Welcome to EEP 596! Autumn 24

Welcome to EEP 596 "Practical Introduction to Deep Learning Applications and Theory"! This is a graduate level course aiming to provide **fundamental skills, concepts, and applications of deep learning** and neural networks for the investigation of complex datasets with heavy emphasis on hands-on practices.

Learning Goal

Understand fundamentals of artificial neural networks (ANN) and their underlying principles making them generic computing frameworks.

Build computational skills for training such networks by understanding and working with algorithms such as stochastic gradient descent, Adam, Dropout, initialization etc.

Survey different types of ANN models to learn their strengths, limitations and apply them to a variety of real-world applications.

Prerequisites

Theoretical aspects
Multi-variable calculus, Linear Algebra, Statistics and Probability Theory.

Practical aspects
Basic knowledge of computer science and Python programming skills.

Schedule

W 6:00 – 9:50 PM (ECE 037)

Instruction Team

Instructor: Jimin Kim (jk55@uw.edu) (Google Scholar)
TA: Yang (Caleb) Zheng (zheng94@uw.edu) (Google Scholar.)

Syllabus (Tentative)

Week	Subject	Lecture (Theory)	Lecture (Lab)	Assignment Due
0 (09/25)	Deep Learning fundamentals and Feed-forward Networks	IntroductionLinks to an external site.	Python basics, NumPy,Links to an external site. Data processingLinks to an external site.	

1 (10/02)		Regression and ClassificationLinks to an external site.	Introduction to PyTorch, RegressionLinks to an external site.	Lab 1
2 (10/09)		Optimizations in Deep Learning, MLPLinks to an external site.	MLPs in PyTorch, ClassificationLinks to an external site.	Lab 2 Quiz 1
3 (10/16)		Convolutional Neural NetworksLinks to an external site.	CNNs in PyTorch, Image classificationLinks to an external site.	Lab 3 Quiz 2
4 (10/23)	Sequence Models	Recurrent Neural NetworksLinks to an external site.	Vanilla RNNs in PyTorch, Sequence modelingLinks to an external site.	Lab 4 Quiz 3
5 (10/30)		Advanced RNNs (LSTM, GRU, Encoder-Decoder)Links to an external site.	Encoder-Decoder in PyTorch. Time-series processingLinks to an external site.	Lab 5 Quiz 4
6 (11/06)	Generative Models	Generative Adversarial Network (GAN)Links to an external site.	GANs in PyTorch, Image generationLinks to an external site.	Lab 6 Quiz 5
7 (11/13)		Attention and TransformerLinks to an external site.	Transformers in PyTorchLinks to an external site.	Lab 7 Quiz 6
8 (11/20)	Advanced Model (TBA)	Advanced Topics (TBA)	Preparing final project	Lab 8 Quiz 7
9 (11/27)	Final Project	Thanksgiving Break		Project Plan
10 (12/04)		Selected project (Mid-project Feedback)	Selected project	
11 (12/11)		Project Presentation		Project Codebase

Activities & Grading

The activities are aligned with the designation of the course as 4 academic credits and time investment of 3-4 hours per credit, i.e., 12-16 weekly hours. For a detailed schedule of activities, please see the Syllabus page.

Grading scale for each activity is divided as follows:

(i) Canvas Quiz (Individual, weekly): 20%

Quizzes consist of several critical questions selected for providing theoretical concept feedback. Your first round of answers must be submitted **before** the Wednesday class. After quiz discussion during lecture, you will be given an opportunity submit final answers by **end of Wednesday**, which will be graded.

(ii) Lab Assignments (Individual, weekly): 40%

Each lab report is evaluated on 1) Task completion, 2) Code Organization, and 3) Code Documentation.

(iii) Final Project (Oral presentation, Individual/Team): 40%

Final project is evaluated on 1) Project Planning, 2) Oral Presentation and 3) Project Codebase

Course Materials

Each lab consists of following 4 files

1) Lecture slides (.pdf, Panopto video)
2) Lab slides (.pdf, Panopto video)
2) Lab examples (.ipynb) (Jupyter Notebook with all the examples covered in the lab portion of the lecture)
3) Lab report starter files (.ipynb) (A template Jupyter Notebook for the lab assignment)

We will post lab materials on Canvas (in the Assignments folder) generally on every Sunday.

Additional Resources

Python Programming

1. Python Programming and Numerical Methods: A Guide for Engineers and ScientistsLinks to an external site. by Berkeley.

Deep Learning

1. *Deep learning* (Links to an external site.) by Ian Goodfellow, Yoshua Bengio, and Aaron Courville (theory and concepts; available online)

2. *Neural Networks and Deep Learning* (Links to an external site.) by Michael Nielsen (concepts and examples; online book)
3. *Deep Learning with Python* by Francois Chollet (learning through examples; Keras)

Practical Deep Learning

1. Machine Learning Yearning (Links to an external site.) by Andrew Ng (practical concepts; available online)
2. *Hands-On Machine Learning with Scikit-Learn and TensorFlow* by Aurélien Géron *(ML and Tensorflow)*
3. *TensorFlow Deep Learning Cookbook* by Antonio Gulli and Amita Kapoor *(cookbook examples)*

Machine Learning

1. *A Course in Machine Learning (Links to an external site.)* by Hal Daume III (Introduction; available online)
2. *Machine Learning: A Probabilistic Perspective* by Kevin Murphy (Extensive text)

Course Policies

Missing a Wednesday lecture session

You won't be penalized for missing a Wednesday lecture, but you will lose an opportunity to discuss the canvas quiz answers and lab introduction of that week with the instruction team.

Late quiz submission

Initial answers - Any quiz question that is left unanswered, makes no sense or doesn't answer the question being asked is considered incomplete and won't receive a completion score.

Final answers - Only your final answers before the due date will be considered for grading. Modification to your answers after the final due date will not be accepted.

Lab report guidelines

For tips regarding forming your lab report, see the lab report guideline

Late lab report submission

We will deduct -2pts from the lab report score for each day late.

Academic Integrity

We expect each student in this course to abide by the University of Washington Student Code of Conduct. The lab report must be the your individual work. Copying code or results made by another student or letting others copy your code/results is cheating. We will monitor for cheating and will resolve all cheating cases in accordance with College

of Engineering and University policy - which may result in failure of the course and/or eventual expulsion from the university. The use of outside sources must be cited appropriately.

Accessibility

We endeavor to make the course welcoming and accessible to all students. Standard accessibility requests will be handled through DRS.

Washington state law requires that UW develop a policy for the accommodation of student absences or significant hardship due to reasons of faith or conscience, or for organized religious activities. The UW's policy, including more information about how to request an accommodation, is available at Religious Accommodations Policy (https://registrar.washington.edu/staffandfaculty/religious-accommodations-policy/ (Links to an external site.)). Accommodations must be requested within the first two weeks of this course using the Religious Accommodations Request form (https://registrar.washington.edu/students/religious-accommodations-request/ (Links to an external site.)).

Other Policies:

Religious Accommodations: Washington state law requires that UW develop a policy for the accommodation of student absences or significant hardship due to reasons of faith or conscience, or for organized religious activities. The UW's policy, including more information about how to request an accommodation, is available at Religious Accommodations Policy (https://registrar.washington.edu/staffandfaculty/religious-accommodations-policy/ (Links to an external site.)). Accommodations must be requested within the first two weeks of this course using the Religious Accommodations Request form (https://registrar.washington.edu/students/religious-accommodations-request/ (Links to an external site.)).

Accommodations for students with disabilities: In compliance with the University of Washington policy and equal access laws, the course Instructor is available to discuss appropriate academic accommodations that may be required for students with disabilities. Requests for academic accommodations are to be made during the first three weeks of the quarter, except for unusual circumstances, so arrangements can be made. Students are encouraged to register with Student Disability Services to verify their eligibility for appropriate accommodations.

COVID-19 Health and Safety:

EH&S has made a number of changes to the COVID guidelines to bring it up to date with the CDC recommendations. If you have any questions, please take some time to review the information found in the following links.

- COVID-19 Prevention and Response: https://ehs.washington.edu/covid-19-prevention-and-response/covid-19-health-and-safety (Links to an external site.)
- Quarantine and Isolation: https://ehs.washington.edu/resource/covid-19-public-health-requirements-and-guidance-flowchart-updated-1722-1175 (Links to an external site.)

- Updated Flowchart: https://www.ehs.washington.edu/system/files/resources/COVID-19-public-health-flowchart.pdf (Links to an external site.)

Inclusivity Statement: We understand that our members represent a rich variety of backgrounds and perspectives. The University of Washington is committed to providing an atmosphere for learning that respects diversity. While working together to build this community we ask all members to:

- share their unique experiences, values, and beliefs
- be open to the views of others
- honor the uniqueness of their colleagues
- appreciate the opportunity that we have to learn from each other in this community
- value each other's opinions and communicate in a respectful manner
- keep confidential discussions that the community has of a personal (or professional) nature
- use this opportunity together to discuss ways in which we can create an inclusive environment in this course and across the UW community

Academic Misconduct:
It is essential that students in fulfillment of their academic requirements and in preparation to enter their profession shall adhere to the University of Washington's Student Code of ConductLinks to an external site.. Any student in this course suspected of academic misconduct (e.g., cheating, plagiarism, or falsification) will be reported to the University's Office of Community Standards and Student conduct.

Student code of conduct applies to all mediums in which course activities are held (virtual lectures, discussion meetings, QA sessions, office hours, virtual discussions). In particular, the virtual discussion board is intended for questions and discussions exclusively related to course material. Anonymous posting is not supported and any offensive language toward students or course staff violates the student code of conduct and is to be reported to the Student Code of Conduct council. Communication is for constructive discussion of material and is not a replacement for QA sessions, lectures, and office hours. In particular, the discussion board is NOT intended for asking about problems in your code, Scheduling appointments, Sharing suggestions and impressions of course proceedings. For sharing feedback, we set up an anonymous feedback box and will appreciate any constructive feedback.