CMPE 544 Pattern Recognition

Fall 2020

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Office: BM 24

Office Hours: TBA

Time: Friday 10:00 am - 12:50 pm

Textbooks:

- R. O. Duda, P. E. Hart, D. G. Stork, Pattern Classification, 2nd Edition, Wiley, 2000.
- E. Alpaydın, Introduction to Machine Learning, Third Edition, The MIT Press, 2014.
- C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.

Supporting Material:

- A. K. Jain, R. Duin and J. Mao, "Statistical Pattern Recognition: A Review", *IEEE Transactions on Pattern Analysis and Machine Intelligence*, Vol. 22, pp, 4-37, Jan. 2000
- I. Goodfellow, Y. Bengio, and A. Courville, Deep Learning, The MIT Press, 2016.

Course Description: This course will introduce the fundamentals of statistical pattern recognition with examples from several application areas. Topics include Bayesian decision theory, maximum likelihood and Bayesian parameter estimation, non-parametric techniques (e.g., density estimation, Parzen windows, k-Nearest Neighbors), linear discriminant functions, Tree methods, multilayer neural networks and deep learning, bias and variance in regression and classification, resampling for estimating statistics, bagging, boosting, unsupervised learning and clustering.

Objectives and Learning Outcomes: The objective of this course is to provide the foundations of statistical pattern recognition and its practical use. Upon successful completion of this course, students will have gained the necessary understanding on:

- visualizing and analyzing multi-dimensional data
- Bayesian decision theory
- parameter estimation
- supervised and unsupervised techniques
- neural networks and deep learning
- non-parametric techniques.

Prerequisites: A background in undergraduate level linear algebra, and probability and statistics is necessary. A basic knowledge of Python is essential.

Participation: Classes will be online. Students are expected to be present during the live sessions and participate actively.

Course Announcements: Announcements and course material will be posted on Moodle.

Grading:

- Assignment (3) 45%
- Quiz (5) 25 %
- Project 30%

Project: Projects will be done in groups. Every group will be provided a group of recent papers in the pattern recognition domain. They will choose one paper from that group. In the first half, the proposed approach in the paper will be understood thoroughly and implemented to reproduce the results. During the rest of the semester, students will work on improving the proposed method in the paper.

Tentative Schedule:

Introduction
Bayesian Decision Theory
Parameter Estimation
Non-parametric Techniques
Linear Discriminant Functions
Tree Methods
Multilayer Neural Networks and Deep Learning
Bias/Variance, Resampling, Bootstrap, Bagging, Boosting
Unsupervised Learning and Clustering

Late Submission and Extensions: Late submissions will not be accepted. Assignments should be submitted to Moodle before the deadline. Assignments sent over email due to any excuse will not be accepted. A student may ask for only one extension throughout the semester. Extension requests should be sent to the instructor via email before the original deadline. Extension requests after the deadline will not be accepted and the grade will be 0. The late submission rule also applies to extensions. A student cannot ask for more than **3 days** of extensions starting from the original deadline. Groups cannot request an extension for the project deliverables.

Academic Integrity: Students are expected to complete all projects, quizzes, and exams on their own. If any source is used to do a project, the student needs to cite the reference. Cheating in homework and exams is extremely forbidden. Cheating includes copying answers from the internet or a friend. The grade of the students, who are involved in cheating, will be -100 for that assignment or project. If a student cheats the second time, he/she will fail automatically.