Informatics

Academic doctoral programs at MU in the area of Informatics are coordinated through the Informatics Institute.

muiigraduateprogram@missouri.edu
241 Naka Hall
Columbia, MO 65211-2060
573-882-9007
http://muii.missouri.edu/

About the Informatics Institute (MUII)

Building on a tradition of outstanding informatics education and research at Missouri, the MU Informatics Institute is comprised of over 40 faculty from 17 different departments and 8 schools/colleges, including the Colleges of Agriculture, Food, and Natural Resources; Arts & Sciences; Education; Engineering; Veterinary Medicine; School of Health Professions; Medicine; and Nursing. The Institute offers emphasis areas in bioinformatics and health informatics, along with a concentration area in geoinformatics. Each emphasis area and concentration area stress skill sets and research appropriate to the subfield within the broad area of informatics. A core curriculum provides all students with a foundation of knowledge and tools in biology, computer sciences, health systems, and statistics, after which they complete further coursework in their chosen area. The integrated program assures broad exposure to the field and fosters new insights and innovative research concepts.

Faculty


Associate Research Professor J. Jackson-Thompson** (https://muii.missouri.edu/person/jeannette-jackson-thompson)

Assistant Research Professor C. Fulcher** (https://muii.missouri.edu/person/christopher-fulcher),

Associate Teaching Professor W. Phillips** (https://muii.missouri.edu/person/win-phillips)

• Graduate Faculty Member - membership is required to teach graduate-level courses, chair master's thesis committees, and serve on doctoral examination and dissertation committees.

• Doctoral Faculty Member - membership is required to chair doctoral examination or dissertation committees. Graduate faculty membership is a prerequisite for Doctoral faculty membership.

Undergraduate

While MU does not offer undergraduate degrees specifically in informatics, the University does offer baccalaureate opportunities in a number of related areas. Many successful informatics students have received bachelor's degrees in Geography, Computer Science, Statistics, Business, Biology, and Biochemistry before starting their doctorate.

In addition, MUII offers several service courses designed for upper-level undergraduates and master's students to expose students to the fundamentals of bioinformatics.

Graduate

• PhD in Informatics (http://catalog.missouri.edu/undergraduategraduate/interdisciplinaryacademicprograms/informatics/phd-informatics)

• with emphasis in Bioinformatics (http://catalog.missouri.edu/undergraduategraduate/interdisciplinaryacademicprograms/informatics/phd-informatics-emphasis-bioinformatics)

• with emphasis in Health Informatics (http://catalog.missouri.edu/undergraduategraduate/interdisciplinaryacademicprograms/informatics/phd-informatics-emphasis-hlth-informatics)

Emphasis Areas & Concentration Areas

MUII offers a doctoral degree (PhD) in two emphasis areas: bioinformatics and health informatics (https://muii.missouri.edu). In addition, students may also opt for a doctoral degree with a concentration area in geoinformatics.

Students with areas of interests outside of informatics may also wish to pursue a collaborative degree program between MUII and other degree programs. The purpose of the collaborative degree program is to allow students the opportunity to obtain advanced degrees in fields that complement the study of informatics and expand the student’s knowledge and applicability.

...
MUII students may also select the collaborative degree between the Master of Public Health program and MUII PhD in Informatics program. Students must be accepted by both MUII and the MPH program to be eligible. Upon completion of the PhD requirements for the Informatics Institute and degree requirements for the MPH in Health Promotion and Policy with focus on Informatics, students will receive both the PhD in Informatics and MPH degrees. For a full list of courses for the MPH in Health Promotion and Policy with Focus on Informatics, please visit the MPH program website (http://publichealth.missouri.edu/).

Resources and Facilities

To support the Big Data research and training programs of Informatics Institute, in 2014 the institute secured a National Science Foundation Major Research Instrumentation (MRI) grant to acquire high performance computing (HPC) equipment for data-intensive applications with hybrid cloud computing needs. The equipment ($880,000) is comprised of 89 nodes: (i) 56 16-core CPU nodes, each with 128 GB RAM, (ii) 2 high-memory nodes, each equipped with 4 8-core CPUs and 1TB RAM (one node)/512GB RAM (one node), (iii) 1 K20 nodes, each equipped with an Nvidia K20, 2,496-core GPU, 2 six-core Xeon E5 processors and 64 GB RAM, (iv) 15 Xeon Phi nodes, each equipped with an Intel Xeon Phi 5110P coprocessor, 2 six-core Xeon E5 processors and 64 GB RAM, and (v) a head node for the cluster. The basic CPU nodes allow supporting traditional MPI, MapReduce, and Spark applications; high-memory nodes are currently required by next generation sequence analyses, and hybrid (Nvidia K20 and Intel Xeon Phi) nodes accommodate existing and new informatics applications accelerated on many-core devices. Intel Phi coprocessors particularly satisfy the requirements of users that need to port existing applications written with traditional parallel programming models (such as OpenMP, MPI and Intel TBB) to many-core processors, without investing the significant development time required for implementation in environments such as CUDA and OpenCL.

Faculty Areas of Research Interest

Faculty research covers a wide range of interests including structural bioinformatics, systems biology, cancer informatics, chemical informatics, epigenomics, phenomics, text mining & understanding, electronic health records, evidence-based medicine, personalized medicine, human-computer interactions in health care, consumer informatics, patient safety, public health informatics, geospatial informatics, information retrievals, biomedical data mining & knowledge discovery, and machine learning. For a list of faculty members and their research areas, please visit our web page (https://muii.missouri.edu/people). (http://muii.missouri.edu/people/faculty.php)

Internal Funding

Fellowships and research/teaching assistantships are available for highly qualified applicants. Application information is available on the Institute’s website (https://muii.missouri.edu/admission/#support).

INFOINST 7001: Topics in Informatics

This course provides the overview to the informatics foundations as well as introduces topics regarding the current informatics-driven areas of science. Graded on A-F basis only.

| Credit Hours: | 3 |

INFOINST 7002: Introduction to Informatics

This course provides an overview to informatics foundations in addition to introducing topics regarding the current informatics-driven areas of science. Topics to include: recent trends in informatics; database management and Big Data analytics; data visualization, bioinformatics, health informatics, geoinformatics, nursing informatics, social informatics, and legal informatics. Graded on A-F only.

| Credit Hours: | 3 |
| Prerequisites: | Instructor's consent |

INFOINST 7010: Computational Methods in Bioinformatics

(same as CMP_SC 7010). Fundamental concepts and basic computational techniques for mainstream bioinformatics problems. Emphasis placed on computational aspect of bioinformatics including formulation of a biological problem, design of algorithms, confidence assessment of software development. Graded on A-F basis only.

| Credit Hours: | 3 |
| Prerequisites: | CMP_SC 4050 and STAT 4710 |

INFOINST 7430: Introduction to Health Informatics

Introduction to the use of clinical information systems in healthcare. Topics include clinical data, standards, electronic medical records, computerized provider order entry, decision support, telemedicine, and consumer applications. Graded on A-F basis only.

| Credit Hours: | 3 |
| Prerequisites: | departmental consent required |

INFOINST 8001: Topics in Informatics

Organized study of selected topics. Subjects and earned credit may vary from semester to semester. Repeatable upon consent of department. Graded A-F basis only.

| Credit Hours: | 3 |

INFOINST 8005: Applications of Bioinformatics Tools in Biological Research

This service course is designed for bioinformatics non-major students from life sciences, biological sciences, plant sciences, animal sciences, biochemistry, medicine fields and others. This course will provide an introduction to the current state of the art topics in bioinformatics and the computational tools available to the research community for application to biological research questions. Students will learn how to effectively utilize the tools and software packages to analyze data and visualize the results. Graded on A-F basis only.

| Credit Hours: | 3 |
| Prerequisites: | Instructor's consent |
| Recommended: | Graduate students are expected to have basic knowledge in algorithms, databases, and molecular biology |

INFOINST 8085: Problems in Informatics

Independent, directed study on a topic in the area of informatics. Some sections may be graded A-F or S/U.

| Credit Hour: | 1-6 |
| Prerequisites: | Instructor's consent required |
INFOINST 8087: Seminar in Informatics
Students attend and/or present at informatics seminars approved by the institute. Graded on S/U basis only.

Credit Hour: 0.5-1
Prerequisites: instructor's consent required

INFOINST 8088: Lab Rotations in Informatics
This course is designed to train students in both computational/informatics and life science/hospital laboratories to foster critical research collaborations in biomedical informatics. Students are expected to write reports with their advisors and the mentor of the rotation. Graded on S/U basis only.

Credit Hour: 1-3

INFOINST 8090: Dissertation (pre-candidacy) Research in Informatics
Research leading to dissertation before comprehensive examination. Graded on S/U basis only.

Credit Hour: 1-99

INFOINST 8150: Integrative Methods in Bioinformatics
(same as CMP_SC 8150). With biology entering the Big Data era, scientists are overwhelmed with the amount and the diversity of the experimental, statistical, and omics data about the biological objects they study. As a result, the frontier bioinformatics and computational genomics methods have started to utilize a so-called integrative approach, where the computational and informatics methods are used to combine the high-throughput and low-throughput data. The main objective of this course is to teach students how to utilize bioinformatics and programming techniques for such multi-omics data integration. Graded on A-F basis only.

Credit Hours: 3
Prerequisites: INFOINST 8005 or instructor's permission

INFOINST 8190: Computational Systems Biology
(same as CMP_SC 8390). This course covers current theories and methods in the modeling and analysis of high-throughput experiments such as microarrays, proteomics, and metabolomics. Topics include the inference of casual relations from experimental data and reverse engineering of cellular systems. Graded A-F basis only.

Credit Hours: 3
Prerequisites: INFOINST 7010 or CMP_SC 7010; INFOINST 8010 or instructors consent

INFOINST 8450: Precision Medicine Informatics
(same as PTH_AS 7450). This course will introduce students with the theoretical and practical aspects of precision medicine informatics. Topics include: complex diseases, computational genomics/proteomics, informatics of molecular interactions and biological pathways, somatic mutations, signal transduction and cancer, biomarker discovery, machine learning and data mining for PMI, networks methods for PMI, knowledge representation and reasoning for PMI. The course will consist of a set of didactic lectures, computational assignments, in-class demonstrations of PMI methods and discussions of recent publications.

Credit Hours: 3
Prerequisites: INFOINST 8005 with C or better or INFOINST 7010 with C or better or instructor's consent

INFOINST 8510: Research Methods in Informatics
Research Methods in Health and Bioinformatics is a writing intensive course that provides students with an understanding of research proposal development, literature searching, research synthesis, research designs, evaluation methods, and ethics. Graded A-F basis only.

Credit Hours: 3
Prerequisites: Second semester or later in PhD program or instructor's consent

INFOINST 8810: Knowledge Representation in Biology and Medicine
The main topics presented in the course are: logic systems, knowledge representation methods, production systems and representation of statistical and uncertain knowledge. Graded A-F basis only.

Credit Hours: 3
Prerequisites: HMI 7430 and HMI 7440

INFOINST 8880: Machine Learning Methods for Biomedical Informatics
(same as CMP_SC 8180) This course teaches statistical machine learning methods and their applications in biomedical informatics. The course covers theories of advanced statistical machine learning methods and teaches how to develop machine learning methods to solve biomedical problems. Graded on A-F basis only.

Credit Hours: 3
Prerequisites: CMP_SC 7050 and INFOINST 7010 or CMP_SC 7010 or INFOINST 7005
INFOINST 9090: Dissertation (post-candidacy) Research in Informatics
Research leading to Ph.D. dissertation after comprehensive examination.
Graded on S/U basis only.

Credit Hour: 1-99