GENERAL ASSEMBLY

INTRO TO DATA SCIENCE
LECTURE 2: MACHINE LEARNING

AGENDA

I. WHAT IS MACHINE LEARNING?

II. MACHINE LEARNING ALGORITHMS

III. PYTHON TOOLS FOR ML

IV. LAB: PRACTICE

I. WHAT IS MACHINE LEARNING?

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from Wikipedia:

"Machine learning, a branch of artificial intelligence, is about the construction and study of systems that can *learn from data*."

source: http://en.wikipedia.org/wiki/Machine_learning

WHAT IS MACHINE LEARNING?

from Wikipedia:

"Machine learning, a branch of artificial intelligence, is about the construction and study of systems that can *learn from data*."

- "Field of study that gives computers the ability to learn without being explicitly programmed" *~Arthur Samuel*
- "Improve on task, **T**, with respect to performance metric, **P**, based on experience, **E**" *~Tom Mitchell*

QUESTION

WHAT IS MACHINE LEARNING USED FOR?

WHAT IS MACHINE LEARNING USED FOR?

Pattern Recognition

Prediction

Search Engines

Diagnostics

Bioinformatics

Machine Translation

Summarization

MACHINE LEARNING STRENGTHS

- finding patterns in large data sets
- scaling out decision making that is time-consuming or repetitive for humans

MACHINE LEARNING WEAKNESSES

- algorithms vary in ability to generalize over patterns
- possibility of over-generalizing
- limited by available data

II. MACHINE LEARNING ALGORITHMS

TYPES OF MACHINE LEARNING ALGORITHMS

1. supervised

2. unsupervised

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1. supervised
   - ➢ making predictions
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TYPES OF MACHINE LEARNING ALGORITHMS

1. supervised
   - ➢ making predictions

2. unsupervised
   - ➢ extracting structure

SUPERVISED LEARNING

- Outcome measurement ***Y***, (also called dependent variable, response, target)
- Vector of ***p*** predictor measurements ***X*** (also called inputs, regressors, covariates, features, independent variables)
- In ***regression***, *Y* is quantitative (e.g. price, temperature)
- In ***classification***, *Y* has values in a finite, unordered set (survived/died, cancer class of tissue sample, category of document)

SUPERVISED LEARNING

On the basis of training data $(x_1, y_1),\ldots,(x_N, y_N)$ we would like to:

- accurately predict unseen test cases
- understand which inputs affect the outcome, and how
- asses the quality of our predictions and inferences

UNSUPERVISED LEARNING

- No outcome variable, just a set of predictors (features) measured on a set of samples
- objective is less clear-- find features/groups of samples that behave similarly, find linear combinations of features with the most variation
- difficult to know how well you are doing
- can be useful as a pre-processing step for supervised learning

SUPERVISED OR UNSUPERVISED?

- spam filtering

SUPERVISED OR UNSUPERVISED?

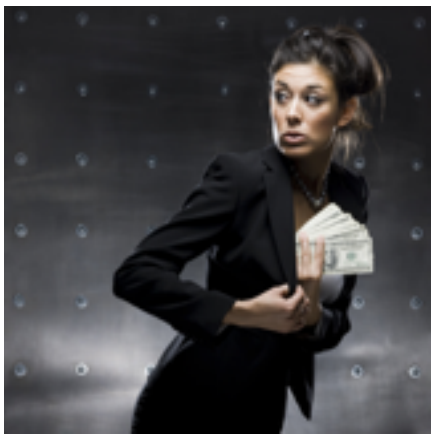
- spam filtering
- character recognition

SUPERVISED OR UNSUPERVISED?

- spam filtering
- character recognition
- document clustering

SUPERVISED OR UNSUPERVISED?

- spam filtering
- character recognition
- document clustering
- fraud detection



SUPERVISED OR UNSUPERVISED?

- spam filtering
- character recognition
- document clustering
- fraud detection
- dimensionality reduction

III. Python Tools
IV. Lab Practice