

# ADVANCED MACHINE LEARNING (FALL 2026)

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**Instructor:** Dr. Yuqi Ouyang  
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**Section 1:** Thursday, 13:50 – 16:25, S103

## Office Hours:

Monday, 13:00 – 18:00. Room N524.

Please send an email to schedule a meeting.

## Textbook:

*Probabilistic machine learning: Advanced topics.* Kevin P. Murphy. The MIT Press. 2023.

## Prerequisites:

Not a prerequisite, but holding a basic understanding of Machine Learning and Deep Learning will facilitate learning of this course.

## Course Description:

This course provides an advanced study of modern machine learning, with an emphasis on the principles, architectures, and learning paradigms underlying contemporary AI systems. It covers deep representation learning, generative models, deep reinforcement learning, and learning under concept drift. The course combines mathematical foundations with recent developments in machine learning, enabling students to understand how modern models are formulated and applied to complex learning problems.

## Course Objectives:

- Understand advanced machine learning principles and the mathematical foundations underlying modern learning algorithms.
- Critically evaluate modern machine learning methods by understanding their assumptions, objectives, strengths, limitations, and appropriate applications.
- Formulate machine learning solutions to open ended problems, including identifying suitable models, datasets, evaluation strategies, and potential methodological approaches.

## Learning Outcomes:

- Explain and interpret the principles, architectures, and mathematical foundations of modern machine learning methods.
- Analyze and evaluate modern learning methods, including deep representation learning, generative models, deep reinforcement learning, and learning under concept drift.
- Design and justify appropriate machine learning approaches for complex learning problems based on their characteristics, objectives, and requirements.

## Assessment:

|                                  |     |
|----------------------------------|-----|
| Attendance                       | 20% |
| Presentation                     | 40% |
| Research Proposal + Oral Defense | 40% |

**List of Topics:**

- Week 1: Course Overview; Machine Learning Crash Course Part 1.
- Week 2: Machine Learning Crash Course Part 2.
- Week 3: Deep Representation Learning Part 1.
- Week 4: Deep Representation Learning Part 2.
- Week 5: Deep Generative Models Part 1.
- Week 6: Deep Generative Models Part 2.
- Week 7: Deep Generative Models Part 3.
- Week 8: Deep Generative Models Part 4.
- Week 9: Mid-Term Presentation Sessions.
- Week 10: Mid-Term Presentation Sessions.
- Week 11: Deep Reinforcement Learning Part 1.
- Week 12: Deep Reinforcement Learning Part 2.
- Week 13: Deep Reinforcement Learning Part 3.
- Week 14: Deep Reinforcement Learning Part 4.
- Week 15: Learning under Concept Drift Part 1.
- Week 16: Learning under Concept Drift Part 2.
- Week 17: Oral Defense of Research Proposal.

**Grade Composition:**

Class letter grade is given within the following score ranges:

|              |           |             |           |             |           |             |          |             |           |
|--------------|-----------|-------------|-----------|-------------|-----------|-------------|----------|-------------|-----------|
| 90.00–100.00 | <i>A</i>  | 85.00–89.99 | <i>A–</i> | 80.00–84.99 | <i>B+</i> | 76.00–79.99 | <i>B</i> | 73.00–75.99 | <i>B–</i> |
| 70.00–72.99  | <i>C+</i> | 66.00–69.99 | <i>C</i>  | 63.00–65.99 | <i>C–</i> | 60.00–62.99 | <i>D</i> | 0.00–59.99  | <i>F</i>  |

**Make-up Policy:**

No exam will be arranged.

**Academic integrity:**

- Unacknowledged direct copying from the work of another person, or the close paraphrasing of somebody else's work, is called plagiarism and is a serious offence, equated with cheating in examinations. This applies to copying both from other students' work and from published sources such as books, reports or journal articles.
- Paraphrasing, when the original statement is still identifiable and has also no acknowledgement, is plagiarism. A close paraphrase of another person's work must have an acknowledgement to the source. It is not acceptable for you to put together Unacknowledged passages from the same or from different sources linking these together with a few words or sentences of your own and changing a few words from the original text: this is regarded as over-dependence on other sources, which is a form of plagiarism.

**Other Course Policies:**

- Please come to the class, respect the efforts of preparing the course.
- Please increase your participate willing, interact.
- If you have special situations and want to ask for a leave about the next course, you need to send emails before the lecture time, any request after 13:50 in the afternoon will be rejected.
- If you need to take a long leave for internship, you need to get formal proof from the institute, and request for the leave at least one week earlier than the upcoming lecture.
- Please regularly check the announcements on QQ groups and Blackboard
- Please bring urgent questions to face-to-face sessions.
- Carefully use AI tools, you need to make sure full understanding of your submissions.
- Zero-tolerance to both two persons in plagiarism.
- Late submissions cause penalties, please report mitigating circumstances early.

**Mitigating Circumstances:**

If you have a medical situation or any personal circumstances that substantially affect your study or exam. You are encouraged to contact the department or the instructor as soon as possible. With valid proof, mitigation may be applied when assessing your works.