20IT7301-DEEP LEARNING

Course Category:	Program Core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	2-0-2
Prerequisites:	20IT6302-Machine Learning	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Analyze the performance of feed forward neural networks with different hyper parameters
	CO2	Apply CNN, Auto encoders, Attention mechanisms and GANs on image processing applications
	CO3	Design a suitable RNN model for time series applications
	CO4	Create a suitable intelligent model for the given application

Contribution of Course Outcomes towards achievement of Program Outcomes 1-Low, 2-Medium, 3-High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1		2				1	1			1	1	1
CO2	2	2			2			1	1			1	2	2
CO3	2	2	3		2			2	2			2	2	2
CO4	3	2	3	2	3			2	2			3	3	3

Course Content

UNIT I:

The Neural Network: Building Intelligent Machines, The Limits of Traditional Computer Programs, The Mechanics of Machine Learning, The Neuron, Expressing Linear Perceptrons as Neuron, Feed-Forward Neural Networks, Linear Neurons and Their Limitations, Sigmoid, Tanh, and ReLU, Softmax Output Layers

Training Feed-Forward Neural Network: Gradient Descent, The Delta Rule and Learning Rates, Gradient Descent with Sigmoidal Neurons, The Backpropagation Algorithm, Stochastic and Minibatch Gradient Descent, Test Sets, Validation Sets, and Overfitting, Preventing Overfitting in Deep Neural Networks

UNIT II:

Convolutional Neural Networks: Neurons in Human Vision, The Shortcomings of Feature Selection, Filters and Feature Maps, Convolutional Layer, Max Pooling, Full Architectural Description of Convolution Networks, Image Preprocessing pipelines, Accelerating training with batch normalization

Embedding and Representation Learning: Learning Lower-Dimensional Representations,Principal Component Analysis, Motivating the Autoencoder Architecture, Denoising to Force Robust Representations, Sparsity in Autoencoders

UNIT III:

Sequence Modeling: **Recurrent and Recursive nets:** Unfolding Computational Graphs, Recurrent neural networks, Bidirectional RNNS, Encoder-Decoder sequence-to –sequence architectures, Deep Recurrent networks, Recursive neural networks.

	The Challenge of Long-Term Dependencies: Echo State Networks, Leaky Units &Other strategies for multiple timescales, The Long Short-Term memory
	UNIT IV: **Advanced Topics in Deep Learning:** Introduction, Attention Mechanisms, Recurrent Models of Visual Attention, Attention Mechanisms for Machine Translation, Neural Networks with External Memory-Neural Turing Machine **Generative Adversarial Networks:** Training a Generative Adversarial Network, Using GANs for Generating Image Data, Conditional Generative Adversarial Networks, Competitive Learning, Limitations of Neural Networks
	Content Beyond: The Transformer Neural Network
Text books and Reference books	**Text Book(s):** [1]. Nikhil Buduma, Nicholas Locascio, "Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms", O'Reilly Media, 2017 [2]. Ian Goodfellow, YoshuaBengio, Aaron Courville, "Deep Learning(Adaptive Computation and Machine Learning series",MIT Press, 2017 [3]. Charu C. Aggarwal, Neural Networks and Deep Learning, c Springer International Publishing AG, part of Springer Nature 2018, ISBN 978-3-319-94462-3 ISBN 978-3-319-94463-0 (eBook) **Reference (Book)s:** [1]. Li Deng and Dong Yu, "Deep learning Methods and Applications", Now publishers, 2013 [2]. Michael Nielsen,"Neural Networks and Deep Learning", Determination Press 2015 [3]. Vaswani A, Shazeer N, Parmar N, Uszkoreit J, Jones L, Gomez AN, Kaiser Ł, Polosukhin I. Attention is all you need. Advances in neural information processing systems. 2017; 30.
E-resources and other digital material	[1]. MiteshKhapra, "Deep Learning", Sep 20, 2018, https://www.youtube.com/watch?v=4TC5s_xNKSs&list=PLH- xYrxjfO2VsvyQXfBvsQsufAzvlqdg9 [2]. AfshineAmidi and ShervineAmidi ,"Deep Learning cheat sheets for Stanford's CS 230", 2018, https://github.com/afshinea/stanford-cs-230-deep-learning [3]. YoshuaBengio, Deep learning: "Theoretical Motivations, Canadian Institute for Advanced Research", 2015 http://videolectures.net/deeplearning2015_bengio_theoretical_motivations/ [4]. Geoffrey Hinton's GoogleTech Talk,"Recent developments on Deep Learning" March 2010, https://www.youtube.com/watch?v=VdIURAu1-aU