<u>Subject</u>: Neural Network and Deep Learning

Lecture	Date	Topics	Hours
	Chapter 1	*Introduction to Deep Learning and Deep Neural Network*	4
1	23-07-2023	About deep learning, Perceptron, Activation Functions, Perceptron examples, Multi-output Perceptron, Single Layer and Deep/Dense Neural Network, Loss Function, Gradient Descent, Backpropagation, Learning Rates, and Regularization Lab Work 1: • Perceptron in Tensorflow • Iris using Dense Neural Network Assignment 1: • Estimate first iteration of single neural network with two variables. • Design a DNN to identify whether employee is searching for new job or not.	4
	Chapter 2	*Deep Convolution Network*	12
2	30-07-2023	Computer vision (CV) and applications, Disadvantage of applying DNN in CV (use case in lab work), convolutions and filters with examples, feature maps, pooling (max and average), and strides Lab Work 2: • MNIST using DNN • Convolution and Pooling step-by-step in python • MNIST using CNN Assignment 2: • Convolution by hand • CNN for Cifar10	4
3	06-08-2023	Backpropagation in CNN, Image Generator, Augmentation, Regularization Lab Work 3: • Building and Visualizing effect of CNN to classify different types of flowers. • Auto-Encoder for Image Compression on flower dataset Assignment 3: • Building and visualizing the effect of CNN layers for different types of mushrooms. • Auto-Encoder for Image Denoising on mushrooms dataset	4
4	13-08-2023	Case Study: Speech Recognition using CNN, basics of audio speech recognition, spectral bandwidth, short term Fourier transform, and MFCC spectral, Adam optimizer Lab Work 4: • Building a CNN model to identify emotions from an audio speech	4

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		Assignment 4: • To design and build a CNN model to identify dysarthria disease	
	Chapter 3	*Deep Sequence Modelling*	20
5	20-08-2023*	Applications and relationships, Neurons with recurrence, RNN and intuition, backpropagation through time, gradient issues, tokenization, pad sequences and embeddings Lab Work 5: • To build an NLP model to rank McDonalds reviews using Embeddings. Assignment 5: • Estimating next value of time series using simple RNN network by hand. • Performing NLP Analysis on the fake and real news. • Build NLP classifier to determine if a news article is fake or real using Embeddings.	4
6	27-08-2023	RNN for time series, LSTM, and bidirectional LSTM Lab Work 6: • To build LSTM model for electricity production forecasting. Assignment 6: • Build a LSTM model for shampoo sales forecasting. OR • Build a LSTM model for monthly beer production forecasting.	4
7	03-09-2023	Convolution and MaxPooling with 1D, Tag Generation Models in NLP Lab Work 7: • Study Book Genre Model • Conv1D and MaxPool1D on temperature forecasting Assignment 7: • Study Tag Generation model and apply the same process to generate tags of a movie through plot synopsis.	4
8	10-09-2023	Case Study: Generative Pre-trained Transformers (GPT) Lab Work 8.1: • Design Machine Translation from scratch using GPT – Part 1 Assignment 8.1: • Write a report on BERT vs GPT (individual assignment - handwritten). • Draw a layout of transformer by hand.	4
9	17-09-2023	Case Study: Generative Pre-trained Transformers (GPT) Lab Work 8.2: • Design Machine Translation from scratch using GPT – Part 2	4

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		Assignment 8.2: • Convert the Spanish news article to English using customized transformers	
	Chapter 4	*Transfer Learning*	8
10	24-09-2023	About transfer learning, weights sharing, VGG16, Xception, InceptionV3	4
		Lab Work 9.1: • VGG16, Xception, InceptionV3 to classify Benign and Malignant in tensorflow	
		Assignment 9.1: • Draw VGG16, Xception and InceptionV3 network	
11	01-10-2023*	ResNet 50, 101, 152 and DenseNet 121, 161	4
		Lab Work 9.2: • ResNet 50, 101, 152 and DenseNet 121, 161 to classify Benign and Malignant in fastai	
		Assignment 9.2: • Draw ResNet 50, 101, 152 and DenseNet 121, 161	
	Chapter 5	*Deep Generative Modelling and Projects*	16
12	08-10-2023	Object Detection and Segmentation Models	4
		Lab Work 10: • Data Annotation using LabelImg for Object Detection Models • U-Net Model for Breast Cancer Segmentation	
		Assignment 10: • Annotate, generate, and visualize bounding boxes of traffic roads. • U-Net model for Brain MRI Segmentation	
13	15-10-2023	Project Presentation and Evaluation	4
14	22-10-2023	About generative modelling, and Variational Auto Encoder	4
		Lab Work • Variational Auto Encoder for celebrity face generation	
15	29-10-2023	GANs - generator and discriminator	4
		Lab Work • GANs in Python	

* ICA Test – 20 marks each

Dates are tentative | Assignments: 25 marks | Project: 5 marks

Text Books:

1. Charu C. Aggarwal, Neural Networks and Deep Learning, Springer International Publishing, 2018.
2. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016.

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Reference Books:

1. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer-Verlag, 2006.
2. Duda, Richard, Peter Hart, and David Stork, Pattern Classification, 2nd edition, Wiley-Interscience, 2000.
3. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.
4. Reza Zadeh, Bharath Ramsundar, TensorFlow for Deep Learning, 1st edition, O'Reilly Media Inc, 2018.
5. Zaccone, Giancarlo, Deep Learning with TensorFlow, 2nd edition, Packt Publishing, 2018.

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