

Proposal for New Course

1. Course code and Title : CS5xxx: Deep Learning

2. Course category : PME/Research

3. Course credit : (3-0-0-3)

4. Prerequisite course : Probability, Data Structures and Algorithms

5. Consent of Teacher : Required

6. Learning Objectives: Deep learning covers the theory and practice of a big family of very effective techniques today in the domain of machine learning. The objective of the course is to enable students to get familiarity with this area and to gain adequate knowledge to apply the techniques in solving real world problems.

7. Learning Outcomes: At the end of the course, the students should be able to precisely state the classical algorithms, models, and theories in the area. Students should be able to identify appropriate algorithm given a practical task. Students should also be able to implement and solve the tasks using deep learning techniques.

8. Course content:

1. Revision of Linear Algebra, Probability. Machine learning Basics. [2 weeks]
2. Introduction to deep learning tools: tensorflow, pytorch [1 week]
3. Perceptron, Neural network, deep feedforward networks. Optimization techniques for deep networks: back propagation, gradient descend, sampling techniques. Regularization, dropout. [3 weeks]
4. Convolutional networks with application in computer vision. [2 weeks]
5. Recurrent networks, Long Short Term Memory networks with application in natural language processing. [2 weeks]
6. Autoencoders, variational autoencoders with application in representation learning. [1 week]
7. Generative adversarial networks [1 week]
8. Bayesian deep learning. [1 week]
9. Case studies [1 week]

9. Text books:

1. Deep Learning. Ian Goodfellow and Yoshua Bengio and Aaron Courville. MIT Press. 2016.ISBN-13: 978-0262035613.

10. References:

1. Pattern Recognition and Machine Learning. Christopher Bishop. Springer. 2006. ISBN-13 978-0-387-31073-2.

Proposing Faculty : Dr. Mrinal Kanti Das

Department / Centre : Computer Science and Engineering

Proposal Type : New Course

Programme : B.Tech/M.Tech/Research

Reviews and rebuttal

1. Title can be called “Deep Learning” than deep machine learning.
 - a. agreed.
2. Students need knowledge of computer vision, natural language processing and machine learning before taking the course. Otherwise, they may finding it difficult to follow the LSTM and Deep reinforcement learning.
 - a. Agreed. We have included extra lecture hours with CNN and RNN to cover required knowledge in CV and NLP respectively. LSTM will come after RNN, and should be easy to follow.
3. It may be good idea to teach PyTorch implementation simultaneously to help student to visualize the understanding with examples.

- a. Agreed. Included one week on tools.
- 4. Time given for Boltzmann machine and deep reinforcement learning is too less. One of the topic can be dropped.
 - a. Agreed. Both the topics are dropped. In place of that we have included tools for deep learning.
- 5. Good idea to provide a project/laboratory session which help the student to understand the topics better.
 - a. Agreed. Project or assignments will be part of learning and evaluation. However due to some other constraints we can not have an associated lab with this course. But we are proposing a separate lab course that will benefit students.