ADVANCED MACHINE LEARNING

Instructor:

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COURSE OUTLINE

This course is designed for graduate students of mathematics, statistics, computer science, artificial intelligence, and related quantitative fields. The course objective is to equip students with basic research tools of the domain.

Lectures appear on Saturdays (8:00-11:00 New York time =16:30-19:30 Tehran time). Each lecture is followed with several theory, data analysis, and computation exercises to complete the lecture. Each exercise must be submitted 24 hours before the next lecture, no delay is tolerated. A latex template is provided for each exercise. Send your questions to my personal email: vpartovinia atsign gmail dot com and expect one to two days to get a reply.

Students must check the blog regularly for updates. The course blog appears here

http://admalearn.blogspot.com

Basic information about the course appears on the course website here

http://datawisdom.ca/admalearn/

Each course requires completing a kaggle competition in a team. The team must include exactly 3 students. A report on the designed methodology for the kaggle competition must be submitted at the end of the course. The kaggle ranking link must be enclosed. The codes must be uploaded on GitHub, and the GitHub link must be included in the report. A latex template will be given for the project report. The project presentation is internal with a prize for the best project.

Evaluation of the course is based on exercise, project presentation, project report, and a final exam. Minimum 50% is required to pass the course. The result of the course is announced confidentially and individually: fail [0-49]/pass [50-79]/excellent [80-100].

	Number	percentage
Exercises	6	60
Project presentation	1	10
Project report	1	10
Final exam	1	20
		100

COURSE OBJECTIVE

- Use R or Python to visualize and execute a predictive model
- Install, load, and use conventional libraries
- Combine different algorithms to execute a predictive task
- Implement parameter estimation and regularization
- Perform model selection and model inference
- Improve predictive performance by combining different algorithms

ABSOLUTE REQUIREMENTS

Introductory Probability and Statistics, Linear Algebra, Computer Programming.

RECOMMENDED REQUIREMENTS

Linear Regression, Multivariate Statistical Methods, Mathematical Statistics, Mathematical Analysis, Numerical Analysis, Probability Theory, Algorithm.

COURSE 1: STATISTICAL MACHINE LEARNING

Sessions 1 Introduction, loss function, likelihood, and beyond

Session 2 ridge, lasso, and lar

Session 3 Cross validation and model selection

Session 4 Smoothing splines, kernel methods, and lowess

Session 5 Flexible discriminant, cart, mars, and random forest

Session 6 Support vector machines and Hilbert spaces

Session 7: Final exam, project presentation

COURSE II: DATA SCIENCE FOR ARTIFICIAL INTELLIGENCE

Session 1 The EM algorithm and semi-supervised learning

Session 2 Feed-forward neural networks

Session 3 Convolutional neural networks

Session 4 Recurrent neural networks

Session 5 Bayesian neural networks

Session 6 Sum-product networks

Session 7: Final exam, project presentation