Motivation and Basics

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Weekly Objectives

- Motivate the study on
  - Machine learning, AI, Datamining….
  - Why? What?
  - Overview of the field
- Short questions and answers on a story
  - What consists of machine learning?
  - MLE
  - MAP
- Some basics
  - Probability
  - Distribution
  - And some rules…

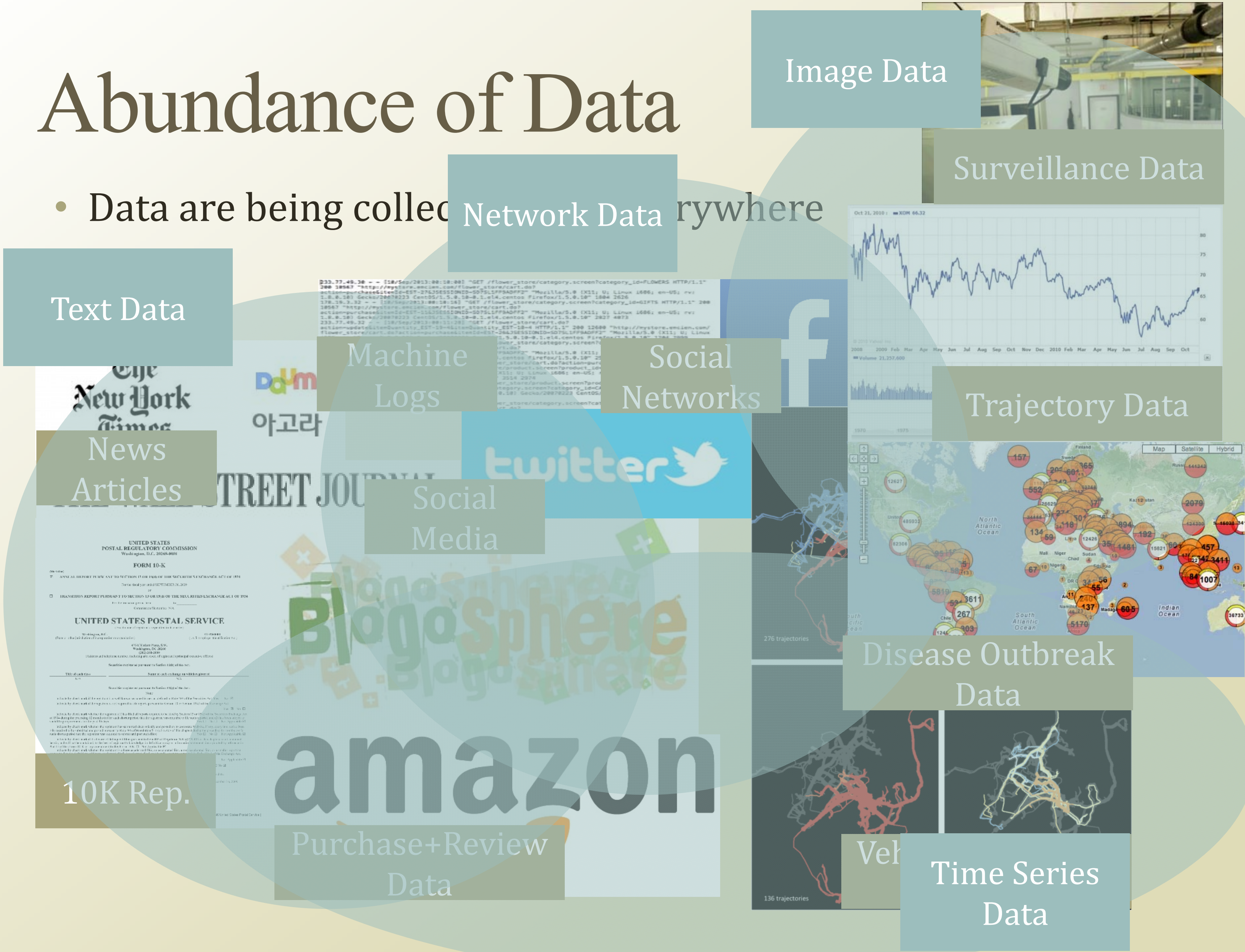
MOTIVATION

Keywords

- Many floating keywords
  - Data-mining, Knowledge discovery, Machine Learning, Artificial Intelligence…
- Comes from territory, perspectives, types of problems, researchers, etc
- We are going to focus on substance, not labeling.
- I am just going to call it "Machine Learning"
  - You can call it whatever you want

Abundance of Data

- Data are being collec rywhere



Examples of Machine Learning Applications

- Machine Learning is everywhere…

Document Classification

Sports
Science
News

Stock Market Prediction

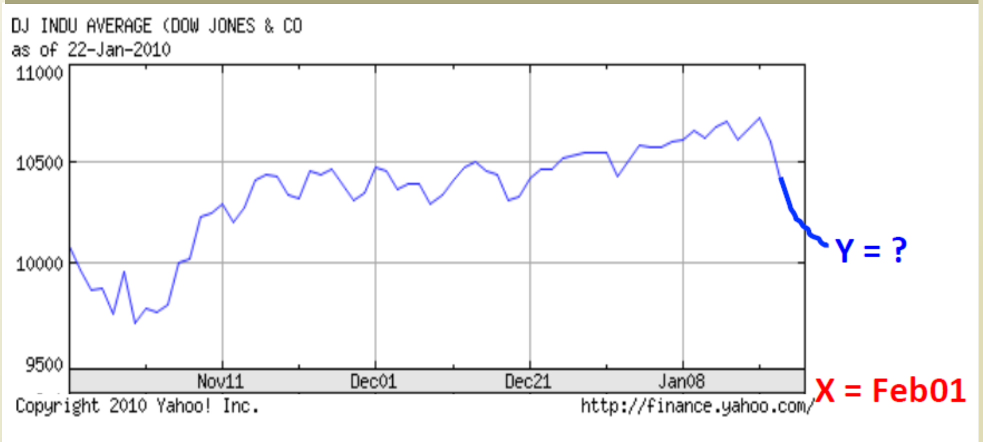


Plate Num. Recognition

SNS Recommendation

Helicopter Control

Spam Filtering and more

Importance

Table 2: Detailed evaluation results of SVMs with each representation scheme and varying training-set sizes. Macro-averaged MAE scores are provided with p-values, indicating the statistical significances of performance improvement over that of BF (using basic features alone). Numbers in bold fond indicate the best method for each fixed training-set size. One star indicates the p-values in (0.01, 0.05]; two stars indicate the p-values equal or less than 1%.

	BF	BF+NC		BF+SI		BF+SIP		BF+SI+NC		BF+SI+NC+SIP	
# of tr	MAE	MAE	p-value	MAE	p-value	MAE	p-value	MAE	p-value	MAE	p-value
10	0.9666	0.9063	* 0.0382	0.8837	* 0.0106	0.8968	* 0.0311	0.9112	* 0.0211	**0.8827**	** 0.0087
20	0.9720	0.8969	0.0506	**0.8596**	* 0.0315	0.9095	* 0.0435	0.9071	0.0558	0.8659	* 0.0235

SVM?

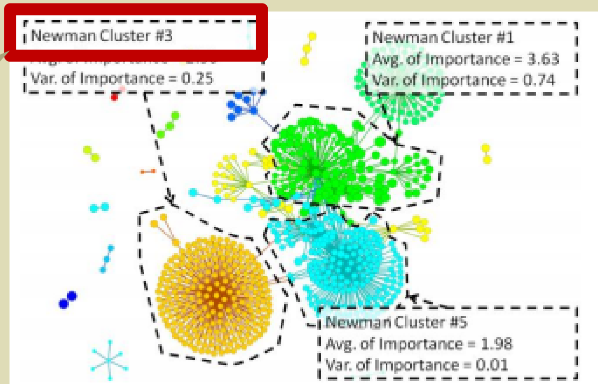
- Spam filter
- More?
  - Importance vs. Urgency
- How to predict an important email?
  - Social networks
  - Contents
- Shinjae Yoo, Yiming Yang, Frank Lin, and Il-Chul Moon, Mining Social Networks for Personalized Email Prioritization, ACM SIGKDD Conference, Paris, France, Jun, 28, 2009

Features

5.3 Features

The basic features are the tokens in the sections of *from*, *to*, *cc*, *title*, and *body text* in email messages. Let us use a v-dimensional vector to represent those features for each email message where v is the vocabulary size. We call it the *basic feature* (BF) sub-vector.

Clusters? Is this a machine learning technique?

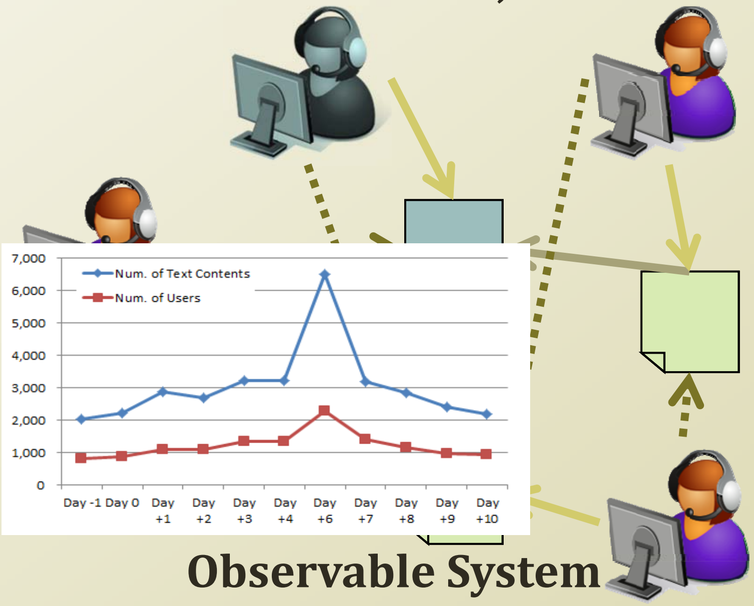


Il-Chul Moon, Alice H. Oh, and Kathleen M. Carley, ***Analyzing Social Media in Escalating Crisis Situations,*** **IEEE Conference on Intelligence and Security Informatics (ISI 2011), pp. 71-76, Beijing, China, Jul 10-12, 2011**

Opinion Mining and more

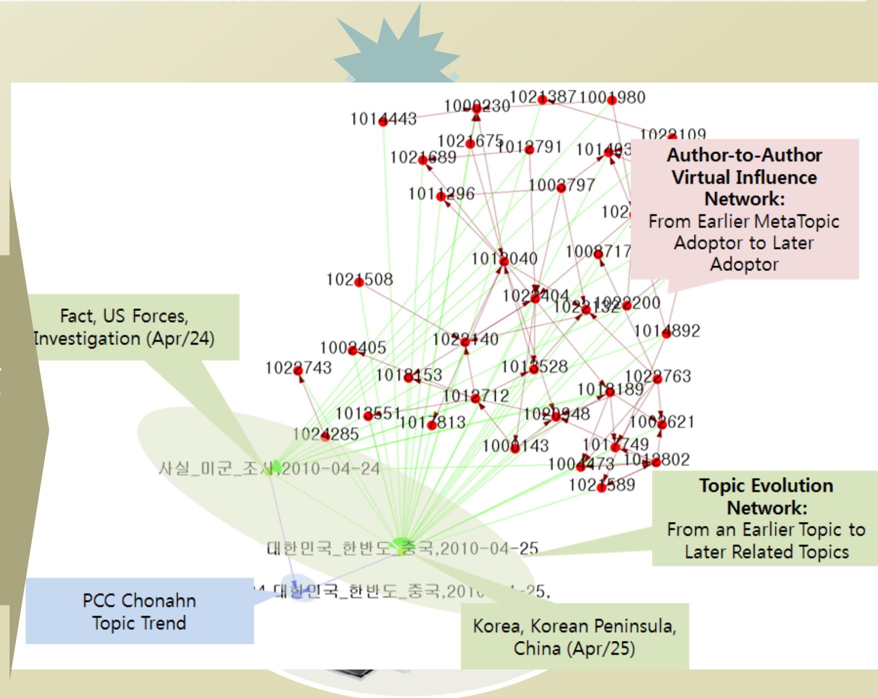
PCC Cheonan
Sank on Mar 26, 2010

Finding out consensus of the population
- Mining population's perception of the event
- Mining key opinion buried in a data chunk
- Estimating future polarity of the population
- Strategy to maintain the unity of the population



Observable System

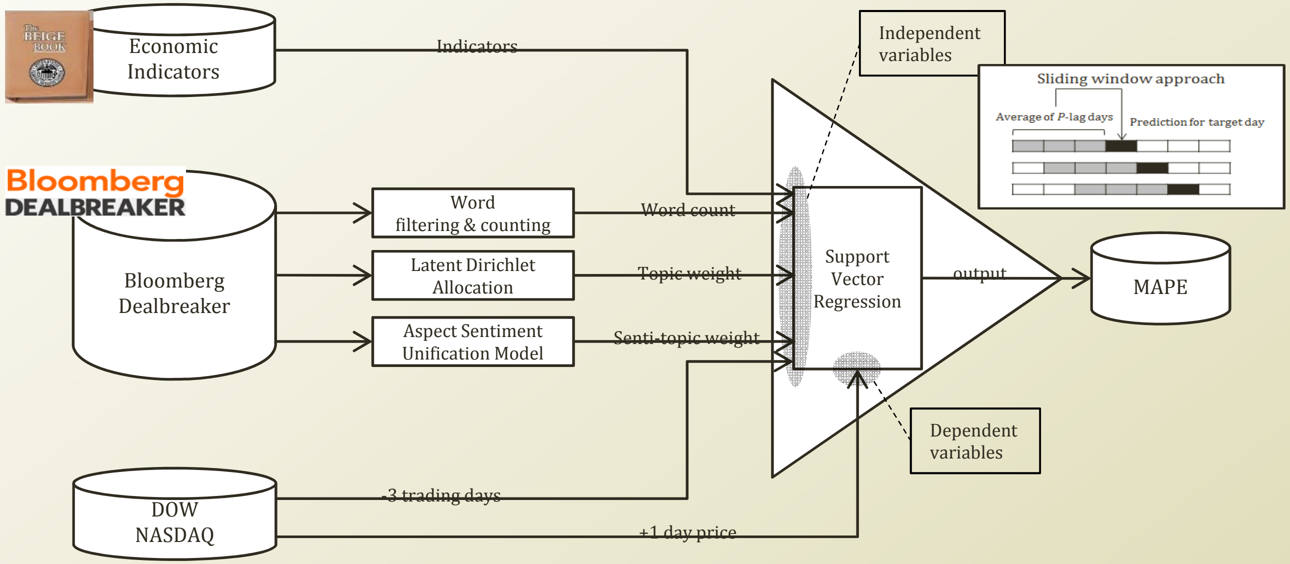
Data-mining on SNS and Texts



Implicit System

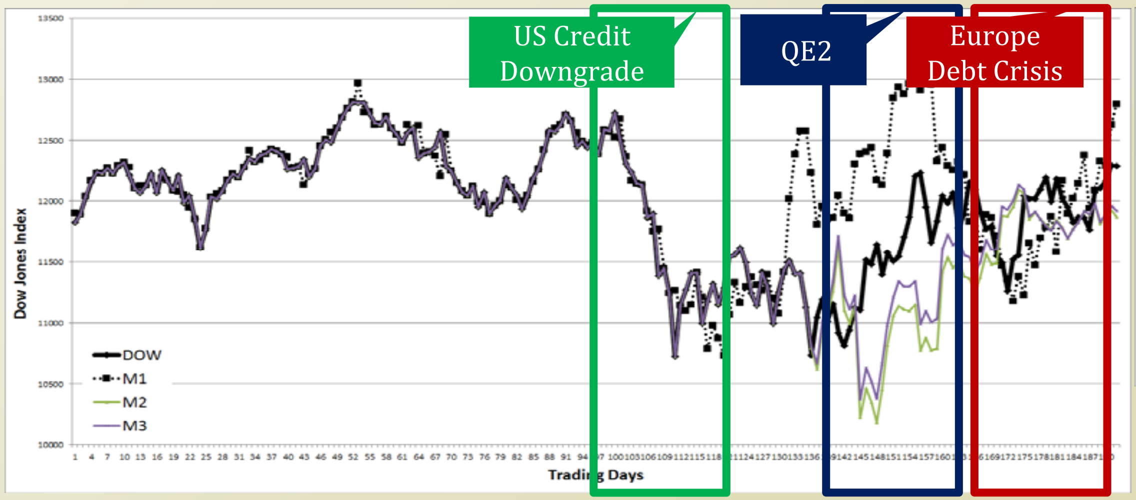
W.S. Lee, J.Y. Bak, A.H. Oh, and I.-C. Moon. Media Analysis to Estimate Stock Market Movement. Information Fusion. Major Revision

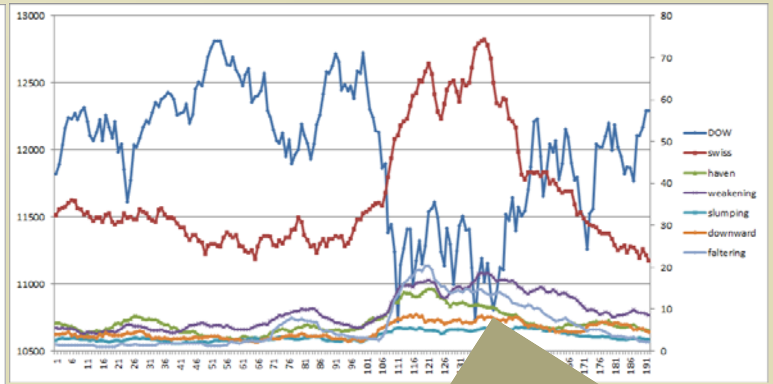
Stock Market Prediction and more



High Coefficients on Prediction

TopicWeight 26	TopicWeight 1	TopicWeight 7
-0.609	0.520	0.508
notes	obama	jun
moodys	republican	pence
swaps	republicans	na
treasuries	congress	swiss
versus	senate	chg
ratings	bill	francs
auction	barack	spa
default	lawmakers	fullyear
strategist	administration	nv
franc	democrats	dividend
twoyear	taxes	firstquarter
samp	white	ks
currencies	workers	paris
yen	democrat	reporting
swiss	obamas	tech

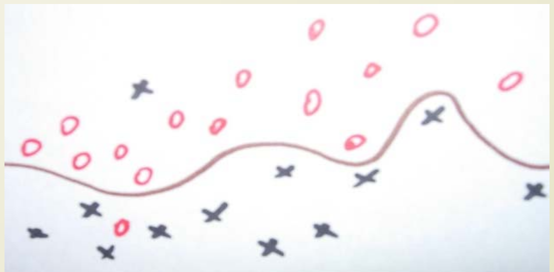
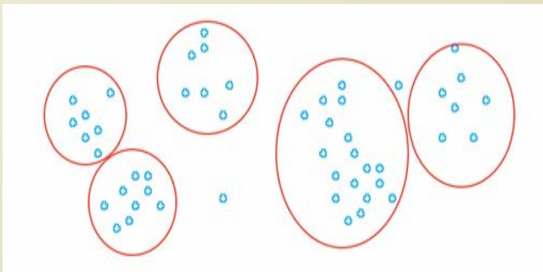
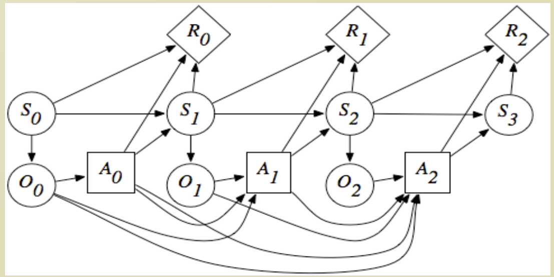




Heavy negative correlation between "*swiss*" and DJIA

Types of Machine Learning

Machine Learning → Supervised Learning, Unsupervised Learning, Reinforcement Learning, ……

Supervised Learning	Unsupervised Learning	Reinforcement Learning
You know the true answers of some of instances	*You* do not know the true answers of instances	*You* do know the objective, but you do not know how to achieve
		

- ***You*** can
  - Machine learning
  - Dataset provider
  - Machine learning users
  - etc

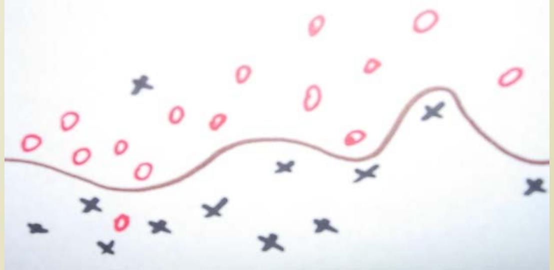
- Various classifications by different professors
  - Purpose, data types, etc
- Other learning classifications also exist

Supervised Learning

- **You know the true value, and you can provide examples of the true value.**
- Cases, such as
  - Spam filtering
  - Automatic grading
  - Automatic categorization
- Classification or Regression of
  - Hit or Miss: Something has **either disease or not.**
  - Ranking: Someone received **either A+, B, C, or F**.
  - Types: An article is **either positive or negative**.
  - Value prediction: The price of this artifact is **X.**
- Methodologies
  - Classification: estimating a discrete dependent value from observations
  - Regression: estimating a (continuous) dependent value from observations

Supervised Learning

You know the true answers of some of instances



Unsupervised Learning

- **You don't know the true value, and you cannot provide examples of the true value.**
- Cases, such as
  - Discovering clusters
  - Discovering latent factors
  - Discovering graph structures
- Clustering or filtering or completing of
  - Finding **the representative topic words from text data**
  - Finding **the latent image from facial data**
  - Completing the incomplete **matrix of product-review scores**
  - Filtering the **noise from the trajectory data**
- Methodologies
  - Clustering: estimating sets and affiliations of instances to the sets
  - Filtering: estimating underlying and fundamental signals from the mixture of signals and noises

Unsupervised Learning

You do not know the true answers of instances