

CS 480 Course Notes

Introduction to Machine Learning

Michael Socha

University of Waterloo
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1 Course Overview

This is an applied introductory machine learning course covering the basics of machine learning algorithms and data analysis. Topics covered include:

- Regression analysis
- Probabilistic modeling
- Support vector machines
- Supervised vs unsupervised learning
- Reinforcement learning
- Neural networks

2 Introduction - What is Machine Learning?

Machine learning is the field of study of how computers can improve their performance at tasks (i.e. learn) without being explicitly programmed to do so. Machine learning can be useful for tasks for which it is difficult to write a step-by-step imperative program. Sample applications include optical character recognition, computer vision, and game playing.

2.1 Learning Frameworks

- **Supervised Learning:** Goal is to learn a function based on its input and output (e.g. determining if an email is spam based on a set of emails labeled as spam or not spam).
- **Unsupervised Learning:** Goal is to learn a function based on its input alone (e.g. organizing data into clusters).
- **Reinforcement Learning:** Goal is to learn a sequence of actions that maximize some notion of reward (e.g. learning how to control a vehicle to perform some maneuver).

2.2 Challenges

Some of the challenges facing machine learning today are:

- Dealing with large amounts of data (algorithm complexity and distributed computing become very relevant)
- Generating reproducible results
- Challenges concerning real-world adoption of work (e.g. human computer interaction, robustness, ethical concerns)