Class enrollment

- typically the class is limited to 30
- we’ve allowed 80 to register
- > 60 are on the waiting list

- unfortunately, those still on the waiting list will not be able to enroll
- but 760 will be offered in the Spring semester!
CS 760: Machine Learning

• instructor: Mark Craven  
  email: craven@biostat.wisc.edu  
  office hours: 4:00-5:30 Wed and Thurs,  
  or by appointment  
  office: 4775A Medical Sciences Center

• TA: Jongho Lee  
  email: jongho@cs.wisc.edu  
  office hours: 2:30-4:30 Tues and Thurs  
  office: 4378 Computer Sciences

Finding my office

• 4775A Medical Sciences Center  
• easiest to enter from Charter St. and take elevator immediately to your right

[Map of the area showing the location of 4775A Medical Sciences Center]
Monday, Wednesday *and* Friday?

- we’ll have 30 lectures in all, just like a standard TR class
- most weeks we won’t meet all three days
- this arrangement facilitates making up for days I’m out of town
- *see the schedule on the course page*

Course emphases

- a variety of learning settings: supervised learning, unsupervised learning, reinforcement learning, active learning, etc.

- a broad toolbox of machine-learning methods: decision trees, nearest neighbor, neural nets, Bayesian networks, SVMs, etc.

- some underlying theory: bias-variance tradeoff, PAC learning, mistake-bound theory, etc.

- experimental methodology for evaluating learning systems: cross validation, ROC and PR curves, hypothesis testing, etc.
Two major goals

1. Understand what a learning system should do
2. Understand how (and how well) existing systems work

Course requirements

- 4 homework assignments: ~50%
  - programming
  - computational experiments (e.g. measure the effect of varying parameter $x$ in algorithm $y$)
  - written exercises
- final exam (scheduled for 12/2): ~30%
- team project (due 12/16): ~ 20%
Expected background

- CS 540 (Intro to Artificial Intelligence) or equivalent
  - search
  - first-order logic
  - unification
  - deduction

- good programming skills

- basics of probability: but we’ll review

- calculus, including partial derivatives

Programming languages

- for the programming assignments, you can use
  C
  C++
  Java
  Perl
  Python
  R

- programs must be callable from the command line
Course readings


- additional on-line articles, surveys, and chapters

What is machine learning?

- the study of algorithms that improve their performance $P$ at some task $T$ with experience $E$

- to have a well defined learning task, we must specify: $<P, T, E>$
ML example: spam filtering

- $T$: given new mail message, classify as spam vs. other
- $P$: minimize misclassification costs
- $E$: previously classified (filed) messages
ML example: mammography

[Burnside et al., Radiology 2009]

- $T$: given new mammogram, classify as benign vs. malignant
- $P$: minimize misclassification costs
- $E$: previously encountered patient histories (mammograms + subsequent outcomes)
ML example: predictive text input

- **T**: given (partially) typed word, predict the word the user intended to type
- **P**: minimize misclassifications
- **E**: words previously typed by the user
  (+ lexicon of common words + knowledge of keyboard layout)
ML example: Netflix Prize

- $T$: given a user/movie pair, predict the user’s rating (1-5 stars) of the movie
- $P$: minimize difference between predicted and actual rating
- $E$: histories of previously rated movies (user/movie/rating triples)
ML example: reinforcement learning to control an autonomous helicopter

video of Stanford University autonomous helicopter from http://heli.stanford.edu/

ML example: autonomous helicopter

- \( T \): given a measurement of the helicopter’s current state (orientation sensor, GPS, cameras), select an adjustment of the controls
- \( P \): maximize reward (intended trajectory + penalty function)
- \( E \): state, action and reward triples from previous demonstration flights
Reading assignment

• For Friday: read Chapter 1 of Mitchell

• For Wednesday next week: sections 1.1-1.6, 2.1-2.3 of online Probability book by G. Lebanon

• www.biostat.wisc.edu/~craven/cs760/