CS-540 Final Exam Study Guide

Saturday, May 6th, 7:45am - 9:45am
Engineering Hall 1800

For algorithms, expect to be tested in ways that require knowledge of runtime (where applicable), correctness, branching factor, and pseudocode.

Neural Networks (18.7 – 18.7.4, Mitchell readings, Nature article)

Algorithms: Neural network classification, neural network regression, back propagation, stochastic gradient descent

Concepts & Vocabulary: multi-layer feed forward neural network, activation functions, hidden units, gradient descent, sigmoid vs. ReLU, convolutional neural networks, auto-encoders, deep learning

Probability (13.2 – 13.5)

Algorithms: Inference through marginalization, Bayes Rule, Chain rule, inference using conditional probabilities

Concepts & Vocabulary: random variables, probabilistic inference, conditional probability, marginalization, independence, conditional independence, evidence

Bayesian Networks (14.1 – 14.5.1)

Algorithms: exact inference using Bayesian Networks, variable elimination algorithm (loosely), Bayes Network construction (from slides), probability estimation through direct sampling, add-one smoothing, Naïve Bayes construction and classification

Concepts & Vocabulary: Bayesian Networks, observation smoothing, conditional probability table, inference, estimation, Naïve Bayes classifier

Support Vector Machines (18.9)

Algorithms: classification using a support vector machine, loose understanding of the variables required in the dual optimization problem*

Concepts & Vocabulary: margin, linear separator, maximum margin separator, Support Vector Machine, support vectors, kernel trick, kernel function, slack variables, soft margin classifier (C term)

**No quadratic optimization required, I promise.*

Hidden Markov Models (15.1-15.3, HMM tutorial)

Algorithms: Markov model probability inference, Hidden Markov model probability inference, Forward Algorithm,

Concepts & Vocabulary: Markov model, first-order Markov assumption, hidden Markov models, π vector, start states, observation likelihood matrix, relevance to speech recognition,

Machine Learning Models to Know Just Well Enough to Compare:

Decision Trees (classification)
KNN (classification and regression)
SVM (classification)
Perceptrons (classification and regression)
Multi-Layer Neural Networks (classification and regression)
Naïve Bayes (classification)
Bayes Net (classification or inference, which isn't exactly an ML task)
Random Forests (classification and regression)
Hidden Markov Machines

Supervised vs. Unsupervised Learning