Advanced Artificial Intelligence

Course Code	Credit Hours
SE-805	3+0

Course Description

This course is designed to build upon your existing knowledge of deep learning and artificial intelligence. We will delve deeper into the field of deep learning, exploring advanced techniques and methodologies that will enable you to tackle complex problems across various domains. By the end of this course, you will have acquired the skills and knowledge necessary to design and implement advanced deep learning models. Through a combination of theoretical concepts and a term project, you will gain a comprehensive understanding of deep learning techniques. This will empower you to apply these techniques effectively in real-world scenarios, pushing the boundaries of what is possible in the field of artificial intelligence and deep learning.

Text Book:

1. Deep Learning by Ian Goodfellow, Yoshua Benjio, and Aaron Courville

Reference Book:

1. Any material (papers, notes, slides, video) on the web from credible sources.

Prerequisites

None

ASSESSMENT SYSTEM FOR THEORY

Assessment	Weightage (%)
Quizzes	10
Assignment	10
Term Paper	15
Mid-Semester Exam	25
End-Semester Exam	40

Teaching Plan

Week No.	Topic	Learning Outcomes
1	Introduction to Deep Learning	Course Outline, objectives, teaching plan, assessment method, concepts review
2	Artificial Neural Networks: Perceptron and Multi-Layer Perceptron	Understand structure and limitations of single-layer perceptrons, explain the architecture and functionality of multi-layer perceptrons (MLPs)
3	Artificial Neural Networks: Backpropagation, Optimisation, and Implementation	Discover activation functions, Implement MLP using backpropagation.
4	Training Neural Networks: Hyperparameter Selection, Optimization Algorithms	Select various hyperparameters to avoid overfitting. Understand the working of different optimisation algorithms.
5	Convolutional Neural Networks	Components of CNN, Dilated Convolution, Transposed Convolution
6	Common CNN Architectures	VGG, Inception, Residual Networks, Dense Networks (Transfer Learning)
7	Computer Vision - I: Object Detection	
8	Computer Vision - II: Semantic Segmentation	
9	**Mid Term Break**	
10	Natural Language Processing-I	Sequence Modelling using RNN, GRU, LSTM
11	Natural Language Processing-II	Machine Translation using seq2seq models and Cross Attention
12	Natural Language Processing-II	Transformers and self-attention
13	Generative Models:	Autoencoders, VAEs, GANs, Diffusion Models
14	Reinforcement Learning	Introduction to Reinforcement Learning and Q-Learning, epsilon-greedy policy
15	Bias in AI	Identifying and mitigating biases in data and deep models.
16	Advanced Topics in Deep Learning	
17	Project Presentations	
18	**End Term Exam**	