Course Code	21CSE422T	Course Name	Convolutional Neural Networks Foundation	Course Category		Professional Elective	L	T	P	C
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Pre-requisite Courses	Nil ,	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	DSBS	*Data Book / Codes / Standards*	Nil		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	Learn the evolution of neural networks
CLR-2 :	Utilize the knowledge for model development
CLR-3 :	Fine tune the performance with optimization techniques
CLR-4 :	Utilize class and build domain model for real-time programs
CLR-5 :	Construct CNN model for image based applications

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)												Program Specific outcomes		
		1	2	3	4	5	6	7	8	9	10	11	12			
		Engineering Knowledge	Problem Analysis	Design/development of solutions	Conduct investigations of complex problems	Modern Tool Usage	The engineer and society	Environment &	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	Understand fundamentals of Neural Networks	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO-2:	Understand fundamentals of CNN Architecture	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-
CO-3:	Apply performance optimization	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
CO-4:	Compare different CNN Architectures	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CO-5:	Apply CNN in image classification	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1

Unit-1 : Introduction to AI & ML

Types of ML-Old versus new ML-Artificial neural networks-Activation functions The XOR problem-Training neural networks-Backpropagation and the chain rule-Batches Loss functions-The optimizer and its hyperparameters- Underfitting versus overfitting Feature scaling-Fully connected layers
T1: Implement Simple Programs like vector addition in TensorFlow.
T2: Implement a simple problem like regression model in Keras.
T3: Implement a perceptron in TensorFlow/Keras Environment.

Unit-2 : Fundamental CNN Architecture

Convolution Input padding-Calculating the number of parameters (weights)- Calculating the number of operations-Converting convolution layers into fully connected layers-The pooling layer-1x1 Convolution-Calculating the receptive field-Building a CNN model in TensorFlow.
T1: Implement a CNN based classifier of handwritten digits: The Convolution Layer
T2: Implement a CNN based classifier of handwritten digits: The Max Pooling Layer
T3: Implement a CNN based classifier of handwritten digits: The Fully Connected Layer

Unit-3: Performance Optimization
Number of hidden layers -Number of neurons per hidden layer -Batch normalization -Advanced regularization and avoiding overfitting -Applying dropout operations with TensorFlow -Which optimizer to use? -Memory tuning - Appropriate layer placement -Building the second CNN by putting everything together -Dataset description and preprocessing -Creating the CNN model -Training and evaluating the network. T1: Implement a CNN with Adam optimizer T2: Implement a CNN and apply dropout operations with TensorFlow T3 Implement a CNN with a validation technique
Unit-4 : Popular CNN Model Architectures
Introduction to ImageNet -LeNet -AlexNet architecture -VGGNet architecture -VGG16 image classification code example -GoogLeNet architecture -Architecture insights -Inception module -ResNet architecture. T1: Implement Image Net model for a Dataset T2: : Traffic sign classifiers using AlexNet T3 : Implement VGGNet model for a Dataset
Unit-5: Image Classification
CNN model architecture-Cross-entropy loss (log loss)-Multi-class cross entropy loss-The train/test dataset split-Datasets-ImageNet-CIFAR-Loading CIFAR- -Building the CNN graph-Learning rate scheduling-Introduction to the tf.data API-Main training loop-Model Initialization-Do not initialize all weights with zeros-Initializing with a mean zero distribution-Xavier-Bengio and the Initializer-Improving generalization by regularizing-L2 and L1 regularization. T1: Implement Image classification with TensorFlow T2: Build TensorFlow input pipelines for image T3: Implement a CNN for Image processing L2 regularization

Learning Resources	1. Iffat Zafar, Giounona Tzanidou, Richard Burton, Nimesh Patel, Leonardo Araujo," Hands-On Convolutional Neural Networks with TensorFlow", ",Packt Publishing,,2018. 2. ,Mohit Sewak, Pradeep Pujari, Md. Rezaul Karim,"Practical Convolutional Neural Networks: Implement Advanced Deep Learning Models Using Python, ",Packt Publishing ,2018	3. Charu C. Aggarwal. Neural Networks and Deep Learning: A Textbook. Springer. 2019. 4.Stanford University Course http://cs231n.stanford.edu/2018/syllabus.html

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life Long Learning CLA-2 – (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	-	15%	-	15%	-
Level 2	Understand	25%	-	20%	-	25%	-
Level 3	Apply	30%	-	25%	-	30%	-
Level 4	Analyze	30%	-	25%	-	30%	-
Level 5	Evaluate	-	-	10%	-	-	-
Level 6	Create	-	-	5%	-	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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	2.	2.