CSCE 5218 - Deep Learning

Course Information & Syllabus (Spring 2026)

https://hengfan2010.github.io/teaching/26S-5218

Basic Course Information

- **Instructor:** Dr. Heng Fan
  - Note: The instructor reserves the right to modify course policies, the course calendar, assignment or project point values, and due dates
- **E-mail:** heng.fan@unt.edu (the best way to reach out)
  - Please use your UNT e-mail for communication
- **Office:** Discovery Park F284
- **Phone:** 940-565-3209
- **Office Hours:** Wednesday 8:00 - 10:00 am or by appointment
- **Lecture**
  - **Time:** Tuesday/Thursday 1:00 - 2:20 pm
  - **Classroom:** NTDP E265
- **Teaching Assistant (TA)**
  - **Xiaoqiong Liu:**
    Office: Discovery Park F232
    Office hours: Thursday 10:00 am - 12:00 pm or by appointment
    E-mail: xiaoqiongliu@my.unt.edu

Course Description

This course aims to cover the basics of modern deep neural networks. In specific, the first part will introduce the fundamental concepts in neural networks including network architecture, activation function, loss, optimization, etc. Then, the second part will describe specific types of deep neural networks such as convolutional neural networks (CNNs), recurrent neural networks (RNNs) and attention-based Transformer, as well as their applications in computer vision and natural language processing. In the final part we will briefly discuss some recent advanced topics in deep learning such as graph neural networks, unsupervised representation learning, deep reinforcement learning, generative adversarial networks (GANs), etc. In this course, hands-on practice of implementing deep learning algorithms (in Python) will be provided.

Tentative topics of this course include:

- Review of machine learning
- Basic concepts in neural networks
- Loss, optimization, and training of deep neural networks
- Convolutional neural networks (CNNs)
- Recurrent neural networks (RNNs)
- Transformer
- Applications of deep neural networks
- Graph neural networks
- Unsupervised representation learning
- Deep reinforcement learning
- Generative adversarial networks (GANs)

Detailed class schedule of this course can be found on the course website.

Textbook

We will have required readings from the following textbook:

- ***Deep Learning***, by Ian Goodfellow, Yoshua Bengio, and Aaron Courville, 2016.

Besides, the following textbooks are useful as additional references:

- ***Dive into Deep Learning***, by Aston Zhang, Zack C. Lipton, Mu Li, and Alex J. Smola, 2019.
- ***Neural Networks and Deep Learning***, by Michael Nielsen, 2019.
- ***Introduction to Deep Learning***, by Eugene Charniak, 2019.

Prerequisite(s)

Students are required to master basic knowledge about calculus, linear algebra, (Python) programming, and algorithm implementation. Machine learning background is beneficial for this course.

Programming Language/Framework

We will use Python, NumPy/SciPy, and PyTorch (https://pytorch.org/) for this course.

Expected Student Outcomes

Students in this course will learn basic concepts in deep neural network and different neural network types such as convolutional neural networks (CNNs), recurrent neural network (RNNs), and Transformer. The goals including the following:

- Learn the basic concepts and tools that underlie all modern deep neural networks
- Be able to select a suitable model architecture to process different types of data
- Grow hands-on experience implementing deep neural network models for computer vision, natural language processing, robotic applications, etc
- Team up and implement an existing research paper or algorithm

Grading

- Paper review: 30%
- Course Project: 55%
  - Project proposal: 20%
  - Final report: 25%
  - Presentation: 10%
- Final exam: 15%

Paper review: A list of papers will be suggested during the semester. Every student is required to select up to 16 papers (one per week) for review (a review example will be provided on the course website).

Course project: After a few weeks into the course, you will select among several collaborative projects (the project must be related to deep learning) suggested by the instructor, but the students are free to suggest, especially if they are related to their current research. The project is important to improve the hands-on skill of implementing the deep models. A small team of at most two members can work on a project together (each team member will receive the same grade for the project; it is up to the team members to divide the work fairly). For the project, each team requires to include:

- *Project proposal*: On the indicated due date, each team needs to submit the proposal that consists of abstract, introduction, related work, potential solution, datasets and metrics for experiments, and reference.
- *Final report*: On the indicated due date, each team needs to submit a final report which is similar to a research paper. Besides all the components in the proposal, the details of the proposed approach, implementation, and experimental analysis and results should be included in the final report.
- *Project presentation*: All teams need to present the project in class
- Team up and implement an existing research paper or algorithm

Final exam: There will be a final exam for this course. The final exam must be taken in class unless otherwise specified in advance. The final exam will be taking place from 10:00 am to 12:00 pm on May 7, 2026.

Attendance: Attendance may be checked on randomly selected days. You are responsible for any missed material and completing all work by the assigned due dates. You should notify the instructor of your absence as soon as possible.

Late submission: Late submissions will **not** be accepted. It is your responsibility to submit any required submission on time. There will be no exceptions.

Grading scale (based on 100 points):

- 90−100 = A
- 80−89 = B
- 70−79 = C
- 60−69 = D
- below 60 = F

No exceptions will be made.

Attendance Policy

Students are required to attend all lectures and recitations in order to gain the full benefit of the course. While I will be posting my slides before class, they may not contain all of the content discussed during class, nor the examples presented on the board. You are responsible for any missed material and completing all work by the assigned due dates. You should notify the instructor or teaching assistant of your absence as soon as possible if you are not able to attend class or recitation.

Make-up Policy

For most situations there will be no make-up work for any assessment in this course. However, in the event of an unavoidable absence for one of the reasons below, email the instructor as soon as possible so we can work out a solution. The following events are grounds for make-up work: being a participant in a conference in which you are presenting; being in an athletic or other UNT associated event in which you are an active participant; a family emergency; a severe illness; military duty; or in certain cases and with some restrictions a religious event. Additionally, in the case of a missed assignment due to illness, make-up work will only be allowed by providing the instructor with a physical copy of a signed doctor's note. See the UNT Attendance Policy for more information.

Content Responsibility Policy

Students are responsible for all content presented during class and required readings from the textbook. While attendance will be taken randomly in class, you will be expected to know and

understand the requisite topics and concepts. If you are confused or unsure about anything, please ask the instructor or teaching assistant.

Generative AI Course Policy

AI-generated submissions are not permitted and will be treated as plagiarism. In case a student needs to use an AI tool, they must ask for the instructor's permission before utilizing AI writing software (such as ChatGPT and all other similar tools) for any assignments in this course. Utilizing these tools without obtaining permission could jeopardize your academic integrity.

Access to Digital Materials

This course has digital components. To fully participate in this class, students will need internet access to reference content on the Canvas Learning Management System and other software such as Microsoft Office, Adobe, etc. If circumstances change, you will be informed of other technical needs to access course content. Information on how to be successful in a digital learning environment can be found at Learn Anywhere (https://online.unt.edu/learn).

UNT Policies

Academic Integrity and Consequences: According to UNT Policy 06.003 (`https://policy.unt.edu/policy/06-003`), Student Academic Integrity, academic dishonesty occurs when students engage in behaviors including, but not limited to cheating, fabrication, facilitating academic dishonesty, forgery, plagiarism, and sabotage. A finding of academic dishonesty may result in a range of academic penalties or sanctions ranging from admonition to expulsion from the University.

In addition, the CSE department policies on Academic Integrity and Student Conduct apply for this course – these are available at the following webpage: `https://engineering.unt.edu/cse/students/resources/academic-integrity.html`. Any exceptions to this policy are noted explicitly in the syllabus.

Most lectures in class will have homework assignments. Students may discuss the homework problems and approaches with each other but must work on their solutions individually unless otherwise stated in the assignment. Students must not copy homework from any source, including other students or the internet. No collaboration is allowed in quizzes and exams.

Acceptable Student Behavior: Student behavior that interferes with an instructor's ability to conduct a class or other students' opportunity to learn is unacceptable and disruptive and will not be tolerated in any instructional forum at UNT. Students engaging in unacceptable behavior will be directed to leave the classroom and the instructor may refer the student to the Center for Student Rights and Responsibilities to consider whether the student's conduct violated the Code of Student Conduct. The university's expectations for student conduct apply to all instructional forums, including university and electronic classroom, labs, discussion groups, field trips, etc.

Americans with Disabilities Act: We cooperate with the Office of Disability Accommodation to make reasonable accommodations for qualified students (cf. Americans with Disabilities Act and Section 504, Rehabilitation Act) with disabilities. If you have not registered with ODA, we encourage you to do so. If you have a disability for which you require accommodation, please discuss your needs with the instructor or submit a written Accommodation Request on or before the fourth-class day.

Disclaimer

Please note, this syllabus is to serve as a guide and may be subject to changes. For up-to-date information, assignments, and class material, students are recommended to check out course website or Canvas regularly. This syllabus may be updated in the future to reflect changes. The updated version will be available in the course website and on Canvas.