most fruitful problem statement, to collect data and to present and discuss solutions.

HCI 719. Foundations of AI in Medicine for Healthcare Leaders. 3 Hours.
This course equips healthcare executives and clinical leaders with the essential knowledge and strategic frameworks needed to successfully implement AI solutions within their organizations. Through a blend of theoretical foundations and practical applications, students will develop the expertise to lead AI initiatives that enhance patient care, operational efficiency, and clinical outcomes.

HCI 720. Organizing for High Reliability AI in Healthcare. 3 Hours.
Applies High Reliability Organization principles to AI-enabled healthcare systems. Students learn to use principles of organizational theory & behavior to manage organizational readiness for AI adoption. Topics include principles of HRO and organizational theory, design and strategic planning. Health AI (HAI) 360 framework.
Prerequisites: HCI 611 [Min Grade: C](Can be taken Concurrently) and HCI 719 [Min Grade: C](Can be taken Concurrently)

HCI 721. Responsible AI Implementation in Healthcare. 3 Hours.
This course teaches healthcare leaders how to responsibly implement AI systems to improve performance & outcomes of healthcare organizations. Students learn to identify and address bias, ensure transparency in AI decision-making, engage stakeholders in system design. Core topics include responsible AI & implementation science.
Prerequisites: HCI 611 [Min Grade: C](Can be taken Concurrently) or HCI 719 [Min Grade: C](Can be taken Concurrently)

HCI 723. AI for Healthcare Quality and Patient Safety. 3 Hours.
This course prepares healthcare leaders to leverage AI tools to leverage AI tools to improve patient safety, efficiency & effectiveness of care delivery. Students learn to conduct risk assessments for AI applications, evaluate diagnostic algorithm safety, optimize AI-powered clinical & management decision support, and design effective monitoring systems. Topics include hazard analysis, medication safety protocols, human factors engineering, incident reporting, regulatory compliance, and safety culture development.
Prerequisites: HCI 611 [Min Grade: C](Can be taken Concurrently) or HCI 719 [Min Grade: C](Can be taken Concurrently)

HCI 798. Non-Dissertation Research. 1-6 Hour.
The purpose of this course is for students to engage in meaningful research and writing activities.

HCI 799. Dissertation Research. 1-12 Hour.
Design and completion of the dissertation.
Prerequisites: HCI 798 [Min Grade: P]