CSE 849: Deep Learning

Spring 2026

Course Information

This course provides a comprehensive introduction to deep neural networks. Major topics include multilayer perceptrons, convolutional neural networks, practical aspects of model creation from scratch and training, sequence modeling with recurrent neural networks and transformers, and generative probabilistic modeling. Advanced topics, including Bayesian deep learning, will also be explored. Students will learn basic concepts of deep learning and hands-on experience to solve real-word problems. This course requires a strong background in linear algebra, probability and statistics, and machine learning. Python will be used for all the assignments. Proficiency in Python or being able to quickly learn it is required.

Class Information

Lecture hours: Tue Thu: 1pm – 2:20pm
Lecture room: Holden Hall C131

Instructor

Zijun Cui

Email: cuizijun@msu.edu
Office location: Engineering building 2212
Office hour: Tuesday and Thursday 2:30pm -3:30 pm

Optional Textbooks for Additional Reading

- Deep Learning: Foundations and Concepts
  By: Christopher M. Bishop , Hugh Bishop
  Access provided by Michigan State University (MSU)
- Probabilistic Machine Learning
  By: Kevin Murphy
  https://probml.github.io/pml-book/
- Deep Learning
  By: Ian Goodfellow, Yoshua Bengio, Aaron Courville
  https://www.deeplearningbook.org/

Deep Learning Frameworks

PyTorch (preferred)

Class Structure **(subject to changes as class progresses)**

Week of	Tuesday	Thursday
1/13	1 Introduction	2 Why Deep **Warm-up Project Out**
1/20	3 Learning a Neural Network	4 Forward and Backward Propagation
1/27	5 Automatic Differentiation	6 Create Your Model with PyTorch **Project 1 Out; Warm-up Project Due**
2/3	7 Train Your Model: Optimization 1 (Convergence and Learning Rate)	8 Train Your Model: Optimization 2 (Stochastic GD and Mini Batch)
2/10	9 Tame Your Model: Tricks	10 Convolutional Neural Network **Project 2 Out; Project 1 Due**
2/17	11 Convolutional Neural Networks – 2	12 Graph Neural Network
2/24	13 Recurrent Neural Network	14 Recurrent Neural Network – 2 **Project 2 Due**
3/3	**No Class (Spring Break)**	**No Class (Spring Break)**
3/10 *** Last day to drop classes**	15 Seq-to-Seq	16 Attention **Project 3 Out**
3/17	17 Transformer	18 Transformer and ViT
3/24	19 Transformer and LLMs	20 VLMs and Multimodal Learning **Project 3 Due**
3/31	21 Probabilistic Deep Learning and Generative modeling	22 Generative Modeling
4/7	23 Diffusion Models 1	24 Diffusion Models 2 **Project 4 Out**
4/14	25 Diffusion models and Flow matching	26 Diffusion models applications
4/21	27 Bayesian Deep Learning and Deep PGM	No Class **Project 4 Due**

Grading Policy

The students' final grade will be based on points earned on projects and attendance:

15% attendance
10% one warm-up project
15% quiz

60% projects (in total four projects, 15% each)

Grading Rubric

Range	Grade
(86, 100]	4.0
(79, 86]	3.5
(72, 79]	3.0
(65, 72]	2.5
(55, 65]	2.0
(48, 55]	1.5
(40, 48]	1.0
(00, 40]	0.0

Course Policies

- **[Complete Assignments]** Assignments for this course will be submitted electronically through D2L unless otherwise instructed. Assignments must be submitted by the given deadline or special permission must be requested from the instructor before the due date. Extensions will not be given beyond the next assignment except under extreme circumstances.

- **[Late submission]** Homework assignments are due on the specified due date. Late submissions without an approved extension will receive a 10% deduction per day late. Each student has a total of 5 free late days for the semester, which can be used across assignments as needed.

- **[Plagiarism]** You are encouraged to form study groups to learn the materials in class. However, all submitted assignments (including computer programs) must be your own work. If plagiarism is detected, students will automatically receive a 0 for the grade and will be reported to the university.

- **[Attendance]** Attendance at all regularly scheduled class meetings is a requirement of this course.

Inform Your Instructor of Any Accommodations Needed

Michigan State University is committed to providing equal opportunity for participation in all programs, services and activities. Requests for accommodations by persons with disabilities may be made by contacting the Resource Center for Persons with Disabilities at 517-884-RCPD or on the web at rcpd.msu.edu. Once your eligibility for an accommodation has been determined, you will be issued a verified individual services accommodation ("VISA") form. Please present this form to me at the start of the term and/or two weeks prior to the accommodation date (test, project, etc). Requests received after this date will be honored whenever possible.

Academic Honesty

Article 2.3.3 of the Academic Freedom Report states that "The student shares with the faculty the responsibility for maintaining the integrity of scholarship, grades, and professional standards." In addition, the Computer Science department adheres to the policies on academic honesty as specified in General Student Regulations 1.0, Protection of Scholarship and Grades; the allUniversity Policy on Integrity of Scholarship and Grades; and Ordinance 17.00, Examinations. (See Spartan Life: Student Handbook and Resource Guide and/or the MSU Web site: www.msu.edu). Therefore, unless authorized by your instructor, you are expected to complete all course assignments, including lab work, quizzes, tests and exams, without assistance from any source.

The Spartan Code of Honor Academic Pledge

As a Spartan, I will strive to uphold values of the highest ethical standard. I will practice honesty in my work, foster honesty in my peers, and take pride in knowing that honor in ownership is worth more than grades. I will carry these values beyond my time as a student at Michigan State University, continuing the endeavor to build personal integrity in all that I do.