CSE 575: Statistical Machine Learning
(subject to change)

General Course Information

- Instructor: Dr. Hanghang Tong
- Office: BY 416
- Office Hours: Th/F 10:00-11:00am
- Email: hanghang.tong@asu.edu
- Meeting Times: F 12:00pm–3:00pm
- Location: Tempe ART 220
- TA: Ms. Chen Chen
- Prerequisite: Basics of linear algebra, probability, statistics algorithm design and analysis, proficient programming in one of the following languages (Matlab, Python, C++ or Java). *It is likely that we will have a screen-quiz in the first class, which can be used as a reference on whether you have sufficient prerequisite for this class.*
- Course Textbook: Pattern Recognition and Machine Learning, Christopher M. Bishop, 2006.
- Reference book: The Elements of Statistical Learning: Data Mining, Inference, and Prediction (2nd Edition). Trevor Hastie, Robert Tibshirani and Jerome Friedman. Springer-Verlag, 2009. (`http://web.stanford.edu/~hastie/local.ftp/Springer/OLD/ESLII_print4.pdf`)

Catalog Description

Probability distributions, MLE, regression, classification, decision tree, boosting, kernel methods, clustering, mixture models, graphical models, dimensionality reduction, Bayesian networks, Hidden Markov Models, and heterogeneous learning.

Objective

An in-depth understanding of machine learning and statistical pattern recognition techniques and their applications in a variety of real problems.

Additional Reference Books

- Semi-Supervised Learning. Olivier Chapelle, Bernhard Schölkopf, and Alexander Zien. The MIT Press, 2006. (`http://enpub.fulton.asu.edu/cseml/Spring07/ssl_book/ssl_toc.pdf`)
- Kernel Methods for Pattern Analysis. John Shawe-Taylor and Nello Cristianini. Cambridge University Press, 2004. (`http://read.pudn.com/downloads167/ebook/769401/Kernel%20Methods%20for%20Pattern%20Analysis.pdf`)

- Pattern Classification (2nd edition). Richard Duda, Peter Hart, and David Stork. Wiley, 2000.
- Machine Learning. Tom Mitchell. McGraw Hill, 1997.
- Introduction to Data Mining. Pang-Ning Tan, Michael Steinbach, and Vipin Kumar. Addison Wesley, 2005.
- Data Mining: Theories, Algorithms, and Examples. Nong Ye. CRC Press, 2013.

Grading

- Project (1): 30%. Five to six students form a group to carry out a research project. It can be an implementation and a comparative study of existing methods, a review of a specific topic, or the development of a new idea. Each team will give a 10-min presentation at the end of the semester.
- Exams (3): 55%. There will be 3 exams: two mid-terms (10% each) and the final (35%).
- Homework (3): 15%. There are three in total, with equal weight.

Tentative Project Schedule

- **Project proposal (10%, due on February 20th):**
  It should contain the following information:
  (1) Project title
  (2) Team members: please specify the role of each member
  (3) Description of the problem you try to address
  (4) Research plan
  (5) Literature Survey (include a paper list that you have read and the ones you plan to read)
- **Final project presentation (10%, on April 22nd and April 29th):**
- **Final project report (10%, due on May 3rd):**
  It should have the following format:
  (1) Introduction, including a summary of the problem, previous work, methods, and results
  (2) Problem description, including a detailed description of the problem you try to address
  (3) Methodology, including a detailed description of methods used
  (4) Results and analysis, including a detailed description of your observations from the experiments
  (5) Conclusions and future work, including a brief summary of the main contributions of the project and the lessons you learn from the project, as well as a list of some potential future work

Topics to Cover (tentative)

- Classifications (KNN, Bayes Classifier, Naive Bayes Classifier, Logistic Regression and SVM)
- Clustering (K-means, GMM, Spectral clustering)
- Feature Selection and Dimension Reduction (PCA and SVD)
- Model Selection: Variance and Bias, Cross-validation
- HMM
- Advanced topics (e.g., graph learning, sparse learning)

ASU Policies on Academic Integrity

Plagiarism or any form of cheating in assignments, projects, or exams is subject to serious academic penalty; this may range from a grade of zero for the work to failure of the course. To understand your responsibilities as a student at ASU read:

- Student Code of Conduct and Student Disciplinary Procedures: `http://students.asu.edu/srr/code`
- Student Academic Integrity Page: `http://provost.asu.edu/academicintegrity`
- See also the content under the "Collaboration: What is and is not permitted" folder under the *Syllabus & Course Information* tab on Blackboard (will be available once the class starts).

Title IX and ASU Policy

Title IX is a federal law that provides that no person be excluded on the basis of sex from participation in, be denied benefits of, or be subjected to discrimination under any education program or activity. Both Title IX and university policy make clear that sexual violence and harassment based on sex is prohibited. An individual who believes they have been subjected to sexual violence or harassed on the basis of sex can seek support, including counseling and academic support, from the university. If you or someone you know has been harassed on the basis of sex or sexually assaulted, you can find information and resources at `http://sexualviolenceprevention.asu.edu/faqs/students`.