MACHINE LEARNING

CSCI-B555

Spring 2015

Predrag Radivojac, Indiana University
BASIC INFORMATION

Class meets:
  Time: TR 1:00pm – 2:15pm
  Place: Lindley Hall 008

Instructor:
  Predrag Radivojac
  Office: Lindley Hall 301F
  Email: predrag@indiana.edu
  Web: www.informatics.indiana.edu/predrag

Office Hours:
  Time: T 3:00pm-4:00pm
    R 4:00pm-5:00pm or by appointment
  Place: Lindley Hall 301F

Class Web Site:
  http://www.informatics.indiana.edu/predrag/classes/b555.htm
ASSOCIATE INSTRUCTOR (TEACHING ASSISTANT)

Chenyou Fan

Email: fan6@indiana.edu
Office: Informatics West 202
Times: MW 2:30pm-4:00pm
A LITTLE ABOUT ML

• Machine Learning is concerned with developing, analyzing, and applying algorithms that make useful inferences when provided with data

• Specific problems always in mind, but frameworks are important too

• Balance between theory and application

• Probability theory, statistics, computer science
  – artificial intelligence
  – engineering
  – optimization
  – psychology
  – biology
A LITTLE MORE DETAIL...

\[
\Gamma(t|k, \theta) = \frac{t^{k-1}e^{-\frac{t}{\theta}}}{\theta^k \Gamma(k)}
\]
STILL MORE DETAIL...

What Can Be Automated?
What Cannot Be Automated?
So…

• 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 provide inferences, some of which facilitate decisions

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

• Decision theory: probability theory + utility theory

• Rational decision: decision that maximizes expected utility
OVERVIEW OF THE CSCI-B555 COURSE

See online syllabus...

- mathematical foundations of machine learning
- overview of machine learning
- foundations of parameter estimation
- 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
- graphical models (if time permits, CSCI-B554)
- special topics (if time permits)
Main book:
• Pattern Recognition and Machine Learning - by C. M. Bishop, Springer 2006.

Recommended readings:
• The Elements of Statistical Learning - by T. Hastie, R. Tibshirani, and J. Friedman, 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: 25%
• Final exam: 25%
• Homework assignments (4-5): 40%
• Class participation and quizzes (4): 10%

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

• Midterm exam – Week 9, March 10 (in class)
• Final exam – May 7 (2:45pm)
• Spring break – March 14-22 (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! Programming in Matlab.

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

- Homework assignments are due on the specified due date through Oncourse

- Lecture notes should be sent to AIs (all three) and me by email

- Late assignments will be accepted (unless there are legitimate circumstances) using the following rules

  - points (on time)
  - 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)

  } recommended!

  } not recommended!
ACADEMIC HONESTY

• **Code of Student Rights, Responsibilities, and Conduct !!!**
  – Many interesting things there, including that… Students are responsible to “facilitate the learning environment and the process of learning, including attending class regularly, completing class assignments, and coming to class prepared”.

• **Academic honesty taken seriously!**
  – I have to report every cheating incident to the university
  – I will fail you in case you do bad things
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