CSE11139	Neural Networks and Deep Learning Application	L	T	P	C
Version 1.0	Contact Hours 45	3	0	0	3
Pre-requisite/Exposure	Discrete Mathematics, Calculus, Machine Learning				
Co-requisite	NIL				

Course Objectives:

- To enable students to analyze different components of a neural network
- To provide the fundamentals of building problem specific neural networks
- To enhance the skill of students to manipulate the parameters of deep learning models
- To allow students to identify challenging areas where deep learning solutions can be implemented

Course Outcomes:

On the completion of this course the student will be able to

CO1: Understand the fundamental building blocks neural networks

CO2: Analyze the different parameters that controls the performance of neural networksCO3: Explain various types of deep learning techniques

CO4: Compare several key deep learning models for different types of problemsCO5: Develop deep learning models by using state-of-the-art tools.

Course Description:

This course requires minimal knowledge in discrete mathematics, differential calculus and basic machine learning. The course starts from single node neurons to multi-layered neural networks. While discussing all relevant challenges in this field, deep learning techniques are introduced. Most advanced features of deep learning techniques have been discussed; A broad array of deep learning models have been analysed to aid in problem specific model design. Finally,with the help of modern deep learning tools such as Tensorflow, Keras and Pytorch, students are prepared to tackle challenging problems in the field of computer vision, natural language processing, sequence analysis and so on.

Course Content:

Units	Lecture Hours
Unit-I: Introduction: Evolution of machine learning techniques, history of neural learning systems, linear and logistic regression,decision boundaries. Neural Network Architecture: Biological vs artificial neuron, perceptron, XOR problem, stochastic gradient descent, weights and biases, activation functions, non-linearity, multi-layered perceptron	9

Units	Lecture Hours
Unit-II: Controlling the Neural Network: Restricted Boltzmann machines, backpropagation, learning rate, momentum, adaptive learning rates, regularization, hyper-parameter management, ensemble techniques. Neural Network Models: Hopfield neural networks, recurrent neural networks, Self-organizing feature maps, auto-encoders.	**9**
Unit-III: Deep Learning Techniques: Vanishing gradients, deep belief networks, long short-term memory, representation learning, convolutional neuralnetworks, Subsampling, rectified-linear units, deep convolutional auto-encoders, layer-wise training, auxiliary classifiers, residual connections, adversarial learning.	**9**
Unit-IV: Deep Learning Models: Classification: LeNet-5, AlexNet, VGG-Net, GoogLeNet, ResNet, DenseNet, MobileNet. Detection: R-CNN, YOLO Segmentation: Seg-Net, U-Net, SegFastSequential Learning: LSTM, GRU Generative Learning: Variational auto-encoder, GAN, Conditional GAN	**9**
Unit-V: Deep Learning Tools: PyTorch: Installation, Tensors, autograd, modules, dataset and dataloader, Training and TestingTensorFlow: Installation, Loading dataset, Model, Training, Testing	**9**

Examination Scheme:

Components	Mid Term	Class Assessment	End Term
Weightage (%)	20	30	50

Relationship between Course Outcomes (COs) and Program Outcomes (POs):

1 = Weakly Mapped

2 = Moderately Mapped3 = Strongly Mapped

Course Code	Course Name	COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CSE11	Neural	CO1113	2	3	2	3	1	2	2	-	3	-	-	2	3	2	1
139	Networ	9.1															
	ks and	CO1113	3	2	2	3	3	1	3	-	2	-	-	2	1	1	2
	Deep	9.2															
	Learning Application	CO1113 9.3	2	2	3	2	2	1	1	-	2	-	-	3	3	2	1
	Learning	CO1113 9.4	3	2	3	2	2	2	1	-	2	-	-	1	3	1	2

Course Code	Course Name	COs	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	Applicat ion																
		CO1113	2	3	2	1	2	1	2	-	1	-	-	3	1	2	2
		9.5															
		CO1113	2.	2.	2.	2.	2.	1.	1.	-	2.	-	-	2.2	2.2	1.6	1.6
		9	4	4	4	2	0	4	8		0						