CS559/659 Machine Learning - Course Syllabus

Course Name:

CS559/659 Machine Learning

Instructor:

Dr. Xubo Song
OHSU

Time and Location:

T/Th 2:00 – 3:30 pm
GH5

Course Description:

The goal of the field of machine learning is to build computer systems that learn from experience and that are capable to adapt to their environments. Machine learning techniques have wide applications in many areas such as bioinformatics, speech and image processing, robotics, medical diagnostic systems, gene discovery, defense and security, financial forecasting, complex system modeling, and design of adaptive web agents.

This course aims to provide theoretical foundations and practical experience in machine learning. It will give an overview of many models and algorithms used in modern machine learning, including linear models, multi-layer neural networks, support vector machines, density estimation methods, graphical models, mixture models, clustering, and ensemble methods. The course will give the student the basic ideas and intuition behind these methods, as well as a more formal understanding of how and why they work. Students will have an opportunity to experiment with machine learning techniques and apply them a selected problem in the context of a term project.

Prerequisites:

Sufficient and working knowledge of multi-variate calculus, linear algebra, probability and statistics, and optimization. At least one high-level programming language (Matlab, Python, C/C++, Java, R etc).

Textbook

Chris Bishop. *Pattern recognition and Machine Learning* Springer, 2006. Required textbook.

Other Useful Books

- Kevin Murphy, *Machine Learning: a probabilistic perspective,* the MIT Press, 2012.
- R.O. Duda, P.E. Hart, D.G. Stork. *Pattern Classification.* Second edition. John Wiley and Sons, 2000.
- Tom Mitchell. *Machine Learning.* Mc Graw Hill, 1997.
- Neural Networks for Pattern Recognition, Chris Bishop, 1995.
- The Elements of Statistical Learning, Hastie & Friedman, 2001
- Information Theory, Inference and Learning algorithms, McKay, 2003

Tentative Course Outline:

- Machine learning introduction
- Density estimation
- Supervised learning:
    - Linear and logistic regression
    - Generative classification models
    - Multi-layer neural networks
    - Support vector machines
    - Gaussian Processes
- Unsupervised learning
    - Clustering
    - Gaussian Mixture Models
    - Expectation maximization
- Dimensionality reduction/feature selection
    - Feature filtering
    - Wrapper methods
    - PCA
    - Kernel PCA and Kernel LDA
- Ensemble methods (mixtures of experts, bagging and boosting)

Grading:

The final grade for the course will be determined based on homework assignments, the term project and your lecture attendance and activity. There will be several homework assignments, which follow the progression of the lectures. They are generally due one week from the assignment date. Homeworks should be done independently without collaborations, unless you are specifically instructed to work in groups. The term project presentations will be held the finals week.

Home-works	60%
Class participation	10%

Final Project 30%

Disability Statement for Course Syllabus

Our program is committed to all students achieving their potential. If you have a disability or think youmay have a disability (physical, learning, hearing, vision, psychological) which may need a reasonable accommodation please contact Student Access at (503) 494-0082 or e-mail at orchards@ohsu.edu to discuss your needs. You can also find more information at www.ohsu.edu/student-access. Because accommodations can take time to implement, it is important to have this discussion as soon as possible. All information regarding a student's disability is kept in accordance with relevant state and federal laws.