# BIOMEDICAL IMAGE COMPUTING, MS

*for the degree of Master of Science in Biomedical Image Computing (on-campus and online)*

The M.S. in Biomedical Image Computing blends together the fields of biomedical imaging science and machine learning. Students will receive a rigorous training in imaging systems and analysis, computational imaging, and machine learning, in preparation for an industry career.

## Department Research

Bioengineering faculty perform research in the areas of Bio-Imaging at Multi-Scale, Molecular, Cellular and Tissue Engineering, Bio-Micro and Nanotechnology, Computational and Systems Bioengineering, and Synthetic Bioengineering. In addition to Bioengineering faculty, the Department of Bioengineering has more than 50 affiliate faculty (http://bioengineering.illinois.edu/directory/).

The Department of Bioengineering offers studies leading to the Master of Engineering in Bioengineering (MEng), the Master of Science in Bioengineering (MS), the Master of Science in Biomedical Image Computing (MS in BIC), and the Doctor of Philosophy (PhD) in Bioengineering. The Bioengineering Graduate Program provides students with educational and research experiences that integrate the sciences of biology and medicine with the practices and principles of engineering. For the MS and PhD programs, areas of focus include Bio-Imaging at Multi-Scale, Molecular, Cellular and Tissue Engineering, Bio-Micro and Nanotechnology, Computational and Systems Bioengineering, and Synthetic Bioengineering.

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| Code | Title | Hours |
|------|-------|-------|
| **Required Coursework** | | |
| BIOE 483 | Biomedical Computed Imaging Systems | 4 |
| BIOE 484 | Statistical Analysis of Biomedical Images | 4 |
| BIOE 485 | Computational Mathematics for Machine Learning and Imaging | 4 |
| BIOE 486 | Applied Deep Learning for Biomedical Imaging | 4 |
| BIOE 488 | Applied High-Performance Computing for Imaging Science | 3 |
| BIOE 489 | Regulations, Ethics and Logistics in Biomedical Applications of Machine Learning | 4 |
| BIOE 580 | Foundations of Imaging Science | 4 |
| BIOE 588 | Biomedical Image Computing Capstone Project Literature Review | 1 |
| BIOE 589 | Biomedical Image Computing Capstone Project | 4 |
| Choose one of the following: | | 4 |
| BIOE 586 | Deep Generative Models in Bioimaging | |
| OR | | |
| BIOE 504 | Analytical Methods in Bioeng | |
| BIOE 505 | Computational Bioengineering | |
| BIOE 507 | Advanced Bioinstrumentation | |
| BIOE 597 | Individual Study | |
| CS 547 | Deep Learning | |
| ECE 513 | Vector Space Signal Processing | |
| ECE 534 | Random Processes | |
| ECE 543 | Statistical Learning Theory | |
| ECE 544 | Topics in Signal Processing | |
| ECE 547 | Topics in Image Processing | |
| ECE 549 | Computer Vision | |
| ECE 558 | Digital Imaging | |
| ECE 561 | Statistical Inference for Engineers and Data Scientists | |
| ECE 564 | Modern Light Microscopy | |
| ECE 566 | Computational Inference and Learning | |
| ECE 569 | Inverse Problems in Optics | |
| ECE 580 | Optimiz by Vector Space Methds | |
| **Total Hours** | | **36** |

## Other Requirements

| Code | Title | Hours |
|------|-------|-------|
| Minimum 500-level hours required overall: | | 12 |
| Minimum GPA: | | 3.0 |
| Minimum credit hours taken from the University of Illinois at Urbana-Champaign campus: | | 12 |
| Maximum number of previous University of Illinois at Urbana-Champaign graduate-level coursework not applied to any other degree that may be transferred and applied to the major pending department and Graduate College approval. | | 12 |

Some elective courses may not be available online. Check the course schedule.

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Student learning objectives will be as follows:

1. Ability to apply quantitative skills, engineering principles, and computational principles to propose novel and practical solutions to biomedical imaging problems.
2. Ability to recognize and understand professional and ethical responsibilities.
3. Ability to identify and communicate real-world biomedical imaging problems with bigger vision and offer solutions, as well as their impact, effectively to a diverse audience and stakeholders, both orally and in writing.
4. Ability to develop effective leadership skills in order to foster the ability to collaborate and work with a diverse team, which is essential for a career in either academia or industry.

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## Admission Requirements

Applicants should have a bachelor's degree in an engineering or other quantitative discipline from an accredited college or university. Students should have a minimum grade point average of 3.00 (A=4.00) or equivalent for the last two years of undergraduate study and show evidence of strong quantitative skills and of serious interest in imaging and machine learning through their personal statement. Students in the program do not have automatic admission to the Ph.D. program in any engineering department.

All applicants whose native language is not English are required to submit TOEFL (http://www.toefl.org/) or International English (http://www.ielts.org/) Language Testing System (IELTS) (http://www.ielts.org/) scores as evidence of English proficiency. Minimum admission requirements (https://grad.illinois.edu/admissions/instructions/04c/) for English proficiency are set by the Graduate College. Students applying to the online program must satisfy the full status admissions requirement.

Applicants may be exempt from the English proficiency requirements if certain criteria (http://grad.illinois.edu/admissions/instructions/04c/) are met. Applicants with lesser scores may still apply. Limited status (http://grad.illinois.edu/admissions/instructions/04c/) is granted for lesser scores and requires enrollment in English as a Second Language (ESL) courses (https://linguistics.illinois.edu/languages/english-second-language/) based on an ESL Placement Test (EPT) taken upon arrival to campus.

## Financial Aid

The tuition and fees for the M.S. in Biomedical Image Computing are the standard Graduate and Professional Programs rates for the College of Engineering. Students in the M.S. in Biomedical Image Computing program are not eligible for Board of Trustees (BOT) tuition-waiver generating assistantships at the University of Illinois Urbana-Champaign.

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## Bioengineering Department

Department Head: Mark Anastasio (maa@illinois.edu)
Director of Graduate Studies: Wawrzyniec Dobrucki (dobrucki@illinois.edu)
Bioengineering Department website (https://bioengineering.illinois.edu/)

## Bioengineering Master of Science in Biomedical Image Computing

Director of Biomedical Image Computing: Fan Lam (fanlam1@illinois.edu)

Biomedical Image Computing Program website (https://bioengineering.illinois.edu/academics/graduate/msbic/)

## Grainger College of Engineering

Grainger College of Engineering website (https://grainger.illinois.edu/)

## Admissions

Biomedical Image Computing Program Admissions Requirements (https://bioengineering.illinois.edu/admissions/graduate/programs/msbic/who-should-apply/)
Graduate College Admissions & Requirements (https://grad.illinois.edu/admissions/apply/)

## Graduate Contact

Graduate Programs Contact: bioe-gradprograms@illinois.edu
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