About this course

Deriving generalizable models from some given training data is central to statistical machine learning. Statistical machine learning has found wide applications in many fields including artificial intelligence, computer vision, natural language processing, finance, bioinformatics, and etc. This course provides a systematic introduction to common learning paradigms in statistical machine learning, accompanied by an exploration of a set of foundational algorithms. Main topics covered include supervised learning, unsupervised learning, and deep learning.

Specific topics covered include:
- Mathematical foundations for machine learning
- Maximum likelihood estimation
- Naive Bayes classification
- Logistic regression
- Support vector machines
- Probabilistic graphical models
- Mixture models
- K-means clustering
- Spectral clustering
- Dimensionality reduction
- Principal component analysis
- Neural networks and deep learning
- Convolutional neural networks

Required prior knowledge and skills
- Basics of linear algebra, statistics, calculus, and algorithm design and analysis
- Programming in Python

Learning Outcomes

Learners completing this course will be able to:
- Distinguish between supervised learning and unsupervised learning
- Apply common probability distributions in machine learning applications
- Use cross validation to select parameters
- Use maximum likelihood estimate (MLE) for parameter estimation
- Implement fundamental learning algorithms such as logistic regression and k-means clustering
- Implement more advanced learning algorithms such as support vector machines and convolutional neural networks
- Design a deep network using an exemplar application to solve a specific problem
- Apply key techniques employed in building deep learning architectures

Estimated Workload/Time Commitment Per Week

15 - 20 hours per week
Technology Requirements

Hardware - Standard with recent major OS
Software and Other (programs, platforms, services, etc.) - Clingo, protégé

Creator

Baoxin Li

Baoxin Li is currently a professor and the chair of the Computer Science & Engineering Program and a Graduate Faculty Endorsed to Chair in the Electrical Engineering and Computer Engineering programs. From 2000 to 2004, he was a Senior Researcher with SHARP Laboratories of America, where he was the technical lead in developing SHARP’s HiIMPACT Sports™ technologies. He was also an Adjunct Professor with the Portland State University from 2003 to 2004. His general research interests are on visual computing and machine learning, especially their application in the context of human-centered computing.