Introduction to Deep Learning

CS/CE 316/365 L1

Fall Semester 2024

[… What we want is a machine that can learn from experience. Alan Turing 1947]

Course Information

Start Date	End Date	Class Location	Meeting Time
Aug 19 2024	Dec 03 2024	GF-E121	Tues Thurs (10:00 AM-11:15 AM)

Hardware/Software Prerequisites (if any): Laptop, headphones with mic, Internet connectivity (support live stream of video), Canvas, MS teams, Acrobat Reader, MS office, Internet browser, Python with related libraries including TensorFlow, Jupyter Notebook , Hacker Rank, LaTeX, etc.
Content Area: Covers CS- Elective

Instructor Information

Instructor: Abdul Samad
Title: Associate Professor
Office Location: E-117
Email: abdul.samad@sse.habib.edu.pk
Office Hours: Wednesday 11:30-12:30 PM and Thursday 11:30-12:30 PM or any other time by appointment

Instructor: Sandesh Kumar
Title: Research Assistant
Office Location: E105
Email: sandesh.kumar@sse.habib.edu.pk
Office Hours: Monday 10 AM to 12 PM and Wednesday 10 AM to 11 AM

Course Description

Deep learning is a key enabler of AI powered technologies being developed across the globe, and it is opening immense economic opportunities in the field of intelligent systems. We need to equip our students to understand and develop these systems. This course will provide a practical introduction to deep learning.

Course Aims

The goal of this course is to give learners understanding of modern neural networks, their applications in different domains such as computer vision, natural language processing, etc. This course aims to provide expertise to develop intelligent systems using deep learning from scratch, using best practices to solve real world problem.

Course Learning Outcomes (CLOs)

By the end of the course, students will be able to:

SLO/CLO	Description	Learning-Domain Level
CLO 1	Understand some basic theory behind deep Neural Networks	Cog-2
CLO 2	Explore the design choices for different parameters of Neural Networks	Cog-4
CLO 3	Develop appropriate deep model, for real world scenarios/problems.	Cog-5

CLO 4	Code in deep learning framework	Cog-1

Mode of Instruction

a. Two synchronous lectures per week will be held during each week. All classes will be of 75 minutes duration. Attendance is compulsory for these classes and students are expected to participate mandatorily. Class participation during these live sessions will also be noted. We will also meet once during each week for the lab session of 3 hours. The policy for the lab is same as that of the lectures.

b. Details of work-hours. Overall, in-class & outside class work-hours (per week) are as follows:

| No	Type of activity	Hours/ week	Total hours (15 weeks)
1	**Lectures:** Synchronous (online or in-person) – contact hours	2.5	37.5
2	**Labs:** Synchronous (online or in-person) – contact hours	3	45
2	Outside classroom preparation	7.5	112.5
	Total Hours	**13**	**195**

Engagement & Participation Rules

a. Norms regarding engagement and participation will be mutually decided during the first lecture.

b. Class participation activities will be shared regularly which will be mandatory to attempt and graded.

c. Do's and Don'ts—would be collectively developed in the first two weeks of classes.

Format and Procedures

1. Submission of assessment in teams/individuals and may be followed up by a viva called by the instructor. Viva will be called as necessary and need not apply to all groups or all assessments.
2. **Contesting marks Concerns regarding a score can be reported up to a week after its release. Concerns raised later cannot be entertained.**
3. **Requests for grace marks for whatever reason will not be entertained and each such request will result in a penalty of 1% of your overall score.**
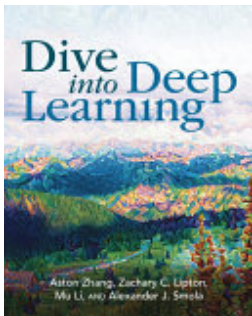
Required Texts and Materials
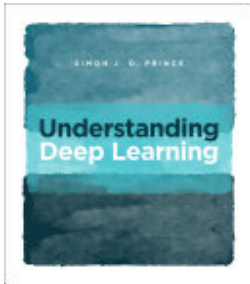
Understanding Deep Learning
ISBN: 9780262377102
Authors: Simon J.D. Prince
Publisher: MIT Press
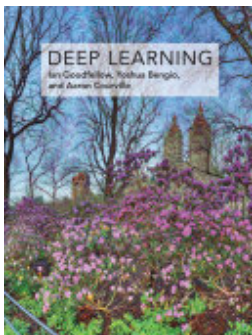Publication Date: 2023-12-05

Dive into Deep Learning
ISBN: 9781009389433
Authors: Aston Zhang, Zachary C. Lipton, Mu Li, Alexander J. Smola
Publisher: Cambridge University Press
Publication Date: 2023-07-31

Optional Materials

Deep Learning
ISBN: 9780262035613
Authors: Ian Goodfellow, Yoshua Bengio, Aaron Courville
Publisher: MIT Press
Publication Date: 2016-11-18

Neural Networks and Deep Learning
Authors: Michael Nelson

Assessments

Assessment type	Frequency	Weight (%)	Remarks
Short 20-30 minute quiz (best 5 out of 6)	6	15	These will mostly be based on the lectures and practice questions from the synchronous

			sessions. Any student can be picked for a random viva for the solutions he has submitted. Failure to explain the solution will result in a file of conduct case and a failure of the course.
Project	1	30	Project (30%) [Rubrics for project will be shared on LMS] Team Size:2-4 Intersection groups are not allowed
Mid-term Exam (written)	1	15%	Any student can be picked for a random viva for the solutions he has submitted. Failure to explain the solution will result in a file of conduct case and a failure of the course.
Lab Exam	1	10%	Offline
Lab Assessments	12	10%	Each lab is worth 1%.
Class-Participation	1	10%	This grade will be assigned based on the submission of class participation activities that are assigned outside of class via LMS.
Lab Quizzes	5	10%	Best 4 will be counted towards grade

Grading Scale

Letter Grade	GPA Points	Percentage
A+	4.00	[95-100]
A	4.00	[90-95)
A-	3.67	[85-90)
B+	3.33	[80-85)
B	3.00	[75-80)
B-	2.67	[70-75)
C+	2.33	[67-70)
C	2.00	[63-67)
C-	1.67	[60-63)
F	0.00	[0, 60)

Note: [a, b) is a range of numbers from a to b where a is included in the range and b is not.

Week-Wise Schedule (Tentative)

Fall 2024 Weekly Schedule

Week	Description	Topic(s)	Assessments and Due Date	Lab(s)
Week-1	Sessions & Add / Drop period Last day to drop courses: 24 August 2024	Logistics, Introduction to Deep Learning, Supervised Learning		
Week-2	Sessions Arbaeen/Chehlum Imam Hussain†‡: August 26, 2024 Last Day to Add Course(s): 27th August	Shallow Neural Network		Project Proposal
Week - 3	Sessions	Deep Neural Network	Quiz-1	
Week – 4	Sessions	Loss Functions		
Week - 5	Sessions 12th Rabi-ul-Awwal†‡: September 16, 2024	Loss Functions	Quiz-2	
Week - 6	Sessions	Optimization		
Week - 7	Sessions & Mid Term Examinations	Backpropogation	Quiz-3	
Week - 8	Sessions & Mid Term Examinations	Measuring Performance		

Week	Description	Topic(s)	Assessments and Due Date	Lab(s)
Week - 9	Sessions (No Classes on 14th & 17th October 2023)	Regularization, Convolution NN		Midsemester Project Update
Week - 10	Sessions	Convolution NN	Midterm	
Week – 11	Sessions	Advanced Convolution NN		Lab Exam
Week – 12	Sessions Iqbal Day‡: November 9, 2023 Last day to Withdraw from Course(s): November 08, 2024	Transformers	Quiz - 4	
Week - 13	Sessions	Transformer, Graph NN	Quiz - 5	
Week - 14	Sessions	GAN, Graph NN		
Week - 15	Sessions	Advanced Deep Models	Quiz - 6	Final Project Presentations
	Reading Days			
	End Term Examinations Days§			

Notes:

* The University reserves the right to correct typographical errors or to adjust the Academic Calendar at any time it deems necessary.

† Subject to the sighting of the moon.

‡ No Class(es).

Final Exam Policy

Final Exam is not included in assessments.

Academic Integrity

Each student in this course is expected to abide by the Habib University Student Honor Code of Academic Integrity. Any work submitted by a student in this course for academic credit will be the student's own work.

Scholastic dishonesty shall be considered a serious violation of these rules and regulations and is subject to strict disciplinary action as prescribed by Habib University regulations and policies. Scholastic dishonesty includes, but is not limited to, cheating on exams, plagiarism on assignments, and collusion.

a. Plagiarism: Plagiarism is the act of taking the work created by another person or entity and presenting it as one's own for the purpose of personal gain or of obtaining academic credit. As per University policy, plagiarism includes the submission of or incorporation of the work of others without acknowledging its provenance or giving due credit according to established academic practices. This includes the submission of material that has been appropriated,// bought, received as a gift, downloaded, or obtained by any other means. Students must not, unless they have been granted permission from all faculty members concerned, submit the same assignment or project for academic credit for different courses.

b. Cheating: The term cheating shall refer to the use of or obtaining of unauthorized information in order to obtain personal benefit or academic credit.

c. Collusion: Collusion is the act of providing unauthorized assistance to one or more person or of not taking the appropriate precautions against doing so.

All violations of academic integrity will also be immediately reported to the Student Conduct Office.

You are encouraged to study together and to discuss information and concepts covered in lecture and the sections with other students. You can give "consulting" help to or receive "consulting" help from such students. However, this permissible cooperation should never involve one student having

possession of a copy of all or part of work done by someone else, in the form of an e-mail, an e-mail attachment file, a diskette, or a hard copy.

Should copying occur, the student who copied work from another student and the student who gave material to be copied will both be in violation of the Student Code of Conduct.

If you wish to use generative-AI tools to complete any of your assessments, you must first obtain permission from your course instructor. AI generated work will not be accepted in all classes or even all assessments. The instructor's permission is required. If the permission is granted, you should declare its use and properly cite the source of the generated content. Failing to identify AI written or assisted work is academic dishonesty and will be treated as any case of plagiarism by the university.

The principle for academic integrity is that your submissions must be substantially your own work and that any work that is not originally your thought must be identified and credited. If the use of AI tools is prohibited in the course, respect the rules and do not use these tools for assessments. The fundamental purpose of assessment is to learn, synthesize information and explain new connections and interpretations that arise from your secondary research. Be aware that unauthorized use of AI tools for assessments can result in a conduct case being filed. This can have serious consequences for your academic standing and future career opportunities.

During examinations, you must do your own work. Talking or discussion is not permitted during the examinations, nor may you compare papers, copy from others, or collaborate in any way. Any collaborative behavior during the examinations will result in failure of the exam, and may lead to failure of the course and University disciplinary action.

Penalty for violation of this Code can also be extended to include failure of the course and University disciplinary action.

Late Submission Policy

- No late submission is allowed in **QUIZ** and **EXAM**. All the quizzes will be during the class timings.
- Lab assessments and Lab Exam will be taken during Lab timing.
- **In case of an anticipated delay in the submission of project deliverables, you must inform, and discuss it with me at least 24 hours before the submission is due. Late submission will be allowed up to a day, which will be penalized by 10%.**

The use of AI tools including Chat GPT in any of the assessments will be considered as plagiarism and is strictly prohibited.

Attendance Policy

The attendance policy of this course is the automatic (Biometric) attendance policy as announced by the Registrar's Office.

Program Learning Outcomes (For Administrative Review)

Upon graduation, students will have the following abilities:

- PLO 1: Theoretical Computer Science: recall and apply foundational principles of computer science.

- PLO 2: : Application Development: build software systems of varying complexity in light of fundamental computer science principles and any other constraints.

- PLO 3: Analysis and Design: perform technical analysis and design using core computing and mathematical knowledge.

- PLO 4: Systems: apply the knowledge of computing systems.

- PLO 5: : Research and Exploration: develop expertise in and contribute to a given sub-field of computing by drawing upon a strong foundation in the fundamentals of computer science and mathematics to solve real-life problems.

- PLO 6: Problem Solving: identify and analyze problems and propose effective computing-based solutions.

- PLO 7: Practical Exposure: make effective use of current tools, technologies, and good industry practices.

- PLO 8: Responsible Citizenship: conduct their computing practice in a manner that is ethical and socially responsible and corresponds to their distinct sense of identity and service to the community.

- PLO 9: Self-Learning: continuously adapt their skills to the changes taking place around them.

- PLO 10: Design Thinking: apply design thinking principles to the design of a solution.

- PLO 11: Multi-disciplinarity: incorporate knowledge and input from multiple disciplines.

- PLO 12: Communication and Teamwork: communicate and function effectively as a member or a leader of a variety of teams.

Program Learning Outcomes (PLOs) mapped to Course Learning Outcomes (CLOs)				
	CLOs of the course are designed to cater following PLOs: PLO 1: Analysis PLO 2: Design PLO 4: Implementation PLO 6: Self learning			
	Distribution of CLO weightages for each PLO			
	CLO 1	CLO 2	CLO 3	CLO 4
PLO 1	100%			
PLO 2		100%		
PLO 4				100%
PLO 6	25%	25%	25%	25%

Mapping of Assessments to CLO

	CLO #01	CLO #02	CLO #03	CLO #04
Quiz No 01	███			
Quiz No 02	███			
Quiz No 03	███	███		
Quiz No 04	███	███		
Quiz No 05		███	███	███
Quiz No 06		███	███	███
Lab Exam	███	███		
Course Project	███	███	███	███
Midterm Exam	███	███	███	
Lab 1	███			
	███			

Lab 2				
Lab 3				
Lab 4				
Lab 5				
Lab 6				
Lab 7				
Lab 8				
Lab 9				
Lab 10				
Lab 11				
Lab 12				

Recording Policy

Only asynchronous and synchronous online sessions will be conducted and recorded via MS Teams. Link to the recordings will be available to all students on Canvas Learning Management System.

Accommodations for Students with Disabilities

In compliance with the Habib University policy and equal access laws, I am available to discuss appropriate academic accommodations that may be required for student with disabilities. Requests for academic accommodations are to be made during the first two weeks of the semester, except for unusual circumstances, so arrangements can be made. Students are encouraged to register with the Office of Academic Performance to verify their eligibility for appropriate accommodations.

Inclusivity Statement

We understand that our members represent a rich variety of backgrounds and perspectives. Habib University 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 Habib community

Office Hours Policy

Every student enrolled in this course must meet individually with the course instructor during course office hours at least once during the semester. The first meeting should happen within the first five weeks of the semester but must occur before midterms. Any student who does not meet with the instructor may face a grade reduction or other penalties at the discretion of the instructor and will have an academic hold placed by the Registrar's Office.