MACHINE LEARNING

CS6140

Spring 2020

Predrag Radivojac
BASIC INFORMATION

Class meets:
  Time: TF 3:25pm – 5:05pm
  Place: Churchill Hall 101

Instructor:
  Predrag Radivojac
  Office: WVH 310D
  Email: predrag@northeastern.edu
  Web: https://www.ccs.neu.edu/home/radivojac/

Office Hours:
  Time: T 5:30pm-6:30pm
  F 5:30pm-6:30pm or by appointment
  Place: WVH 310D

Class Web Site:
  https://www.ccs.neu.edu/home/radivojac/classes/2020springcs6140/
TEACHING ASSISTANTS

Yisu Peng
Email: peng.yis
Office: WVH 310
Office hours: R 10-11:30am in 462 WVH and F 1:30-3pm in 166 WVH

Rashika Ramola
Email: ramola.r
Office: WVH 310
Office hours: M 1-4pm in 362 WVH (exception: 1:30-3pm in 166 WVH on 1/13/20)

Daniel Zeiberg
Email: zeiberg.d
Office: WVH 310
Office hours: TW 10:30-noon in 462 WVH
A LITTLE ABOUT ML

- Machine Learning is concerned with developing, analyzing, and applying algorithms that make useful inferences in the real world
- “Learn” functions and rules from data
- Specific problems always in mind, but frameworks are very important
- Balance between theory and application, slanted towards theory
- Probability theory, statistics, computer science
  - artificial intelligence
  - engineering
  - optimization
  - psychology
  - biology
How High Is Your XQ?

Your next job might depend on it

BY ELIZA GRAY

Is it true to say you have never hated anyone? Do you understand why stars twinkle? Have you used a display of emotion to get what you want? Would you rather read or watch TV? Do you usually notice when you are boring people? Do you hate opera singing? Would you consider yourself to be an ordinary person? Are you shy? Do you prefer problems that require a lot of thought? Do you enjoy giving parties? When you do something rebellious? Do you believe people get stressed when they try to do something in your day that makes you feel happy? Are you uncomfortable accepting help from others? Are you ever stressed at work? Do you think sometimes you are someone around at work? Do you like to have a lot of things about you? Do your friends all the time? Do you make new friends at all? Do you like to change your mind? Have you ever pretended to know more than you do? Would your colleagues be surprised if you were very confident? How much does
AN EXAMPLE FROM REDDIT

Let Artificial Intelligence guess your attractiveness and age

#howhot
PROFESSOR’S SUMMER (ONLINE ADVERTISING)
A LITTLE MORE DETAIL...

\[ \Gamma(t|k, \theta) = \frac{t^{k-1}e^{-\frac{t}{\theta}}}{\theta^k \Gamma(k)} \]
WHERE ELSE DO WE SEE IT…

What Can Be Automated?
What Cannot Be Automated?
• In real situations we have uncertainty
  – We have incomplete knowledge of the environment
  – Actions of other actors are not provided

• Applied everywhere to learn from data and make predictions, some of which facilitate decisions

• Utility theory: incorporates an agent’s preferences towards certain scenarios

• Decision theory: probability theory + utility theory

• Rational decision: decision that maximizes expected utility
Overview of the CS 6140 Course

See online syllabus…

- mathematical foundations of machine learning
- overview of machine learning
- foundations of parameter estimation
- basic unsupervised learning
- classification algorithms (prediction of discrete outputs)
- regression algorithms (prediction of continuous outputs)
- kernel methods (as part of classification/regression)
- ensemble methods
- practical aspects in machine learning
- special topics (if time permits)
**TEXTBOOK INFORMATION**

**Main books:**

**Recommended readings:**
- The Elements of Statistical Learning - by T. Hastie et al., Springer, 2009

Supplementary material will be provided in class!
WHAT DO I EXPECT AND ASSUME?

• Basic mathematical skills
  – calculus
  – probabilities
  – linear algebra

• You are patient and hardworking

• Your integrity is impeccable

• You are motivated to learn (machine learning)

• You are motivated to succeed in class
Grading Policy

• Midterm exam: 20%
• Final exam: 20%
• Homework assignments (4-5): 30%
• Mini project: 25%
• Class participation: 5%

• I decide on the final grade (I don’t necessarily enjoy this)

• Midterm exam – Week 7 (in class)
• Final exam – April 17, in class, last week of classes
• Spring break – February 29- March 8 (no classes)
MORE ON GRADING

• Top performers in the class will get As

• Distributions of scores will be shown (I hope regularly)

• If you don’t know where you stand in class, ask me

• All assignments count, must be typed to show formulas properly! Plan ahead!

• All assignments are individual!

• All the sources used for problem solution must be acknowledged (people, web sites, books, etc.)
# Roadmap

<table>
<thead>
<tr>
<th>Month</th>
<th>Date 1</th>
<th>Date 2</th>
<th>Date 3</th>
<th>Date 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>6</td>
<td>13</td>
<td>20</td>
<td>27</td>
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<td>27</td>
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<td>February</td>
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<td>March</td>
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<td>30</td>
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<tr>
<td>April</td>
<td>6</td>
<td>13</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>
**ROADMAP**

January:  
- 6  
- 13 h1  
- 20  
- 27 H1, h2

March:  
- 2 (SB)  
- 9 h4  
- 16 H4  
- 23 h5  
- 30

February:  
- 3  
- 10 H2, pp (h3)  
- 17 M  
- 24 PP (H3)

April:  
- 6 H5  
- 13 F  
- 20 P
LATE ASSIGNMENT POLICY

• Homework assignments are due on the specified due date through Blackboard

• Late assignments will be accepted* according to the following rules

- points (on time) \{ recommended!
- points x 0.9 (1 day late)
- points x 0.7 (2 days late)
- points x 0.5 (3 days late)
- points x 0.3 (4 days late)
- points x 0.1 (5 days late)
- 0 (after 5 days) \} not recommended!

* if there are legitimate circumstances to not apply this policy, please inform me early
ACADEMIC HONESTY

• *The Code of Student Conduct*

  – Interesting things there, including that…
  – “Students are expected to display proper respect for the rights and privileges of other members of the University community and their guests.”
  – “Furthermore, students must follow the reasonable directions of University personnel.”
  – “The Code of Student Conduct applies both on and off campus”

• Academic honesty taken seriously!
  – I have to report every incident to the university
MISCELLANEA

- Do not record instructor(s) without explicit permission
- Turn off cell phones and other similar devices during class
- Use laptops if you have to (unless it bothers someone)
- “will u be in ur office after class”; “I need a letter of recommendation.”
- BE NICE TO PEOPLE