Carnegie Mellon University

17644: Applied Deep Learning

Tues & Thurs, 8:00AM to 9:20AM Location: 300 S. Craig St., Room 265

Semester: Spring (Mini 4) **Year:** 2025

Units: 6 **Section(s):** A4 / D4 / Lecture 44

Instructor information

Name	Dr. Clarence Worrell (Clarence)
Contact Info	cworrell@andrew.cmu.edu
Office location	Zoom
Office hours	By Appointment

TA Information [If applicable]

TA name	Tushar Nayak
TA Contact Info	tusharn@andrew.cmu.edu
Office location	Zoom
Office hours	By Appointment

Course Description

Deep neural networks have made in-roads in virtually every industry, propelled by exponential increases in compute power and fundamental progress in modeling. Knowledge of these models is fast becoming a key asset for software engineers, as current systems are quickly starting to include many neural components, and the practice of software engineering itself is starting to benefit from neural program assistance (incl. automated bug finding, translation between programming languages). This course equips the next generation of software engineers with knowledge of neural models, the software engineering challenges involved in using these, and hands-on experience with their applications. It teaches both a rich vocabulary of general, essential concepts (including architectures), and recent work on applications of these models, aimed primarily at applications for and in software engineering itself. The course includes a hands-on deep learning project aimed that will be used to teach the various stages (and their pitfalls) of building and deploying deep learners.

Prior Knowledge

Basic knowledge of programming (especially Python) and software engineering concepts. Familiarity with basic machine learning concepts.

Learning Objectives

- Assess the deep learning needs and options in a variety of real-world problem settings
- Construct datasets and training pipelines that effectively meet performance targets
- Accurately and realistically evaluate model performance and validity

Learning Resources

- There are no required textbooks for this course
- Course readings will consist of readings from publicly available sources and/or the CMU library system
- Students will need access to a personal computer, an internet browser, and basic productivity software
- No special equipment or software will need to be purchased for this course

Tentative Schedule

Lecture	Topic
1	Introduction
2	Single Neuron
3	Feedforward Neural Networks
4	Regularization
5	Optimizers & Hyperparameter Tuning
6	Computer Vision
7	Text & NLP
8	Time Series
9	Generative Deep Learning
10	Guest Presenters
11	Case Study 1
12	Case Study 2
13	Student Final Presentations
14	Student Final Presentations

Assessments

Assessment	Percentage of Final Grade
Assignment 1	15%
Assignment 2	15%
Assignment 3	15%
Assignment 4	15%
Assignment 5	15%
Project Report & Presentation	25%

Final course grades will be calculated using the following categories (see note on attendance below):

Grade	Percentage Interval
A+	98-100%
A	92-97%
A-	90-91%
B+	88-89%
B	82-87%
B-	80-81%
C+	78-79%
C	72-77%
C-	70-71%
D	65-69%
R (F)	0-59%

Course Policies

- **Attendance & Participation**: Attendance is required for this course. Please contact your instructor if you are unable to attend class.
- **Late-work policy**: Late work will be accepted with the following conditions:
  -Work submitted 24 hours or less past the original due date & time will be accepted with no penalty
  -Work submitted more than 24 hours past the original due date & time will be accepted with a 10% penalty for up to 5 days (120 hours) past the original due date & time
  -Work will not be accepted more than 5 days (120 hours) past the original due date & time
- **Laptops & Mobile Devices:** Students are permitted to use laptops and mobile devices during class sessions, such as for note-taking purposes. Please ensure audio sounds are muted so as not to disturb the class. Some class activities may benefit from students having laptops & mobile devices, such as for referring to online sources, but laptops & mobile devices will never be required to have during class sessions.

- **Re-grade policy:** Students may request a re-grade within one week from the date the graded assignment is returned to students. If requesting a regrade, students should be prepared to make a compelling argument as to why the original grade needs to be reconsidered. *The student should discuss the grade with the TA first before requesting instructor re-grade*. The process for requesting an instructor re-grade is to email the instructor with the request within one week from the date the graded assignment is returned. The instructor and student(s) will then decide on a mutually agreeable time and place to discuss the assignment.
- **Hacking & Criminal Activity:** Assignments for this course will involve topics surrounding cybersecurity of AI & ML systems. No one should engage in criminal activity, cyber hacking, or other illegal/improper methods for the course requirements.

Statement on Inclusivity

We must treat every individual with respect. We are diverse in many ways, and this diversity is fundamental to building and maintaining an equitable and inclusive campus community. Diversity can refer to multiple ways that we identify ourselves, including but not limited to race, color, national origin, language, sex, disability, age, sexual orientation, gender identity, religion, creed, ancestry, belief, veteran status, or genetic information. Each of these diverse identities, along with many others not mentioned here, shape the perspectives our students, faculty, and staff bring to our campus. We, at CMU, will work to promote diversity, equity and inclusion not only because diversity fuels excellence and innovation, but because we want to pursue justice. We acknowledge our imperfections while we also fully commit to the work, inside and outside of our classrooms, of building and sustaining a campus community that increasingly embraces these core values.
Each of us is responsible for creating a safer, more inclusive environment.
Unfortunately, incidents of bias or discrimination do occur, whether intentional or unintentional. They contribute to creating an unwelcoming environment for individuals and groups at the university. Therefore, the university encourages anyone who experiences or observes unfair or hostile treatment on the basis of identity to speak out for justice and support, within the moment of the incident or after the incident has passed. Anyone can share these experiences using the following resources:

- **Center for Student Diversity and Inclusion:** csdi@andrew.cmu.edu, (412) 268-2150
- **Report-It online anonymous reporting platform:** reportit.net username**:** *tartans* password**:** *plaid*

All reports will be documented and deliberated to determine if there should be any following actions. Regardless of incident type, the university will use all shared experiences to transform our campus climate to be more equitable and just.

Student Wellness

As a student, you may experience a range of challenges that can interfere with learning, such as strained relationships, increased anxiety, substance use, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may diminish your academic performance and/or reduce your ability to participate in daily activities. CMU services are available, and treatment does work. You can learn more about confidential mental health services available on campus at: http://www.cmu.edu/counseling/. Support is always available (24/7) from Counseling and Psychological Services: 412-268-2922.

Food Insecurity

If you are worried about affording food or feeling insecure about food, there are resources on campus that can help. Email the CMU Food Pantry Coordinator to schedule an appointment:
Pantry Coordinator
cmu-pantry@andrew.cmu.edu
412-268-8704 (SLICE office)

Accommodations for Students with Disabilities

If you have a disability and have an accommodations letter from the Disability Resources office, I encourage you to discuss your accommodations and needs with me as early in the semester as possible. I will work with you to

ensure that accommodations are provided as appropriate. If you suspect that you may have a disability and would benefit from accommodations but are not yet registered with the Office of Disability Resources, I encourage you to contact them at access@andrew.cmu.edu.

Academic Integrity

Honesty and transparency are important features of good scholarship. On the flip side, plagiarism and cheating are serious academic offenses with serious consequences. If you are discovered engaging in either behavior in this course, you will earn a failing grade on the assignment in question, and further disciplinary action may be taken. For a clear description of what counts as plagiarism, cheating, and/or the use of unauthorized sources, please see the University's Policy on Academic Integrity (revised in April 2013): http://www.cmu.edu/policies/documents/Academic Integrity.htm

Recording of Class Sessions

For this course, I do not intend to record class sessions. However, circumstances may arise where this policy is changed and all or some class sessions are recorded. If a class session is being recorded, students will be notified as soon as practical, and the recording will be made available to all students. In the event one or more class sessions is recorded, the following policy applies:

Class recordings are for your personal, educational use. Recordings of class sessions are covered under the **Family Educational Rights and Privacy Act (FERPA)** and must *not* be shared with anyone outside your course-section. The purpose of these recordings is so students in this course (and only students in this course) can watch or re-watch past class sessions. Feel free to use the recordings if you would like to review something we discussed in class or if you are temporarily unable to attend class.

SASC Resources

SASC programs to support student learning include the following (program titles link to webpages):

- **Academic Coaching** – This program provides holistic, one-on-one peer support and group workshops to help undergraduate and graduate students implement habits for success. Academic Coaching assists students with time management, productive learning and study habits, organization, stress management, and other skills. Request an initial consultation here.
- **Peer Tutoring** – Peer Tutoring is offered in two formats for students seeking support related to their coursework. Drop-In tutoring targets our highest demand courses through regularly scheduled open tutoring sessions during the fall and spring semesters. Tutoring by appointment consists of ongoing individualized and small group sessions. You can utilize tutoring to discuss course related content, clarify and ask questions, and work through practice problems. Visit the webpage to see courses currently being supported by Peer Tutoring.
- **Communication Support** – Communication Support offers free one-on-one communication consulting as well as group workshops to support strong written, oral, and visual communication in texts including IMRaD and thesis-driven essays, data-driven reports, oral presentations, posters and visual design, advanced research, application materials, grant proposals, business and public policy documents, data visualisation, and team projects. Appointments are available to undergraduate and graduate students from any discipline at CMU. Schedule an appointment (in-person or video), attend a workshop, or consult handouts or videos to strengthen communication skills.
- **Language and Cross-Cultural Support** – This program supports students seeking help with language and cross-cultural skills for academic and professional success through individual and group sessions. Students can get assistance with writing academic emails, learning expectations and strategies for clear academic writing, pronunciation, grammar, fluency, and more. Make an appointment with a Language Development Specialist to get individualized coaching.

Use of Generative AI

Certain assignments in this course will permit or even encourage the use of generative artificial intelligence (AI) tools, such as ChatGPT. When AI use is permissible, it will be clearly stated in the assignment prompt

posted in Canvas. Otherwise, the default is that use of generative AI is disallowed. In assignments where generative AI tools are allowed, their use must be appropriately acknowledged and cited. For instance, if you generated the whole document through ChatGPT and edited it for accuracy, your submitted work would need to include a note such as “I generated this work through Chat GPT and edited the content for accuracy.” Paraphrasing or quoting smaller samples of AI generated content must be appropriately acknowledged and cited, following the guidelines established by the APA Style Guide. It is each student’s responsibility to assess the validity and applicability of any AI output that is submitted. You may not earn full credit if inaccurate on invalid information is found in your work. Deviations from the guidelines above will be considered violations of CMU’s academic integrity policy. Note that expectations for “plagiarism, cheating, and acceptable assistance” on student work may vary across your courses and instructors. Please email me if you have questions regarding what is permissible and not for a particular course or assignment.