Syllabus Overview

CSE 4311 –Neural Networks and Deep Learning
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Getting Started

- Bookmark the course website:

`https://athitsos.utasites.cloud/courses/cse4311_spring2025/`

  – This link is posted on Canvas and on my home page.

- The course website will be the main source of information for this class.

  – The schedule and lecture slides are available on the "Schedule and Lecture Slides" link.

  – Assignments are available on the "Assignments" link.

- Canvas will only be used for assignment submissions.

Syllabus

- A link to the syllabus is posted on Canvas.

- There are detailed policies on grading, submissions, etc.

- **You are responsible for reading and understanding what the syllabus says.**

- **Do not ask for exceptions from any syllabus policy.**

- If you did not read, or did not understand the syllabus, you are responsible for the consequences.
  - See comments later on getting ready for the real world.

Hybrid Modality

- You can attend any lecture in person, at GACB 105, or online using Teams or Echo360.

- Video recordings of all lectures will be available for offline review.

- Attendance is optional, but live attendance is strongly encouraged.

About the Course

- This course is an introduction to neural networks and deep learning.

- Objectives:
  - Cover basic theory explaining:
    - How neural networks work.
    - How different types of networks (fully connected, convolutional, recurrent, etc) differ from each other, and why.
  - Cover practical issues and real-world applications.
    - Tensorflow and Keras for quick software development.

- We will try to keep a balance between theory and practice.
  - In assignments 2 and 3, you will implement simple neural networks from scratch. That demonstrates understanding of basic algorithms, and ability to modify everything as needed.
  - In subsequent assignments, you will be using Tensorflow and Keras, which are widely used programming libraries for deep learning.

About the Course

- Expectations:
  - Calculus (derivatives, integrals).
  - Linear algebra (vector and matrix operations).
  - Solid algorithmic background.
  - Solid programming background.

Expectations: Calculus

- Neural network algorithms rely heavily on calculus.
  - Neural networks are a really good example of how calculus is used (and makes a difference) in the real world.

- Familiarity with derivatives is required for this class.

Expectations: Algorithms and Linear Algebra.

- You should be able to analyze the space and time complexity of various algorithms.
  - You are expected to understand big-Oh notation (and Theta notation, Omega notation, etc).

- You are expected to understand and be able to use/implement basic data structures:
  - linked lists, priority queues, trees, graphs.

- You should be familiar with matrix operations.

- Prerequisites:
  - CSE 3318 (algorithms).
  - CSE 3380 or Math 3330 (linear algebra).

Expectations: Programming

- You are expected to be expert programmers.
- Being expert programmers means (among other things) that:
  - You have no trouble converting pseudocode to real code.
  - You can debug your own code.
- No programming or debugging help will be offered in this class.
- Programming assignments should be done in Python, and run on Google Colab.

More on Programming

- Based on past experiences, it is important to doublecheck that students have the appropriate theoretical and programming background.

- Hence, assignment 1.

- A few examples of absolutely basic skills that students taking this class should be experts on:
  - Writing functions and structuring programs modularly.
  - Searching and manipulating multidimensional arrays.
  - Debugging using unit testing.

Assignment 1

- Will be posted on Canvas soon.
  - Due Thursday next week.

- Assignment 1 is there to verify that you have an adequate knowledge of the required background in calculus, algorithms, and linear algebra.
  - If you have the right background, the tasks should be extremely easy.

- If you do not have the right background, the assignment gives you an early warning, and an opportunity to do something about it:
  - Review the material.
  - Discuss with the instructor how to better prepare.
  - Drop the class if you find it necessary.

Theory, Practice, Industry, Research

- Different students may be more or less interested in different aspects of deep learning.
  - Most graduates get jobs in industry, where practical skills are heavily used.
    - Typically, the key question to answer is **how**: how can we get something done.
  - Some graduates move on to graduate school, and possibly to research careers. Understanding the theory is important for more advanced studies and research.
    - Typically, the key question here is **why**: why are things done in a certain way and not other ways? What is the intuition/rationale/mathematical proof/algorithmic justification?
- We will keep a balance, with more emphasis on practice, but also covering some of the basic theory in the first few weeks.

Preparing for the Real World

- A key goal of this course is to prepare, to the extent possible, students for professional life in the real world.

- In the real world there are rules and responsibilities.
    - You are responsible for understanding the rules and carrying out your responsibilities.

- In the real world, your supervisors and your customers care about you getting the job done.
    - Your evaluations will depend on the quality of your work.
    - If you do not get the job done, the reasons or excuses for that may not matter much to your supervisors and customers.

Grading

- Grades depend on seven assignments and two midterm exams.
  - 70%: assignments
  - 30%: midterm exams

- No homework or exam scores will be dropped.
  - Exception: for people who would earn a B, C, or D based on their assignment scores, their exam scores will be dropped if they would lower the grade.

- Little extra credit will be given.
  - Any extra credit will be given to all students.
  - Do not ask for individual extra credit opportunities to improve your grade.

- No make-up work will be given to individuals who want a better grade.

Grading

- Grading is based on performance.
  - 90% = A, 80% = B, 70% = C, 60% = D.
- Grading criteria do **not** include:
  - Effort.
  - Class participation.
  - What grade you need to qualify for financial aid, for a job, for graduation, etc.
- **All requests for leniency in grading will be ignored, as they are essentially requests to violate the official course syllabus.**

Grading - FAQ

- (Towards the end of the semester) I would like a grade of X, but I am afraid I may get a grade of Y. What can I do?
  - Answer: Make sure your assignment/exam scores exceed the threshold for grade X. If not, nothing else can be done.

- (At the end of the semester) I REALLY need a grade of X, but I got a grade of Y, which will cost me my ____ (fill in any choice of: job, financial aid, 4.0 GPA, self esteem...). Can I get bumped up? Or, can I get make-up work? Or, extra credit work? Or something?
  - Answer: No.

Grading - Recap

- If your goal is an easy A (or an easy B, or an easy C), this may not be the right class for you.

- If your goal is a light course load, this may not be the right class for you.

- This is one of the most advanced courses we offer.
  - You decide if you want to take it.

- Machine learning has become an extremely important computer science area.

- The goal is to train students to be competitive for the most demanding machine learning jobs out there.
  - This goal is not compatible with either easy grading or light workload.

Assignments

- You must submit on Canvas.

- Late penalty: 1 point per hour.
  - No exceptions, except for medical/personal emergencies documented in writing.
  - Network/computer crashes will not be accepted as an excuse.

- Every semester, some people get 0 in an assignment (or more), because they submitted the wrong file(s).
  - Then they ask for leniency, because they did all the work, and just made a silly mistake in submitting.
  - Unfortunately, there can be no leniency on this issue.
    - Otherwise, everyone can use the same excuse at any time.
  - Please verify your submission every time.

Regarding Submission Problems

- If, for whatever reason, you cannot submit on Canvas, then you can send us your assignment by e-mail.

- In that case, e-mail (**before the deadline)** your submission files to me and to the teaching assistant.

  - If you e-mail us after the deadline, you still get the late penalty.

- Use your UTA e-mail, so that you can prove that you sent your message on time.

- Check with us ASAP to make sure we received your e-mail.

- You will still need to provide ASAP very convincing documentation that you really had problems with Canvas.

Assignment Resubmission Policy

- Students can resubmit any assignment on Canvas until the end of Tuesday, April 29.

- **For the purposes of making an A for the semester, the resubmission will NOT be considered.**
  - A-level performance should mean getting it right the first time.

- For the purposes of making a B, C or D for the semester, the resubmission score will **replace** the original submission score.

- Overall rationale:
  - Maintain high standards for making an A for the semester.
  - Give students more opportunities and help to catch up and pass the class.

Attendance

- You have to attend the exams in person, or you will receive a score of 0.

- You do not have to attend other lectures.

- However, if you do not attend lectures, you are still responsible for understanding the material.
  - Do not expect a private lecture during office hours or by e-mail.

Class Participation

- Class participation is not part of the grading criteria.

- However: asking questions, and trying to answer questions, can help you in understanding the material.

  - If you have questions and you do not ask in class, where are you going to get the answers?

- If you do not understand something, always feel free to raise your hand and ask a question, or type in the question as a chat message on Teams.

Getting Help (1)

- The teaching assistant and myself are available for help.

- Feel free to use our office hours.

- Feel free to send e-mails with your questions.

- If you send us an e-mail, always CC the TA and me, to maximize chances of getting a reply fast.

- **Do not expect responses to frantic queries in the last minutes/hours before an assignment is due**.
  - If you send us assignment-related questions the day that the assignment is due, we may not manage to respond to you before the deadline.
  - The earlier you start, the more chances you will have to ask questions, and to get your questions answered.

- **You should start each assignment at least a week in advance.**

Getting Help (2)

- The instructor and TA duties do **<u>not</u>** include programming help and debugging.
  - (See comments earlier on preparing students for the real world outside the university.)
  - Obviously, if we can spot a bug easily, we will be happy to help.
  - Also, we will be happy to provide suggestions that can help with debugging.
  - However, typically it is not feasible to spot bugs without spending significant time. So, it is not that we do not want to help, but that (usually) we cannot.

Using Existing Libraries/Tools (1)

- Every semester, I get many questions of the type:
  - "Can I use this existing library/tool for the assignment"?

- Answer: I do not know. Use at your own risk.
  - Exceptions: Keras and Tensorflow are mandatory starting with assignment 4. The numpy library will also be used extensively.

- Assignments specify that you need to implement specific methods and report specific results.
  - Instructions for how to implement those specific methods are provided on the assignment page and on the course slides.

- Existing libraries/tools (beyond Keras, Tensorflow, numpy) may implement variations that, while reasonable and useful, do not match the specifications on the assignment.
  - If that happens, it will count as wrong.

Using Existing Libraries/Tools (2)

- If you use existing libraries/tools/code:
  - If your output complies exactly to the assignment specifications, great!
  - If not, it will count as wrong. Do not blame the library or tool, you made the choice to use it.
  - The teaching assistant and I will not spend time to check if your proposed library/tool complies with the assignment specifications. We do not recommend the usage of such tools anyway, so we have no reason to help you do it.

Assignment-Related Questions

- Assignments are used to evaluate performance.

- You are free to ask any assignment-related question, at any time, but we may not give an answer.
  - Before the deadline, we may not answer some questions, if we judge that figuring out those answers is part of your evaluation for that assignment.
  - After the deadline, we will answer (almost) any questions. Remember, you can resubmit assignments for which you got poor grades.

- Overall, you should always feel free to ask a question.
  - Sometimes, instructions or slides may have an ambiguity. Your questions can help us identify and resolve such ambiguities.
  - If in doubt, ask. If we feel that we can only answer after the deadline, we will let you know. We will never hold it against you that you asked a question.

Electronic Communication

- Please use your UTA e-mail for electronic communication with the instructor and the teaching assistant.

- You can also use chat messages on Microsoft Teams.

- We do not monitor any other means of communication (Canvas, MyMav, …).
  - If you make comments on Canvas, we will assume that they are notes to yourself.

Grades vs. Learning

- Making an A does not mean that there is nothing else to learn.

- I would encourage everyone to engage with the material, ask questions, think about the topics, identify plusses and minuses of the methods we are learning.

- To help, I will be posting optional assignments, that will not count towards the grade, not even as extra credit.
  - For students who want to gain a deeper understanding and have the time, these optional assignments will be a great starting point.