Marwadi University
Marwadi Chandarana Group

Syllabus for Master of Technology

Computer Engineering- Data Science

Subject Code: 01DS0204
Subject Name: Neural Network & Deep Learning
M.Tech. Year –2023-24

Objective:

- To understand the basics in deep neural networks
- To understand the basics of associative memory and unsupervised learning networks
- To apply CNN architectures of deep neural networks
- To analyze the key computations underlying deep learning, then use them to build and train deep neural networks for various tasks.
- Introduce major deep learning algorithms, the problem settings, and their applications to solve real world problems.
- To apply autoencoders and generative models for suitable applications.

Credits Earned: 3 Credits

Course Outcomes: After completion of this course, student will be able to (Atleast 4)

- Ability to understand the concepts of Neural Networks
- Ability to select the Learning Networks in modeling real world systems
- Ability to use an efficient algorithm for Deep Models
- Ability to apply optimization strategies for large scale applications

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	Mid Sem (M)	Internal (I)	Viva (V)	Term work (TW)	
3	0	0	3	50	30	20	0	0	100

Contents:

Unit	Topics	Contact Hours
1	**Unit Title: Introduction** Neural Networks-Application Scope of Neural Networks-Artificial Neural Network: An Introduction- Evolution of Neural Networks-Basic Models of	6

	Artificial Neural Network- Important Terminologies of ANNs-Supervised Learning Network.	
2	**Unit Title: Feedforward neural network & Training Neural Network** Artificial Neural Network, activation function, multi-layer neural network, Risk minimization, loss function, backpropagation, regularization, model selection, and optimization.	8
3	**Unit Title: Conditional Random Fields** Linear chain, partition function, Markov network, Belief propagation, Training CRFs, Hidden Markov Model, Entropy.	8
4	**Unit Title: Deep Learning & Probabilistic Neural Network** Deep Feed Forward network, regularizations, training deep models, dropouts, Convolutional Neural Network, Recurrent Neural Network, Deep Belief Network, Hopfield Net, Boltzman machine, RBMs, Sigmoid net, Autoencoders.	8
5	**Unit Title: Deep Learning research** Object recognition, sparse coding, computer vision, natural language processing.	5
6	**Unit Title: Deep Learning Tools** Caffe, Theano, Torch.	4
	Total Hours	39

References:

Text Books

1. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016..
2. Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006.

Reference Books

3. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
4. Golub, G., H., and Van Loan,C.,F., Matrix Computations, JHU Press,2013.
5. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

Books on Optimization Techniques

6. Ravindran, K. M. Ragsdell, and G. V. Reklaitis , ENGINEERING OPTIMIZATION: Methods and Applications , John Wiley & Sons, Inc. , 2016..
7. Antoniou, W. S. Lu, PRACTICAL OPTIMIZATION Algorithms and Engineering Applications, Springer, 2007.

Suggested Theory distribution:

Distribution of Theory for course delivery and evaluation

Remember	Understand	Apply	Analyse	Evaluate	Create
10%	25%	30%	15%	10%	10%

Instructional Method:

a) The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
b) The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
c) Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
d) Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.

Supplementary Resources:

Links for the several useful tools and lecture videos:

1. **NPTEL Course**
   - Neural Network and Its Applications , Prof. Somnath Sengupta , IIT Kharagpur.
2. **Useful link for Learning Programming**
   - Python Tutorial
   - Introduction to the numpy library
   - MATLAB Tutorial
   - Learning MATLAB (Video Tutorials)
3. **Optimization problem solver (Matlab)**
   - Optimization Toolbox
   - Choosing a Solver
4. **Optimization problem solver (Python)**
   - Optimization and root finding
   - pyOpt

Links specific to Deep Learning:

1. Links to Deep learning softwares
2. **Torch**
   1. Deep Learning with Toch
   2. Cheatsheet
3. **Caffe**

1. Tutorial
2. Deep learning tutorial on Caffe

4. **Matlab**
    1. Toolbox
    2. Deep Learning for Computer Vision with MATLAB and cuDNN