



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

DEEP NEURAL NETWORKS

VII Semester: CSE (AI & ML)

Course Code	Category	Hours / Week			Credits	Maximum Marks		
ACAC16	Core	L	T	P	C	CIA	SEE	Total
		3	1	0	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil			Total Classes: 60			

Prerequisite: Python programming, Foundations of Machine Learning

I. COURSE OVERVIEW:

Machine learning is a powerful set of techniques that allow computers to learn from data rather than having a human expert. Neural networks are a class of machine learning algorithms originally inspired by the brain, but which have recently seen a lot of success at practical applications. They're at the heart of production systems at companies like Google and Face book for face recognition, speech-to-text, and language understanding. This course gives an overview of both the foundational ideas and the recent advances in neural net algorithms. It covers the history of neural networks and state-of-the-art approaches to deep learning. Students will learn how to design neural network architectures, training procedures and hyper parameter tuning.

II. COURSE OBJECTIVES:

The students will try to learn:

- I. The theoretical foundations, algorithms and methodologies of Neural Network.
- II. The designs of single and multi-layer feed-forward deep networks and tune various hyper-parameters.
- III. The practical knowledge in handling and analyzing real world applications.
- IV. The role of neural networks in engineering, artificial intelligence, and cognitive modeling.

III. COURSE SYLLABUS

MODULE-I: MACHINE LEARNING BASICS(09)

Learning algorithms, Maximum likelihood estimation, Building machine learning algorithm, Neural Networks Multilayer Perceptron, Back-propagation algorithm and its variants Stochastic gradient decent, Curse of Dimensionality.

MODULE –II: DEEP LEARNING ARCHITECTURES(09)

Machine Learning and Deep Learning, Representation Learning, Width and Depth of Neural Networks, Activation Functions: RELU, LRELU, ERELU, Unsupervised Training of Neural Networks, Restricted Boltzmann Machines, Auto Encoders, Deep Learning Applications

MODULE-III: CONVOLUTIONAL NEURAL NETWORKS(09)

Architectural Overview, Motivation, Layers, Filters, Parameter sharing, Regularization, Popular CNN Architectures: ResNet, AlexNet– Applications

MODULE –IV: TRANSFER LEARNING AND AUTO ENCODERS(09)

Transfer learning Techniques, Variants of CNN: DenseNet, PixelNet. Under complete Auto encoder, Regularized Auto encoder, stochastic Encoders and Decoders, Contractive Encoders.

MODULE –V: SEQUENCE MODELLING – RECURRENT AND RECURSIVE NETS(09)

Recurrent Neural Networks, Bidirectional RNNs, Encoder-decoder sequence to sequence architectures - BPTT for training RNN, Long Short Term Memory Networks.

IV. TEXT BOOKS:

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, "Deep Learning", MIT Press, 2017.
2. Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017.

V. REFERENCE BOOKS:

1. Giancarlo Zaccane, Md. RezaulKarim, Ahmed Menshawy "Deep Learning with TensorFlow: Explore neural networks with Python", Packt Publisher, 2017

2. Antonio Gulli, Sujit Pal "Deep Learning with Keras", Packt Publishers, 2017.
3. Umberto Michelucci "Applied Deep Learning. A Case-based Approach to Understanding Deep Neural Networks" Apress, 2018.

V. WEB REFERENCES:

1. http://noiselab.ucsd.edu/ECE228/Murphy_Machine_Learning.pdf
2. <https://medium.com/intro-to-artificial-intelligence/deep-learning-series-1-intro-to-deep-learning-abb1780ee20>
3. <https://www.analyticsvidhya.com/blog/2018/10/introduction-neural-networks-deep-learning/>
4. https://d2l.ai/chapter_convolutional-modern/alexnet.html
5. <https://www.geeksforgeeks.org/residual-networks-resnet-deep-learning/>