CSCI 4931-H01: Deep Learning

Dept. of CSE, College of Engineering, Design and Computing, CU Denver

Course Syllabus (*last updated on August 27, 2025*)

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Course website: Canvas

Term: Fall-2025
Web: cse.ucdenver.edu/~biswasa
Class Hours: Tue 2pm – 3:15pm (Zoom)&
Thu 2pm – 3:15pm (Zoom/In-person)
Class Room: Tue, Zoom @98957130732 &
Thu, Zoom @98957130732/in-person @NORTH-1608
TA office hours: TBD

Course Description

Deep Learning is a subfield of machine learning that adds on to the field the concepts and techniques of the artificial neural network to solve the learning tasks. This branch of machine learning has gained exponential popularity over the years as deep learning systems are taking over all artificial intelligent tasks, ranging from image classification, language modeling, machine translation, playing games, autonomous vehicle driving, speech recognition, cancer detection and numerous other applications and is behind many recent advances in Artificial Intelligence (AI). In this course you will gain both theoretical and practical knowledge of deep learning concepts and techniques. So, welcome aboard!

Course Objectives

In this course, you will –

1. Understand fundamentals of artificial neural network, and deep neural networks.
2. Develop an understanding on how to train a neural network.
3. Determine how a deep neural network can be designed, and implemented to solve real world problems.
4. Demonstrate an in-depth understanding of more than one concepts which will be introduced in the course through a final project.

Course Credits

3 credits

Recommended Readings

Bishop, C. and H. Bishop (2024). *Deep learning*. https://www.bishopbook.com. Springer.

Goodfellow, I., Y. Bengio, A. Courville, et al. (2016). *Deep learning*. https://www.deeplearningbook.org. MIT press Cambridge.

Zhang, A., Z. C. Lipton, M. Li, et al. (2020). *Dive into Deep Learning*. https://d2l.ai.

Recommended background

1. Good understanding of Calculus, Linear Algebra, Statistics and Probability theories.
2. Good Programming skills (in Python),

(For CSCI-4931 Enrollees) Course pre-requisites and agreement form submission

1. MATH-3195 (Linear algebra and differential equations) and,
2. CSCI-3412 (Algorithms).

PLEASE NOTE: Each enrolled undergraduate students must submit the Prerequisites Agreement form at the department front-desk to receive any credit for any assignment or exam. If this form is not signed by the end of census date, the student will be administratively dropped from the course.

(For CSCI-4931 Enrollees) ABET Assessment Criteria:

There will be 5 programming assignments, daily class activities, a semester-wide final project, a midterm and a final exam for the assessments of the following outcomes:

- *Criterion 1*: Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions
- *Criterion 2*: Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline
- *Criterion 3*: Communicate effectively in a variety of professional contexts.
- *Criterion 4*: Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.
- *Criterion 6*: Apply computer science theory and software development fundamentals to produce computing-based solutions.

Course Format

`Hybrid`

Grading Policy

- **15%** of your grade will be determined by daily post-class activities (your individual work).
- **40%** of your grade will be determined by 5 homeworks (your individual work).
- **10%** midterm (your individual work)
- **15%** final exam (your individual work)
- **20%** of your grade will be determined by 1 semester-wide project (team works encouraged). Activity includes: project proposal (5%), progress reporting (5%), demo+code delivery (10%).

Course Policy

I will detail the policy for this course below. Basically, ABIDE BY THE STUDENT HONOR CODE – DO NOT CHEAT and try to learn stuff. Don't be that guy.

Attendance Policy

> *Showing up is 80 percent of life* – Woody Allen, via Marshall Brickman

Please do not skip classes, unless you have a documented emergency. There are daily post-class activities scheduled,and you will lose points if not notified the teaching staffs with documentations.

Availability of the Course materials

- Lecture notes, supplement reference materials will be posted in Canvas.
- Scheduled quizzes, Programming assignments, exam materials and your **grades** will be available in **Canvas**.
- I will invite a discord channel to all of you to encourage discussions on course specific topics.

Communication Policy and Discord Discussion Channel

I encourage you use **Canvas** messaging to communicate with the teaching staffs including the instructor. However, there will be a Discord channel available and invitation will be sent during the first week. Before contacting us, please make sure to follow the checklist below:

1. The student first needs to read the syllabus to solve anything s/he might have missed.
2. The student missed a class for which there was no quiz. I do not need to know the exact reason for a missed class. Students with excusable absences are responsible for giving me a note *in legible copy* that documents the reason for the missed class. An e-mail is unnecessary unless the impromptu absence involved missing a quiz or presentation or a demo.
3. The student wants to know what topics s/he missed during a class s/he skipped. The answer is always "you missed what was on the syllabus. It is your responsibility to cover it yourself – the teaching staffs may assist you on that but do not expect a private lecture from any of the staffs."
4. The student is protesting a grade without reference to specific points of objection. See the policy on protesting a grade in the syllabus. These e-mails tend to be expressive utility on the part of the student and do not require a response from me. Students interested in improving their knowledge of material should see me during office hours.
5. The students wants to know how many classes s/he missed at some point during the semester. I assume the student has a better answer to that question than me until the end of the semester.
6. The student is requesting an extension on an assignment for which the syllabus already established the deadline. The answer is always "no".
7. The student is "grade grubbing" or asking to round up a grade, or asking to apply (bell) curve any assignment. The answer is always "no".

Make-Up Policy

There are **NO** make-ups for missed quizzes, exams, assignments or projects unless you have a `reasonable` issue to talk to the instructor beforehand and take permission.

Semester-wide Project

It is expected to be a **team project** having a minimum of 2 (two) and a maximum of 3 (three) members per team. Graduate students can not pair with any undergraduate student in forming

teams. If you have an exceptional situation regarding team formation, please reach out Dr. B before the proposal submission date.

Team formation with project proposal is expected to happen prior to the proposal submission deadline. There are 3 phases of the semester-wide team project, as marked in the schedule:

1. Project Proposal
2. Project Progress Reporting
3. Project demonstration (presentation) and submission of deliverable including source codes, report, etc..

Homeworks

Homeworks will be your individual work. Each homework is designed to highlight specific and/or aggregate theoretical concepts and practical issues to facilitate your understanding throughout the progression of the course.

All homeworks should be submitted via Canvas. Email/hard-copy submissions will not be accepted.

Everything is due by 11:59pm (MST) on the due date. You can still turn in assignment after the deadline. However, you will lose 1 point per hour after the submission is due, till you get 0. I will not be waiving the late submission penalty unless there was a case of illness or other substantial impediments beyond your control and you notified me in advance.

Quizzes / Class activities

These are daily post-class activities to check both theory (lecture materials) and practical aspects (in the recent homework) covered. Each quiz will not be longer than 20 minutes.

Midterm and Final exams

- The midterm exam is like a checkpoint halfway through the course that helps both students and us, the teaching staffs see how well the material is being learned, so we can adjust and improve before the end of the course.
- The final exam is going to be a comprehensive test at the end of a course, during the final exam week, that measures how well you've learned and can apply everything covered throughout the term.

Both the midterm and final exams will be held in-person in classroom (NORTH-1608)

Grading/Re-grading Policy:

Regrading requests must be made within 7 (seven) consecutive days after we post scores in **Canvas**.

Grades

You are going to receive the formal grades from the set: {A, A-, B+, B, B-, C+, C, C-, D+, D, D-, F, I} according to the following rubric:

Table 1: Grading details

Grade Letter	**Range of your obtained total score,** t
A	$94 \leq t \leq 100$
A-	$90 \leq t < 94$
B+	$87 \leq t < 90$
B	$84 \leq t < 87$
B-	$80 \leq t < 84$
C+	$77 \leq t < 80$
C	$74 \leq t < 77$
C-	$70 \leq t < 74$
D+	$67 \leq t < 70$
D	$64 \leq t < 67$
D-	$60 \leq t < 64$
F	$t < 60$

An incomplete grade (i.e., the grade letter "I") is given only in situations where unexpected emergencies prevent a student from completing the course and the remaining work can be completed in the following two months. I am the final authority to approve whether you qualify for an incomplete. Incomplete work must be finished in 2 (two) months following the publication of grades. Failure to complete in the alotted time will automatically be recorded as an "F" on your transcript.

Civility

My commitment is to create a climate for learning characterized by respect for each other and the contributions each person makes to class. I ask that you make a similar commitment.

Professionalism

Since mobile devices can be a distraction during class, I ask that all devices be put into "silent" mode and not utilized during class; this includes checking Facebook, sending a Tweet, or checking email. If I feel that you or your mobile device is becoming a distraction for either other students, or myself I will ask you to leave the classroom.

Academic Policy and Student Honor Code and a note on collaboration and Cheating

A university's reputation is built on a standing tradition of excellence and scholastic integrity. As members of the CU Denver academic community, faculty and students accept the responsibility to maintain the highest standards of intellectual honesty and ethical conduct in completing all forms of academic work associated with the University. Education at CU Denver is conducted under the honor system. All students entering an academic program should have developed the qualities of honesty and integrity, and each student should apply these principles to his or her academic and subsequent professional career. All students are expected to achieve a level of maturity which is reflected by appropriate conduct at all times.

Students are thereby expected to know, understand, and comply with the ethical standards of the university, including rules against plagiarism, cheating, fabrication and falsification, multiple submissions, misuse of academic materials, and complicity in academic dishonesty. For more

information on Academic Honesty and the Student Code of Conduct please see: https://www.ucdenver.edu/docs/librariesprovider29/default-document-library/student-honor-code.pdf

I encourage you to review course materials and discuss ideas together for projects and other assignments, and to work on problems you encounter. It is a characteristic of computing that discussions often help to clarify problems and resolve difficulties – feel free to take advantage of this to improve your understanding of the material, and to complete projects, but make sure you create your own work. It's important that you go through the program design, coding, and debugging processes yourself, otherwise you will not be developing your own programming skills and understanding. "Working together" does not mean that one student does the majority of the work and other students put their names on it! If you have any questions about what this means, please see me. Every student must create their own work on their own!

Here are few examples of conduct that will be regarded as being in violation of the Student Honor Code including but not limited to:

1. Copying from another's assessment submission or allowing another to copy from one's own submission
2. Plagiarism in any shape or form. Plagiarism is defined as the use, without giving reasonable and appropriate credit to or acknowledging the author or source, of another person's original work, whether such work is made up of code, formulas, ideas, language, research, strategies, writing or other form(s).
3. Hiring anybody else other than yourself (including a business, a friend, or a teaching staff) for preparing and/or submitting work for this course.

Consequences of violating the honor code

Most student disciplinary cases have involved Honor Code violations. Of these, most cases arise when a student submits another's work as his or her own, gives or receives not-permitted aid, or engages in unauthorized collaboration. If a violation occurs during a quiz or on an assignment, the student will receive a zero for that quiz or assignment. The standard penalty for a first offense may include suspension from the College of Engineering, Design and Computing (CEDC) for a severe infraction of the Honor Code. The penalty for a second violation will be expulsion from the University.

University Accessibility Policy

Federal law mandates the provision of services at the university-level to qualified students with disabilities. The University of Colorado Denver is committed to providing reasonable accommodation and access to programs and services to persons with disabilities. Students with disabilities who want academic accommodations must register with Disability Resources and Services (DRS) in Student Commons Building, Suite 2116, Phone: 303-315-3510, TTY: 303-556-4766, Fax: 303315-5315. I will be happy to provide you with approval for such accommodations, once you provide me with a copy of DRS's letter. DRS requires students to provide current and adequate documentation of their disabilities. Once a student has registered with DRS, DRS will review the documentation and assess the student's request for academic accommodations in light of the documentation. DRS will then provide the student with a letter indicating which academic accommodations have been approved. For further details, see: DRS website.

Academic Freedom

Freedom of expression, as guaranteed under the First Amendment, and academic freedom, as defined by the University of Colorado Laws of the Regents, while distinctly separate concepts, are central to CU Denver's academic mission and underlie our community values of respect, civility and inclusion. I expect everyone on board in this course will respective to each other's comments, ideas during throughout the semester. For details, see: https://www1.ucdenver.edu/free-expression

Family Educational Rights and Privacy Act (FERPA)

FERPA deals specifically with the education records of students, affording them certain rights with respect to those records. FERPA gives students who reach the age of 18 or who attend a post-secondary institution the right to inspect and review their own education records. Furthermore, the right to request amendment of records and to have some control over the disclosure of personally identifiable information from these records, shift from the parent to the students at this time. FERPA applies to the education records of persons who are or have been in attendance in post-secondary institutions, including students in cooperative and correspondence study programs, video conference, satellite, internet, or other electronic forms. FERPA does not apply to records of applicants for admission who are denied acceptance or, if accepted, do not attend an institution. For further details, please see: https://www.ucdenver.edu/registrar/student-resources/ferpa

Discrimination and Harassment Policy and Procedures

Unlawful discrimination and harassment has no place on the CU Denver | CU Anschutz Campus and it offends the University's core values, including a commitment to equal opportunity and inclusion. All University employees, faculty members, students and community members are expected to join with and uphold this commitment. For further details, please see: CU Denver Office of Equity

Grade Appeal Policy

The School of Education and Human Development houses the Student Committee (SC) whose purpose is to review students' academic appeals regarding retention, disenrollment, dismissal and other academic matters such as grade appeal, academic dishonesty, or honor code issues. For details, please see: Academic Appeals Processes

Ad-hoc policy

- It is the responsibility of the student to seek clarification from the instructor when in doubt about these course-policy and guidelines mentioned in the syllabus.
- Being absent in a class does not exclude you from the topic covered in that particular class.
- Class schedule found below with this syllabus, and also in the course website and in Canvas might change **with either in-class or canvas announcements**. It is also the student's responsibility to keep up with the changes and the announcements.

Class Schedule

Important: class schedule is subject to change, contingent on mitigating circumstances and the progress we make as a class. Students are encouraged to attend lectures and check *Canvas* for updates.

Table 2: Tentative Course Schedule

Class	Topic	Task
08/19 Tue	Introduction	Q1
08/21 Thu	Round 1: Machine Learning (ML) Preliminaries	Q2
08/26 Tue	Round 1: ML Preliminaries	Q3
08/28 Thu	Round 1: Artificial Neural Networks (ANN)	Q4
09/02 Tue	Round 1: ANN	HW1 due; Q5
09/04 Thu	Round 1: Convolution Neural Networks (CNN)	Q6
09/09 Tue	Round 1: CNN	Project Proposal due; Q7
09/11 Thu	Round 1: Recurrent Neural Networks (RNN)	Q8
09/16 Tue	Round 1: RNN	Q9
09/18 Thu	Round 1: Generative Adversarial Networks (GAN)	Q10
09/23 Tue	Round 1: GAN	HW2 due; Q11
09/25 Thu	Round 1: Transformers	Q12
09/30 Tue	Round 1: Transformers	Q13
10/02 Thu	Round 1: Reinforcement Learning	Q14
10/07 Tue	Round 1: Reinforcement Learning	Q15
10/09 Thu	Round 2: ML Preliminaries	Q16
10/14 Tue	Midterm	Midterm
10/16 Thu	Round 2: CNN	HW3 due; Q17
10/21 Tue	Round 2: CNN	Project Progress due;Q18
10/23 Thu	Round 2: RNN	Q19
10/28 Tue	Round 2: RNN	Q20
10/30 Thu	Round 2: GAN	Q21
11/04 Tue	Round 2: GAN	HW-4 due; Q22
11/06 Thu	Round 2: Transformers	Q23
11/11 Tue	Round 2: Transformers	Q24
11/13 Thu	Round 2: Reinforcement Learning	Q25
11/18 Tue	Round 2: Reinforcement Learning	Q26
11/20 Thu	Selected Topics	Q27
11/25 Tue	Fall Break – no class	
11/27 Thu	Fall Break – no class	
12/02 Tue	Selected topics	HW-5 due; Q28
12/04 Thu	Selected topics	Q29
12/09 Tue	Finals Week – No class	Project presentation+deliverables due
12/11 Thu	Final Exam	Final Exam
12/12 Fri	Online Submission	Project peer-reviews due