Good News:
- Test #1 on Thursday
- Agents and Agent Architecture.

**Machine Learning**

Learning: improve behavior with experience
- Range
- Accuracy of actions
- Speed

Components:
- data: experience from where to learn
- Task: what to learn
- Measure of Improvement: Is the agent learning?

![Diagram of learning process]

**Common Learning Tasks**

- **Supervised Classification:** Given a set of pre-classified examples, classify a new instance.
  - Spam filter
    - data: e-mail
    - task: given new e-mail, is it spam?
  - Movie recommender
    - data: watch history
    - task: given a movie, would you like it?
* Unsupervised Learning:
  - Find patterns in data: Clustering.

* Reinforcement Learning:
  - Determine what to do based on rewards and punishments
    Agent is allowed to Act, and finish an "episode"
    - data: win/lose

* Inductive Learning:
  - Logic Programming: Infer representations from examples
    - data: database of cat information
    - Infer: all cats have fur

* Statistical Learning:
  - Infer: with probability 98% cats have fur.

Feedback:

Feedback at every step: Supervised Learning
Some Feedback: Reinforcement Learning
No Feedback: Unsupervised Learning

Online vs Offline Learning:

Offline: Examples are available to agent before acting.
Online: Examples arrive as agent is acting.
Active Learning - Agent acts to get examples.

**Measuring Success**
Success is measured not on the data, but on the task.

**Representation of Model**
Not the data: compact representation.
- The richer the model, the more useful
  - The more difficult to learn.

EX Spam classifier
  - data: spam
  - regular

Simple model: 1 string: "free"
Complex model: double
strs

**Bias**
The tendency to prefer one hypothesis over another.
what is a good bias?

**Data**
- Data isn't perfect
  - Data misses examples
  - Data can be misclassified
- Overfitting: Agent identifies distinctions that appear in training data, but not in task.

**Learning as Search**
- Learning Model
  - Tree
  - Neural Network
  - Graph
Search for Learning Model that is best for task

Search Driven by data

Learning Algorithm: Search Space.