



National Computing Education Accreditation Council NCEAC



NCEAC.DOC.001-E

COURSE DESCRIPTION

NAME OF INSTITUTION	Lahore Garrison University
PROGRAM (S) TO BE EVALUATED	Computer Science , Spring 2022

Course Description : With applications in search, image understanding, apps, maps, medical, drones, and self-driving automobiles, computer vision has become omnipresent in our culture. Visual recognition tasks including picture classification, localization, and detection are at the heart of many of these applications. The performance of these state-of-the-art image identification systems has been substantially improved thanks to recent breakthroughs in neural network (also known as "deep learning") techniques. This course delves into the specifics of deep learning architectures, with an emphasis on developing end-to-end models for various tasks, notably image classification. Students will learn to design and train their own neural networks as well as obtain a thorough understanding of cutting-edge computer vision research over the duration of the course. In addition, the final term project will allow them to train and apply multi-million parameter networks to real-world vision problems of their choosing. Students will gain the toolbox for setting up deep learning problems as well as practical engineering strategies for training and fine-tuning deep neural networks through many hands-on assignments and the final course project.

Course Code	CSC															
Course Title	Neural Networks For Visual Recognition															
Credit Hours	3															
Prerequisites by Course(s) and Topics	Image Processing, Calculus , Computer Programming															
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	SESSIONAL (Quizzes, Assignments, Presentations) =25 % Midterm Exam =25 % Final Exam = 50%															
Course Coordinator	Dr. Mujtaba Asad															
URL (if any)	https://classroom.google.com/u/2/c/MzUzNDU2NzIxOTU2															
Current Catalog Description																
Textbook (or Laboratory Manual for Laboratory Courses)	MIT Deep Learning Book Ian GoodFellow ,															
Reference Material	Python Crash Course 2nd Edition															
Course Goals	The student will be able to understand the science behind the neural network. The student will be able to easily differentiate the type of network for specific visual recognition application. The students will be able to acquire the toolset for setting up deep learning tasks and practical engineering tricks for training and fine-tuning deep neural networks.															
Course Learning Outcomes (CLOs):	<table><tr><td>At the end of the course the students will be able to:</td><td>Domain</td><td>BT Level*</td></tr><tr><td>Understand principles of Neural Networks.</td><td>C</td><td>2</td></tr><tr><td>Identify the difference between multiple type of neural networks and their respective applications</td><td>C</td><td>3</td></tr><tr><td>Model a solution for a given visual problem using deep neural network technologies.</td><td>C</td><td>3</td></tr><tr><td colspan="3">* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain</td></tr></table>	At the end of the course the students will be able to:	Domain	BT Level*	Understand principles of Neural Networks.	C	2	Identify the difference between multiple type of neural networks and their respective applications	C	3	Model a solution for a given visual problem using deep neural network technologies.	C	3	* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		
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Topics Covered in the Course, with Number of Lectures on Each Topic (assume 15-week instruction and one-hour lectures)	Week	Lecture	Topics Covered
	Week 1	1	History of Computer Vision, Top Research in the area, Introduction to Machine Learning, Learning algorithms
		2	Introduction to deep learning, Types of Machine Learning, Problems Classification vs Regression, Linear Regression
	Week 2	3	What is a Neural Network , House Price Prediction example using Linear Regression, Loss Function
		4	Training a Neural Network, Logistic Regression (Binary Classification), Sigmoid Activation Function, Logistic Regression Cost Function, Log Based Loss Function, Computational Graph
	Week 3	5	Gradient Descent mathematical derivation, Neural Network with one hidden layer, Computing output of the neural network,
		6	Vectorization for programming NN, Gradient Descent on 'm' examples, Different Type of activation function in NN
	Week 4	7	Propagation in Neural Networks, Forward propagation , Backward Propagation
		8	Step by Step example for forward and backward propagation for neural network with one hidden layer (XOR Example)
	Week 5	9	Neural Network Implementation in python (XOR Example), Techniques for Improving Neural Networks : hyper-parameter Tuning, Dataset Splits
		10	Bias and Variance Trade-off, regularization, dropout Regularization,
	Week 6	11	Improving Neural Networks, hyperparameters, Dataset splits, Bias and Variance , Mismatched Train/Test Distributions, Data Augmentation Techniques,
		12	Early Stopping Technique, Orthogonalization in Machine Learning, Normalizing Inputs, Vanishing and exploding gradients,
	Week 7	13	Weight Initialization ,Batch Vs. Mini batch gradient descent,
		14	Training with mini-batch Gradient Descent , Multiclass classification
	Week 8	1 hours	Mid Term
	Week 9	15	SoftMax Function, Training a neural network with softmax function
		16	Edge Detection Examples , Convolutions, Convolutional Masks
	Week 10	17	Padding ,Strided Convolutions, Convolutions Over Volumes
		18	One Layer of a Convolutional Net, Simple Convolutional Network Example,
	Week 11	19	Pooling Layers ,CNN Example ,Why Convolution, Why look at case studies
		20	Classic CNN Based Networks, ResNets , Why ResNets Work
	Week 12	21	Network In Network, Inception Network Motivation , Object Localization
		22	Landmark Detection, Object Detection , Convolutional Implementation Sliding Windows
	Week 13	23	Intersection Over Union, Non-max Suppression, Anchor Boxes
		24	CVPR-RESEARCH ARTICLE -1 (YOLO Algorithm)
	Week 14	25	What is face recognition, Face Verification, One Shot Learning
		26	Siamese Network, Triplet loss, CVPR-RESEACH PAPER 2
	Week 15	27	What is neural style transfer, What are deep CNs learning, Cost Functions
		28	1D and 3D Generalizations, RESEACH PAPER 3
	Week 16	29	Group Presentations -1
		30	Group Presentations-2
	Week 17	2 hours	Final Term
	Laboratory Projects/Experiments Done in the Course		
Programming Assignments Done in the Course			

