48-770:
Inquiry into Machine Learning and Design

Course information:

Description:

With the recent blooming of artificial intelligence (AI) and machine learning (ML) came a renewed interest in how these technologies may impact architecture and other creative practices. Inquiry into Machine Learning and Design introduces students to this emerging field, giving them the tools to make their own machine-learning-based design tools by adapting state-of-the-art models, developing new models, and understanding how data shapes machine learning processes.

Throughout this course, students explore three fields of machine learning and their potentials in design and making problems: 1) Unsupervised Generative Models, 2) Natural Language Processing (NLP) for Multimodal Machine Learning, and 3) Reinforcement Learning. Students will be introduced to the fundamental concepts of each field and get hands-on experience with state-of-the-art research and tools to implement them.

Course Level:

Graduate, open to 4th and 5th-year undergrad students with special permission

Course Info:

Semester: Fall 21

Section: 1

Section Type: Lecture + lab

Mini: No

Instructor:

Ardavan Bidgoli, Pedro Veloso, Manuel Rodriguez Ladron De Guevara, Jinmo Rhee

Delivery mode: REO

Building/Room: -

Day: TR

Begin Time: 10:10 AM

End Time: 11:30 AM

Final Exam: No

Course Profile:

Key Topics:

Machine learning, generative models, multimodal machine learning, reinforcement learning, design tool making.

Prerequisite Knowledge:

Python programming background, some knowledge of machine learning will be a plus.

Course Relevance:

This course introduces students with a background in architecture and design with the applications of artificial intelligence and specifically machine learning in creative practices. Throughout this course, students will develop skills to cast

their creative design challenges into machine learning problems and develop machine learning-based tools to solve them.

Course Goals:

The primary objective of this course is to introduce the fundamental concepts of machine learning that can be applied to creative design and to understand the purpose and value of incorporating machine learning tools into a design workflow. The secondary objective of this course is to develop a high degree of competency and skills in developing a machine learning pipeline (data generation, model design/fine-tuning, and training) through short exercises as well as assignments. The third objective of this course is to help students develop a critical approach to data collection, data curation, and bias in machine learning pipelines.

Assessment Structure:

Attendance and class participation, homework, small coding challenges.

Learning Resources:

The resource will include lecture slides, textbooks, webpages, Google CoLabs, videos, and a paper reading list. Additional coding tutorials on PyTorch will be provided.

- Primary textbook:
    - *Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play*, available online through CMU library.
- To read but not mandatory:
    - Machine Learning, Tom M. Mitchell
    - Artificial intelligence, a modern approach (4th edition)
    - Deep Learning (The MIT Press Essential Knowledge)

Extra Time Commitment:

~12 hours per week is expected to be sufficient.

Course Tags:

Machine learning, Artificial intelligence, Generative design, Natural language processing, Reinforcement learning, Interdisciplinary, Team project, Research project