SABANCI UNIVERSITY
CS412 - Machine Learning

Instructor(s): Berrin Yanikoglu

Office hour: Tuesday 7:00-7:30pm (we will add more if needed)

Zoom Link for lectures: https://sabanciuniv.zoom.us/j/3365523929
(no password for the Add-Drop period)

TA(s):

Buse Carik busecarik@sabanciuniv.edu
Office Hour: Monday 6-7pm
https://us02web.zoom.us/j/3474898051?pwd=L3RGUT1xTTdRSkpvdmpOCiQS1Q4dz09

Mehmet Can Yavuz <mehmetyavuz@sabanciuniv.edu>
Office Hour: Tuesday 6-7pm
https://zoom.us/j/91728605808?pwd=a29sVktMY1l2UktlyWphys0ZFdMUT09

Ozgur Can Seckin seckinozgurcan@sabanciuniv.edu
Office Hour: Wednesday 6-7pm
https://zoom.us/j/97124924256?pwd=c2VLYVk2Y2NEbThUETJ1QTJrRFBJQT09

Furkan Coskun (Student) furkancoskun@sabanciuniv.edu
Office Hour: Thursday 6-7pm
https://zoom.us/j/4365779496?pwd=QzFEZXFOY3FkZiNLv0MyMXRwZUZKQT09

The office hour links contain the password but if asked, it is ml2020

Course Content

This is an introductory machine learning course that will aim a solid understanding of the fundamental issues in machine learning (overfitting, bias/variance), together with several state-of-the-art approaches such as decision trees, linear regression, k-nearest neighbor, Bayesian classifiers, neural networks, logistic regression, and classifier combination.

Recommended or required reading

Textbooks: None, some references will be provided.

Optional Readings: Advanced or alternative explanations will be provided as supplement to lecture slides and course textbook. There are also many ML or Pattern Recognition books in IC, some as online resources. E.g. E. Alpaydin, Machine Learning.
Course Outline (Roughly one topic in 1-1.5 weeks and in tentative order)

1. Introduction to ML concepts
2. Simple ML approaches: Linear regression; Decision tree learning; Nearest Neighbor Classifier
3. Bayesian Approaches
4. Multivariate Distr.-Gaussian Bayes - Parameter Estimation
5. Multi-Layer Perceptron
6. Gradient Descent
7. Deep learning: Convolutional neural Networks
8. Practical Issues (Missing values, imbalanced classes,...)
9. Bias-Variance and Ensemble Methods
10. Support Vector Machines

Learning Objectives:

1. Understand the basic concepts, issues, assumptions and limitations in machine learning (e.g. overfitting, error measures, curse of dimensionality...).
2. Have a working knowledge of the basic mathematics (probability, expectation, entropy, basic linear algebra, ...) and algorithms behind common machine learning techniques; together with their suitability in given situations.
3. Given a machine learning problem, be able to implement and evaluate one of the standard machine learning algorithms (e.g. decision trees, neural networks, SVMs) using a tool such as Weka/Matlab or a programming language Python/R.

Learning Outcomes

- Have a solid understanding of the basic concepts, issues, assumptions and limitations in machine learning and how they apply to various machine learning techniques.
- Have a working knowledge of the basic mathematics (probability, expectation, entropy, basic linear algebra, ...) and algorithms behind common machine learning techniques; together with their suitability in given situations.
- Given a machine learning problem, select, implement and evaluate one of the appropriate machine learning algorithms (e.g. decision trees, neural networks, SVMs) using a programming environment such as Python (Colab) or Matlab.
Course Policies

■ Grading:

- **Final:** 30%
  - Currently planned to be online, but it can be in-person if YÖK and the University will allow it (if things are much better at finals time)
  - In online exam, we will ask for cameras to be ON, so we will ask for a consent form in the first week.
  - May include a short oral exam.

- **Homeworks:** 20% - 4-5 total: 2 or 3 written, 2 or 3 programming (Python)

- **Project:** 10%
  - Project will be chosen among few given alternatives
  - Can be done in groups of 2-4
  - Individual grading.

- **Quizzes (at least 14, each of them about 5-15 points worth): 40%**
  - Quiz times will be announced ahead of time – always at the end a lecture and occasionally on recitations.
  - If the max total is 200 points, your quiz score will be computed as:
    - \[ \min(100, \text{sum(all your quiz scores)}/(200*0.8)) \]
    - to allow for missing quizzes due to any reasons. I.e. you can lose 20% of quiz points and still have 100 as your quiz score.
  - This is designed to take care of any exception situation (comfortably), **so please do not write to me long emails for not counting one quiz due to some unfortunate event** (including being sick, or not having Internet connection that day). It is very difficult to read and understand long email and be a judge, all the while trying to be fair.
  - **People who will add the course during the Add/Drop period**, are expected send their first 2 quiz answers in the allocated time (before the end of submission time via private chat to instructor).

  - First quiz will be on Tuesday 6th, at 4:20pm.

■ Passing Grade:

- To pass the course you grade as calculated above must be at least 35 (strict) and "final exam grade" should be above 29/100 (you shd. be able to answer "near" one third of the question to claim to have learned the material).
- If you take the final but get a failing grade (<30), you need to take the makeup as well, in which case the average of the final and the makeup will be considered as your final exam grade. You will fail the course if that weighted average is below 30.
- Attendance & class participation is taken into account in border-line grades.