NDSU NORTH DAKOTA STATE UNIVERSITY

IME774: Neural Networks (3 credits) 2024 Fall

Class Time:	12:30-1:45pm, TuTh	**Instructor:**	Harun Pirim, PhD
Room:	FLC 120		Work P: 701 231 7285
Web:	Blackboard Ultra		Office: ENG 106
Office Hours:	11:30-12:30, TuTh or by e-mail		e-mail: harun.pirim@ndsu.edu

Text Book:
Simon J.D. Prince, Understanding Deep Learning, MIT press, 2024

Course Description (This will change soon)**:**
(Prerequisites: graduate standing).
Introduction to the parallel processing paradigms that have been developed recently including neuronetworks and genetic algorithms. Students will work on projects using these tools. Cross-listed with PSYC 735 and CSCI 735.

Course Objectives:
Graduate students will be introduced to contemporary topics in neural networks (NNs), with a focus on deep learning. Both shallow and deep NNs will be covered, including matrix notation, loss functions, model fitting, performance measurement, and regularization techniques. The course will also explore Convolutional NNs, transformers, Graph Neural Networks (GNNs), and Generative Adversarial Networks (GANs). Students will learn to distinguish different NN architectures designed for specific data types, such as images and text. Python code will be provided for hands-on experience. Through assignments, presentation and a course project, students will gain practical experience in applying various NN architectures learned throughout the course.

Learning Outcomes:
1- Comprehend the fundamental concepts and architectures of neural networks
2- Model applications for different data types
3- Analyze and evaluate neural network models
4- Design and apply a neural network project to a solve a unique problem

Types of Assessments

Assignments
There will be weekly assignments to help better understand concepts and apply them on some datasets.

Midterm exam
Students will have a computer-based midterm exam in class. Let me know if you do not have a laptop to bring into the classroom. The exam will include all the topics covered.

Presentation
Students will present a recent paper discussing the novelty of the ideas and possible future research extension. Grading rubric will be provided.

Project
The project will require students to apply deep learning to solve a real-world problem. The students can form a group of at most two members. Detailed project description will be posted on Blackboard. The project report will be written as a conference or a journal paper. A grading rubric will be posted on Blackboard.

Grading Policy

An overall course grade will be assigned based on performance using the following:

Course Requirement	Percentage of grade
Assignments	30%
Midterm exam	20%
Presentation	20%
Project	30%

Letter grades will be assigned using a traditional 10 pt scale (e.g., 90 – 100% = A, 80 – 89.999...% = B, 70 – 79.999...% = C, etc.).

NO make-up exams will be given for any reason except university-excused ones.

Tentative** Course Outline:

Week	Topic*	Hrs
1	Introduction	3
2	Mathematics background	3
3	Shallow NNs	3
4	Deep NNs	3
5	Loss functions	3
6	Fitting models	3
7	Gradients and initialization	3
8	Measuring performance	3
9	Regularization	3
10	Convolutional NNs	3
11	Transformers	3
12	Graph NNs	3
13	Generative adversarial networks	3
14	Student presentations	3
15	Student presentations	3

* related files will be provided as necessary, you will also be responsible for all of the course materials
** We may not have time to cover some topics

Important Dates:

Midterm: Oct 17
Presentation dates: Dec 3, 5, 10, 12
Project Report Submission Due: Dec 20

ATTENDANCE STATEMENT

According to NDSU Policy 333 (www.ndsu.edu/fileadmin/policy/333.pdf), attendance in classes is expected. *Pointsolutions* software will be used for attendance. It will be opened at the beginning of the class and closed at the end. NO make-up assignments, tests, and the project will be given for any reason except university-excused ones. See NDSU Policy 333 for faculty and student responsibilities related to attendance, including for university-sponsored activities. Veterans and student service members with special circumstances or who are activated are encouraged to notify the instructor as soon as possible and are encouraged to provide Activation Orders.

STUDENTS WITH SPECIAL NEEDS STATEMENT

Any students with disabilities or other special needs, who need special accommodations in this course, are invited to share these concerns or requests with the instructor and contact the Disability Services Office (www.ndsu.edu/disabilityservices) as soon as possible.

FERPA STATEMENT

Your personally identifiable information and educational records as they relate to this course are subject to FERPA.

ACADEMIC HONESTY STATEMENT

The academic community is operated on the basis of honesty, integrity, and fair play. NDSU Policy 335: Code of Academic Responsibility and Conduct applies to cases in which cheating, plagiarism, or other academic misconduct have occurred in an instructional context. Students found guilty of academic misconduct are subject to penalties, up to and possibly including suspension and/or expulsion. Student academic misconduct records are maintained by the Office of Registration and Records. Informational resources about academic honesty for students and instructional staff members can be found at www.ndsu.edu/academichonesty.

AI USAGE (Generated by GPT4o)

AI tools may be used to assist in understanding concepts, generating ideas, and even writing code. However, the work you submit must be your own. This means that any output from AI tools should be carefully reviewed, understood, and, if necessary, modified to reflect your own understanding and style. If AI tools (e.g., ChatGPT, code generation tools) significantly contribute to your work, you must clearly acknowledge this in your submission. Include a brief statement outlining how AI was used and the extent of its contribution. You are responsible for verifying the accuracy, relevance, and quality of any AI-generated content before including it in your work. Blind reliance on AI outputs without critical evaluation may lead to errors and will not be considered a valid excuse for incorrect results or interpretations. Ensure that your use of AI aligns with ethical standards, including avoiding plagiarism, misrepresentation, and other forms of academic dishonesty. Misuse of AI tools in a manner that violates academic integrity will result in disciplinary action.