

ESTABLISHMENT OF A NEW PROGRAM FOR THE MASTER OF SCIENCE IN ARTIFICIAL INTELLIGENCE

Recommendation

It is recommended that the Board of Governors establish a new degree program, the Master of Science in Artificial Intelligence in the College of Engineering, effective Fall term, 2022.

Background

The proposed program is a response to the growing interest in Artificial Intelligence (AI). The industry is suffering from a limited supply of engineering graduates with AI qualifications. Students are interested in AI because of the employment opportunities, and because engineers love the deployment of AI at work. Currently, faculty are engaged in AI-related research, interact with the industry, and have developed relevant courses in the areas of algorithms and systems, hardware acceleration, and industrial AI applications.

Program Description

This proposal for a new Interdisciplinary Master's Degree program in Artificial Intelligence with 3 concentrations in the College of Engineering is set to launch in Fall 2022. The goal of this new program is to build a highly visible and coherent program serving the interests of students, industry, and faculty in AI foundations and applications.

The program is organized into three concentration tracks. Students will enter one of the three concentration tracks:

- AI Hardware and Systems, hosted by the Electrical and Computer Engineering (ECE) department
- AI Algorithm and Systems, hosted by the Computer Science (CSC) department
- Industrial AI, hosted by the Industrial and Systems Engineering (IE) department

Admission Requirements

Applicants must meet the Graduate School requirements for admission. Students must have a bachelor's degree or the equivalent in Engineering from an accredited college or university. The program will consider students from all science, technology, engineering, and math (STEM) disciplines for admission.

All applicants are required to be admitted to the Graduate School, the College of Engineering, a department within the College, and meet all applicable admission requirements, including a minimum grade point average of 2.75 for regular admission and 2.5 to 2.74 for qualified admission. Professional experience will also be considered for admission.

The ECE, CSC and IE departments in the College of Engineering will administer each track. Students applying for an MS AI must meet the application requirements of the department administering the track to which they are applying.

Additional items that are encouraged to aid the admission evaluation process include Letters of Recommendations, a Statement of Objectives, and an updated resume or Curriculum Vitae.

Application and admittance to the program will be by application track (i.e., applicants will specify the track to which they are applying). The MS AI Program Committee will make the admission decisions in coordination with the participating units.

AGRADE students who demonstrate competency are able to take graduate courses as an undergraduate student. The MS in AI program is bound by the applicable standards and policies of the University, allowing AGRADE and transfer credits to count toward meeting application core requirements and apply them directly to the 30-credit requirement for the MS in AI degree, with approval by the committee.

Curriculum Requirements

The program requires students to complete a minimum of thirty credits using master's degree Plan A (24 course credit hours plus a 6-credit hour master's thesis) or Plan C (30 credit hours of coursework). Plan A is intended for students planning to go on to pursue a Doctoral degree. All courses must be graduate-level courses offered in the College of Engineering. The program requires applicants to declare one of the three concentration tracks, focused on our strengths and regional needs. The requirements for each concentration track are:

AI Hardware and Systems Track

Hosted by the Electrical and Computer Engineering (ECE) department.

Degree Requirements:

- 9 credit hours from AI Hardware and Systems core
- 3 credit hours from AI Algorithms and Systems core
- 3 credit hours from Industrial AI core
- Plan A: 9 credit hours from AI Program electives, including at least 6 credit hours from AI Hardware and Systems electives, or
- Plan C: 15 credit hours from AI Program electives, including at least 12 credit hours from AI Hardware and Systems electives
- Plan A: 6 credit hours of ECE master's thesis
- All courses are 3 – 4 credits.

Most of the special topic courses will be converted to regular courses.

Core Courses:

- ECE 5995: Design of Deep Convolutional Neural Networks
- ECE 7500: AI for Natural Language Processing
- ECE 7640: Online and Adaptive Methods for Machine Learning

Elective Courses:

- ECE 5690: Digital Image Processing
- ECE 5770: Digital Signal Processing
- ECE 5560: Analysis and Design of Analog Integrated Circuits
- ECE 5995: Smart Grid and Smart Systems
- ECE 7430: Discrete Event Systems with Machine Learning
- ECE 7680: Advanced Digital Image Processing and its Applications

- ECE 7995: Mixed Signal ICs for SoC

AI Algorithms and Systems Track

Hosted by the Computer Science (CS) department.

Degree Requirements:

- 9 credit hours from AI Algorithms and Systems core
- 3 credit hours from AI Hardware and Systems core
- 3 credit hours from Industrial AI core
- Plan A: 9 credit hours from AI Program electives, including at least 6 credit hours from AI Algorithms and Systems electives, or
- Plan C: 15 credit hours from AI Program electives, including at least 12 credit hours from AI Algorithms and Systems electives
- Plan A: 6 credit hours of CSC master's thesis
- All courses are 3 – 4 credits

Core Courses:

- CSC 5825: Introduction to Machine Learning and Applications (Fall)
- CSC 6800: Artificial Intelligence I (Fall)
- CSC 7760: Deep Learning (Winter)

Elective Courses:

- CSC 5100 Introduction to Mobility
- CSC 5272 Principles of Cyber Security
- CSC 5280 Introduction to Cyber-Physical Systems
- CSC 5430/1: Game Programming and Design I
- CSC 5710 Design of Intelligent Information Retrieval Systems
- CSC 5800: Intelligent Systems: Algorithms and Tools
- CSC 5870 Computer Graphics I
- CSC 5991: **Special Topics in Computer Science** (Note: Non-repeatable)
- CSC 6430/1: Game Programming and Design II
- CSC 6710 Database Management System I
- CSC 6860: Digital Image Processing and its Applications
- CSC 7710 Database Management Systems II
- CSC 7800: Artificial Intelligence II
- CSC 7810: Data Mining: Algorithms and Applications
- CSC 7825: Machine Learning
- CSC 7991: **Advanced Special Topics in Computer Science** (Note: Non-repeatable)

Industrial AI Track

Hosted by the department of Industrial & Systems Engineering (ISE).

Degree Requirements:

- 9 credit hours from Industrial AI core
- 3 credit hours from AI Hardware and Systems core

- 3 credit hours from AI Algorithms and Systems AI core
- Plan A: 9 credit hours from AI Program electives, including at least 6 credit hours from Industrial AI electives, or
- Plan C: 15 credit hours from AI Program electives, including at least 12 credit hours from Industrial AI electives
- Plan A: 6 credit hours of ISE master's thesis
- All courses are 3-credit each.

Core Courses:

- IE 5995: IoT and Edge AI Programming
- DSA 6100: Statistical Methods for Data Science and Analytics
- IE 7860: Intelligent Analytics

Elective Courses:

- IE 5995: Simulation in Robotics using ROS
- DSA 6000: Data Science and Analytics
- IE 6000: Digital Automation
- DSA 6200: Operations Research (or IE 6560: Deterministic Optimization, take at most one from the two).
- IE 7220: Advanced Statistical Methods
- IE 7445: Manufacturing Analytics
- IE 7480: Knowledge Based Design
- IE 7521: Large-scale Optimization and Integer Programming
- IE 7995: Practicum – Industrial AI Projects

Graduation Requirements

The proposed program requires 30 credits for graduation, either Plan A (24 credits of coursework plus 6 credits of master's thesis) or Plan C (30 credits of coursework). All courses must be graduate-level courses offered in the College of Engineering.

A minimum grade point average of 3.00 is required for the MS AI program to obtain the MS Degree. A maximum of one course in which a C has been received may be used to meet graduation requirements, provided this is offset by sufficient A grades to maintain the required 3.00 average.

Program Administration

A council of four co-directors: one from each of the departments hosting the three AI tracks, plus one representing the College of Engineering will administer the program.

The council of co-directors, with input from the advisors, will be responsible for recruitment, admission, student advising and evaluation, curriculum development, and program evaluation. They will be responsible for:

- Refining and adjusting the core course requirements in each application track,
- Aligning electives between the AI application tracks and foundational areas,
- Developing, refining, and executing plans to promote the program internally and externally

- Coordinating with individual departments regarding when specific courses will be offered, and
- Producing program change recommendations and working through university administration to refine and adjust the program to meet student and industry needs, evolving technologies, and changes in faculty personnel.

Budget and Resource Requirements

Additional budget and resources are not required. The program will use the courses offered by the individual departments.

Accreditation

Specialized accreditation is not required.

Approvals

The proposal was approved by the faculty of Electrical and Computer Engineering, Computer Science, and Industrial and Systems Engineering, the Dean of the College of Engineering, the Graduate Council, the Dean of the Graduate School, and the Provost.