

ARTIFICIAL INTELLIGENCE (A-I)

A-I 500: Quantitative Methods

3 Credits

This course aims to provide essential quantitative skills required for advanced studies and practical applications that are important in algorithm optimization, signal processing, data manipulation, analysis, and data-driven decision making under uncertainty. It covers a range of topics including vector and matrix operations, advanced calculus with a focus on differentiation and integration techniques, Fourier transformations, and basic statistics and probability.

Cross-listed with: DAAN 500

A-I 501: Interdisciplinary Research Design for Artificial Intelligence

3 Credits

This course provides graduate students with the principles and practical skills necessary to conduct rigorous scientific research in artificial intelligence. Emphasizing interdisciplinary perspectives, the course introduces research design principles, methodologies, and evaluation strategies that prepare students to define and pursue novel research questions in AI disciplines. Students will learn how to critically engage with existing literature, design reproducible experiments, analyze results, and communicate findings in scholarly formats. The course is designed to support students in preparing for their master's thesis and to serve as a bridge toward doctoral-level research. By the end of the course, students will have produced a research proposal and gained hands-on experience in articulating, justifying, and refining AI-focused research that address academic and professional challenges.

Prerequisite: AI 500 or STAT 500

A-I 570: Deep Learning

3 Credits

Deep Learning has become a prevalent area and accomplished near-human level in image classification, speech recognition, and autonomous driving. This course will cover the foundations on Neural Networks and Deep Learning Networks and give students a practical understanding of the field of Deep Learning. It covers the core concepts of Deep Neural Networks, including the Convolutional Neural Networks for image recognition, Recurrent Neural Networks for sequence generation, and Generative Adversarial Networks for image generation, and more!

Prerequisite: STAT 500 Recommended Prep: Requires basic math-college calculus & linear algebra. Should be able to take multivariable derivatives & understand matrices, vectors operations & notations. Preliminary programming skills in Python are required.

A-I 572: Reinforcement Learning

3 Credits

Reinforcement learning, along with supervised learning and unsupervised learning, is one of the three basic types of machine learning. Applications of reinforcement learning span across medical intervention, robotics, game playing, autonomous driving, financial trading, and marketing, among many others. This course will cover the main theory and

approaches of reinforcement learning, along with deep learning and common software libraries and packages.

Recommended Preparation: STAT 500 or equivalent: probabilities, gaussian distributions, mean, standard deviation, etc. Able to take multivariable derivatives and understand matrices and vectors operations and notations. Preliminary skills in Python.

A-I 574: Natural Language Processing

3 Credits

Natural Language Processing (NLP) is a subfield of Artificial Intelligence. This course covers basic as well as advanced concepts to gain a detailed understanding of NLP tasks such as language modeling, text to speech generation, natural language understanding, and natural language generation. Students will learn the necessary skills to design a range of applications, including sentiment analysis, translating between languages, and answering questions. Throughout the course, the practical implementation of these applications with deep neural networks is also discussed.

A-I 596: Individual Studies

1-9 Credits/Maximum of 9

Creative projects, including nonthesis research, that are supervised on an individual basis, and which fall outside the scope of formal courses.

A-I 600: Thesis Research

1-15 Credits/Maximum of 999

No description.

A-I 801: Foundation of Artificial Intelligence

3 Credits

Artificial Intelligence (AI) is the discipline that attempts to build and understand intelligent entities. Computers with human level intelligence would have a huge impact as intelligent systems with natural language processing, robotics, building networked assistants, speech recognition, and autonomous driving. This course will teach the foundations of AI and give students a practical understanding of the field. This course gives an overview of the core concepts of AI, including the intelligent agents, knowledge and reasoning, reinforcement learning, planning and acting, belief networks, computational learning, Markov decision process, and more!

A-I 804: Ethics of Artificial Intelligence

3 Credits

Artificial Intelligence (AI) is the use of machines to do tasks that seem to require human intelligence and cognitive skills (thinking, natural language, inference, decision making etc.) The Ethics of Artificial Intelligence is the young branch of applied ethics that seeks to study the far-reaching and diverse ethical issues that arise with the widespread and rapid integration of AI technologies into various aspects of our lives. The challenge is that we are in an uncharted ethical territory with regard to AI: we need to radically adjust our existing ethical paradigms or introduce new ones as we experience and acquire a better grasp of the problems involved in AI-human interaction. A large portion of these issues reflect our concerns about the harm that the use and misuse of AI might cause for humanity. Such issues range from threats to individual privacy and

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freedom to wider social implications regarding economic justice and race and gender equality. However, as AI systems develop and attain higher levels of intelligence, questions about their moral status become more pressing. If these systems are capable of moral agency, then not only do they have responsibilities towards other moral agents like us, but they also have rights that we should respect in our conduct towards them. This course offers an overview of the nature and extent of the ethical issues arising from AI-human interaction as well as the philosophical background (particularly, in ethics and philosophy of mind) required to develop an informed methodology in approaching these issues, with the help of the flourishing literature on the subject.

Cross-listed with: PHIL 804

A-I 810: Artificial Intelligence in Practice

3 Credits

This course offers a comprehensive exploration of the foundational concepts, techniques, and applications of Artificial Intelligence (AI). Designed to cater to a wide range of learners, including those with limited programming experience, this course emphasizes practical hands-on learning. Students will delve into key AI topics such as search algorithms, multi-agent systems, data processing, machine learning, deep learning, natural language processing, computer vision, and reinforcement learning. The course also features a group project, enabling participants to collaborate on solving real-world problems using AI. The course is structured to be accessible for those without extensive programming experience, utilizing low-code/no-code tools to facilitate learning and hands-on case studies from accounting, finance, marketing, innovation, creative work and entrepreneurship.

Cross-listed with: DAAN 810

A-I 820: Generative Artificial Intelligence

3 Credits

Generative AI is a transformative technology that is reshaping industries such as healthcare, finance, education, and entertainment. Understanding its technical fundamentals and ethical implications is essential for any AI practitioner or leader. This comprehensive course is designed to provide students with in-depth knowledge of generative AI, from foundational models to advanced techniques, while emphasizing the importance of ethical considerations. Students will gain hands-on insights into the intricacies of building, training, and optimizing foundation models, exploring the diverse applications of generative AI, and understanding its broader impact on society. The course emphasizes a human-centric approach, ensuring that the development and deployment of AI technologies align with ethical standards and societal values. The course is structured to be accessible for those without extensive programming experience, utilizing low-code/no-code tools to facilitate learning and hands-on case studies from accounting, finance, marketing, innovation, creative work and entrepreneurship.

Cross-listed with: DAAN 820

A-I 830: Applied Machine Learning

3 Credits

This course covers practical knowledge and skills in supervised machine learning and data mining, emphasizing real-world business applications. Students will learn how to acquire, explore, and preprocess data, apply supervised and unsupervised learning techniques, and understand the

importance of fairness and explainability in AI. Utilizing low-code/no-code tools, the course fosters hands-on experience through group projects, enabling students to make data-driven decisions and present actionable insights effectively with applications from accounting, finance, marketing, innovation, creative work and entrepreneurship.

Recommended Preparation: Basic knowledge of statistics and probability. Familiarity with business operations and strategic decision-making.

Cross-listed with: DAAN 830

A-I 840: Responsible AI

3 Credits

Responsible AI involves developing, deploying, and utilizing artificial intelligence (AI) systems in ways that are ethical, transparent, accountable, and aligned with societal values. This course focuses on understanding and applying the principles and practices of Responsible AI, ensuring that AI technologies are developed and used in ways that are fair, unbiased, and beneficial to individuals, communities, and society. Through practical exercises and real-world scenarios, students will learn to conduct bias audits, implement governance frameworks, conduct stakeholder consultations, and form cross-disciplinary teams to tackle the multifaceted challenges associated with AI ethics. The course is structured to be accessible for those without extensive programming experience, utilizing low-code/no-code tools to facilitate learning and application.

Cross-listed with: DAAN 840

A-I 850: Autonomous AI Agents

3 Credits

This course delves into the theoretical underpinnings and practical implementation of intelligent agents and autonomous AI systems. Students will learn to design systems that can perceive complex environments, formulate long-horizon plans, and execute multi-step workflows with minimal human intervention. The course covers foundational agentic concepts, advanced transformer-based language models, sophisticated prompt engineering, hierarchical planning, memory systems, and robust tool integration. A significant focus will be placed on developing modular Large Language Models (LLM) based-agent systems and addressing the ethical and governance challenges inherent in autonomous AI. This course prepares students to be leaders in the design, implementation, and responsible deployment of AI Agent with cutting-edge platforms.

Cross-listed with: DAAN 850

A-I 860: AI-Driven Automation and Planning

3 Credits

This course examines the theoretical foundations and practical methodologies for automating complex workflows using both symbolic and data-driven AI techniques. Students will explore classical planning formalisms, Large Language Model (LLM)-guided task planning, and workflow orchestration and scheduling to design, implement, and govern end-to-end automated systems. The course also includes topics such as process mining, multimodal and IoT-driven automation. Ethical, security, and regulatory considerations are integrated throughout, preparing

graduates to lead responsible AI automation initiatives across diverse sectors.

Prerequisite: A-I 850

Cross-listed with: DAAN 860

A-I 879: Machine Vision

3 Credits

This course will focus on the design of computer-based, machine vision systems using appropriate algorithms and best practices. Students will study various techniques for image representation and structuring, feature extraction and segmentation, information extraction, filtering and analysis.

A-I 894: Capstone Experience

3 Credits

The capstone course in the MPS in Artificial Intelligence program. A practical experience in which students, working in teams, employ contemporary methods, process, and tools in the design and implementation of an AI-enabled system including problem identification, methodology selection, data identification and gathering, implementation, training, and deployment. As the culminating experience in the AI program, students demonstrate their ability to design and implement a full AI-enabled systems using a real-world dataset applying the tools and techniques explored throughout their preceding studies.

A-I 897: Special Topics

1-3 Credits/Maximum of 3

Formal courses given on a topical or special interest subject with a professional orientation that may be offered infrequently.