INTERDISCIPLINARY STUDIES: SPECIALIZATION IN ARTIFICIAL INTELLIGENCE IN MEDICINE (PHD)

Doctor of Philosophy in Interdisciplinary Studies, specialization in Artificial Intelligence in Medicine and Health
Unit: Graduate School (http://louisville.edu/graduate/)
Academic Plan Code(s): IS_ _ PHDAIM

Program Information

The Interdisciplinary PhD program in Artificial Intelligence in Medicine and Health integrates the fields of bioengineering and public health, providing a unique emphasis on interdisciplinary engagement supporting healthcare professionals to help improve health outcomes and patient experiences. Students in the program will learn to apply Artificial Intelligence tools to develop innovative biological/medical solutions to sustain, restore, or improve human life.

The program will prepare students to analyze medical or public health data where manual or empirical methods of data analysis are inadequate. With this degree, students will learn to implement, analyze, present, and use data through computation, modeling and simulation, machine learning, and advanced statistical analysis. The program will prepare students for ongoing changes in patient and public health data analysis, making them more marketable in these and other fields.

The program is well-suited for students with a Bachelor's or Master's degree in Bioengineering or Public Health, or healthcare professionals with extensive math backgrounds interested in earning advanced knowledge in the field of Artificial Intelligence and applying these techniques to medical problems. The program is intended to last 4-5 years for full-time graduate students and to develop students with mastery of skills in methods and tools in Artificial Intelligence in Medicine and Health for employment in industry, academia or government.

Admission Requirements

Applicants for interdisciplinary doctoral programs must present complete admission credentials and have an approved program of study in order to be formally admitted by the Graduate School (http://louisville.edu/graduate).

- Complete graduate application (http://louisville.edu/graduate/futurestudents/apply-materials/application).
- A 3.00 grade point average is recommended for admission, but applicants may be considered with a 2.75 grade point average under special conditions for admission.
- Completion of prerequisite coursework in calculus I, II, and III with coverage through multivariable calculus, and completion of an introductory course in computer programming (e.g., BE 340 or PHST 301 or equivalent).
- Proof of a Baccalaureate Degree and official transcripts of all undergraduate and graduate course work.
- International students for whom English is not their primary language must show English language proficiency by one of the following:
  - TOEFL examination score 213 (computer-based test) or 79 (internet-based test)
  - IELTS test score of 6.5 or higher
  - Duolingo score of 105.
  - PTE Academic score of 55 or higher.
  - Demonstration of a degree awarded from a US-accredited English language institution.
- Submission of a written statement by the applicant describing previous experience related to Artificial Intelligence in Medicine and a statement as to how the PhD program will allow the student to fulfill their career goals.
- Two letters of recommendation from individuals who are able to comment on the student's academic abilities and a potential for success in graduate studies.

Program of Study

Course requirements in the Interdisciplinary PhD Program in Artificial Intelligence in Medicine and Health consist of 36 credits from core courses and 9 credits are from elective courses. The suggested full-time course of study is below.

Year 1		
Fall		**Hours**
BE 604	Introduction to Artificial Intelligence in Bioengineering [1]	3
PHST 620	Introduction to Statistical Computing [1]	3
PHMS 641	Data Mining I [1]	3
	Hours	**9**
Spring		
BE 603	Bioengineering Research Ethics	2
BE 540	Machine Learning in Medicine [1]	3
PHMS 642	Data Mining II [1]	3
	Hours	**8**
Summer		
BE 555	Large Language Models for Healthcare and Medicine	3
Elective (see list below)		3
	Hours	**6**
Year 2		
Fall		
BE 601	Bioengineering Seminar	1
PHST 661	Probability	3
BE 544	Artificial Intelligence Techniques in Digital Pathology	3
Elective (see list below)		3
	Hours	**10**
Spring		
BE 601	Bioengineering Seminar	1
PHST 662	Mathematical Statistics	3
PHST 681	Biostatistical Methods II	3
BE 692	Bioengineering Clinical Rotation	2
Elective (see list below)		3
	Hours	**12**
	Minimum Total Hours	**45**

[1] Course required for obtaining a Master's degree during the PhD program.

Potential Elective Courses

Code	Title	Hours
BE 524	LabVIEW for Bioengineers	3
BE 530	Machine Learning in Python	3

BE 542	Medical Image Computing	3
BE 543	Computer Tools for Medical Image Analysis	3
BE 581	Advanced Computer-Aided Design and Manufacturing for Bioengineers	3
BE 640	Computational Methods for Medical Image Analysis	3
BE 645	Artificial Intelligence and Radiomics	3
BE 685	Modeling of Biological Phenomena	3
CSE 532	Python and Data Analytics	3
CSE 536	Data Management and Analysis	3
CSE 538	Graph Database and Graph Analytics	3
CSE 545	Artificial Intelligence	3
CSE 546	Introduction to Machine Learning	3
CSE 547	Deep Learning Algorithms and Methods	3
CSE 590	Special Topics in Computer Science and Engineering	1-6
CSE 609	Multimedia Processing	3
CSE 619	Design and Analysis of Computer Algorithms	3
CSE 620	Combinatorial Optimization and Modern Heuristics	3
CSE 622	Simulation and Modeling of Discrete Systems	3
CSE 628	Computer Graphics	3
CSE 641	Medical Imaging Systems	3
CSE 645	Advanced Artificial Intelligence	3
CSE 660	Introduction to Bioinformatics	3
ECE 520	Digital Signal Processing	3
ECE 521	Digital Signal Processing Laboratory	1
ECE 528	Deep Learning and AI Tools	3
ECE 529	Deep Learning and AI Tools Laboratory	1
ECE 543	Fundamentals of Microfabrication	3
ECE 544	Microfabrication Laboratory	1
ECE 564	Fundamentals of Autonomous Robots	3
ECE 565	Fundamentals of Autonomous Robots Lab	1
ECE 613	Computational Intelligence Methods for Data Analysis	3
ECE 614	Deep Learning	3
ECE 618	Artificial Intelligence Systems	3
ECE 619	Computer Vision	3
ECE 636	MEMS Design and Fabrication	4
ECE 643	Introduction to Biomedical Computing	3
ECE 645	Computer Vision Laboratory	1
ISE 664	Experimental Design in Engineering	3
PHST 650	Advanced Topics in Biostatistics	1-3
PHST 655	Basic Statistical Methods for Bioinformatics	3
PHST 680	Biostatistical Methods I	3
PHST 682	Multivariate Statistical Analysis	3
PHST 684	Categorical Data Analysis	3
PHST 710	Advanced Statistical Computing I	3
PHST 711	Advanced Statistical Computing II	3
PHST 750	Statistics for Bioinformatics	3
PHST 752	Statistical Genetics	3
PHST 762	Advanced Statistical Inference	3
PHST 782	Generalized Linear Models	3
PHST 785	Nonlinear Regression	3
PHST 791	Bayesian Inference and Decision	3
PHMS 644	Biomedical Foundations for Health Analytics	3
PHMS 670	Statistical Data Management	3
PHMS 671	Statistical Analysis for Population Health	3
PHMS 694	Innovation and Entrepreneurship in Healthcare	3