CompSci 273A : Introduction to Machine Learning
Fall 2015
Instructor: Eric Mjolsness

Rough outline of topics:

- Introduction
  - Example: Perceptron Learning
  - ML tasks
    - data types: inputs and outputs
    - supervised vs. unsupervised vs …
    - classification, regression, relationship learning
    - clustering, dimension reduction
  - ML techniques
    - data models
    - training
    - testing
    - generalization theory

- Supervised learning
  - regression
    - linear regression
    - features & bases
    - overfitting
    - regression for classification (logistic regression)
      - & vice versa (linear output units)
    - Kernal methods
  - classification
    - two-class vs. multiclass
    - decision trees
    - neural networks
    - k-nearest-neighbors
    - SVMs
  - ensemble methods

- Unsupervised learning
  - clustering (k-means, EM-MoG)
  - dimensionality reduction (PCA, NNMF, manifold learning)

- Theory
  - VC dimension
  - Probabilistic & Markov models

- Advanced
  - Deep & structured neural networks
  - belief propagation
  - relaxation neural networks

Assignments and Grading:

There will be a several homework sets worth 40%, a midterm exam worth 30% and a group project worth 30%. The Group Projects will be described in a separate document.

Midterm exam: Tuesday, November 3, in class. Note that this is the first class after the end of Daylight Savings time.

Final Projects due: Roughly, at the regularly scheduled Final Exam time for this class.

References

Required:

C. Bishop: Pattern Recognition and Machine Learning, Springer.

Optional:

P Flach: Machine Learning, Cambridge U. Press. *(Elementary and tutorial but entirely missing important topics including neural networks.)*

Advanced (not stocked in bookstore):

K. Murphy, Machine Learning: A Probabilistic Approach, MIT Press.

T. Hastie, R. Tibshirani, J. Friedman: The Elements of Statistical Learning (Springer).

G. Montavon, G. Orr, K.-R. Muller: Neural Networks: Tricks of the Trade, Springer.

Scholkopf and Smola: Learning with Kernals *(Specialized to kernal methods)*.