



DEEP LEARNING FOR VISUAL COMPUTING

PROF. DEBDOOT SHEET

Department of Electrical and Electronics Engineering
IIT Kharagpur

TYPE OF COURSE : Rerun | Elective | PG

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

EXAM DATE : 24 Apr 2022

PRE-REQUISITES : Digital Image Processing, Machine Learning

INTENDED AUDIENCE : Electrical, Electronics and Computer Sciences

INDUSTRIES APPLICABLE TO : Industry related to Deep Learning and Machine Vision such as Intel, : Microsoft, Google, Nvidia, Philips, GE, Siemens, Samsung, IBM, Apple, TCS, Infosys, Wipro, Robert Bosch, Baidu, Wymo, Tesla, etc.

COURSE OUTLINE :

Deep learning is a genre of machine learning algorithms that attempt to solve tasks by learning abstraction in data following a stratified description paradigm using non-linear transformation architectures. When put in simple terms, say you want to make the machine recognize Mr. X standing in front of Mt. E on an image;; this task is a stratified or hierarchical recognition task. At the base of the recognition pyramid would be features which can discriminate flats, lines, curves, sharp angles, color;; higher up will be kernels which use this information to discriminate body parts, trees, natural scenery, clouds, etc.;; higher up it will use this knowledge to recognize humans, animals, mountains, etc.;; and higher up it will learn to recognize Mr. X and Mt. E and finally the apex lexical synthesizer module would say that Mr. X is standing in front of Mt. E. Deep learning is all about how you make machines synthesize this hierarchical logic and also learn these representative features and kernels all by itself. It has been used to solve problems like handwritten character recognition, object and product recognition and localization, image captioning, generating synthetic images to self driving cars. This course would provide you insights to theory and coding practice of deep learning for visual computing through curated exercises with Python and PyTorch on current developments.

ABOUT INSTRUCTOR :

Prof. Debdoot Sheeth is an Assistant Professor of Electrical Engineering at the Indian Institute of Technology Kharagpur and founder of SkinCurate Research. He received the MS and PhD degrees in computational medical imaging and machine learning from the Indian Institute of Technology Kharagpur in 2010 and 2014 respectively. He was a DAAD visiting PhD scholar to TU Munich during 2011-12. His research interests include deep learning and domain adaptation, computational medical imaging, image and multidimensional signal processing, surgical analytics and informatics, visualization and augmented reality technology design. He has widely published in journals including Medical Image Analysis (MedIA), and conferences like the IEEE International Symposium on Biomedical Imaging (ISBI). He is a member of IEEE, SPIE, ACM, IUPRAI and BMESI and serves as an Editor of IEEE Pulse since 2014.

COURSE PLAN :

Week 1: Introduction to Visual Computing and Neural Networks

Week 2: Multilayer Perceptron to Deep Neural Networks with Autoencoders

Week 3: Autoencoders for Representation Learning and MLP Initialization

Week 4: Stacked, Sparse, Denoising Autoencoders and Ladder Training

Week 5: Cost functions, Learning Rate Dynamics and Optimization

Week 6: Introduction to Convolutional Neural Networks (CNN) and LeNet

Week 7: Convolutional Autoencoders and Deep CNN (AlexNet, VGGNet)

Week 8: Very Deep CNN for Classification (GoogLeNet, ResNet, DenseNet)

Week 9: Computational Complexity and Transfer Learning of a Network

Week 10: Object Localization (RCNN) and Semantic Segmentation

Week 11: Generative Models with Adversarial Learning

Week 12: Recurrent Neural Networks (RNN) for Video Classification