New Jersey Institute of Technology Ying Wu
College of Computing
Computer Science Department

CS 785.003: Neurosymbolic AI

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Semester: Fall 2025
How to submit assignments: Canvas

Time and Location

Fridays 02:30 PM - 05:20 PM
Central King Building | Room 219

Office Hours: Fridays, 1:00–2:30 p.m., or by appointment.

Discussion forum: We will be using Canvas.

Note: I will respond to all messages by the end of the following business day.

Course Description

Modern AI largely relies on deep learning, yet fundamental challenges—such as limited adaptability, poor generalization, reduced robustness, lack of explainability, insufficient abstraction, absence of common-sense reasoning, and weak causal reasoning—remain unresolved. Moreover, these advances often rely on massive datasets for training or pre-training. Symbolic methods offer a complementary path by enabling declarative specifications of expected behavior, embedding prior knowledge, and enriching AI systems with reasoning capabilities.

Neurosymbolic AI integrates data-driven neural models—effective at perception—with symbolic representations grounded in logic and probabilistic reasoning. This synthesis bridges intuitive, fast learning with deliberate, structured reasoning, yielding systems that are more adaptive, explainable, and robust.

This seminar investigates the theoretical and practical foundations of Neurosymbolic AI. Main topics include causal inference, hybrid neural-symbolic architectures, attention-based reasoning, and strategies for merging perceptual models with structured world representations. Additional aspects of Neurosymbolic AI will also be discussed to provide a comprehensive view of the field.

Learning Outcomes

By the end of this course, students will be able to:

1. Analyze the theoretical and practical foundations of Neurosymbolic AI, including causal inference, hybrid architectures, and reasoning.
2. Critically analyze and present recent research papers in Neurosymbolic AI, demonstrating clear understanding of contributions, limitations, and open problems.
3. Compare and evaluate strategies for integrating perceptual models with structured world representations.
4. Design and conduct a research-oriented project that applies or extends Neurosymbolic AI methods.

Prerequisites

The course does not have other course prerequisites.

Course Textbooks and Resources

Textbook: None Required

Course readings will consist primarily of research papers from leading publishers and conferences, which are accessible through the NJIT library. Students are expected to download and review these papers in advance of seminar discussions. Additional resources may be provided by the instructor as needed.

Grading Policy

The final grade will be based on paper presentations (40%), a course project (40%), and in-class discussions (20%).

Final letter grades will be determined by your overall percentage in the course, according to the scale below. At the end of the semester, small class-wide adjustments may be applied if an assessment proves unusually challenging or easy; however, any adjustments will be applied consistently to all students.

Letter Grade	Percentage Range
A	90–100
B+	85–89
B	80–84

Letter Grade	Percentage Range
C+	75–79
C	65–74
F	< 65

Late Work Policy

Late assignments will be penalized at a rate of 10% per day past the deadline. Assignments submitted more than seven days late will not be graded. Students who anticipate difficulties meeting a deadline should contact the instructor in advance to request an extension; reasonable extensions may be granted at the instructor's discretion in cases of documented emergencies or other extenuating circumstances.

Paper Presentations

- **Format:** Presentations will be conducted individually.
- **Duration:** Each presentation should last approximately 60 minutes, followed by a 30-minute Q&A session.
- Each week, **two students will present assigned papers**. All other students are expected to read both papers in advance. For each paper, **30 minutes will be reserved for Q&A**, and students are required to come prepared with thoughtful questions. This component will contribute to **in-class discussions grades**.
- **Paper Selection:** Assigned papers are provided here. Students may propose an alternative paper, subject to instructor approval. Requests must be submitted at least one week before the scheduled presentation to allow classmates sufficient time to prepare.
- **Sign-Up:** Students must register for a presentation slot using the sign-up sheet.
- **Submission:** Presentation slides must be uploaded to the given folder no later than two days before the scheduled presentation.
- **Evaluation:** Presentations will be graded on both clarity of delivery and depth of understanding. Assessment will be based on the following criteria:
    - Comprehension of high-level ideas
    - Accuracy in explaining the paper's design and implementation
    - Quality of evaluation discussion
    - Coverage of related work
    - Responses to audience questions
    - **Future Work:** Opportunities to Extend and Improve the Paper's Ideas

Rules for Making Good Oral Presentations

Course Project

- Students will work in pairs on a semester-long project.
- Projects must address a concrete problem using Neurosymbolic algorithms.
- **Project Proposal:** A document (≤ 2 pages) including:
    - Problem Statement
    - Data (if applicable)
    - Proposed Approach
    - Evaluation Plan
- **Mid-Semester Milestones:**

  - Project Pitch Presentation **(30 minutes)**
  - Written Report outlining progress and a concrete plan for the remainder of the semester
  - Consultations with Instructor for feedback and guidance
- **Final Report:**
  - A conference-style write-up is due on Monday of the last week of classes.
  - **Project Code Submission (ZIP via Canvas):** Submit a single ZIP file containing all code and documentation necessary to reproduce your main results.
- **Final Presentation:** A conference-style presentation with each team presenting for approximately one hour.

Responsiveness and Availability

Under normal conditions, emails will be answered within **48 hours**. To ensure prompt handling, all course-related emails must begin with the subject line: "**CS 785:"**

Assignments will typically be graded within **two weeks** of their due date.

Students are strongly encouraged to seek assistance as needed, whether through email or office hours. Responses to frequently asked questions will be shared via course announcements—please monitor them regularly.

Test policy

You must take the midterms and the final exam on the dates specified in the course schedule. Make-up exams will only be possible if you have medical notes that document your sickness or documentation that you must be out of town on the date of an exam. No exceptions will be made.

Regrade policy

The course staff will grade your work carefully. However, questions about grading do occasionally arise. Please see the grader of that problem (come to office hours or schedule an appointment). In the interests of smooth administration and to encourage you to look at your graded work soon after it is returned, regrade requests must be made within two weeks of when the work was returned. We reserve the rights to make regrade decisions "off-line" (i.e., not immediately at the time requested).

Accommodation of Disabilities:

Office of Accessibility Resources and Services (OARS) offers long term and temporary accommodations for undergraduate, graduate and visiting students at NJIT. If you need accommodations due to a disability, please contact OARS via email at oars@njit.edu. The office is in Kupfrian Hall Room 201. For further information please visit the OARS office website at: https://www.njit.edu/accessibility/. Please notice, if you are eligible for extra time and would like to use it in the final exam, please notify instructor and OARS at least two weeks prior to the exam so that accommodations can be made.

Student Absences for Religious Observations

NJIT is committed to supporting students observing religious holidays. Students must provide notification in writing of any conflicts between course requirements and religious observances, ideally by the end of the second week of classes and no later than two weeks before the anticipated absence. We will do our best to provide academically reasonable accommodations, allowing students to complete missed assignments, exams, quizzes, or other coursework within the term.

Use of Artificial Intelligence Tools

Artificial intelligence (AI) tools may be used as a supplementary aid to support learning, such as clarifying concepts, exploring alternative explanations, or becoming familiar with current technologies; however, the use of AI to generate or complete graded work is strictly prohibited. This includes, but is not limited to, drafting or editing reports, producing or refining project deliverables, creating presentation materials, writing or debugging code, or assisting with examinations. The purpose of this seminar is to cultivate independent mastery of Neurosymbolic AI, critical engagement with the research literature, and originality in scholarly contributions, and therefore all submitted work must reflect the student's own understanding and effort. Any misrepresentation of AI-generated content as one's own constitutes academic misconduct and will be addressed in accordance with NJIT's Academic Integrity Policy.

Academic Integrity Policy

"Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at: NJIT Academic Integrity Code.

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university. If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu."

Canvas Orientation

Students who are new to Canvas are encouraged to complete the self-paced Canvas Student Orientation. This resource provides an overview of the platform's features and will help you navigate course materials, submit assignments, and participate in discussions effectively.

These descriptions and timelines are subject to change at the discretion of the Professor.