



# DEEP LEARNING (IITKGP)

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Department of Computer Science and Engineering  
IIT Kharagpur

**TYPE OF COURSE** : Rerun | Elective | UG/PG

**COURSE DURATION** : 12 weeks (24 Jan' 22 - 15 Apr' 22)

**EXAM DATE** : 23 Apr 2022

**PRE-REQUISITES** : Knowledge of Linear Algebra, DSP, PDE will be helpful.

**INTENDED AUDIENCE** : Electronics and Communication Engineering, Computer Science, Electrical Engineering

**INDUSTRIES APPLICABLE TO** : Google, Adobe, TCS, DRDO etc.

**COURSE OUTLINE :**

The availability of huge volume of Image and Video data over the internet has made the problem of data analysis and interpretation a really challenging task. Deep Learning has proved itself to be a possible solution to such Computer Vision tasks. Not only in Computer Vision, Deep Learning techniques are also widely applied in Natural Language Processing tasks. In this course we will start with traditional Machine Learning approaches, e.g. Bayesian Classification, Multilayer Perceptron etc. and then move to modern Deep Learning architectures like Convolutional Neural Networks, Autoencoders etc. On completion of the course students will acquire the knowledge of applying Deep Learning techniques to solve various real life problems.

**ABOUT INSTRUCTOR :**

Prof. Prabir Kumar Biswas completed his B.Tech(Hons), M.Tech and Ph.D from the Department of Electronics and Electrical Communication Engineering, IIT Kharagpur, India in the year 1985, 1989 and 1991 respectively. From 1985 to 1987 he was with Bharat Electronics Ltd. Ghaziabad as a deputy engineer. Since 1991 he has been working as a faculty member in the department of Electronics and Electrical Communication Engineering, IIT Kharagpur, where he is currently holding the position of Professor and Head of the Department. Prof. Biswas visited University of Kaiserslautern, Germany under the Alexander von Humboldt Research Fellowship during March 2002 to February 2003.

**COURSE PLAN :**

**Week 1:** Introduction to Deep Learning, Bayesian Learning, Decision Surfaces

**Week 2:** Linear Classifiers, Linear Machines with Hinge Loss

**Week 3:** Optimization Techniques, Gradient Descent, Batch Optimization

**Week 4:** Introduction to Neural Network, Multilayer Perceptron, Back Propagation Learning

**Week 5:** Unsupervised Learning with Deep Network, Autoencoders

**Week 6:** Convolutional Neural Network, Building blocks of CNN, Transfer Learning

**Week 7:** Revisiting Gradient Descent, Momentum Optimizer, RMSProp, Adam

**Week 8:** Effective training in Deep Net- early stopping, Dropout, Batch Normalization, Instance Normalization, Group Normalization

**Week 9:** Recent Trends in Deep Learning Architectures, Residual Network, Skip Connection Network

**Week 10:** Classical Supervised Tasks with Deep Learning, Image Denoising, Semantic Segmentation

**Week 11:** LSTM Networks

**Week 12:** Generative Modeling with DL, Variational Autoencoder, Generative Adversarial Network Revisiting Gradient Descent