Outline

1. About this Course
   - Administration
   - Syllabus

2. Overview of machine learning

3. Review of basic maths
Registration

- CSCI561 is *not* a pre-requisite.

- Taking the entrance exam with a passing grade *is* required
  
  *Please do not inquire your grade yet — we are working diligently to grade the exam*

- Breadth requirement for CS PhD students: this course does *not* qualify.

- Auditing is *not* permitted.
Pre-requisite

As reflected in the entrance exam:

- Undergraduate courses in probability and statistics, linear algebra, multivariate calculus.
- Basic concepts in algorithms/complexity: data structures, trees, graphs, Big-O notation, etc.
- Ability to think and reason abstractly.
- Programming: Matlab (accessible through campus computing facility and license)
- Text processing: \texttt{\LaTeX} and Microsoft Word for homework and project typesetting
- Minimum assistance will be provided for debugging and compiling your codes.
Teaching staff

- **Instructors:**
  - Prof. Fei Sha
    - Office: RTH 403
    - Hours: Weds 10am – 12pm
  - Prof. Yan Liu
    - Office: PHE 336
    - Hours: Tues 3:30pm – 5:30pm

- **TAs:**
  - Farhad Pourota (pourtara@usc.edu)
  - Taha Bahadori (mohammab@usc.edu)
  - Wenzhe Li (wenzheli@usc.edu)
  - Yuan Shi (yuanshi@usc.edu)
Blackboard

http://blackboard.usc.edu

- Homework assignments and grades will be posted there.
- Once you are cleared to register, you should sign on asap to verify your access.
Textbook and course material

Lectures
Lecture slides will be posted after class — in some cases, we might also be able to post before lectures.

Textbook

- No required one
- Strongly suggest you obtain one of the following
  - Machine Learning: A Probabilistic Perspective by Kevin Murphy
  - Elements of Statistical Learning by Hastie, Tibshirani and Friedman
- Optional and supplementary: please see syllabus for other reference pointers

Assigned readings to facilitate your understanding of the lectures

- We mark the corresponding chapters in the 2 books
- There can also be research papers, information from the web, etc.
Key dates in the schedule

- Quiz 1: 10/15
- Quiz 2: 12/3
- Mini(final) project due date: TBA
Homework

- 6 Homework assignments
  - Algorithmic components
  - Programming components

- Policy
  - One two-day extension or two one-day extensions.
  - Other late assignments: will be penalized with half of earned credits
  - Group discussion: fine
  
  *But need to write up or code up individual solutions — we check for potential violations*

- Need to typeset your solutions. Learn how to use \LaTeX{} or Microsoft Word if you do not know how to.
Quiz

- Two quizzes
- Length: about 1 hour each.
- No make-up quiz unless with documented and unanticipated personal/medical urgency
Grade

- 60%: 6 homework assignments and final mini-project
- 35%: Quizzes
- 5%: Class participation
  - Raise your hands and ask questions during class
  - Participate discussion forums actively
Re-grading policy

Factual errors will be corrected as promptly as possible and will not bias against you in anyway.

- Homework and quizzes
  Within 2 days of receiving grades: (1) contact and see TAs; (2) if unresolved, contact and see me.

- The final grade
  Follow standard procedures by the University to appeal.

- Curved grading?
  We will not make such decisions until the final quiz is graded.
Not considered for regrading

- I need to upgrade my grade to maintain/boost my GPA.
- I cannot graduate if my GPA is low or if I have failed this course.
- This is the last course I have taken before I graduate.
- I have done well in other courses / I am a great programmer/theoretician.
- I have a deadline prior to the homework/quiz due date.
- I have a regular job requiring a lot of my attention.
- Exam/homework are not the best way to show my competency in learning.

Rules

- Regrading is considered on case-by-case basis.
- The whole homework/quiz will be reviewed in order to regrade.
Academic integrity

**Plagiarism and other unacceptable violations**

- Neither ethical nor in your self-interest.
- We use software as well as manually examine to detect possible plagiarism.
- Zero-tolerance, *one strike out*!

**Things to note specifically**

- Cite relevant and related work (published or unpublished)
- Acknowledge others’ help
Teaching philosophy

The nature of this course

- Describe basic concepts and tools
- Describe algorithms and their development with intuition and rigor

Expectation on you

- Hone skills on grasping abstract concepts and thinking critically to solve problems with machine learning techniques
- Prepare you for studying advanced machine learning techniques
Syllabus (schedules and topics to be covered) will be updated, if necessary, as the semester progresses. Please check/watch for updated versions on Blackboard and CS course website.
Any questions?
Outline

1. About this Course

2. Overview of machine learning
   - What is machine learning?

3. Review of basic maths
What is machine learning?

One possible definition\(^1\)
a set of methods that can automatically detect patterns in data, and then use the uncovered patterns to predict future data, or to perform other kinds of decision making under uncertainty

cf. Murphy’s book
Example: detect patterns

How the temperature has been changing in the last 140 years?

Patterns

- Seems going up
- there seems to be repeated periods of going up and down.
How do we describe the pattern?

Build a model: fit the data with a polynomial function

- The model is not accurate for individual years
- But collectively, the model captures the major trend
Predicting future

What is temperature of 2010?

- Again, the model is not accurate for that specific year
- But then, it is close to the actual one
What we have learned from this example?

**Key ingredients in the machine learning task**

- **Data**
  collected from past observation (we often call them *training data*).

- **Modeling**
  devised to capture the patterns in the data
  - The model does not have to be true — as long as it is close, it is useful
  - We should tolerate randomness and mistakes — many interesting things are stochastic by nature.

- **Prediction**
  apply the model to forecast what is going to happen in future
A rich history of applying statistical learning methods

Recognizing flowers (by R. Fisher, 1936)
Types of Iris: setosa, versicolor, and virginica
Huge success 20 years ago

Recognizing handwritten zipcodes and cheques (AT&T Labs, circa late 1990s)
More modern ones, in your social life

Recognizing your friends on Facebook
The game is to know more about you than yourself

Recommending what you might like
Why is machine learning so hot?

- **Tons of consumer applications:**
  - speech recognition, information retrieval and search, email and document classification, stock price prediction, object recognition, biometrics, etc
  - Highly desirable expertise from industry: Google, Facebook, Microsoft, Yahoo, Twitter, IBM, Linkedin, Amazon, …

- **Enable scientific breakthrough**
  - Climate science: understand global warming cause and effect
  - Biology and genetics: identify disease-causing genes and gene networks
  - Social science: social network analysis; social media analysis
  - Business and finance: marketing, operation research
  - Emerging ones: healthcare, energy, …
What is in machine learning?

Different flavors of learning problems

- Supervised learning
  Aim to predict (as in the previous list of applications)

- Unsupervised learning
  Aim to discover hidden and latent patterns and explore data

- Reinforcement learning
  Aim to act optimally under uncertainty

- Many other paradigms

The focus and goal of this course

- Supervised learning (before quiz 1)
- Unsupervised learning (after quiz 1)
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