



**GRADUATE CERTIFICATE
IN ARTIFICIAL INTELLIGENCE**

FALL 2023

I. PROGRAM HISTORY AND PURPOSE

A. Rationale

1. The new Graduate Certificate program in Artificial Intelligence is closely aligned with the College of Engineering's strategic vision, research, industry partnerships and educational initiatives. The certificate program will address all of these areas by extending the opportunity for students to learn critical skills in demand by employers and which aligns with the national and regional emphasis on Artificial Intelligence workforce development.
2. Artificial Intelligence (AI) continues to expand across all human endeavors, driving the future of our work and our lives. In particular, the use of AI across various industries continues to create demand for credentialed and achievable opportunities that will position University of Delaware graduate students for success. The Department of Computer and Information Sciences has a long history of strong and successful teaching and research in the field of AI. This includes research on the foundations as well as applications. Faculty in the Department of Computer and Information Sciences conduct their work through University of Delaware AI Laboratories including the Healthy LAife Laboratory; Computational Neural and Information Engineering Lab; Multi Agent Systems Laboratory (MAS Lab); VIMS Vision Laboratory; Human Language Technologies Laboratory; Dynamic Vision Lab; Safro Research Group; Text Mining Laboratory; Deep Robust & Explainable AI Lab (Deep-REAL). These extensive opportunities expose students to both cutting edge research with real world applicability.
3. Students in this program will have the flexibility to choose from areas including but not limited to (1) machine learning to outline the development of methods to learn to solve a task using examples, and will explore different machine learning algorithms/techniques, discussing strengths and weaknesses (2) natural language, which covers such topics as text processing to a variety of applications including language models, document classification, topic detection, information extraction, question answering, summarization, sentiment analysis and translation (3) multi-agent systems, which examine issues that arise when groups of self-interested or cooperating autonomous agents interact to solve shared problems. Such systems include reasoning about the knowledge and beliefs of other agents, communication and negotiation, computational organization, coordination and control. (4) the practical and empirical evaluation of data mining in which concepts, techniques, and algorithms for mining large data sets to discover structural patterns are used to make subsequent predictions (5) problem formulation, search strategies, state spaces, applications of logic, knowledge representation, planning and application areas The certificate will be available to individuals who are current UD graduate or undergraduate students, as well as to individuals who hold a baccalaureate degree, all of whom must meet the stated requirements of admission.

B. Current Stage

Proposal stage

C. Degree Offered

Graduate certificate

D. Terms when students may enroll

Fall and Spring

E. Factors that identify student demand for the program

Global trends continue to show strong growth in the hiring demand for artificial intelligence understanding, knowledge and skills. A recent Burning Glass paper titled [How Skills Are Disrupting Work:](#)

[The Transformational Power of Fast Growing, In-Demand Skills](#) underscores four key areas of marked skills growth, yet states that “.AI/ML, the fastest growing of any skill set, has grown at a rate of 370% over the past five years, which is two or three times faster than other high-growth skill sets.” More specifically, relative domestic AI demand by subcategory shows that, while Machine Learning continues to grow, AI categories (including AI web development, AI software development, AI data management and AI research & methodology) are even higher (“Relative domestic AI skill demand by country,” The OECD AI Policy Observatory <https://oecd.ai/en/>). As the AI ecosystems are in their infancy, exposure to workforce disruption can leave even highly trained engineering students vulnerable to technological advancements. Investment in educational opportunities is key to preparing our students for the global challenges ahead ([Global AI Talent Trends: Looking back at AI’s impact in 2019 to understand the challenges and opportunities ahead](#), LinkedIn’s Economic Graph: A digital representation of the global economy. Dec 2019). For now, the data is clear that “...higher-income occupations have a strong positive relationship between our measure of AI impact and both employment and wages. These findings suggest that access to complementary skills and technologies may play an important role in determining the impact of AI, and that AI has the potential to exacerbate labor market polarization.”([The Occupational Impact of Artificial Intelligence: Labor, Skills, and Polarization](#), New York Stern School of Business, rev. 2020). The faculty of the Department of Computer and Information Sciences propose this new certificate program to help students thrive in the expanding and changing landscape of artificial intelligence.

F. College and Department in which the program will reside

The Graduate Certificate in Artificial Intelligence will reside in the College of Engineering’s Department of Computer and Information Sciences.

II. ADMISSION

A. Admission Requirements

Admission to the graduate certificate program is competitive. Those who meet stated requirements are not guaranteed admission, nor are those who fail to meet all of the requirements necessarily precluded from admission if they offer other appropriate strengths.

The following are the admission requirements to the Graduate Certificate in Artificial Intelligence:

1. A bachelor’s degree from an accredited four-year college or university. A minimum grade point average of 3.2 in the major field of study and an overall grade point average of 3.0 in a 4.0 system is required. Significant relevant work experience or a graduate degree in a relevant technical discipline may be considered in lieu of meeting the GPA guideline.
2. *Scholarly competence in the following areas of computer science and mathematics, described as follows:
 - a. structured high-level programming (for example, CISC106, CISC 108, or equivalent)
 - b. data structures (for example, CISC 220 or equivalent).
 - c. at least one (and preferably more) course(s) in higher-level math such as calculus/discrete mathematics/linear algebra/mathematical logic/comparable formal subjects, such as Theory of Computation
 - d. basic background in probability and statistics
3. International applicants must demonstrate a satisfactory level of proficiency in the English

language if English is not their first language. The University requires an official TOEFL score of at least 550 on paper-based or at least 79 on the Internet-based test.

4. A resume or curriculum vita outlining work and academic experience.
5. Two (2) letters of recommendation

B. Prior degree requirements

See Section A. Admission Requirements.

C. Application Deadlines

Admission decisions are made on a rolling basis as applications are completed. Applications are accepted up to the first day of classes for a given semester. Start terms for the graduate certificate include Fall and Spring terms.

D. Special competencies

See Section A. Admission Requirements.

Applicants external to UD must apply to the Graduate Certificate in Artificial Intelligence using the online [graduate admission application](#) and must submit evidence of all the above qualifications.

*Applicants who are currently enrolled in another program at UD may use the [graduate certificate form for UD undergraduate students](#), or the [graduate certificate form for UD graduate students](#) and are subject to the *scholarly competence expectations above.

III. ACADEMIC PROGRAM REQUIREMENTS

The Graduate Certificate in Artificial Intelligence requires 9 credits of graduate-level courses. The three graduate courses may be chosen from the following:

- CISC 642 - Introduction to Computer Vision
- CISC 681 - Artificial Intelligence
- CISC 683 - Introduction to Data Mining
- CISC 684 - Introduction to Machine Learning
- CISC 686 - Introduction to Multi-Agent Systems
- CISC 688 - Introduction to Natural Language Processing
- CISC 689 - Topics: Artificial Intelligence
- CISC 886 - Multi-Agent Systems
- CISC 889 - Advanced Topics in Artificial Intelligence

Each certificate program course must be completed with a grade no lower than a B- and students must obtain at least at 3.0 cumulative grade point average in the program curriculum to receive the Graduate Certificate.

A single course substitution (3 graduate credits) may be considered by the Graduate Program Director with documentation provided through the course substitution form.

Students are expected to complete the [Graduate Certificate Completion Form](#) at the beginning of the semester in which they are registered for the last course needed to complete the certificate.

IV. SATISFACTORY PROGRESS

Multiple courses will be offered each semester so that the certificate program could be completed in as little as one semester of full time work.

To be awarded the graduate certificate, complete the Application for Graduate Certificate by the end of the free/drop add deadline at the beginning of the semester in which the student is registered for the last course needed to complete the certificate.

V. PROGRAM EDUCATIONAL GOALS

Graduates of this program will have an ability to:

1. Analyze complex problems and determine what AI techniques may be appropriate for identifying a solution. .
2. Determine appropriate data sets that may be relevant to a problem solution. Know how to prepare datasets for implementation.
3. Design, implement, and evaluate an AI-based solution to meet a given set of requirements in the context of the program's discipline.
4. Communicate effectively in a variety of professional contexts.
5. Recognize professional responsibilities and make informed judgments in AI practice based on legal and ethical principles.

VI. FINANCIAL AID

This is a tuition generating graduate program and tuition remission and/or stipends are not offered. Graduate students in this program would be eligible to apply for financial aid as applicable.

VII. DEPARTMENTAL OPERATIONS

We anticipate approximately 5-10 students following this course of study each year. Within the Department of Computer and Information Sciences, responsibility for the program will fall under the Department's Graduate Program Director. Administrative support will follow along these same department lines.