Course Title: *Introduction to AI: Concepts, Applications, and Impact*

The goal of the course is to enable Penn students to navigate the opportunities and challenges of AI by giving an overview of how AI works, how it is applied, its limitations and where it might be headed. The concepts underlying AI will only be introduced at a basic level but students will gain an intuitive understanding and feel empowered to use it with greater confidence. Exercises with easy to use AI-based tools will enable students to explore data and carry out experiments with some of the leading AI products. The various ways in which AI carries risks for individuals and our society will be discussed. By understanding the origin of the different risks, students will gain an understanding of the possibilities for mitigating them. Finally, the myriad applications of AI in the real world will be surveyed with an eye towards emerging trends.

Thus the course is a self-contained attempt at "everything you need to know about AI before stepping into the real world". Students will also be better prepared to use AI during college: in their selection and performance in courses, for research projects and internships.

The course has no prerequisites.

The course will be somewhat unusual: its contents will evolve each time it is taught since what is interesting about AI is changing from one semester to the next. A group of 4-5 faculty from SAS and other schools will cover a few lectures each so that students get the benefit of the leading experts in each topic. Each 90 minute slot will typically consist of a 60 minute lecture by the professor followed by an interactive activity, which will span discussions, hands-on experiments with data and visualization, creating text and art, and role playing exercises.

Lecture 1: What makes a machine "intelligent"?

- Defining AI: what it is, and what it isn't
- A brief history: the three "AI revolutions"
- Examples of AI applications in everyday life

Lecture 2: Data science: How do we turn raw data into insights?

- The role of data in AI
- Types of data: text, images, voice, structured vs. unstructured
- Data visualization and exploration: finding meaning in raw data

Lecture 3: Basics of ML: How do machines learn patterns from data?

- How machines learn from data: identifying patterns
- Key approaches: Supervised, unsupervised, and reinforcement learning
- ML in action: regression, classification and decision making

Lecture 4: Neural Networks: How do machines mimic the human brain?

- The biological inspiration of neural networks
- The neural network architecture and how it is trained with data
- Why advanced versions of neural networks power modern AI

Lecture 5: Introduction to Generative AI: How AI systems create

- What is generative AI, and why is it revolutionary?
- Overview of image and text generation systems: a first pass at deep learning
- Does Generative AI “understand” the world?

Lecture 6: Natural Language Processing (NLP) and Large Language Models (LLMs): How machines understand and generate human language?

- How AI interacts with human language: basics of NLP
- LLMs: how they work and how they mastered human-like language
- Limitations of LLMs: why they give biased or fabricated responses
- AI, human cognition and LLMs

Lecture 7: Beyond language: images, voice, video

- Image recognition with Convolutional Neural Nets
- Creating images, video and art with diffusion models
- Multimodal models like DALL-E and GPT: where text, sound and visuals intersect
- How do we understand originality and creativity in the AI era?

Lecture 8: How do we make AI systems smarter and safer?

- The art of prompting and fine tuning
- Reinforcement learning with human feedback
- Baby steps towards making AI safe and transparent

Lecture 9: Risks and Ethics in AI: What are the dangers of AI?

- Understanding bias and misinformation: what are its consequences?
- Privacy concerns in using AI
- Risks of generative AI: misinformation, deepfakes and unintended consequences

Lecture 10: Risks and Ethics in AI: how can we use it responsibly?

- Regulation and responsible AI development
- The energy costs of AI: balancing progress and sustainability
- How to critically evaluate AI claims and systems

Lecture 11: How can we use generative AI in real-world scenarios? Part 1

- Content creation: writing, design and prototyping
- Workflow tools: integrating AI into everyday tasks

- Real-world examples and case studies from industry

Lecture 12: How can we use generative AI in real-world scenarios? Part 2

- Conversational agents and virtual assistants
- Extraction insights from documents and images
- Applications in healthcare, software development and social settings

Lecture 13: What's next for AI, and how will it shape our world?

- Emerging trends in AI research and applications
- The pursuit of Artificial General Intelligence (AGI)
- The evolving relationship between humans and AI: challenges and opportunities