SABANCI UNIVERSITY

CS412 - Machine Learning

Instructor	Berrin Yanikoglu **(Online Office hour Tuesdays 11:00-11:30am)**
TAs	Deren E. Turan **derenege@sabanciuniv.edu** **(Office hour Tuesday 540-630)** Emre Batuhan Baloğlu **ebaloglu@sabanciuniv.edu** **(Office hour Wednesday 540-630)**
Zoom link	**https://sabanciuniv.zoom.us/j/93366735827**
Lecture Hours	**Mondays 2:40-3:30 and Fridays: 2:40-4:30**
Recitations	**Thursdays 5:40-6:30** About every 2 weeks, mainly to cover new software etc.
Textbook(s)	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 Description	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-art approaches such as decision trees, linear regression, k-nearest neighbor, Bayesian classifiers, neural networks, logistic regression, and classifier combination.
Quizzes	○ **Quiz dates are the end 10 minutes of every Friday lecture.** ○ If the max total is 200 points, your quiz score will be computed as: min(100,100*sum(all your quiz scores)/(200*0.9)) to allow for missing quizzes due to any reasons. I.e. you can lose 10% of quiz points and still have 100 as your quiz score. ○ **People who will add the course during the Add/Drop period will have those quizzes not counted.**
Course Related Communication	For questions about course policies or any suggestion or request to follow the lectures better, you can directly email the instructor or the Tas. For any exception request (you want to send a late homework or explain why you missed a quiz,...), **you MUST CC Deren (derenege@sabanciuniv.edu) AND use the subject line "CS412X". Each student has a maximum one exception PER TERM.** See the extra points for quizzes also to remedy exceptional situations. Use subject so we dont lose your email....

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	1. Have a solid understanding of the basic concepts, issues, assumptions and limitations in machine learning and how they apply to various machine learning techniques. 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, 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 Content

Typical ML course content:

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

Grading

- **Midterm & Final: 30% each** – in person
- **Homeworks: 20%** - 4-5 total: 2 or 3 written, 2 or 3 programming (Python)
- **Project: 10%**
  - Project will be chosen among few given alternatives – most likely a **Kaggle** competition
  - Can be done in groups of 2-4, but with **individual grading.**
- **Quizzes (at least 10 quizzes, each of them about 5-15 points worth): 10%**

■ **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.