Applied Machine Learning

Lecturer: Roozbeh Razavi-Far

University of Windsor

roozbeh@uwindsor.ca

Summer 2019

COURSE INFORMATION

Lecturer:
Dr. Roozbeh Razavi-Far
Faculty of Engineering
University of Windsor

Contact Info:
roozbeh@uwindsor.ca

Office Hours:
Fridays, from 14 : 30 until 16 : 00
Office: CEI 2134

Teaching Assistant:TBD

COURSE CONTENTS

The learning problem
Linear models
Under-fitting, over-fitting
Validation and bias-variance trade off
Neural network
Theory of generalization
Evaluating hypothesis
Regularization
Support vector machine
Generative models
Feature selection
Ensemble learning
Imbalanced learning
Semi-supervised learning
Deep learning

COURSE MATERIALS

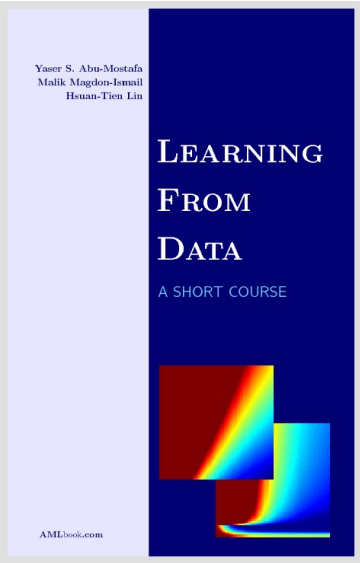
Required resources:

1. Learning from Data, Yaser S. Abu-Mostafa, Malik Magdon-Ismail, and Hsuan-Tien Lin, ISBN: 9781600490064.
2. Deep Learning, Ian Goodfellow, Yoshua Bengio, and Aaron Courville, ISBN: 9780262035613.

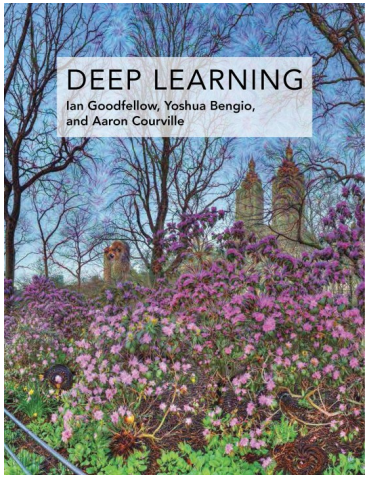
The following books are strongly recommended:

3. Pattern Recognition and Machine Learning, by C. M. Bishop.
4. Reinforcement Learning: An Introduction, R.S. Sutton and A.G. Barto.
5. Machine Learning, T. Mitchell, MIT Press.

COURSE MATERIALS



COURSE MATERIALS



COURSE OBJECTIVES

The main objectives of this course are

- to introduce students to the basic concepts and methods of the Machine Learning;
- to develop and apply recent techniques of machine learning to automatically learn from data without human interference and solving practical problems;
- the material covered in this course is fundamental and is the basis for a wide range of advanced applications.
- during the course, student will complete an applied project.

COURSE OUTCOMES

By the end of the course, the student should be able to:

- Describe the main learning strategies and their difference;
- Describe the mechanisms of the major machine learning techniques;
- Apply machine learning methods to automatically learn from a large volume of data;
- Being able to compare the machine learning techniques and analyze the obtained results.

PREREQUISITES

Mathematics and Statistics: Participants should feel comfortable with the basics of mathematics and probability. An undergraduate level is fine.

As for the project, basic programming skills is required, for instance, Matrix algebra and multivariate calculus, that can be applied in MTLAB /or/ Python /or/ R /or/ FORTRAN /or/ C.

Note: some practical examples and applications will be presented in MATLAB/Python.

EVALUATION

Participation: 5

Assignment: 10

Closed-book Exam: 40

Course Project:

- Primary Report: 5
- Primary Demo: 5
- Class Presentation: 5
- Final Demo: 25
- Final Report: 5

Re-examination: None

A^+ will only be given to outstanding achievement.

ASSIGNMENTS AND EXAM

All the assignments and exam are paper-based.

You have to write your own answers.

Do not copy!

First assignment prepares you for the midterm exam.

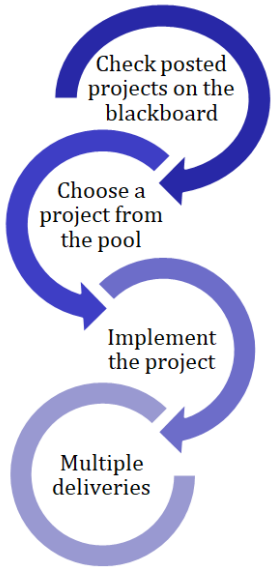
Bonus: Up to 10 extra points.

COURSE SCHEDULE

Note: subject to changes

Week	Date	Wednesdays (4:00 pm-6:50 pm)
1	May 08	Start Date
2	May 15	Check the list of projects in the Blackboard
3	May 22	Deadline to take the projects (groups).
4	May 29	Assignment become available in the Blackborad.
5	June 05	Deadline to submit the primary report.
6	June 12	Deadline to submit the assignments.
7	June 19	Study week
8	June 26	
9	July 03	Closed-book exam.
10	July 10	Class presentations and primary demos.
11	July 17	Volunteer presentation.
12	July 24	Review for final demos.
13	July 31	

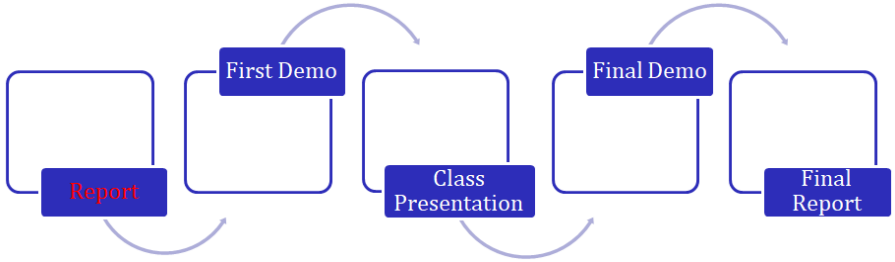
COURSE PROJECT



All the projects must be demonstrated:

- Quality of presentation
- Quality of reports
- Code implementation and execution
- Performance evaluation
- Reliability of the results

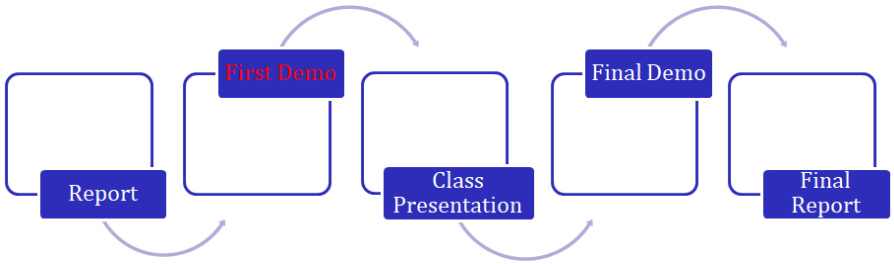
COURSE PROJECT



Each group delivers one report

- 2 to 3 pages
- Describe the topic
- Summarize the work
- Do not copy the given reference
- Explain the development procedure

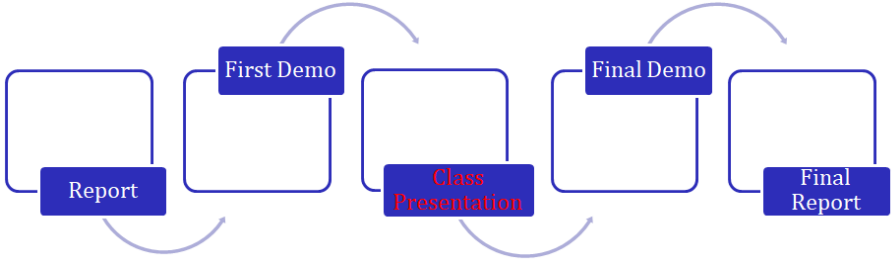
COURSE PROJECT



Demos will be given to the instructor/TA

- All group members must participate and bring the primary report previously submitted For the date, please check the schedule
- Discuss your implementation procedure (Matlab/Python/R/C/C++/Fortran)
- Installation if needed but not recommended
- Explain your ideas about development/inputs/outputs/evaluation/analysis of results
- Initial presentation, then you get confirmation for the class presentation
- Each group delivers one report

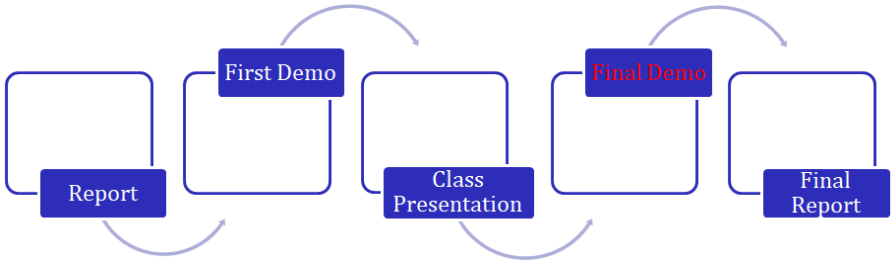
COURSE PROJECT



Class Presentation

- One member of each group will present in the class for all students
- For the date check the schedule
- Presentation time is 15-20 minutes including 5 minutes for questions
- Explain the project/goals/method/algorithm
- Explain your ideas about development/inputs/outputs/performance evaluation
- Discuss your own results (if available by the time of the presentation, not mandatory)

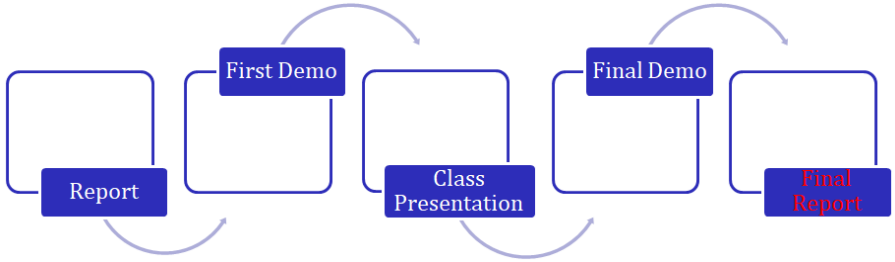
COURSE PROJECT



Final demos will be given to the instructor:

- All group members must participate and bring the final report in the same date
- For the date check the schedule
- Detailed explanation of the implementation procedure
- Execute your code
- Present and analyze your results
- Be prepared for possible questions
- Deliver your code (I will test with different data) and final report

COURSE PROJECT



- Each group delivers a final report
- Up to 10 pages including diagrams and tables
- Describe the work, algorithm, development procedure
- Explain and analyze the attained results
- Do not copy!

COLLABORATION POLICY

You are encouraged to discuss your solutions and problem-solving methods with other students, but ultimately you must write your own code and produce your own results*.

If you have collaborated with other students in the planning and design of solutions, provide their names on your report.

Plagiarism, cheating, misrepresentation of facts and participation in such offences are viewed as serious academic offences.

Work submitted by a student that is the work of another student or any other person is considered plagiarism which is immediately referred to the Dean.

REFERENCES

1 Learning from Data, Yaser S. Abu-Mostafa, Malik Magdon-Ismail, and Hsuan-Tien Lin, ISBN: 9781600490064.

2 Deep Learning, Ian Goodfellow, Yoshua Bengio, and Aaron Courville, ISBN: 9780262035613.