

First Course Handout (CS771A)

2024-25 Odd Semester

Course Webpage: <https://tinyurl.com/cs771-a24>

Instructor: Piyush Rai (piyush@cse.iitk.ac.in)

1. Objectives: Machine Learning is the discipline of designing algorithms that allow machines (e.g., a computer) to learn patterns and concepts from data without being explicitly programmed. This course will be an introduction to the design (and some analysis) of Machine Learning algorithms, with a modern outlook, focusing on the recent advances, and examples of real-world applications of Machine Learning algorithms. This is supposed to be the first ("intro") course in Machine Learning. No prior exposure to Machine Learning will be assumed. At the same time, please be aware that this is NOT a course about toolkits/software/APIs used in applications of Machine Learning, but rather on the principles and foundations of Machine Learning algorithms, delving deeper to understand what goes on "under the hood", and how Machine Learning problems are formulated and solved.

2. Prerequisites: The course expects some familiarity with probability and statistics, linear algebra, calculus, and optimization, and programming in Python.

3. Course Contents

- Basic paradigms in machine learning (supervised and unsupervised learning)
- Data and features, feature extraction and feature learning
- Distance based methods (prototypes and nearest neighbors) and tree based methods (decision trees and their ensembles)
- Loss functions and regularization
- Linear models (linear regression and logistic/softmax regression)
- Probabilistic modeling for machine learning
- Kernel methods for nonlinear learning
- Unsupervised learning (clustering, dimensionality reduction, probability density estimation)
- Generative models
- Deep neural networks
- Reinforcement learning
- Assorted topics from latest advances in machine learning

5. Lecture Schedule & Venue, use of LMS (if any): Mon/Thur 6:00-7:30pm, Venue: L-20, Piazza for course-related discussions, Course website: <https://tinyurl.com/cs771-a24>

6. Office Hours: By appointment (piyush@cse.iitk.ac.in), venue: RM-502

7. Evaluation Components & Policies: (Tentative) There will be 4 quizzes (20%) 2 homeworks/mini-projects (30%), a mid-sem exam (20%), and an end-sem exam (30%). Grading scheme will be relative.

Attendance is not mandatory but we expect you to attend classes regularly.

8. Course Policies

Proration policy: If you miss any quiz or mid-sem due to a genuine reason (e.g., medical condition) which is duly supported by proper documents, your end-sem exam marks will be used for proration.

For anti-cheating policy, please refer to the following link:
<https://www.cse.iitk.ac.in/pages/AntiCheatingPolicy.html>

9. Books & References: Please refer to the course website <https://tinyurl.com/cs771-a24>