Class Logistics and Machine Learning Review

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Introduction to Machine Learning

CSCI-736

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Course Page/Syllabus Up

- Syllabus and policy:
- https://www.cs.rit.edu/~ago/courses/736/index.html
- Prerequisites:
- CSCI 630: Foundations of Intelligent Systems
- Or equivalent background

- Introduce yourselves

Objectives

- What is machine learning?
- What is representation learning?
- Conclusions
- Next time

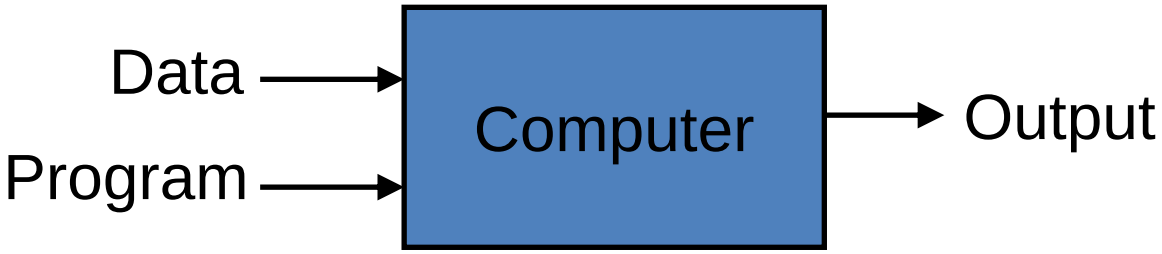
Some Useful Prerequisites

- Basic algorithmic knowledge
- Some linear algebra (matrices/vectors, operations)
- Multivariate calculus

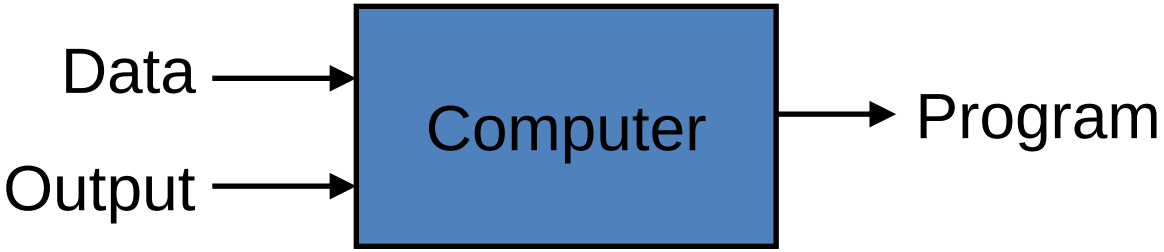
What is machine learning?

- A branch of **artificial intelligence**, concerned with the design and development of algorithms that allow computers to evolve their behavior based on empirical data
  - Automating automation
  - Getting computers to program themselves
  - Writing software is the bottleneck
  - Instead, let the data do the work instead!
- Intelligence requires knowledge, thus it is necessary for computers to acquire knowledge

Traditional Programming



Machine Learning



Is it magic?

No, more like gardening

- **Seeds** = Algorithms
- **Nutrients** = Data
- **Gardener** = You
- **Plants** = Programs

ML in a Nutshell

- Tens of thousands of machine learning algorithms
- Hundreds new every year
- Every machine learning algorithm has three components:
  - **Representation**
  - **Evaluation**
  - **Optimization**

Representation

- Decision trees
- Sets of rules / Logic programs
- Instances
- Graphical models (Bayes/Markov nets)
- Neural networks
- Support vector machines
- Model ensembles
- Etc.

Evaluation

- Accuracy
- Precision and recall
- Squared error
- Likelihood
- Posterior probability
- Cost / Utility
- Margin
- Entropy
- K-L divergence
- Etc.

Optimization

- Combinatorial optimization
  - E.g.: Greedy search
- Convex optimization
  - E.g.: Gradient descent
- Constrained optimization
  - E.g.: Linear programming

Performance

- There are several factors affecting the performance:
  - **Types of training** provided
  - The form and extent of any initial **background knowledge**
  - The **type of feedback** provided
  - The **learning algorithms** used
- Two important factors:
  - Modeling
  - Optimization
- The success of machine learning system also depends on the algorithms.
- The algorithms control the search to find and build the knowledge structures.
- The learning algorithms should extract useful information from training examples.

Questions?