ISLAMIC UNIVERSITY OF SCIENCE & TECHNOLOGY

Department of Computer Science and Engineering

CSE 812T – PATTERN RECOGNITION

Handout: Course Information

Timings and Venue

Timings: To be announced
Office Hours: To be announced
Venue: To be announced

Contact Information

Course Instructor: Rayees Ahmad Dar
Faculty Room, CSE Department
Contact: darrayes@gmail.com
Course page: students.iitmandi.ac.in/~rayees_ahmad_dar/courses/PR/course-site.html
Moodle page: To be announced

Prerequisites:

Students are expected to have the following background:

- Basic programming skills preferably Matlab and Python proficiency.
- Familiarity with probability theory (MTH-411T: Probability & Statistics)
- Familiarity with linear algebra (MTH 211T: Mathematics-II should be sufficient)

Attendance Policy

There are no special attendance rules other than what the university has in place.

1. A leave should be submitted beforehand.
2. In emergency cases, the student should inform the instructor through the mail and necessary documents to avail the leave benefits should be submitted with seven days.
3. There will be no other relaxations. You are strongly recommended to attend all the classes.

Course Materials

1. There is no required text for this course. Notes will be posted periodically on the course-materials page.
2. Any blogs/videos and reading assignments will also be put on the site.

Grading

There will be **four assignments**, one **midterm**, one **end-term** and a major open-ended **term project**. The assignments will require MATLAB/ Python (or if one chooses any other language) programming. In the term project, you will propose a machine learning problem and solve it. Preferably it should lead to a publication.
Course grades will be based **10%** on assignments (2.5% each), **10%** on project, **30%** on the midterm, and **50%** on the endsem exams.

Submitting Assignments

- Students will be required to submit the code and a report preferably written in Latex. Both the report and code will be evaluated.
- Groups of a maximum of three (or four depending upon the strength of the class) students will be formed to solve a single assignment and project. However each student will be evaluated separately depending upon the individual effort.
- **Remember** assignments and project is a group effort and that will also be considered in the final evaluation.

Late assignments

A student is required to submit the assignment before the deadline. However a further relaxation of three days would be given against a penalty of 10% for each extra day. After the expiry of three days the assignment will not be graded. However, the student is still required to submit the report.

Plagiarism

Plagiarism is strongly discouraged and if any student is found indulging in plagiarism he/she will be penalized and in some cases will lead to his/her disqualification.

Course Materials and schedule

About the course

This course provides a broad introduction to statistical pattern recognition. Topics include: Bayesian decision Theory; Generative models (parametric / non-parametric density estimation) Discriminative learning, Logistic Regression; neural networks, support vector machines); Dimensionality reduction - PCA, SVD, LDA

Lecture Plan

Event	Date	Description	Materials and Assignments
Review of Maths Topics necessary for Pattern Recognition (3 classes)			
Lecture 1	TBD	1. Probability Distributions and Densities.	
Lecture 2	TBD	2. Linear Algebra Review	
Lecture 3	TBD	3. Optimization Basics.	
Homework	TBD	Practice Problems	
Generative classifiers; Density Estimation (7 classes)			
Lecture 4	TBD	1. Bayes' Decision Theory; Decision Boundaries and surfaces; Parametric Models.	
Lecture 5	TBD	2. Minimum Error Classifier; Minimum Risk Decision Rule	
Lecture 6	TBD	3. Maximum Likelihood Estimate (Univariate and multivariate Gaussian)	
Lecture 7	TBD	4. Maximum A-priori Estimate (Univariate and Multivariate Gaussian)	
Lecture 8	TBD	6. Multimodal Distributions; k-means algorithm	
Lecture 9	TBD	7. Gaussian Mixture Models; EM Algorithm; MLE Estimation	
Homework	TBD	**Assignment 1**	Instructions.
Homework	TBD	**Project Proposals**	Instructions.
Non-parametric Density Estimation (2 classes)			
Lecture 10	TBD	1. Introduction to Non-parametric Density Estimation	
Lecture 11	TBD	2. Parzen window and Nearest Neighbour Estimation; kNN Classifier.	
Homework	TBD	Practice Problems	
Homework	TBD	**Assignment 2**	Instructions.
Homework	TBD	**Midsem**	Instructions.
Discriminative Models (7 classes)			
Lecture 12	TBD	1. Logistic Regression	
Lecture 13	TBD	2. Perceptron Model; Introduction to the concept of Margins	
Lecture 14	TBD	3. Support Vector Machines - Problem Formulation	
Lecture 15	TBD	4. Support Vector Machines - Soft Margins; Kernel Trick	
Lecture 16	TBD	5. Review of Logistic Regression; Introduction to the Idea of Back Propagation	
Lecture 17	TBD	6. Neural Networks - Forward Propagation	
Lecture 18	TBD	7. Backpropagation	
Homework	TBD	Practice Problems	
Homework	TBD	**Assignment 3**	Instructions.
Dimensionality Reduction (7 classes)			
Lecture 19	TBD	1. Curse of Dimensionality; Introduction to PCA	
Lecture 20	TBD	2. PCA; Singular Value Decomposition	
Lecture 21	TBD	3. Linear Discriminant Analysis	
Homework	TBD	Practice Problems	
Homework	TBD	**Assignment 4**	Instructions.
Homework	TBD	**Project Submission**	Instructions.