Machine Learning (CS 6375)
Lec: Introduction

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Logistics

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- Office: ECSS 3.406
- Office hours: Tuesday and Thursday, 6 to 7 pm
- TA: Vasundhara Komaragiri
- Web: `http://www.hlt.utdallas.edu/~vgogate/ml/2019f/index.html`
- Discussion Board: Piazza. (Link on the class page)
  This will be the main on-line forum for discussing assignments and course material, and interacting with other students, TA and me. We will also post course-wide announcements on Piazza.

Logistics: Evaluation

- 4-5 homeworks (30%, 6-7.5% each)
  - Some programming, some exercises
  - Assigned via elearning.
- One Project (10%)
- Midterm (25%)
- Final (35%)
  Exams are closed book. You will be allowed a one-page cheat sheet (2 pages if you count front and back).
- Out of 100: A (92 and above), A- (88-91), B+ (84-87), B (80-83), B- (76-79), C+ (70-75); C (65-70); F (64 and Below).

Textbooks

- T. Mitchell, Machine Learning, McGraw-Hill (Required/Recommended)
- C. Bishop, Pattern Recognition and Machine Learning, Springer (Required/Recommended)
- Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT press (Recommended)
- Ian Goodfellow and Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press
  - Linkhttp://www.deeplearningbook.org/
- Slides/Class notes

Why Study Machine Learning?

- "A breakthrough in machine learning would be worth ten Microsofts" (Bill Gates, Microsoft)
- It is the next Big thing.
- A large subset of Artificial Intelligence (AI) and AI is everywhere.

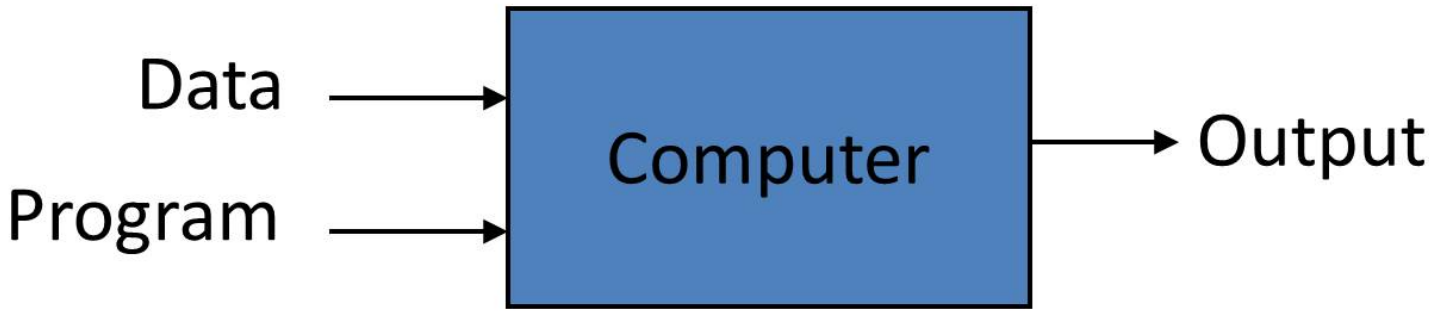
What is Machine Learning?

- Tom Mitchell: Improving performance via experience
  Formally, A computer program is said to learn from experience E with respect to some class of tasks T and performance measure P, if its performance at tasks in T as measured by P, improves with experience.
- Herb Simon: Learning denotes changes in the system that are adaptive in the sense that they enable the system to do the task or tasks drawn from the same population more efficiently and more effectively the next time.
- **The ability to perform a task in a situation which has never been encountered before.**
  (Learning = Generalization)

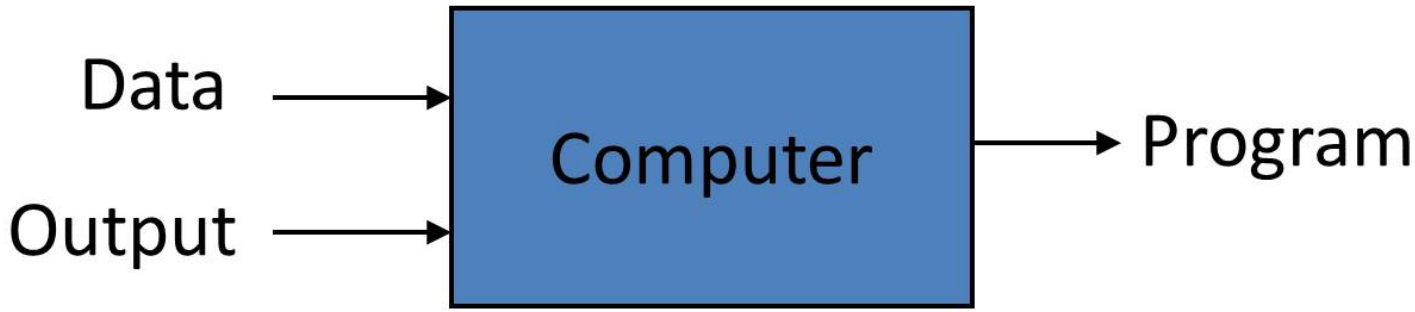
Machine Learning vs Programming

Traditional Programming

- Automating automation
- Getting computers to program themselves



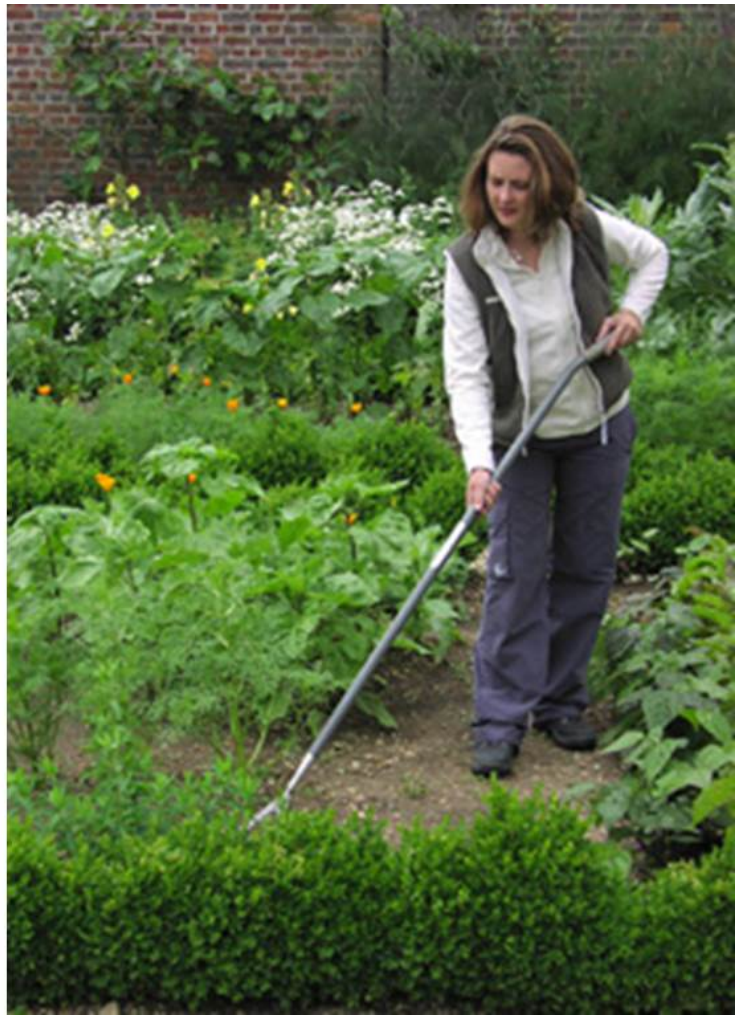
Machine Learning



Machine Learning: Is it Magic?

No, more like gardening

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



When to Use Machine Learning?

- Human expertise is absent
  Example: navigating on mars
- Humans are unable to explain their expertise
  Example: vision, speech, language
- Requirements and data change over time
  Example: Tracking, Biometrics, Personalized fingerprint recognition
- The problem or the data size is just too large
  Example: Web Search

When not to use it: If you can precisely/mathematically describe how to solve the task. Just program it.

Types of Learning

- Supervised (inductive) learning: Training data includes desired outputs
- Unsupervised learning: Training data does not include desired outputs Find hidden/interesting structure in data
- Semi-supervised learning: Training data includes a few desired outputs
- Reinforcement learning: the learner interacts with the world via actions and tries to nd an optimal policy of behavior with respect to rewards it receives from the environment

Example Machine Learning Tasks

- Classification and Regression
  Is Ana credit-worthy?; What is Ana's credit score?
- Ranking
  How to rank images that contain An awesome machine learning model?
- Outlier/Anomaly/Fraud detection
  Is it Ana using the credit card in Mexico or is it someone else?
- Finding patterns
  Almost 60% of shoppers buy Diapers and Milk together!
- Collaborative Filtering
  The problem of collaborative filtering is to predict how well a user will like an item that he has not rated given a set of historical preference judgments for a community of users.
- Structured Prediction
  Convert this natural language sentence into a parse tree

Brush up on:

- Linear algebra
- Statistics 101
- Vectors
- Probability theory