IT 585 : Advanced Machine Learning

Course Placement : Advanced Machine Learning course is a core course for the 2nd Semester M.Tech students with Machine Learning Specialization

Course Format: It is 3 hours of lecture and 2 hours of lab every week.

Credit Structure (L-T-P-C): 3-0-2-4

Course Content: The Advanced Machine Learning course is aimed to be a follow up course to the IT582 course on Machine learning for the M.Tech students in ML specialization. It will focus both on strengthening the theoretical aspects of ML as well as on implementation of both standard ML algorithms and newly introduced algorithms by the research community. The course will touch upon generalization theory, optimization for ML, ensemble techniques, ANNs and new topics like fairness in ML, Explainability in ML etc. The course is designed to help students who want to pursue ML/Data Science research jobs or do further studies in the field of ML.

Prerequisite: IT582 or similar Machine Learning course. Student should have basic knowledge of linear algebra, probability, optimization

Reference Books:
There is no prescribed textbook. We will follow material from different sources. However following is number of reference books

- **Learning from Data: A Short Course by Yaser S. Abu-Mostafa, Malik Magdon-Ismail, Hsuan-Tien Lin**
- **Pattern Recognition and Machine Learning by Christopher Bishop**
- **Machine Learning: A Probabilistic Perspective by Kevin Murphy**

Assessment Method :(Subject to Modifications)

Lab - 10%
Teach Me Something - 10%
Reproducibility challenge -15%
Project -15%
Quizzes/Mid Sem -20%
End Sem -30%

Course Outcomes:

After successful completion of this course, students will be able to:

- Understand some of the ML techniques in details
- Read and Understand research papers in the domain of Machine Learning
- Develop an ML model, implement it , deploy it, evaluate it and report about it for a given project

P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
X	X	X			X				X	X	X

Detailed Topics:

Sr. No.	Description	No. of Lectures
1	Recap of Math preliminaries : SVD interpretation, PSD etc.	4
2	Learning Theory , Theory of Generalization	8
3	Optimization for ML: Family of Gradient based algorithms with guarantees	6
4	Bayesian Setting : Gaussian Mixture Models , Expectation Maximization, MLE, MAP, Latent Dirichlet Allocation, Topic Modeling	6
5	Ensemble Techniques: Voting Classifiers; Bagging; Random Forests; Boosting: AdaBoost, Gradient Boosting	4
6	Advanced topics in: Fairness in ML, Explainability in ML, Scalable ML and other topics depending on time and Mutual interest	8