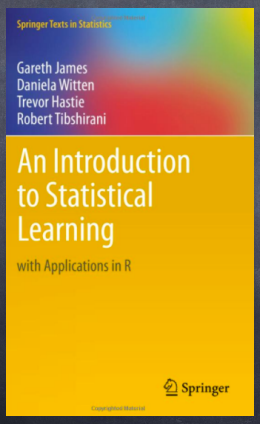
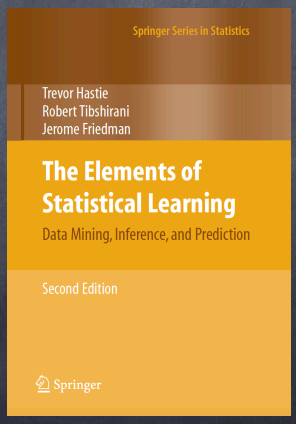
Machine Learning

Stephan Robert | HEIG-Vd | Summer University 2019

Few good books

(Not necessary to buy them, just download them. Free access)

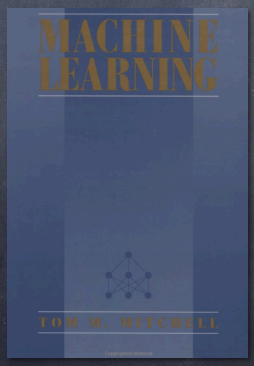


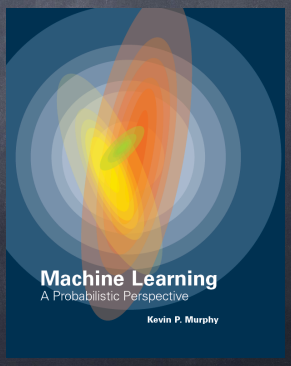


Few good books

(Not necessary to buy them, just download them. Free access)

- Machine Learning, Tom Mitchell
- Machine Learning, Kevin Murphy





Web page and links...

- Lecture slides and handouts
- Documentation, links, software resources
- Announcements and schedule
- Email (labs)
- Slides at http://www.stephan-robert.ch/teaching/machine-learning

... and links...

- Kaggle.com (competitions, jobs,...)
- Datascience.net

Python tutorials and books

- docs.python.org/3/tutorial/index.html
- wiki.python.org/moin/IntroductoryBooks

Python environment

- Python release 3.6 (3.7 from July 2019)
- Anaconda Navigator (Jupyter, Ipython, Spyder,…)

Python Libraries

- Numpy
- Pandas
- Matplotlib
- Scikit-learn
- Scipy
- Tensorflow
- Keras

Syllabus

- **Lesson 1:** Introduction to Machine Learning, Gradient Descent (cost function, many variables)
- **Lesson 2:** Linear regression, logistic regression
- **Lesson 3:** Support vector machines
- **Lesson 4:** Unsupervised learning (PCA, k-means, K-nearest neighbor, classification)
- **Lesson 5:** Deep Neural Networks

Homeworks

- HW 1: **Gradient Descent**
- HW 2: **Linear and logistic regression**
- HW 3: **Support Vector Machines**
- HW 4: **Unsupervised learning**
- HW 5: **DNN (tentative)**

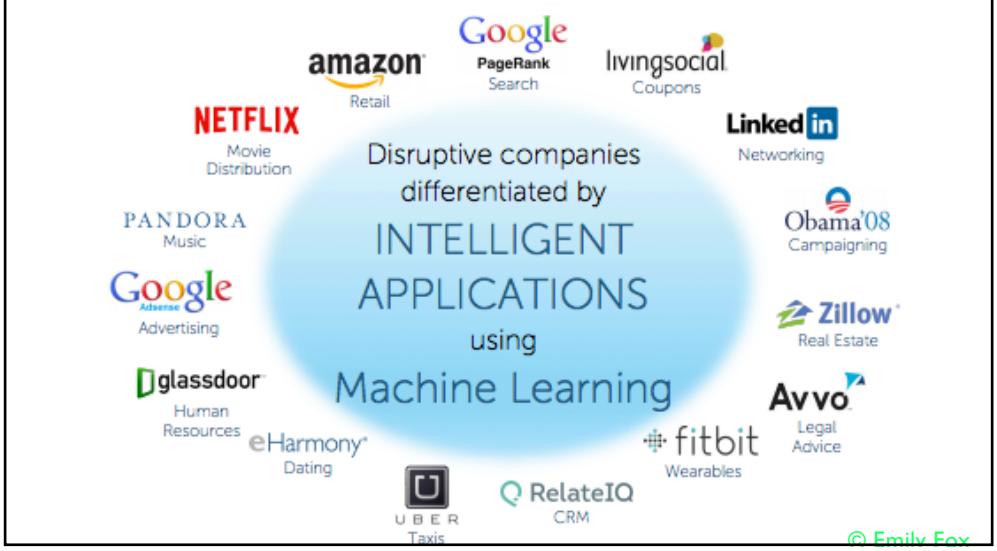
Homeworks

- Each group of students (1-2 students per group) must write their own code for the programming part. Please don't search for answers on the web, Google, previous years' homeworks, etc. Don't post them either!
- HW 1,2,3: Group of two students (1 from SNU + 1 from HEIG-Vd)
- HW 4,5: Individual

Grading

- 3 homeworks
  - HW 1 is mandatory
  - 1 HW amongst HW 2,3
  - 1 HW amongst HW 4,5

Machine Learning is changing the world



Few videos...

- AI in the real life
  https://www.youtube.com/watch?v=PIs_q2aQzHg

What is Machine Learning?

- Study of algorithms that improve their performances at some tasks with experience

Supervised learning

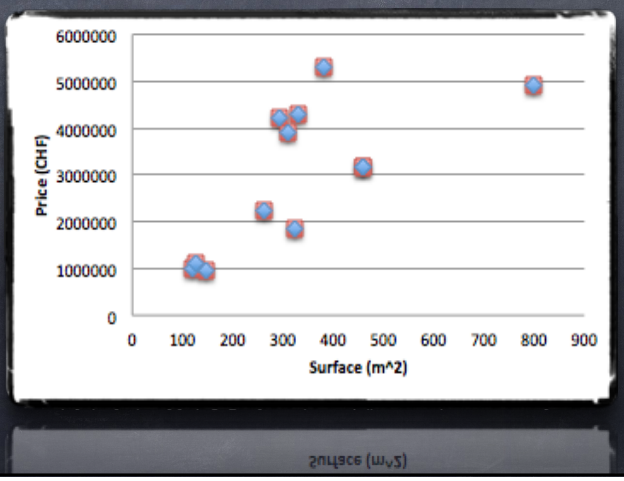
- Knowledge of output

  Learning with the presence of an expert (e.g. Support Vector Machines, Decision Trees, Neural Networks, Bayesian Classifiers,…)

House price prediction

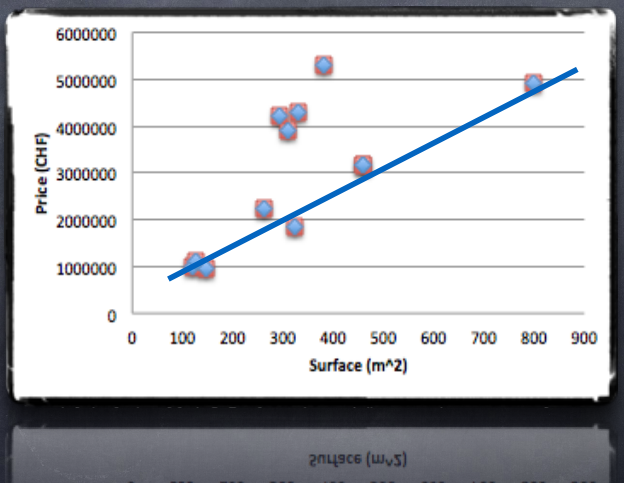
Supervised learning: regression

Example of houses prices in Lausanne



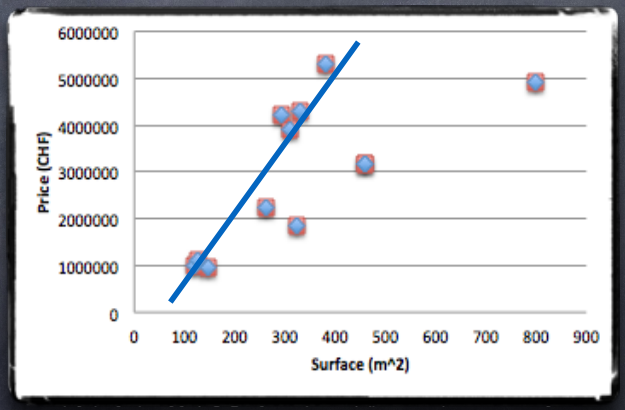
House price prediction

Supervised learning



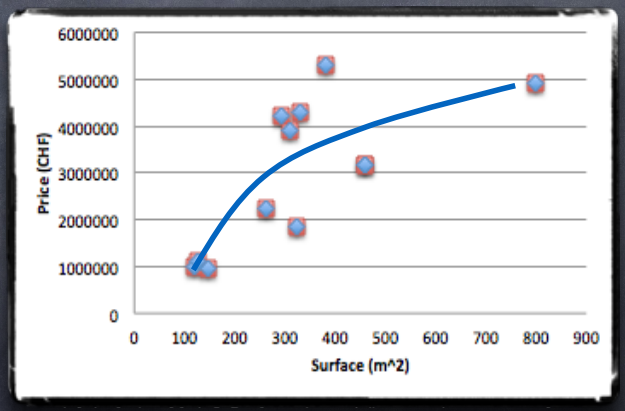
House price prediction

Supervised learning



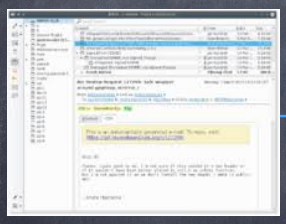
House price prediction

Supervised learning



Spam filtering

Supervised learning: classification



Text of email, IP Source,…

Not Spam

Spam

input

output

Other examples

Supervised learning: classification

- Sentiment analysis
- Personalized medical diagnosis (multiple outputs: flu, healthy, …)

Stock prediction

Supervised learning

Depends on recent history of stock market, news events, …

(Vodafone)

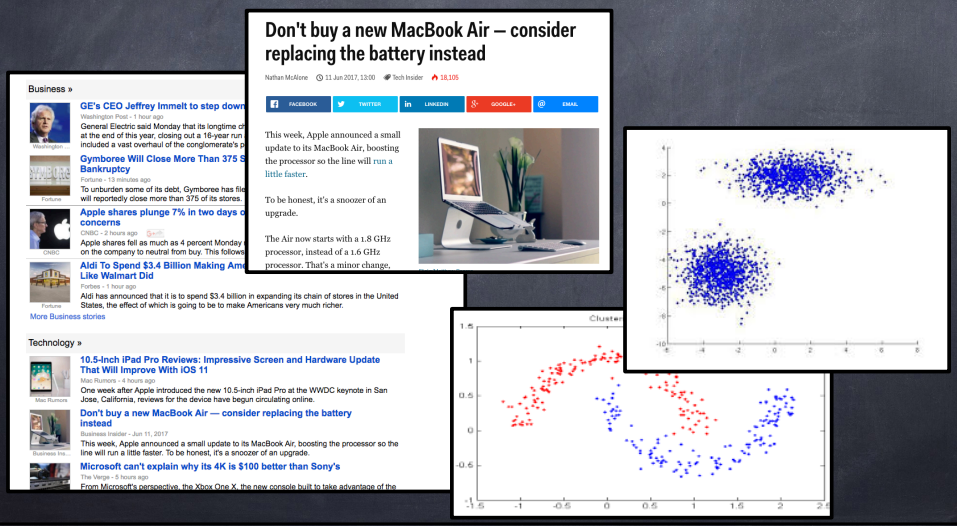
Unsupervised learning

- No Knowledge of output

  Learning without the presence of an expert (e.g k-means, clustering approaches ,…)

Unsupervised learning

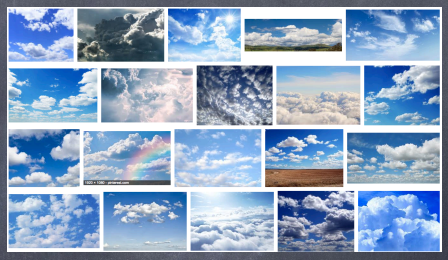
news.google.com

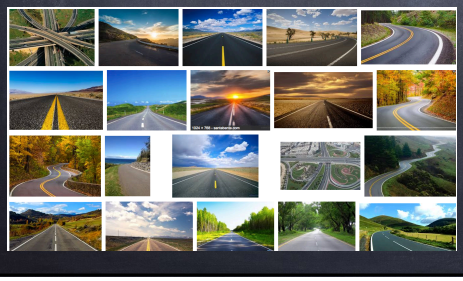


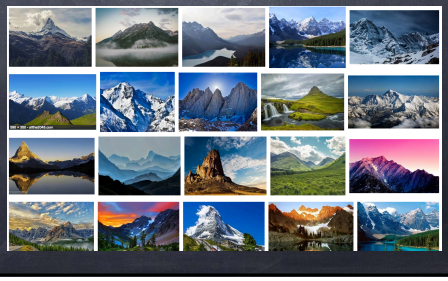
Unsupervised learning

Clustering images, group as:

- Clouds
- Mountains
- Roads







Unsupervised learning

Other examples

- Users on Web sites (groups, activities)
- Words (First names, last names, location words, …)