**EE 4077** **Fundamentals of Machine Learning (3+0)**

**Fall 2021**

**Class Schedule:** Monday 14.00 – 16 (RTEM4.Z01), Tuesday 10.30-11.30 (RTEM4.Z09)

**Instructor :** Dr. Cabir Vural, cabir.vural@marmara.edu.tr

**Office Hours :** Monday, Wednesday 11.30-12.30 (RTEM4.211)

**Course Outline:** Supervised learning, Bayesian decision theory, parametric methods, multivariate methods, dimensionality reduction, clustering, nonparametric methods, decision trees, linear discrimination, multilayer perceptron, local methods, kernel machines, graphical methods, hidden Markov models, Bayesian estimation, combining multiple learners, reinforcement learning.

**Prerequisite:** Calculus, Linear Algebra, Probability Theory

**Objectives:**

1. To familiarize students with supervised learning.
2. To educate students on unsupervised learning
3. To teach students basics of reinforcement learning

**Outcomes:** By the end of the course the student should be able to

1. Learn the concepts of linear and nonlinear classifiers

2. Distinguish supervised and unsupervised learning.

3. Comprehend reinforcement learning.

4. Apply supervised, unsupervised and reinforcement learning to real world problems.

**Textbook:** E. Alpaydın, *Introduction to Machine Learning*, 3rd edition, the MIT Press, 2014.

**References:**

1. C. M. Bishop, Probability, *Pattern Recognition and Machine Learning*, Springer, 2006.
2. S. Haykin, *Neural Networks and Learning Machines*, Pearson Education, 2009.
3. T. Hastie, R. Tibshirani, J. Friedman, *The Elements of Statistical Learning*, Springer, 2017.
4. G. James, D. Witten, T. Hastie, R. Tibshirani, *An Introduction to Statistical Learning*, Springer, 2021

**Honor Code:** All work done on the exams will be done on your own and pledged. Homeworks may be discussed with other students, but the work will be done by the individual.

**Attendance:** Attendance is mandatory.

**Homework:** Several homeworks (theoretical and computer) will be assigned. They will not be graded

**Grade Breakdown:**

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| --- | --- |
| Midterm 1 | 30 % |
| Midterm 2 | 30 % |
| Final exam | 40 % |

**EE7024 Fundamentals of Machine Learning (3+0)**

**Spring Fall 2021**

**Tentative Schedule**

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| --- | --- | --- | --- |
| **Week** | **Date** | **Subject** | **Chapters** |
| 1 | October 4,5 | Introduction to machine learning and supervised learning | 1,2 |
| 2 | October 11,12 | Bayesian decision theory, parametric methods | 3,4 |
| 3 | October 18,19 | Multivariate methods | 5 |
| 4 | October 25,26 | Dimensionality reduction | 6 |
| 5 | November 1,2 | Clustering, nonparametric methods | 7,8 |
| 6 | November 8,9 | Decision trees, linear discrimination | 9,10 |
| 7 | November 15,16 | Multilayer perceptron | 11 |
| 8 | November 22,23 | Midterm-no class | - |
| 9 | November 29,30 | Local methods | 12 |
| 10 | December 6,7 | Kernel machines | 13 |
| 11 | December 13,14 | Graphical methods | 14 |
| 12 | December 20,21 | Hidden Markov models | 15 |
| 13 | December 27,28 | Bayesian estimation | 16 |
| 14 | January 3,4 | Combining multiple learners | 17 |
| 15 | January 10,11 | Reinforcement learning | 18 |
| 16 | January 17,18 | Design and analysis of machine learning algorithms | 19 |