BIOMEDICAL INFORMATICS (BMI)

Biomedical Informatics Graduate Courses

BMI 8000 ADVANCES IN BIOMEDICAL INFORMATICS (0 credits)

BMI 8000 provides a regular forum for BMI graduate students, where the latest developments in the field of Biomedical Informatics are introduced and discussed. The course also functions as a central communication and collaboration hub for graduate students in BMI. Participation is required.

Prerequisite(s): Students in the MS in BMI and PhD in BMI program may register. Not open to non-degree graduate students.

BMI 8020 ADVANCED COURSE IN BIOINFORMATICS (3 credits)

This is a special topics course designed to explore the research interests of faculty and students. Therefore, topics may include, but are not limited to, such areas of study as next-generational sequencing, biological networks, proteomics, metabolomics, and biomedical informatics.

Prerequisite(s): Admission to the MS/PhD Program in the College of Information Science and Technology, or permission of the instructor. Not open to non-degree graduate students.

BMI 8070 HEALTH INFORMATICS RESEARCH METHODS (3 credits)

This is a foundational course for health informatics research methods. Health informatics is a broad term that denotes disciplines that encompass the use of computer and information science to manage all aspects of healthcare data and the use of healthcare information to foster better collaboration among a patient's various healthcare providers. This course takes a practical approach to understanding health informatics research methods through the use of real-life examples, step-by-step research method practices, and applying various analytical procedures. The course will guide the student through the process of designing research studies using a variety of research methods. Students are introduced to quantitative, qualitative and mixed methods designs though hands-on assignments and reviewing selected research studies. In addition, students will learn how to conduct a literature review. Students will learn about grant opportunities, the proposal writing process and IRB applications.

Prerequisite(s): Graduate student status and prior or concurrent enrollment in BMI 8100, or by instructor approval.

BMI 8080 SEMINAR IN BIOMEDICAL INFORMATICS (3 credits)

This is a variable-content course that engages students in current research in Biomedical Informatics and develops skills in the oral and written presentation of scientific research.

Prerequisite(s): Permission of the instructor. Additional prerequisite courses may be required for particular course offerings.

BMI 8100 INTRODUCTION TO BIOMEDICAL INFORMATICS (3 credits)

This course offers students an overview of the field of biomedical informatics, combining perspectives from computing, biosciences and medicine. The historical development of the field and its influence on biological, clinical, and translational research will be discussed. Issues related to bioinformatics, clinical, bioimaging and public health/population informatics will be explored.

Prerequisite(s): Class standing of senior or above.

BMI 8300 PUBLIC HEALTH GENOMICS (3 credits)

This course will address the biopsychosocial issues that bridge genomics and public health, which are generally considered two vastly different disciplines. The focus will center on understanding how genomics may be incorporated into health promotion and disease prevention efforts for individuals and population.

Prerequisite(s): Class standing of senior or above.

BMI 8310 ADVANCED HEALTH INFORMATICS (3 credits)

The purpose of this course is to equip students with advanced skills in analyzing healthcare data using state-of-the-art frameworks, tools, and applications. Students will learn to effectively use medical and health data, interpret results from analyzing this data, and construct a cohesive story outlining their findings in a clinical environment. Upon completion of this course, students will be able to outline current trends in health informatics, summarize the legislative and ethical barriers present in the field, and recognize common standardizations used in health informatics. In addition, students will be able to apply state-of-the-art data analytics and visualization approaches to tackle health relevant problems, using real world data from the MIMIC IV dataset.

Prerequisite(s): BMI 8100 and ISQA 8156 or Permission of the instructor. Not open to non-degree graduate students.

BMI 8320 CONSUMER HEALTH INFORMATION SYSTEMS (1 credit)

Consumer health informatics as a field focuses on health informatics from the perspective of the consumer or patient, health literacy, and consumer education. Creative problem solving and fluency in this subdiscipline requires competence in information structures and processes that empower consumers to manage their own health. In this course, students will strategically review publicly available databases, datasets, and projects involved in consumer health. With this information in hand, students will design their own consumer health information system geared towards addressing a consumer or patient education and literacy challenge of their interest.

BMI 8400 LINEAR ALGEBRA FOR ADVANCED COMPUTING AND AI (3 credits)

Matrix Analysis and Linear Algebra are at the core of several important algorithms and techniques that are widely used in machine learning for data analytics, imaging informatics, and bioinformatics. The course will explore fundamental concepts of matrix analysis and linear algebra as they apply to machine learning, emphasizing applications over proofs. Students will have an opportunity to perform "pencil and paper" calculations as well as more sophisticated numerical computations using a programming language/statistical environment of their choice. Applications of linear algebra to machine learning in the context of imaging informatics and biomedicine will be covered in depth.

Prerequisite(s): Proficiency in programming and knowledge of calculus are required. Familiarity with concepts from biology is beneficial but not required.

BMI 8540 FOUNDATIONS IN PROGRAMMING FOR BIOMEDICAL INFORMATICS (3 credits)

Foundations in programming, software development, pipeline management, and version control are critical for developing a capable biomedical informatics workforce. This course will provide foundations in programming skills necessary for students with a limited computer science background to develop fluency and basic skills in the concepts of software development for biomedical informatics. Specific topics covered will include Unix/Linux shell programming, Python, databases, Applications Programming Interface (APIs), software versioning, and data management.

Prerequisite(s): Experience with programming in a scripting, database management, or object-oriented programming language is strongly recommended but not required.

BMI 8850 BIOMEDICINE FOR THE NONMEDICAL PROFESSIONAL (3 credits)

This course will cover the basic principles of molecular and cellular biology, human anatomy, physiology, and pathology that are essential to an informed use of biomedical data. The biomedical topics will be interspersed and complemented with discussions about relevant data sources and datasets, emphasizing their strengths and weaknesses, and the lectures will be enriched with virtual anatomical dissections. Reading assignments from the primary literature and multimedia materials will supplement the textbook.

Prerequisite(s): Class standing of senior or above

BMI 8866 BIOINFORMATICS ALGORITHMS (3 credits)
The main objective of this course is to provide an organized forum for students to understand the foundations of algorithmic design and analysis in the context of health and biological data. The course will present fundamental concepts in algorithms (exhaustive, greedy, graph, heuristic, and more) and explore how those concepts extend to bioinformatics and related fields, such as biomedical informatics, and health informatics. Students will learn about historical context of these algorithms and how they were pivotal in forming more complex modern approaches, and will explore advanced algorithms in their area of interest. Students will also exercise their programming skills with the opportunity to implement and apply bioinformatics algorithms to real data, so to better grasp the technical components of algorithmic design and analysis. (Cross-listed with BIOI 4860, ACMP 4860).
Prerequisite(s): BMI 8540 or prior completion of an undergraduate data structures course

BMI 8896 COMPUTERIZED GENETIC SEQUENCE ANALYSIS (3 credits)
The goal of this course is to introduce students to major topics in computerized analysis of genetic sequences. In particular the course will allow students to become familiar with the computational tools and software that aid in the modern molecular biology experiments and analysis of experimental results. Following the completion of this course, it is expected that the students will have a basic understanding of the theoretical foundations of the sequence analysis tools and develop competence in evaluating the output from these tools in a biological context. This course will emphasize hands-on experience with the programs for nucleotide and amino acid sequence analysis and molecular phylogeny. (Cross-listed with BIOI 4890).
Prerequisite(s): Permission from the instructor.

BMI 8900 INDEPENDENT RESEARCH IN BIOMEDICAL INFORMATICS (1-3 credits)
The content of the course will vary, however both the student and the faculty member must sign an Independent Research Agreement and file it with the Biomedical Informatics Graduate Program Committee before registration for the course. This agreement will detail the project, the schedule for its completion, the form of the output, the method of evaluation and other relevant information pertaining to the project.
Prerequisite(s): Permission of instructor, and at least 12 hours of course work toward the MS BMI program should be completed.

BMI 8910 INTERNSHIP (1-3 credits)
The purpose of this course is to provide the students with an opportunity for practical application and further development of knowledge and skills acquired in the Biomedical Informatics graduate program. The internship gives students professional work experience and exposure to the challenges and opportunities faced by IT professionals in the workplace.
Prerequisite(s): Students must have completed a minimum of 12 credit hours towards the MS in BMI program. Not open to non-degree graduate students.

BMI 8950 BIOMEDICAL INFORMATICS GRADUATE CAPSTONE (3 credits)
The graduate capstone course challenges students to prove their mastery of the skills and domain knowledge they have gathered throughout their program of study. The course begins with a module on project management and research best practices. The majority of the course is structured around facilitating a non-trivial semester-long project, often in service to a third-party project sponsor, such as a community, industry, or government partner. The course is intended for students that have selected the coursework option, not thesis, and that are close to graduation.
Prerequisite(s): Students must have 9 credit hours or fewer left in the program, including this course. Students must have completed all core courses, and core electives are recommended but not required. Not open to non-degree graduate students.

BMI 8970 INDEPENDENT STUDY IN BIOINFORMATICS (1-3 credits)
This is a variable-credit course designed for graduate students in bioinformatics who would benefit from independent reading assignments and research-type problems. Independent study enables coverage of topics not taught in scheduled course offerings.
Prerequisite(s): Permission of a supervising faculty member and approval of the Bioinformatics Program Committee Chair . A formal description of the problem area to be investigated, the resources to be used, and the results to be produced must be prepared.

BMI 8990 THESIS IN BIOMEDICAL INFORMATICS (1-6 credits)
A research project, designed and executed under the supervision of the chair and approval by members of the graduate student's thesis advisory committee. In this project the student will develop and perfect a number of skills including the ability to design, conduct, analyze and report the results in writing (i.e., thesis) of an original, independent scientific investigation.
Prerequisite(s): Graduate major in BMI and approval of the Thesis Advisory Committee. Not open to non-degree graduate students.

BMI 9900 ADVANCED RESEARCH IN BIOMEDICAL INFORMATICS (3 credits)
This course provides a format for exploring advanced research areas for doctoral students in Biomedical Informatics and related fields. Specific topics will vary in keeping with research interest of faculty and students.
Prerequisite(s): Admission to graduate program in Biomedical Informatics. Not open to non-degree graduate students.

BMI 9980 INDEPENDENT RESEARCH IN BIOMEDICAL INFORMATICS (1-3 credits)
This course allows students to research a topic of their interest that is not available in a formal course. The topic to be studied must be agreed upon by the student and the instructor.
Prerequisite(s): Admission to Ph.D. program in Biomedical Informatics and permission of instructor. Not open to non-degree graduate students.

BMI 9990 DISSERTATION (1-12 credits)
The dissertation is an original research project conducted and written under the direction of a faculty dissertation committee supervisory committee. The dissertation provides the student with an opportunity to do original research that contributes to advancing the body of knowledge in health or bioinformatics and demonstrate technical mastery of the discipline.
Prerequisite(s): Admission to the Ph.D. program in Biomedical Informatics and candidacy for the Ph.D. degree. Prior to enrolling for dissertation hours, the students must have permission of the supervisory committee. Not open to non-degree graduate students.