ARTIFICIAL INTELLIGENCE

The part-time Artificial Intelligence program will educate and train practicing scientists and engineers to be able to carry out engineering and scientifically oriented research and development using their artificial intelligence knowledge and skills.

The rigorous curriculum will provide engineers and computer scientists with a working knowledge of the theoretical concepts in artificial intelligence and will also provide the students with the knowledge and skills to apply both current and future theoretical concepts to real systems and processes. The course content will be based on the foundational content embodied in the current computer science courses modified to provide relevant examples in the artificial intelligence setting.

Courses are offered online as well as in-person at the Applied Physics Laboratory.

Program Committee

John A. Piorkowski, Program Chair
Principal Professional Staff
JHU Applied Physics Laboratory

Anthony N. Johnson, Program Manager
Senior Professional Staff
JHU Applied Physics Laboratory

Eleanor Boyle Chlan
Senior Professional Staff (retired)
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Diana Gehlaus
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Lanier Watkins, Chair CS, CyS
Senior Professional Staff
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Courses

EN.705.601. Applied Machine Learning. 3 Credits.
Machine Learning (ML) is the art of solving a computation problem using a computer without an explicit program. ML is now so pervasive that various ML applications such as image recognition, stock trading, email spam detection, product recommendation, medical diagnosis, predictive maintenance, cybersecurity, etc. are constantly used by organizations around us, sometimes without our awareness. In this course, we will rigorously apply machine learning techniques to real-world data to solve real-world problems. We will briefly study the underlying principles of diverse machine learning approaches such as anomaly detection, ensemble learning, deep learning with a neural network, etc. The main focus will be applying tool libraries from the Python-based Anaconda and Java-based Weka data science platforms to datasets from online resources such as Kaggle, UCI KDD, open source repositories, etc. We will also use Jupyter notebooks to present and demonstrate several machine learning pipelines.

Prerequisite(s): EN.705.621 Introduction to Algorithms OR EN.605.621 Foundations of Algorithms OR EN.685.621 Algorithms for Data Science

EN.705.603. Creating AI-Enabled Systems. 3 Credits.
Achieving the full capability of AI requires a system perspective to effectively leverage algorithms, data, and computing power. Creating AI-enabled systems includes thoughtful consideration of an operational decomposition for AI solutions, engineering data for algorithm development, and deployment strategies. To realize the impact of AI technologies requires a systems perspective that goes beyond the algorithms. The objective of this course is to bring a system perspective to creating AI-enabled systems. The course will explore the full-lifecycle of creating AI-enabled systems starting with problem decomposition and addressing data, design, diagnostic, and deployment phases. The course will also cover ethics and bias in AI systems. The course includes a systems project that will encompass the full-lifecycle with interim milestones throughout the course. Homework assignments will be provided that involves python programming.

EN.705.612. Values and Ethics in Artificial Intelligence. 3 Credits.
Modern artificial intelligence, and the related area of autonomous systems are becoming so powerful that they raise new ethical issues. This course will prepare professional engineers and developers to thoughtfully engage with the moral, ethical, and cultural aspect of these emerging technology. Topics include: safety considerations for autonomous vehicles, algorithm bias, AI explainability, data privacy, ethical considerations of ‘deep fakes’, ethics of artificial life, values advocacy within organizations, technological unemployment, and far-future considerations related to AI safety.

EN.705.621. Introduction to Algorithms. 3 Credits.
This course concentrates on the design of algorithms and the rigorous analysis of their efficiency. Topics include the basic definitions of algorithmic complexity (worst case, average case); basic tools such as dynamic programming, sorting, searching, and selection; advanced data structures and their applications (such as union-find); graph algorithms and searching techniques such as minimum spanning trees, depth-first search, shortest paths, design of online algorithms and competitive analysis.
EN.705.640. Cognitive and Behavioral Foundations for Artificial Intelligence. 3 Credits.
As a result of greater computing power and Big Data, artificial intelligence (AI) is rapidly improving for well-defined tasks and narrow intelligence. Moreover, it has entered all industries in a myriad of ways. But will AI ever have human-like general intelligence? What does humanlike general intelligence even mean? Why should we even care? This course is designed to answer these complex questions by giving students working knowledge of the underlying principles and mechanisms of human behavior and cognition, and how they may be applied to solving current and rising industry challenges. Key topics to be addressed will include vision, audition, language, learning, emotion and social cognition, creativity, and consciousness. Students will apply learned topics to a final group research project on the topic of their choice.