III- Year II - Semester	Name of the Course	L	T	P	C
PC3201	Deep Learning	3	0	0	3

Course Objectives:

1. To understand basic concepts of neural networks.
2. To emphasize on learning, optimization techniques.
3. To learn CNN, RNN, Auto encoder models.
4. To learn deep learning algorithms to solve real world problems.

Syllabus:

UNIT-I: Deep learning basics

Introduction, the perceptron, Practical network training, Back-Propagation,why does it work? Overfitting and generalization, Shallow Neural Network, Deep Neural Networks.

UNIT-II: Optimization

Challenges in neural network optimization, Initialization, Regularization, Gradient Checking,Gradient Descent, Stochastic Gradient Descent, Momentum Optimizer,AdaGrad, RMSProp, Adam, Batch normalization.

UNIT– III: Deep Learning for Natural Language Processing

Computational representation of language, one-hot representation of words, word vectors, The skip-gram word2vec model, The CBOW word2vec model, word vector arithmetic, RNN, LSTM.

UNIT-IV: Deep Learning for Computer Vision

Building blocks of CNN, Local receptive fields, Shared weights and bias, Pooling layers, Max-pooling, Average pooling, CNN for image classification, CNN for segmentation, An example of DCNN — LeNet, LeNet code in Keras, Understanding the power of deep learning, Recognizing CIFAR-10 images with deep learning, Recognizing cats with a VGG-16 net.

UNIT – V: Effective training of Deep Neural Networks and Recent trends in Deep Learning Architecture

Early stopping, Dropout, Instance Normalization, Group Normalization, Transfer Learning, Improving the CIFAR-10 performance with deeper a network, Improving the CIFAR-10 performance with data augmentation, Predicting with CIFAR-10, Very deep convolutional networks for large-scale image recognition.

Recent Trends in Deep Learning Architectures: Residual Network, Skip Connection Network.

Text books:

1. Deep Learning- Ian Goodfellow, YoshuaBenjio, Aaron Courville, The MIT Press
2. Pattern Classification- Richard O. Duda, Peter E. Hart, David G. Stork, John Wiley & Sons Inc.

Reference books:

1. Theodoridis, S. and Koutroumbas, K. Pattern Recognition. Edition 4. Academic Press, 2008.
2. Russell, S. and Norvig, N. Arti□cial Intelligence: A Modern Approach. Prentice Hall Series in Artificial Intelligence. 2003.
3. Bishop, C. M. Neural Networks for Pattern Recognition. Oxford University Press. 1995.Hastie, T., Tibshirani, R. and Friedman, J. The Elements of Statistical Learning. Springer.2001.

4. Koller, D. and Friedman, N. Probabilistic Graphical Models. MIT Press. 2009.

Web Resources & other digital material:

NPTEL Lecture material

1. Lecture Series on Deep Learning by Prof. P. K. Biswas, Department of Electrical & Electronic Communication Engineering, IIT Kharagpur. https://onlinecourses.nptel.ac.in/noc22_cs22/preview#:~:text=Week%201%3A%20Introduction%20to%20Deep,Multilayer%20Perceptron%2C%20Back%20Propagation%20Learning

Course Outcomes: By the end of the course the student will be able to

- Demonstrate basic neural network models
- Perform optimization and evaluate performance of the neural network Model.
- Able to implement mathematical model of neural network.
- Design convolutional neural network for solving problems.
- Design RNN's, Auto encoders.

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