MS in Health Informatics – AI in Healthcare Track

COURSE DESCRIPTIONS

BINF5040 – Biomedical Information Processing (3 Credits)

This course introduces theoretical and practical approach of statistic theories to analyze health care data using R programming methods and procedures. This course covers basic R programming including functions, arrays, packages, loops, procedures, and basic statistical tests and models.

BINF5020 - Biomedical Data Science (3 Credits)

The goal of this course is to develop your data science related problem-solving skills for a broad range of healthcare scenarios. Python will be used as the programming environment because it gives all the key elements of a full programming language while also providing access to a large inventory of built-in functions that enable the solution of complex problems within relatively short, well-structured programs. Applied numerical methods will be introduced as a means for solving a wide variety of mathematical problems. The goal is to develop an inventory of standard mathematical and numerical analysis tools and a good understanding of the programming syntax within Python to allow one to use these tools in practical applications. This course should provide you with a variety of practical Python programming and general problem-solving skills for solving data science related problems.

BINF5513 – Cybersecurity (3 Credits)

Technology has permeated every aspect of our lives, personal as well as professional. These technology-based systems have become prime targets for many forms of malicious activity and attacks. The foundational knowledge provided in this course will allow Health Informatics professionals to better understand cybersecurity gaps that will need to be addressed to better protect organizations against cyber threats.

BINF5210 – Health Data Analytics using SAS (3 Credits)

This course introduces theoretical and practical approach of statistic theories to analyze health care data using SAS programming methods and procedures. SAS will be used to read, write, manipulate, and store the external data in a SAS dataset to perform descriptive and inferential statistics.

BINF5030 - Visualization in Biomedical Sciences (3 Credits)

Advances in technology have caused an explosive growth in information available in the healthcare field. Because of this growth in recent decades, healthcare professionals need to be well versed in the methods and principles of analyzing and presenting data. According to the National Institutes of Health (NIH), “Data visualization is becoming an increasingly common method of presenting large and complex data sets, but the principles of visual communication are not widely understood or practiced”. This course will provide students with the skills to prepare, analyze, visualize, and communicate with healthcare data using Tableau. These skills are prerequisites for data-driven health fields and prepare students for professional success.

BINF5125 – Machine Learning (3 Credits)

This course will provide an overview of three distinct and state-of-art decision making methodologies: Support Vector Machines (SVM), Artificial Neural Networks (ANN) and Fuzzy Logic. All three techniques will be taught using Python as the development environment. The techniques will be introduced along with several examples from research literature. Although a prior and good knowledge of Python Programming maybe useful any such required knowledge will be provided in the first few weeks of the course to help facilitate the learning of the rest of the course material.

BINF5312 – Natural Language Processing (3 Credits)

Technological advances have caused explosive growth in the quantity of information available in the healthcare field. A significant amount of valuable data is stored as unstructured text, and effective natural language processing (NLP) methods are needed to accurately interpret and use this data to improve healthcare. This course will give students an introduction to NLP with applications in the healthcare and biomedical domains. Students will develop and evaluate solutions to address specific NLP challenges.

BINF7592 – Clinical Deep Learning (3 Credits)

This course will provide an in-depth review of advance machine learning and AI techniques, including XGBoost, Random Forrest, Neural Networks and Deep neural networks. The course will focus on theoretical and practical implementation of this technique using Python, TensorFlow and Keras as the development environment. The techniques will be introduced along with several examples from research literature and real-world examples. Prior knowledge of Python and machine learning is essential.

BINF7520 – Artificial Neural Networks (3 Credits)

This course will provide a good breadth and sufficient depth of knowledge in the currently popular Artificial Neural Networks. Various popular Neural Network architectures will be taught as also their applications in clinical decision making, classification, feature extraction and more. Understanding the nature of these neural network architectures and techniques will help students to formulate, assess and evaluate the appropriateness of their use in health informatics projects.

BINF7760 – Governance for Healthcare AI (3 Credits)

This course explores the governance of Artificial Intelligence (AI) in healthcare through ethical, legal, and policy perspectives. Students will engage with frameworks for managing AI risks and opportunities, examining local, national, and global regulatory approaches, ethical dilemmas, and the role of stakeholders. Students are provided with opportunities to understand how to develop governance strategies that balance innovation, ethics, and societal well-being.

BINF5500 – Generative AI for Healthcare AI (3 Credits)

The field of generative AI in healthcare is rapidly evolving, offering significant opportunities to transform various aspects of the healthcare industry. This course will provide students with the foundational knowledge and practical skills needed to harness the potential of generative AI while addressing critical challenges such as bias mitigation, privacy concerns, and ethical implications. Through hands-on experience, students will learn to design, develop, customize, and evaluate generative AI applications tailored to healthcare contexts.

BINF5900 – Data Science Programming (3 Credits)

This course presents advanced topics in Python for healthcare professionals. It contains sections on libraries, logging, debugging, profiling, and packaging. The course will enable students to write relatively advanced, well structured, computer programs in Python as also become familiar with principles and techniques for optimizing the performance of Python numeric applications.

BINF5325 – Clinical Decision Support Systems (3 Credits)

This course will provide an overview of concepts, techniques and software pertaining to clinical decision making and decision analysis. Students will learn the application of decision trees to clinical and health care problems, estimation and revision of probabilities; use of artificial intelligence expert systems and decision-making techniques for their implementation as decision support systems in clinical and health information system settings.

BINF5750 – Core Elements of AI Programming (3 Credits)

This course aims to provide a comprehensive understanding of mathematical concepts and algorithm development in both deep learning and traditional artificial intelligence. It focuses on the creation of rational agents, exploring how these agents can operate effectively to design and implement algorithms such as shortest path, heuristic functions, and greedy best-first search. Through a well-structured curriculum, students will gain valuable insights into the foundational principles that underline modern AI systems.

BINF6000 - Capstone Project (6 Credits)

The Capstone Project is designed to develop the student's ability to provide a contribution to the field of AI in Healthcare – such as filling an empirical, theoretical, and/or methodological gap. The student will select an appropriate topic and formulate relevant research questions or a developmental methodology, perform literature search, explain the place of their research or project in relation to the growing healthcare AI body of knowledge and lastly submit a written report of their project/thesis as per the Department Guidelines. The student will work on the project under the supervision of a Department faculty of his/her choice. The project report should be of such caliber as to warrant publication in a scientific journal or a presentation at a conference.