ISYE 8900 – Special Problems

Semester: Summer/Fall 2026
Instructor: Mohsen Moghaddam, Ph.D.
Course End Date: —

Course Overview

This course provides an opportunity for independent, research-driven study in topics at the intersection of extended reality (XR), artificial intelligence (AI)/machine learning, and human–robot/machine interaction. Projects are tailored to individual student interests and may include applications such as immersive training and task guidance, human–AI–robot teaming, human augmentation, and visualization in XR environments. The course emphasizes the design and development of human-centered computational models, algorithms, and interactive systems that enhance human capabilities—cognitive, physical, and social. Students will engage in research that explores how intelligent technologies can adapt to human needs, support decision-making, and enable effective collaboration between humans and machines across domains such as manufacturing, healthcare, and complex operational environments.

Learning Outcomes

- Formulate a research problem within XR, AI/ML, or human–robot interaction
- Design and implement a prototype system, model, or framework relevant to the chosen problem
- Apply appropriate computational, experimental, or design methodologies
- Evaluate system performance through simulation, experimentation, or user studies (as applicable)
- Communicate research findings through technical writing and presentation

Deliverables

- Project proposal and research plan
- Literature review and problem formulation
- System prototype, model, or framework
- Evaluation results (experimental, simulation-based, or analytical)
- Final report or conference-style paper

Grades Distribution

A All deliverables completed with high quality; strong technical contribution; thorough evaluation; polished, submission-ready paper or report

B Most deliverables completed; solid implementation and evaluation; paper/report complete but may need refinement

C Core components completed; limited evaluation; incomplete or underdeveloped analysis and documentation
D Significant gaps in implementation, evaluation, or documentation
F Failure to submit final report/paper or demonstrate meaningful progress

Course Schedule

Weeks 1–2: Problem Definition & Literature Review
- Identify research topic and scope
- Conduct literature review
- Define research questions and objectives

Weeks 3–5: System/Model Design
- Develop system architecture or modeling approach
- Define datasets, tools, and evaluation metrics

Weeks 6–9: Implementation & Development
- Build prototype, model, or framework
- Iterate on design and functionality

Weeks 10–12: Evaluation
- Design and conduct experiments, simulations, or user studies
- Collect and analyze results

Weeks 13–15: Refinement & Documentation
- Refine system/model based on findings
- Prepare figures, results, and analysis

Week 16: Final Deliverables
- Submit final report or conference-style paper
- Present project outcomes

Notes

- Specific project scope, tools, and methods will be defined in consultation with the instructor.
- Projects may involve programming, system prototyping, data analysis, and/or experimental design.
- Students are encouraged to align their work with ongoing research in human-centered AI, XR, and human–robot interaction.