

How to get Started with Machine Learning?

ENSIAS

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Enrich

- Business Intelligence
 - https://www.youtube.com/watch?v=jkCCnvwO_fg
- Business Analytics
 - <https://www.youtube.com/watch?v=9IlgH0hNtgc>

Content

- Machine Learning Everywhere
- Machine Learning
 - The Big Picture?
 - How it Works?
 - How can I Apply?
 - How can I Learn?
- Terminologies

Machine Learning Everywhere

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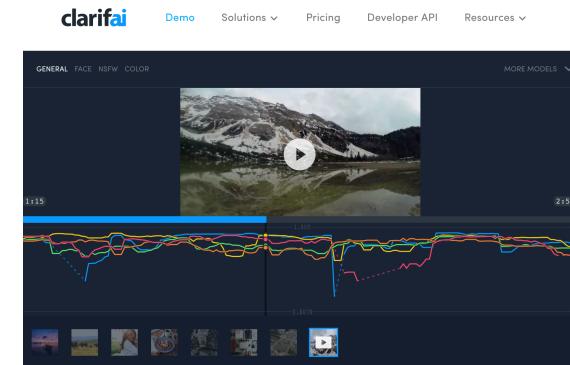
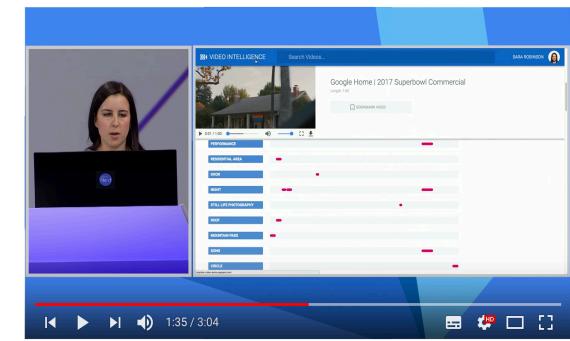
Machine Learning Everywhere

Forbes: The Top 10 AI And Machine Learning Use Cases Everyone Should Know About

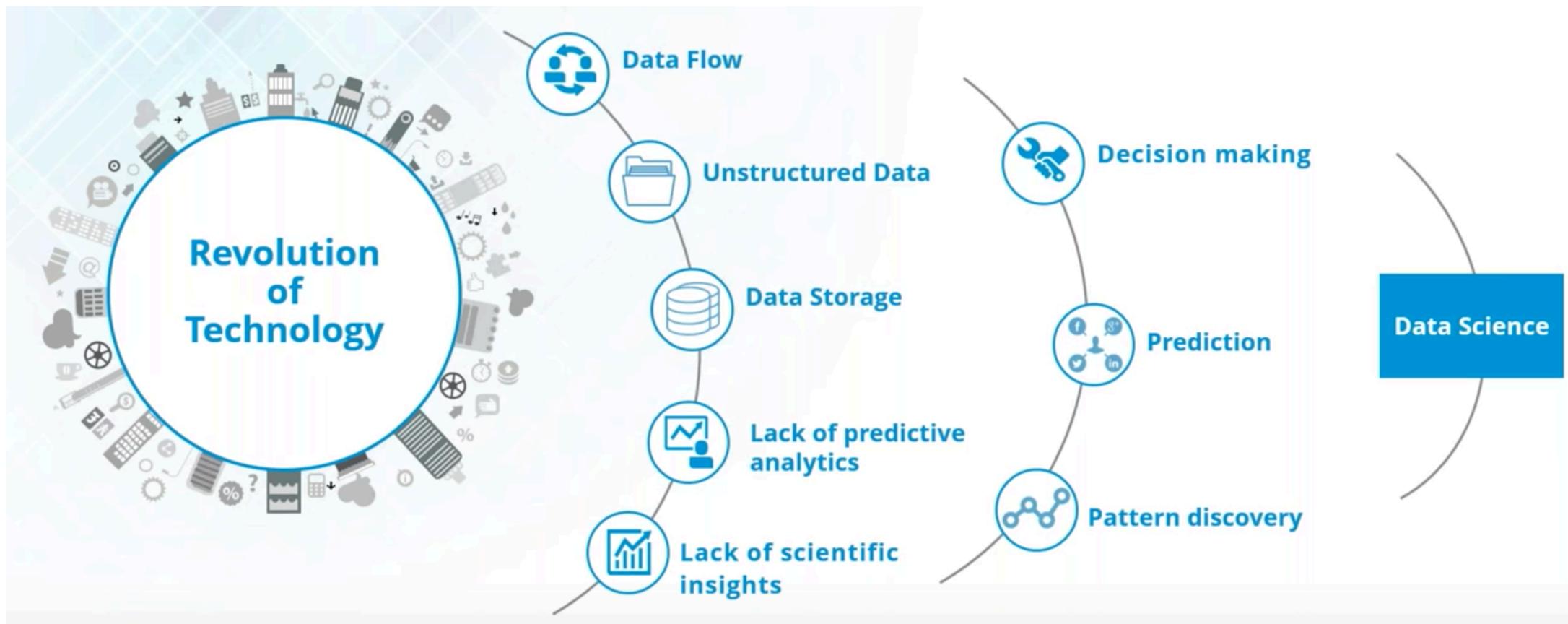
1. Data Security,
2. Personal Security,
3. Financial Trading,
4. Healthcare,
5. Marketing personalization,
6. Fraud Detection,
7. Recommendations,
8. Online Search,
9. NLP,
10. Smart Cars

Machine Learning Everywhere

- Text Analysis
 - uclassify.com
- Voice Recognition
 - [IBM Watson](#)
 - [Speech2Text](#) detect text and speakers from audio file
 - [Text2Speech](#)
 - Siri,
 - Ok Google
- Image and Video Classification:
 - clarifai.com
(<https://www.youtube.com/watch?v=RKU6x1n9Hak>)



Machine Learning Everywhere



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Machine Learning: The Big Picture!

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Machine Learning: The Big Picture!

- **Definition**
 - Arthur Samuel (1959). Machine Learning: Field of study that gives computers the ability to learn without being explicitly programmed.
 - Tom Mitchell (1998) Well-posed Learning Problem: A computer program is said to *learn* from experience E with respect to some task T and some performance measure P , if its performance on T , as measured by P , improves with experience E .

Machine Learning: The Big Picture!

- **Data**

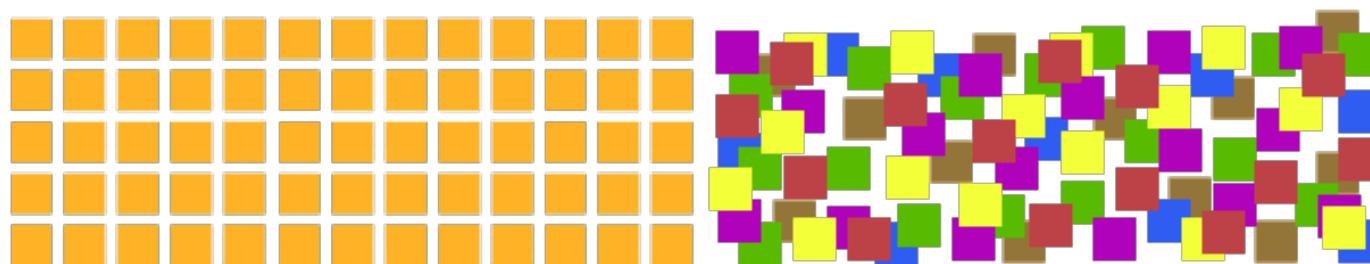
- Example/Instance/Input : x_i
- Feature/Variable/Predictor : x_{ij}
 - Quantitative (numeric, continue)
 - Qualitative (textual, category)
- Dimension, Visualization
 - n Examples: $i = 1..n$
 - p Features: $j = 1..p$
- Label/class/output : y_i
 - For each example (0/1)

University	F1	F2	F3	F4	F5	F6	Region	Budget (MD)	Insertion (%)	Shanghai ranking?
U1	979	561	186	786	835	536	N	7	72.00	1
U2	895	247	985	206	870	246	N	7	67.00	1
U3	344	889	643	951	783	162	E	2	35.00	0
U4	400	959	999	312	981	254	W	8	57.00	0
U5	243	521	393	596	400	138	E	6	29.00	1
U6	882	722	518	541	425	551	W	10	80.00	1
U7	814	193	829	192	334	597	E	8	68.00	0
U8	186	972	763	968	217	772	S	1	20.00	0
U9	647	656	527	393	738	813	S	7	65.00	1
U10	568	570	458	799	682	530	N	4	59.00	1

Machine Learning: The Big Picture!

- **Data**

- Structured
 - CSV, XML, JSON, XLSX, etc.
- Unstructured
 - DOC, HTML, PDF, PNG, MP3, MP4, etc.



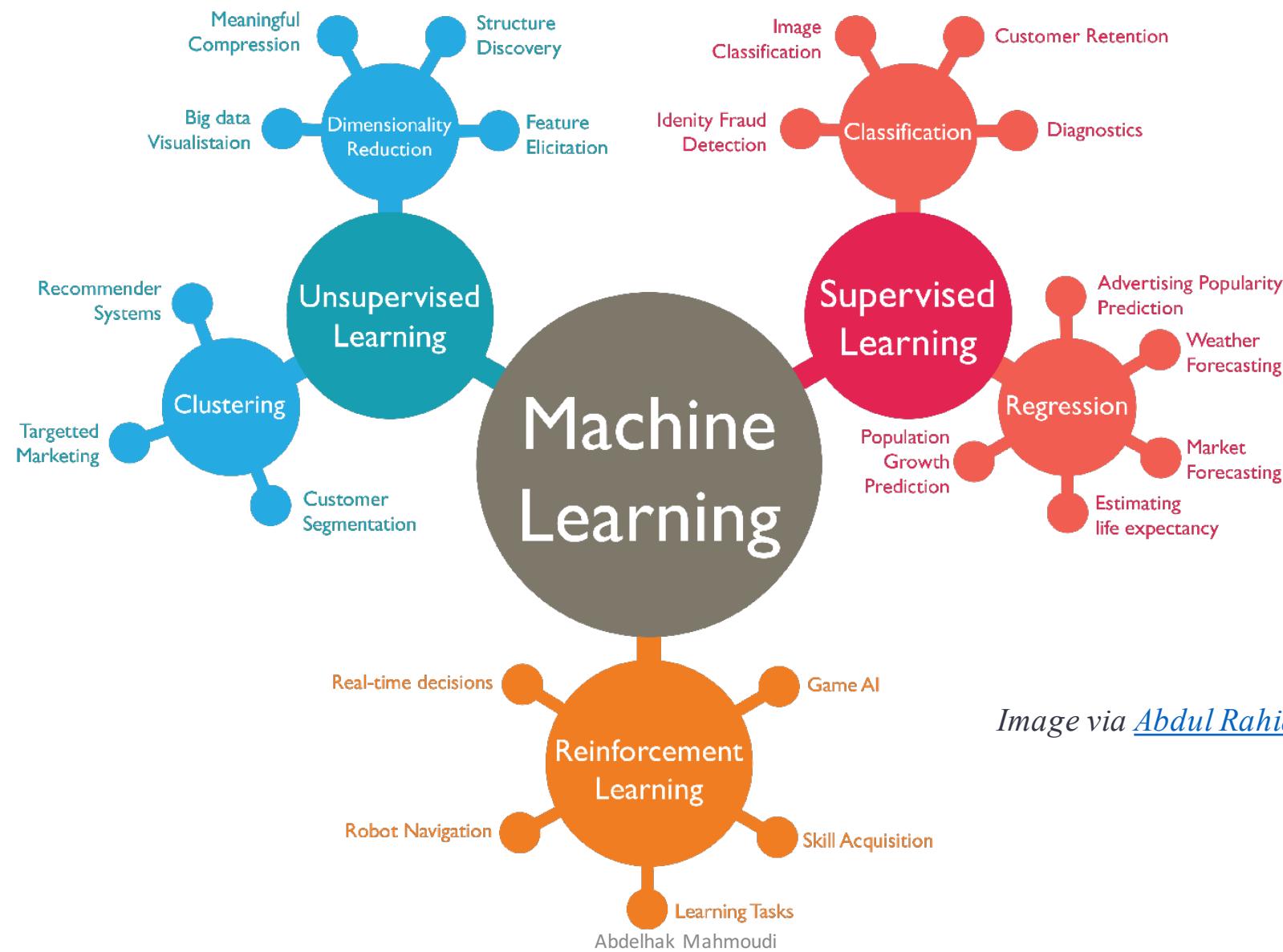
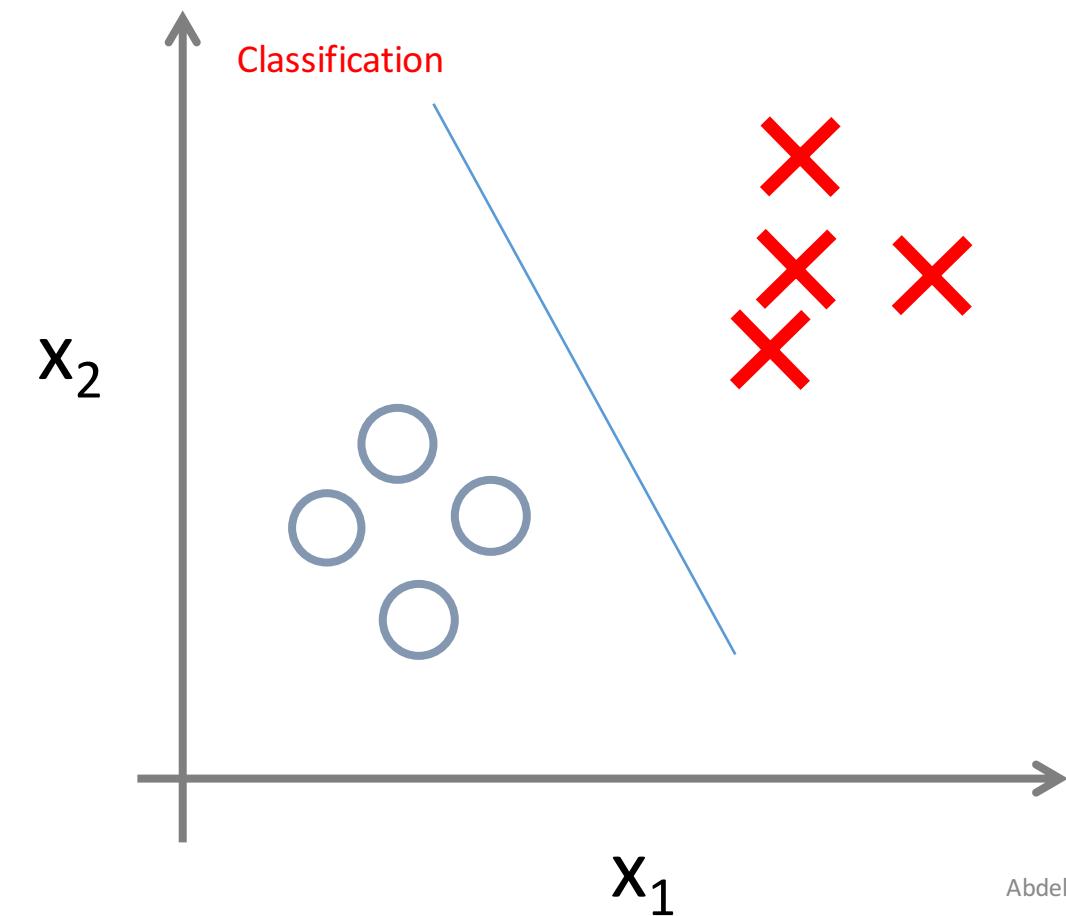
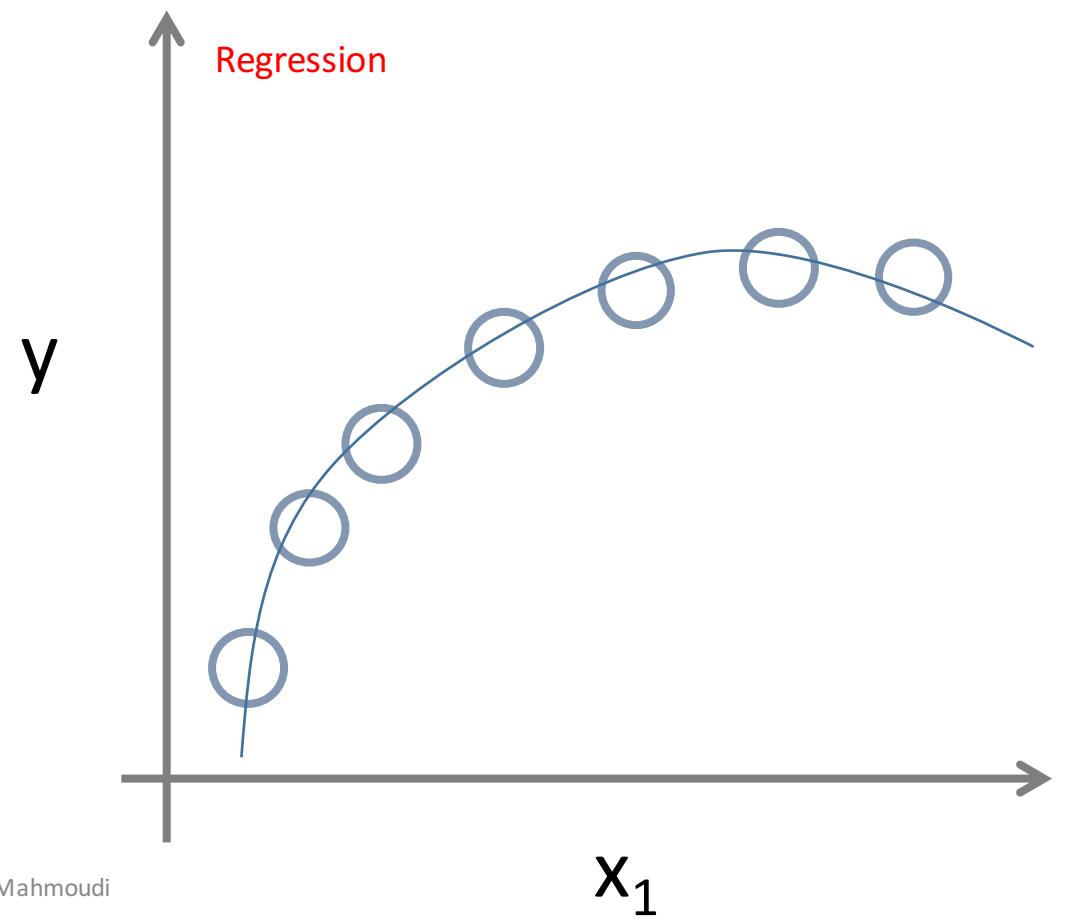


Image via [Abdul Rahid](#)

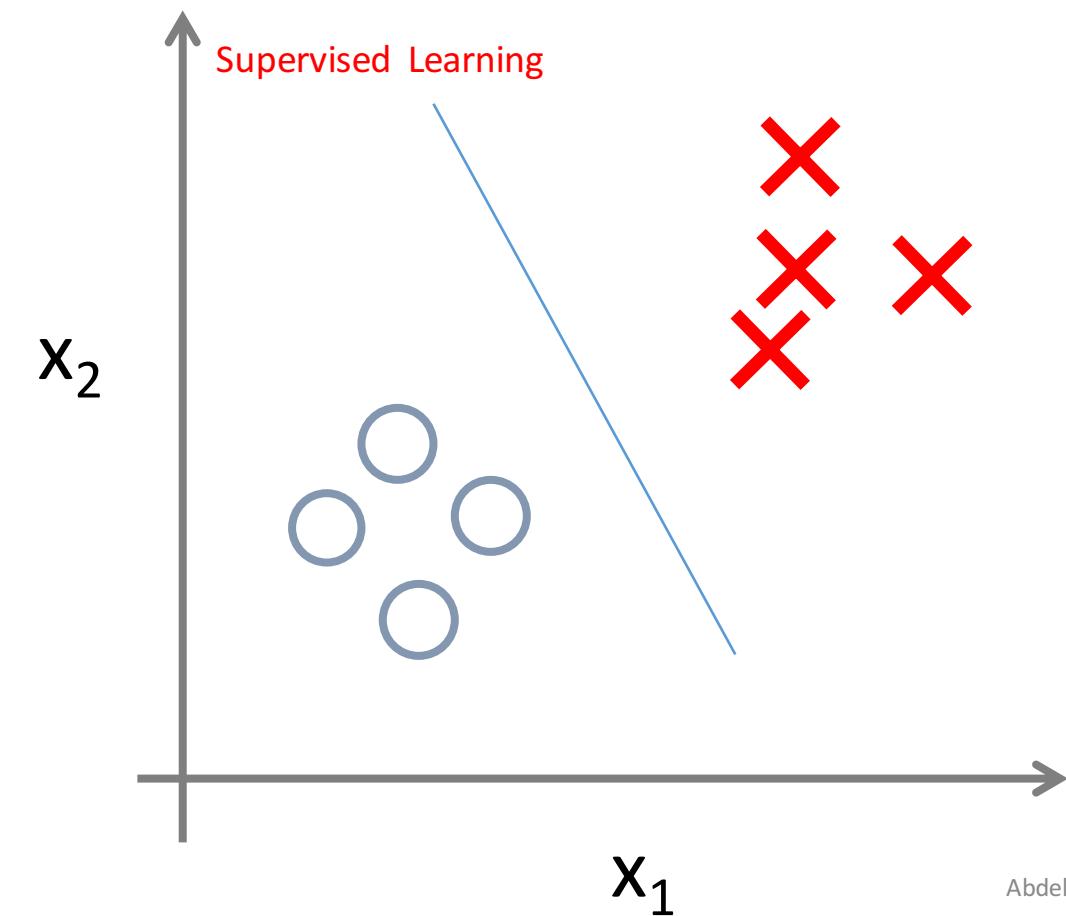
Machine Learning: The Big Picture!



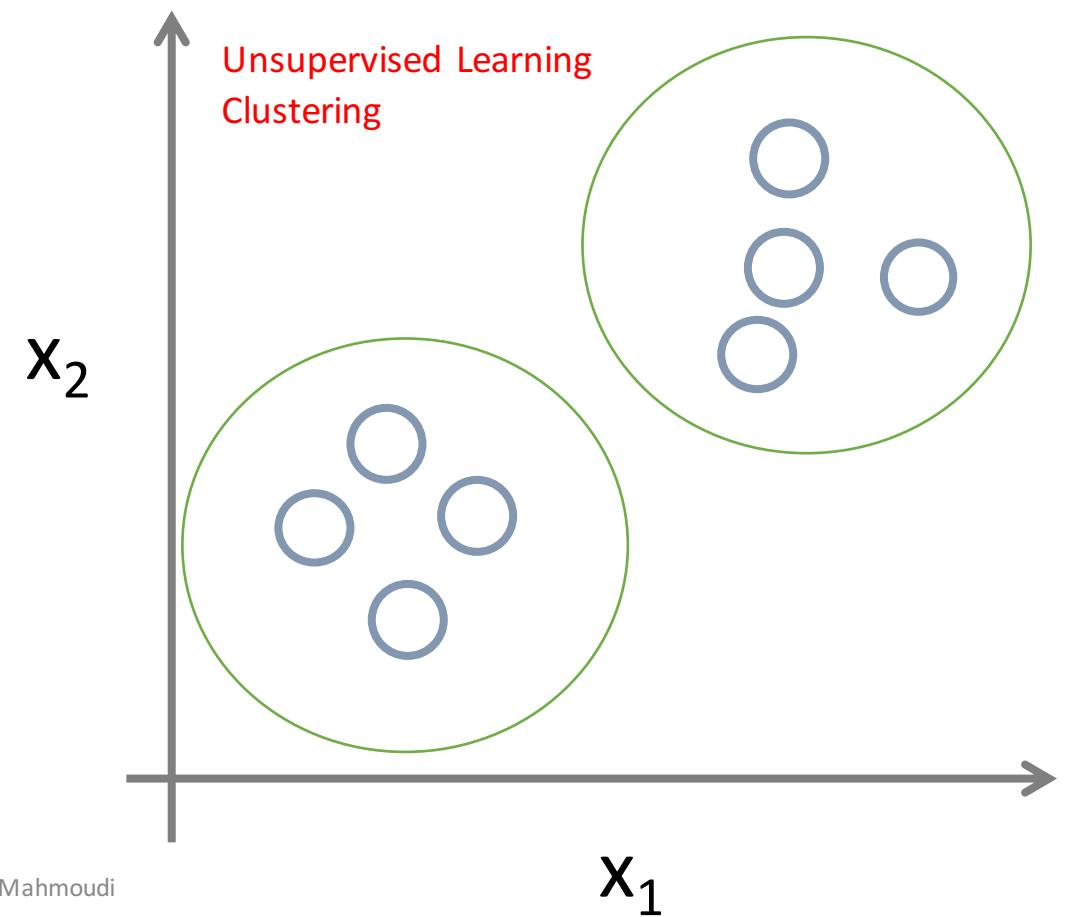
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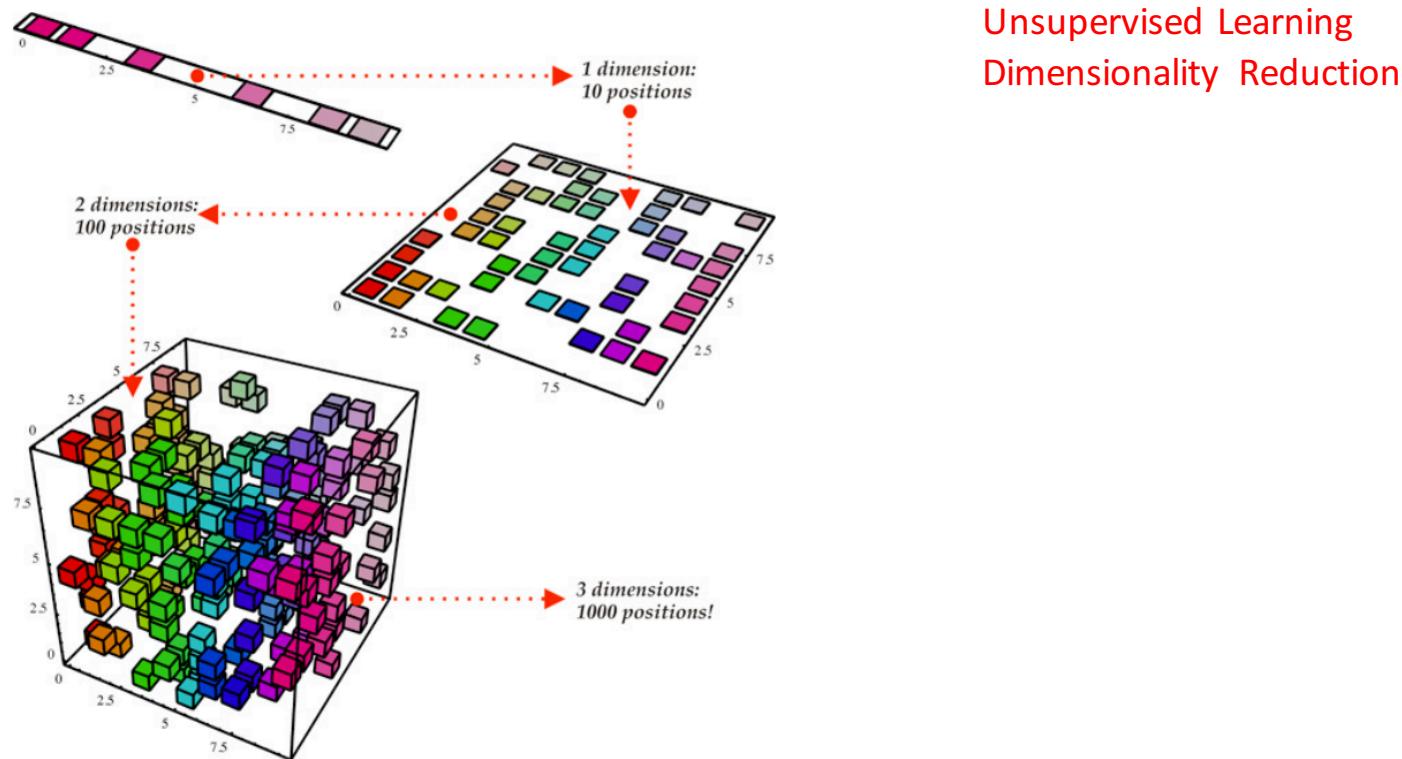
Machine Learning: The Big Picture!



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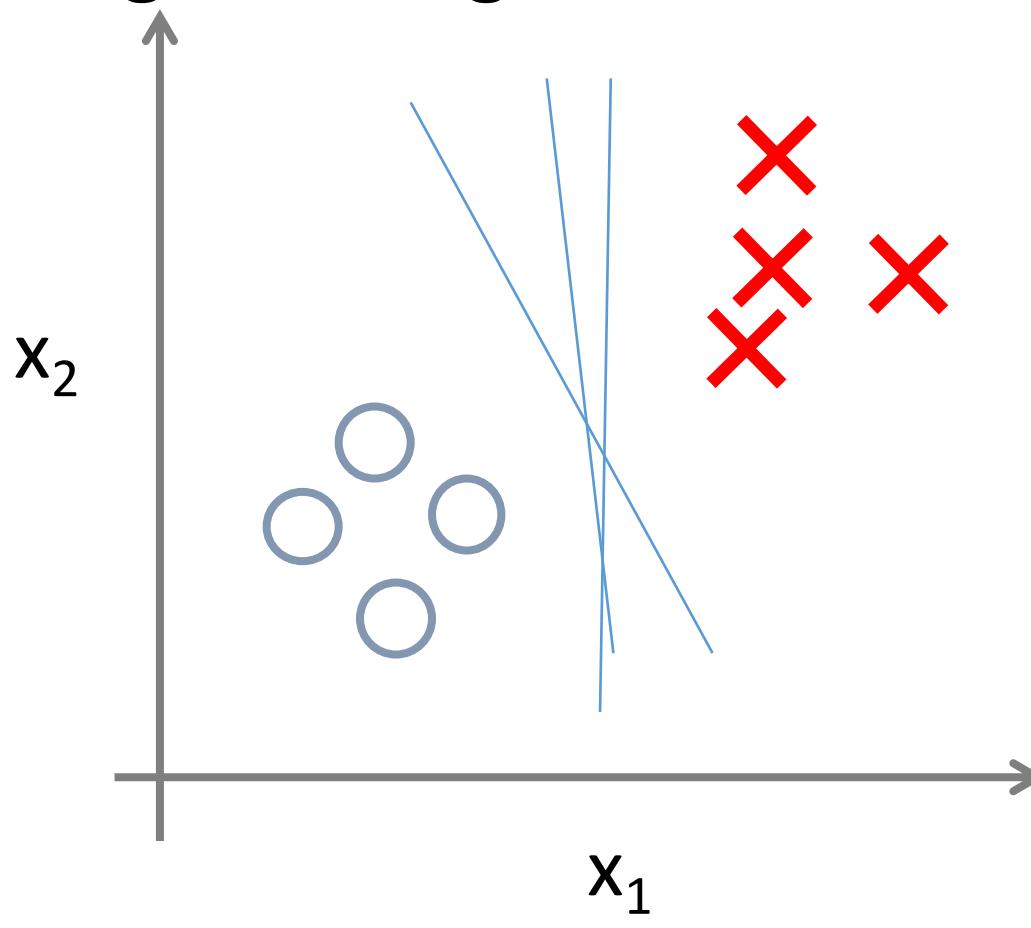
Machine Learning: The Big Picture!



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Machine Learning: The Big Picture!

- Online Learning

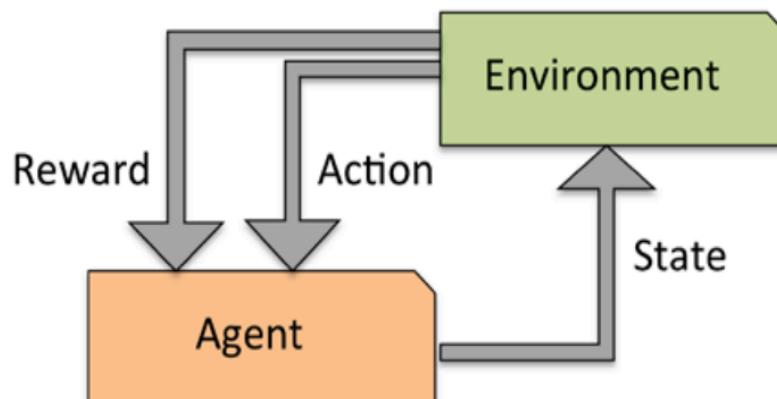


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Machine Learning: The Big Picture!

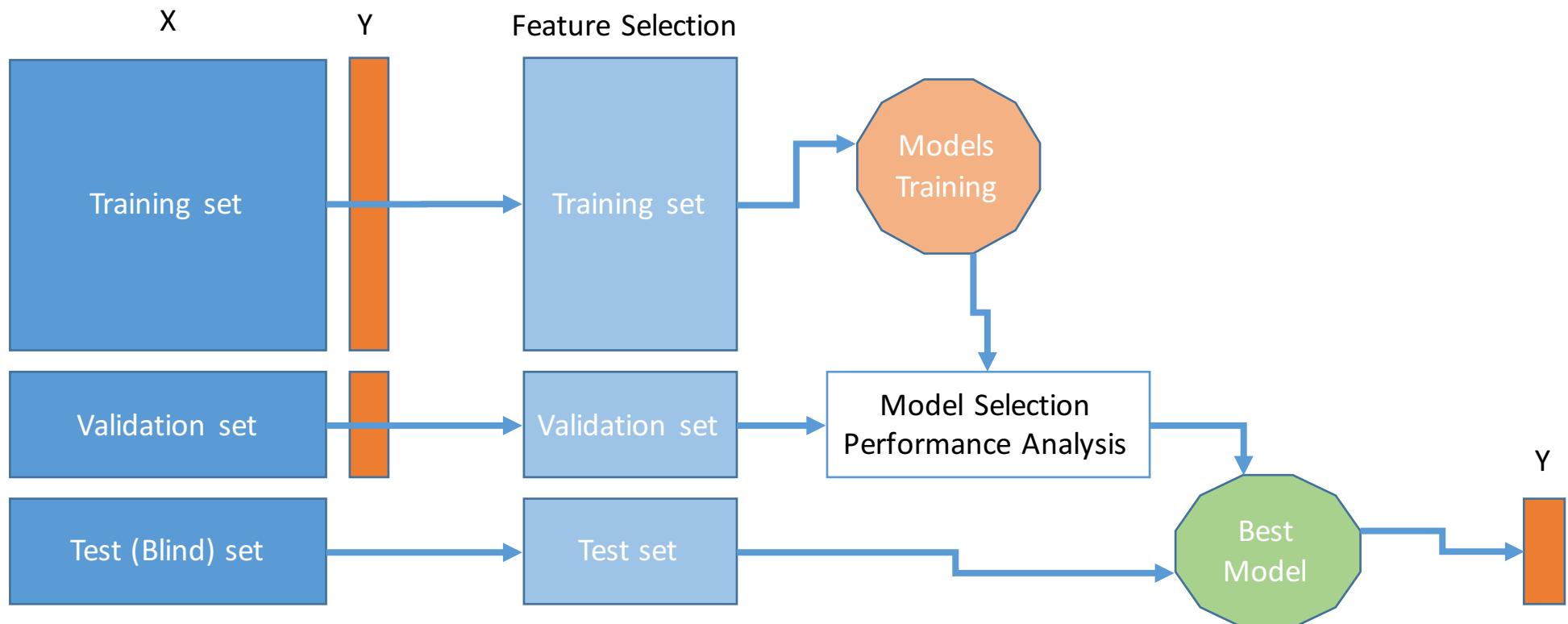
- Reinforcement Learning

- The system (**agent**) improves its performance based on **interactions** with the **environment**.
- **RL** can be considered as field related to **supervised** learning where the feedback is not the correct ground truth **label or value y**, but a **reward function** measuring the **action**.

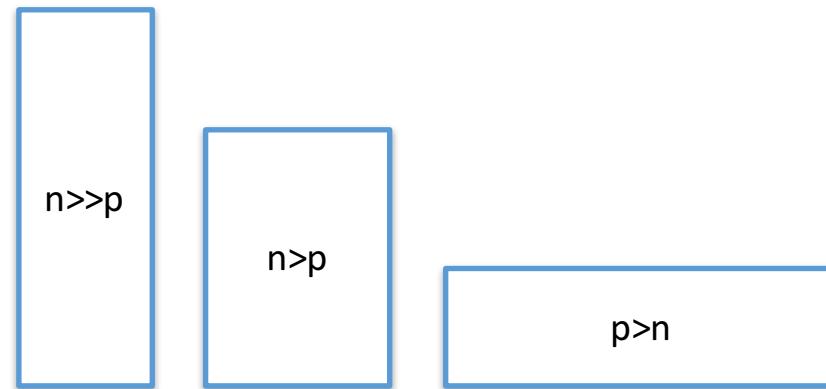


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Machine Learning: The Big Picture!

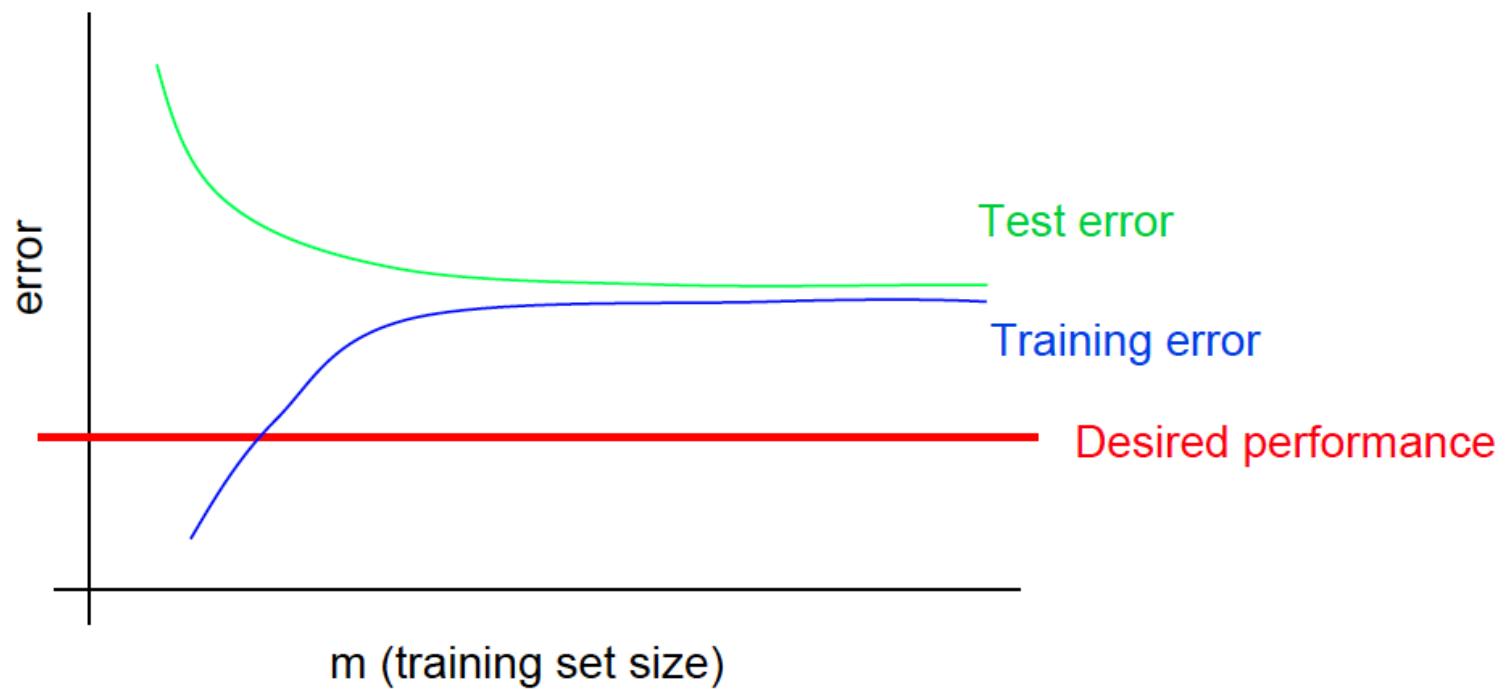


Machine Learning: The Big Picture!



Dimensionality Reduction

Machine Learning: The Big Picture!



Performance Analysis

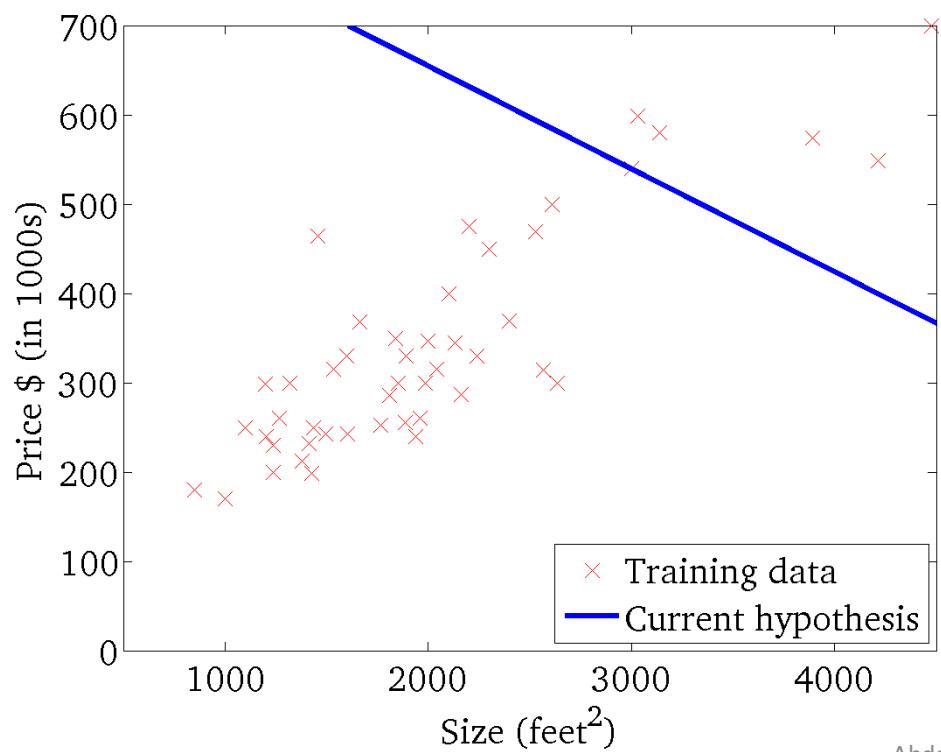
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Machine Learning: How It Works?

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Machine Learning: How it Works?

Linear Regression



Hypothesis

$$h_{\theta}(x) = \theta^T x$$

$$h_{\theta}(x) = \theta_0 + \theta_1 x$$

Cost function

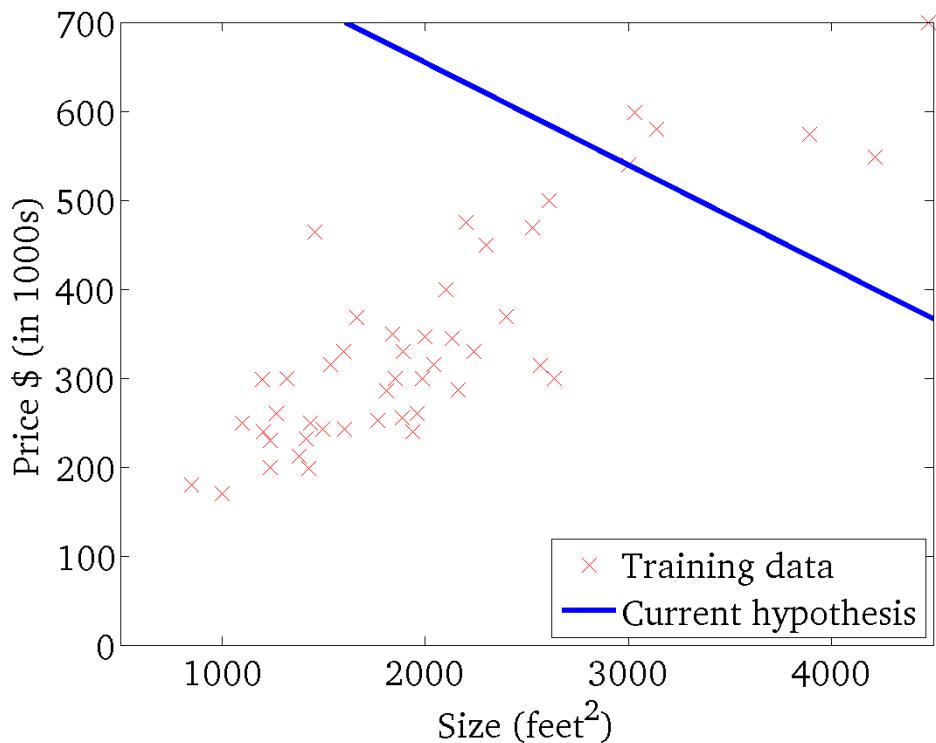
$$J(\theta_0, \theta_1) = \frac{1}{2m} \sum_{i=1}^m (h_{\theta}(x^{(i)}) - y^{(i)})^2$$

Optimization

$$\min_{\theta} J(\theta)$$

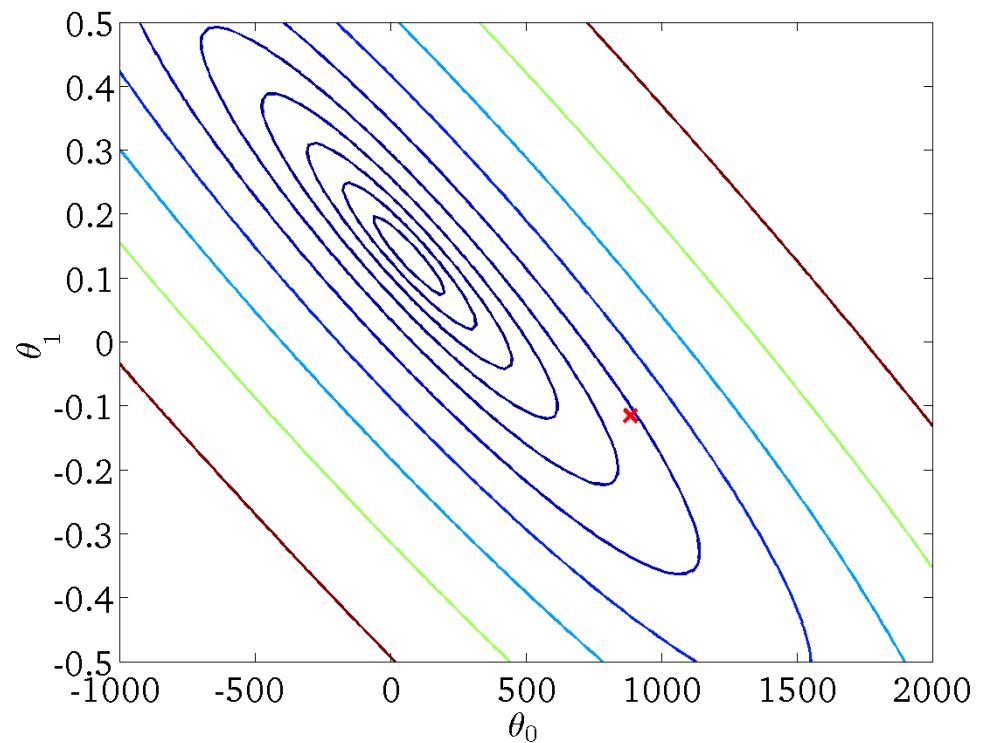
$$h_{\theta}(x)$$

(for fixed θ_0, θ_1 , this is a function of x)



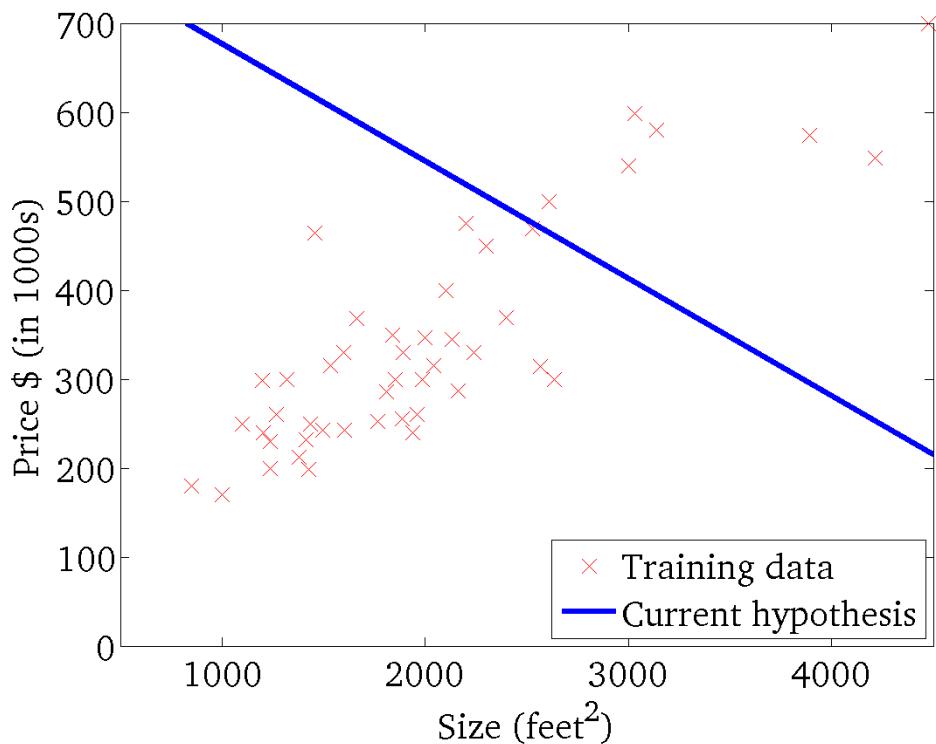
$$J(\theta_0, \theta_1)$$

(function of the parameters θ_0, θ_1)



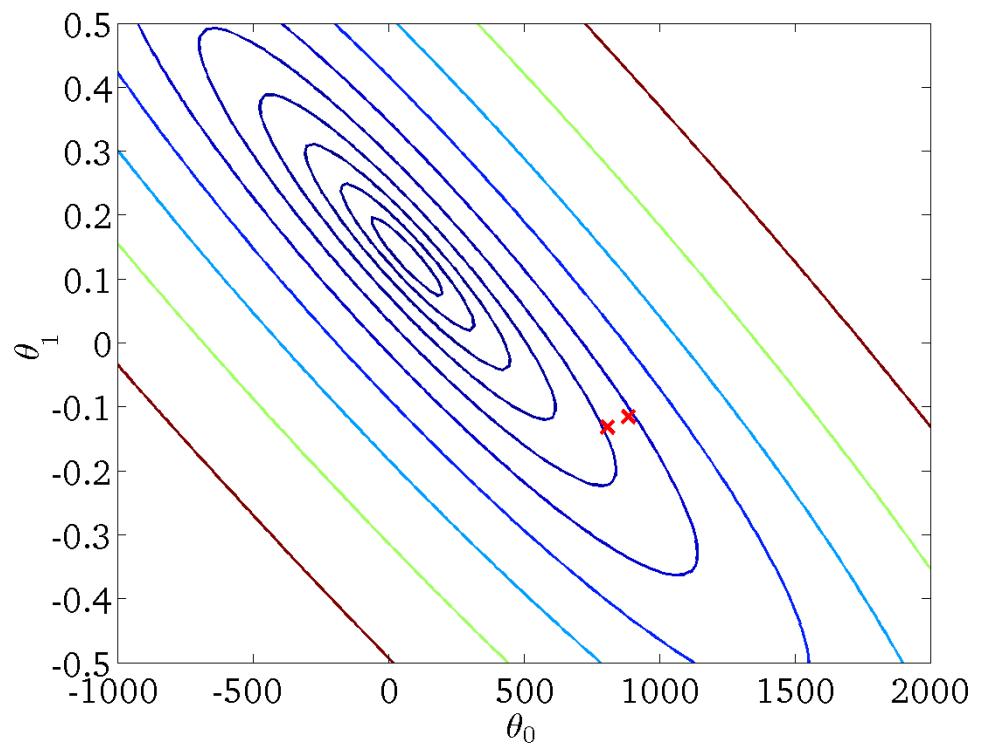
$$h_{\theta}(x)$$

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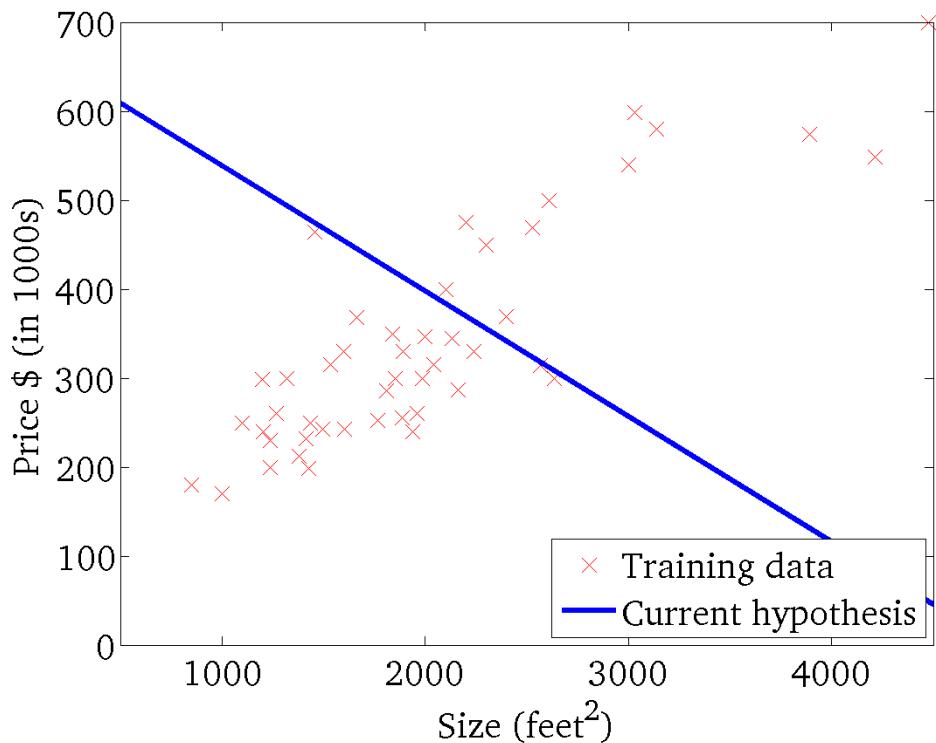
$$J(\theta_0, \theta_1)$$

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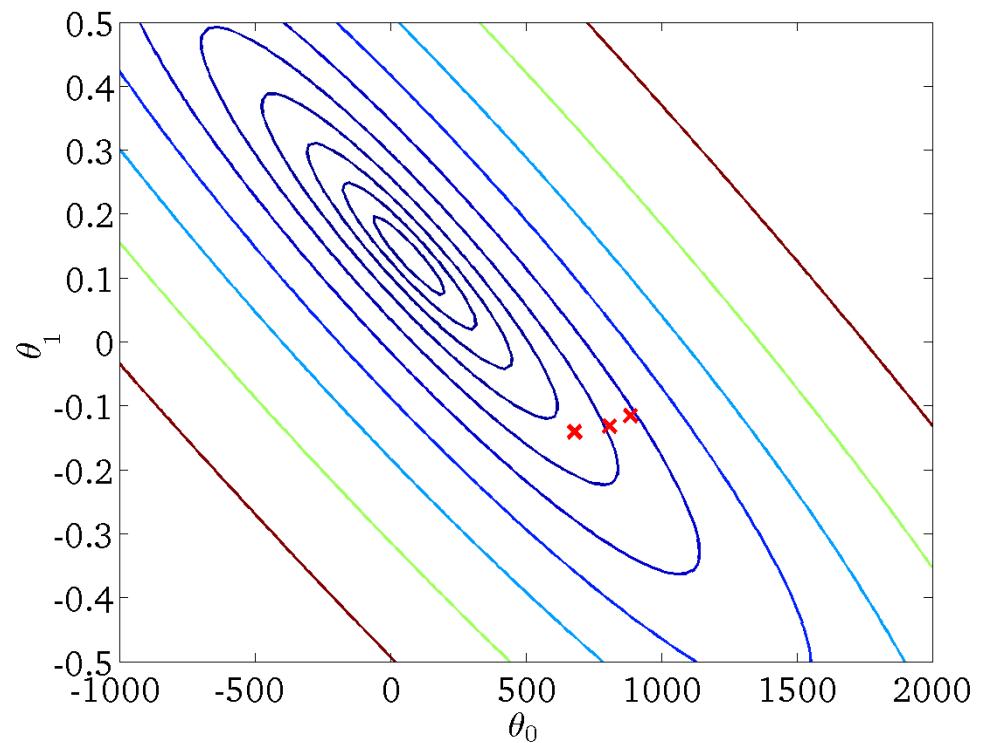
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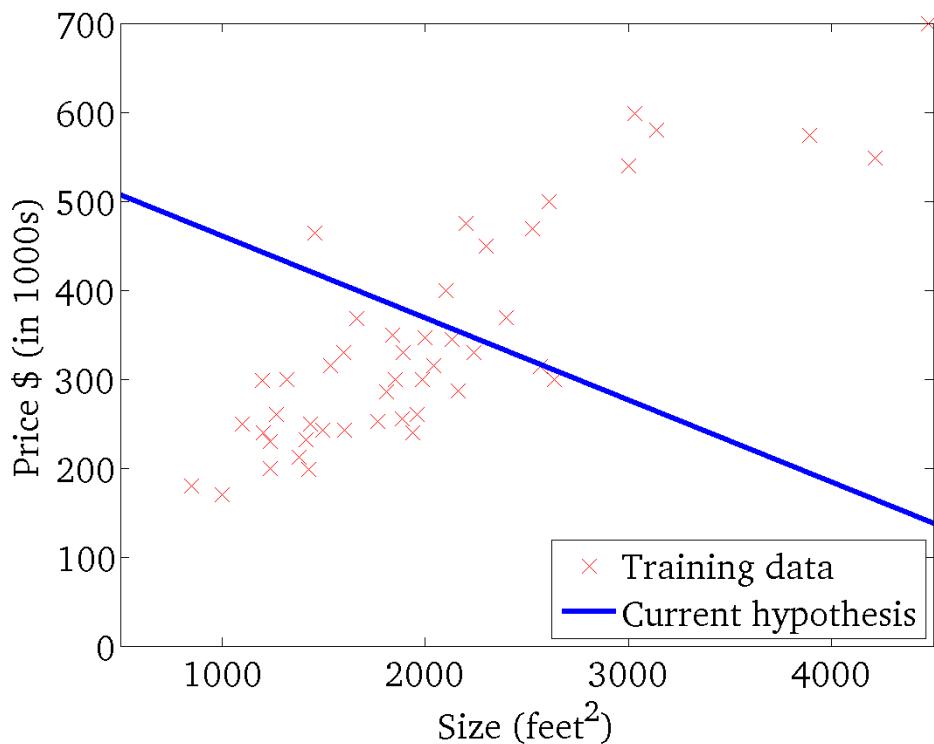
$$J(\theta_0, \theta_1)$$

(function of the parameters θ_0, θ_1)



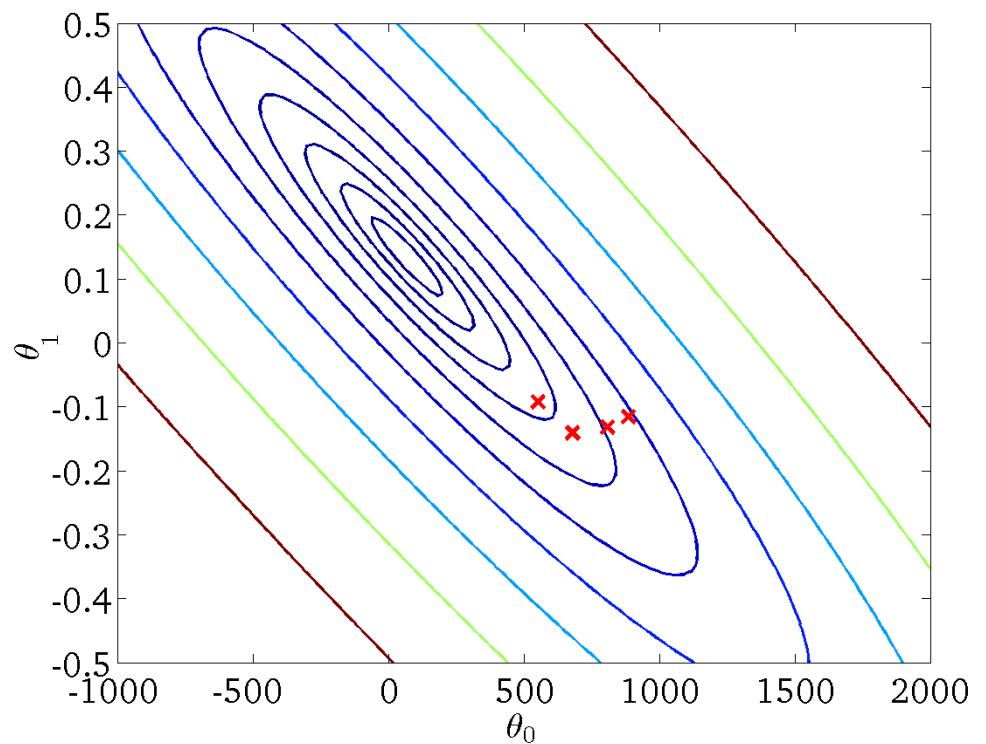
$$h_{\theta}(x)$$

(for fixed θ_0, θ_1 this is a function of x)



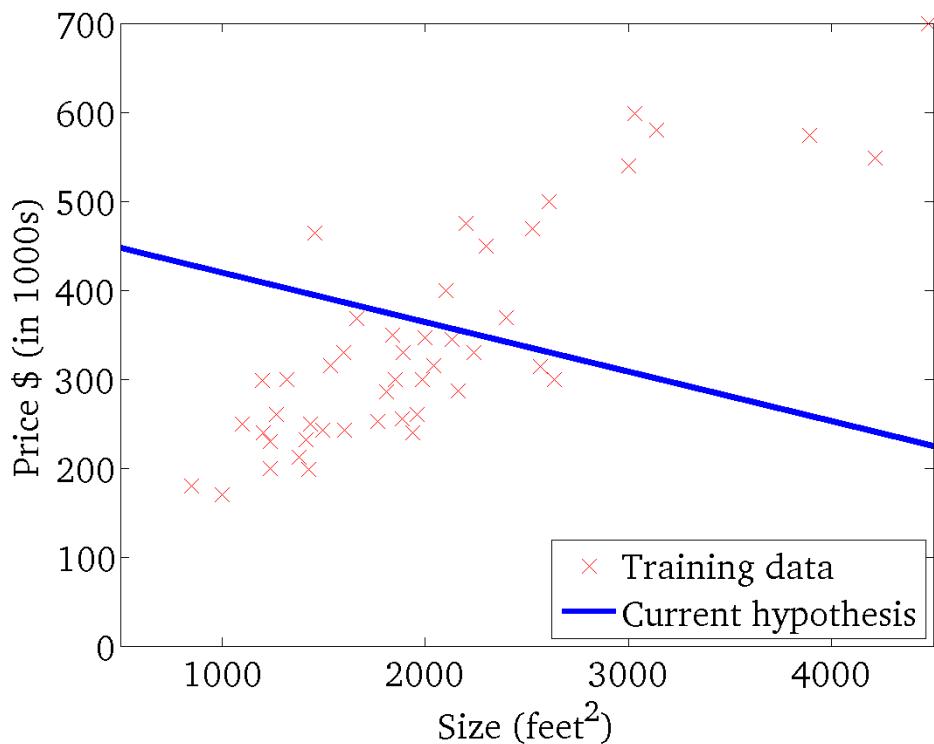
$$J(\theta_0, \theta_1)$$

(function of the parameters θ_0, θ_1)



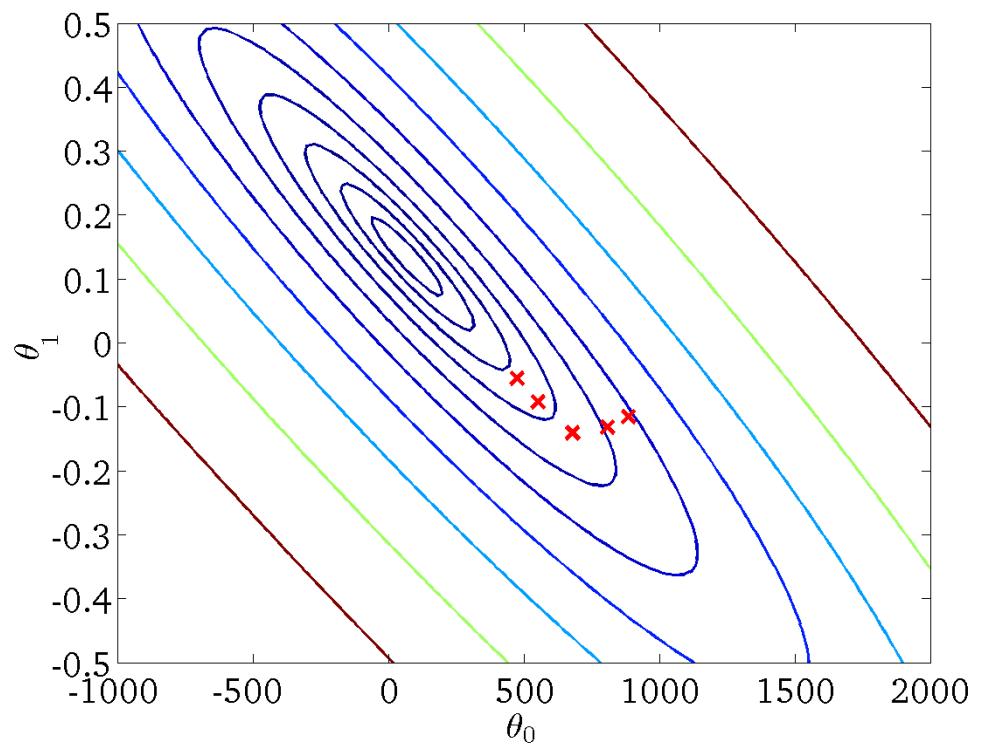
$$h_{\theta}(x)$$

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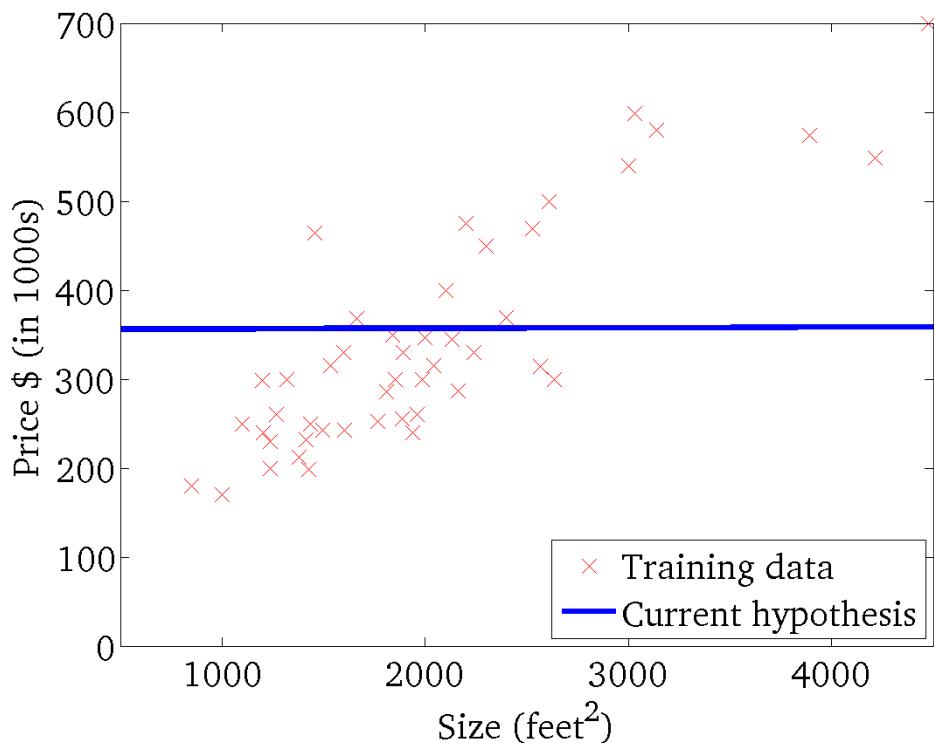
$$J(\theta_0, \theta_1)$$

(function of the parameters θ_0, θ_1)



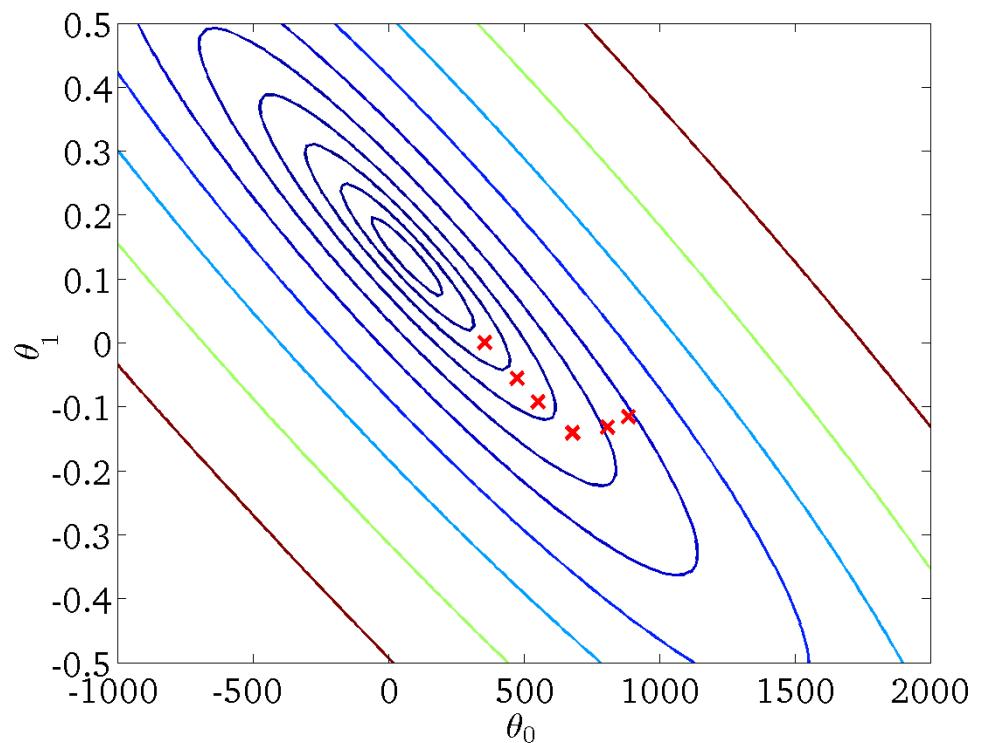
$$h_{\theta}(x)$$

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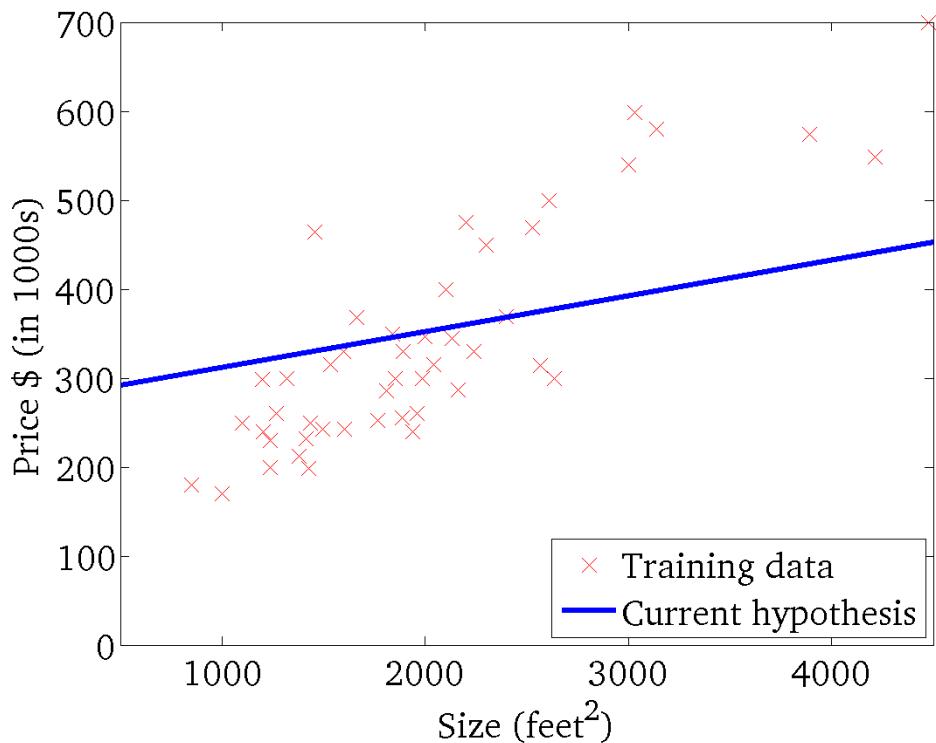
$$J(\theta_0, \theta_1)$$

(function of the parameters θ_0, θ_1)



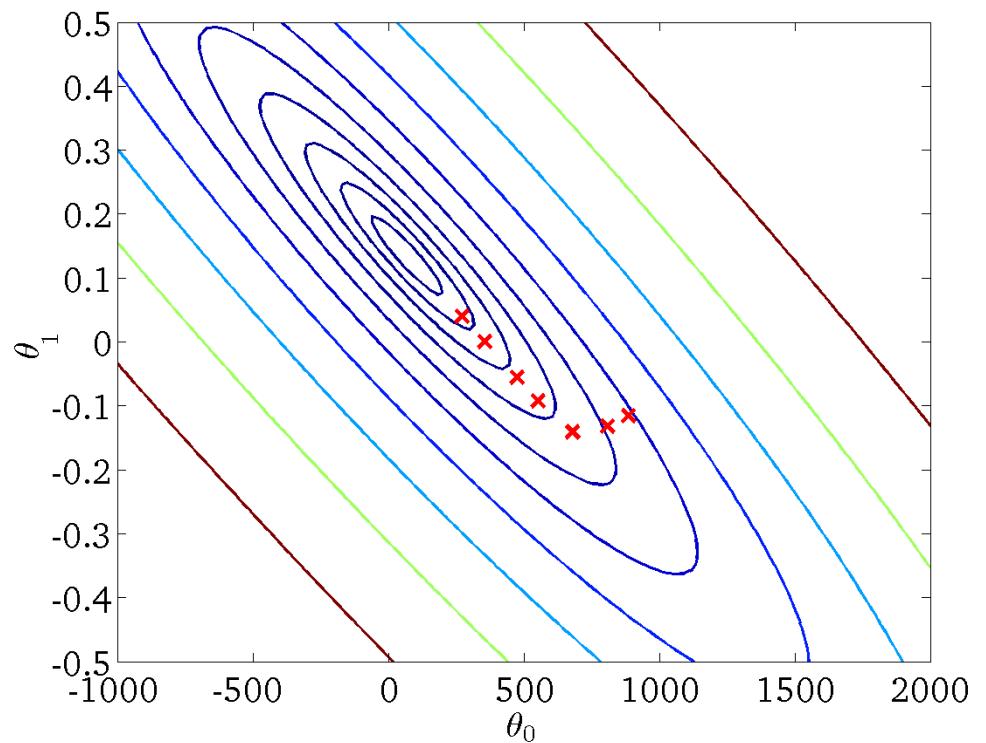
$$h_{\theta}(x)$$

(for fixed θ_0, θ_1 this is a function of x)



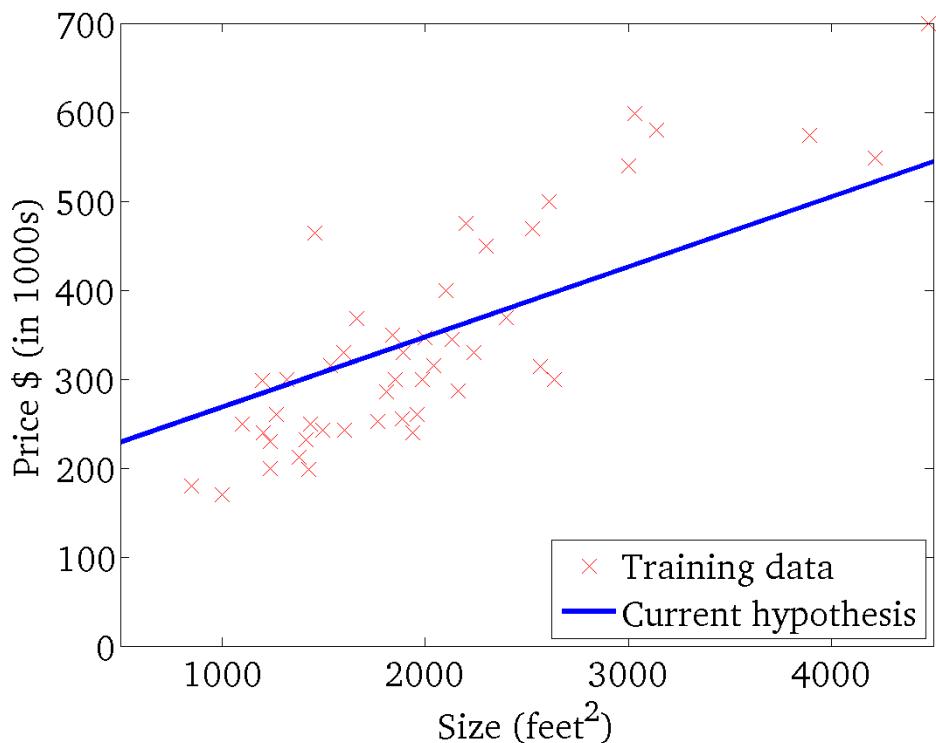
$$J(\theta_0, \theta_1)$$

(function of the parameters θ_0, θ_1)



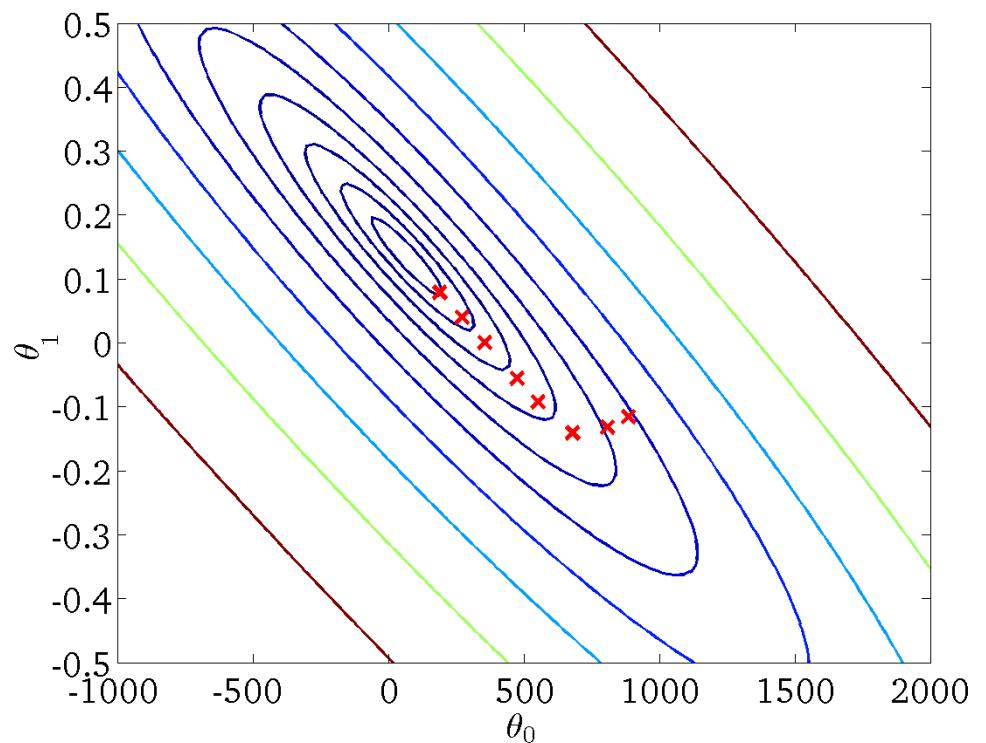
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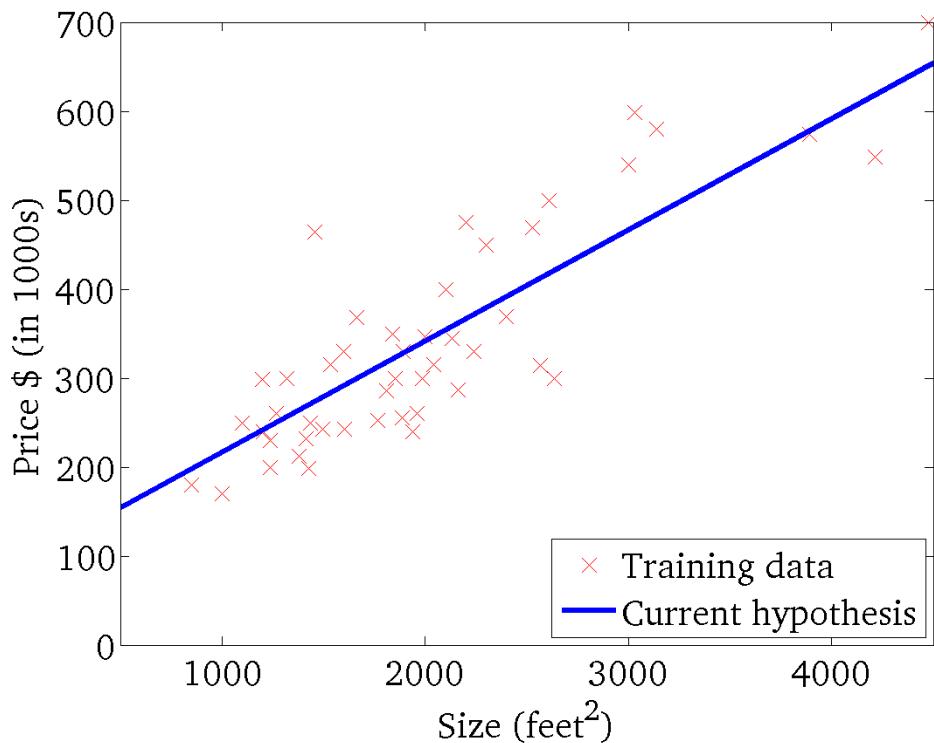
$$J(\theta_0, \theta_1)$$

(function of the parameters θ_0, θ_1)



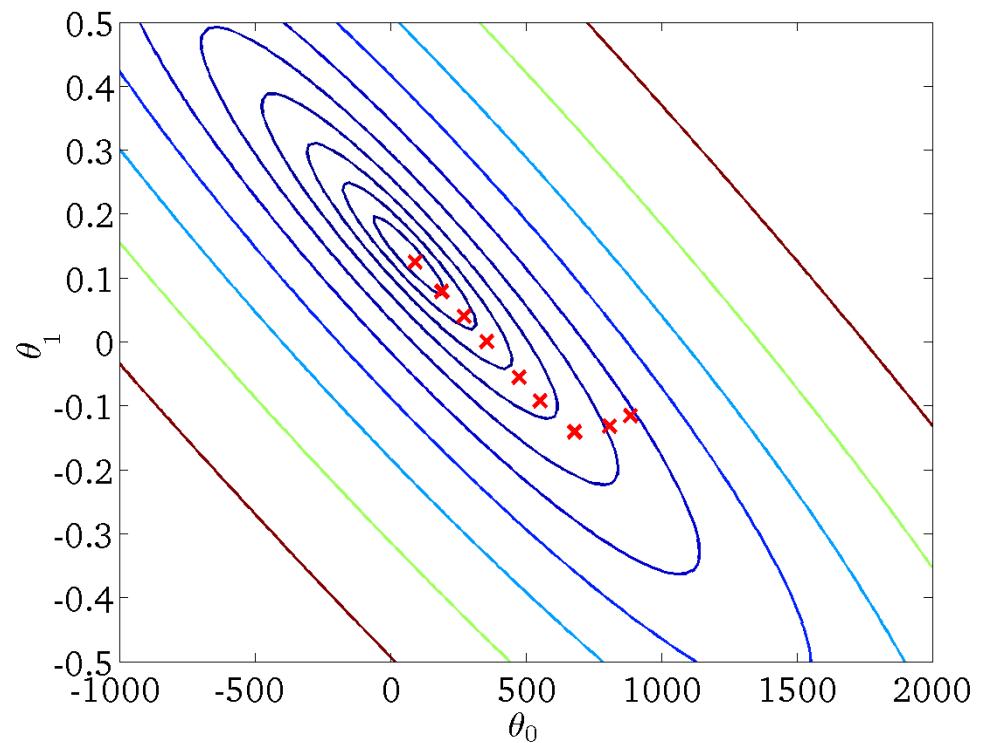
$$h_{\theta}(x)$$

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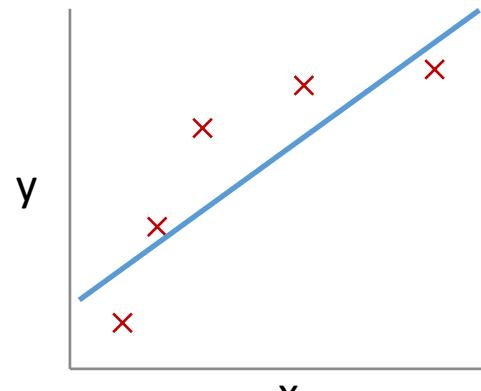
$$J(\theta_0, \theta_1)$$

(function of the parameters θ_0, θ_1)



Machine Learning: How it Works?

Linear Regression



$$h_{\theta}(x) = \theta^T x$$

$$J(\theta_0, \theta_1) = \frac{1}{2m} \sum_{i=1}^m (h_{\theta}(x^{(i)}) - y^{(i)})^2 + \frac{\lambda}{2m} \sum_{j=1}^n \theta_j^2$$

$$\min_{\theta} J(\theta)$$

Regularization

Machine Learning: How it Works?

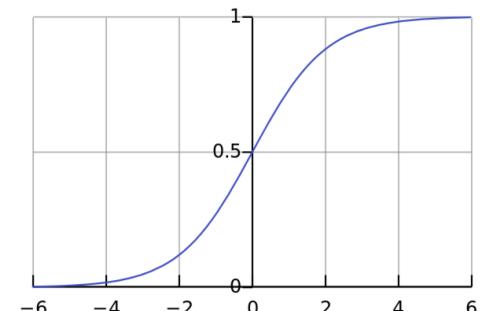
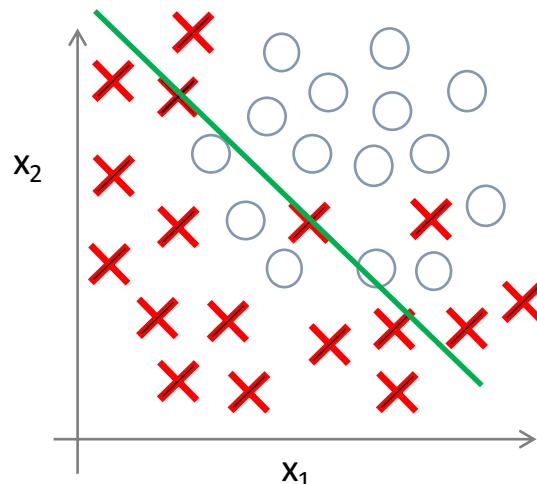
Logistic Regression

Want $0 \leq h_\theta(x) \leq 1$

$$h_\theta(x) = g(\theta^T x)$$

$$J(\theta) = -\frac{1}{m} \left[\sum_{i=1}^m y^{(i)} \log h_\theta(x^{(i)}) + (1 - y^{(i)}) \log (1 - h_\theta(x^{(i)})) \right] + \frac{\lambda}{2m} \sum_{j=1}^n \theta_j^2$$

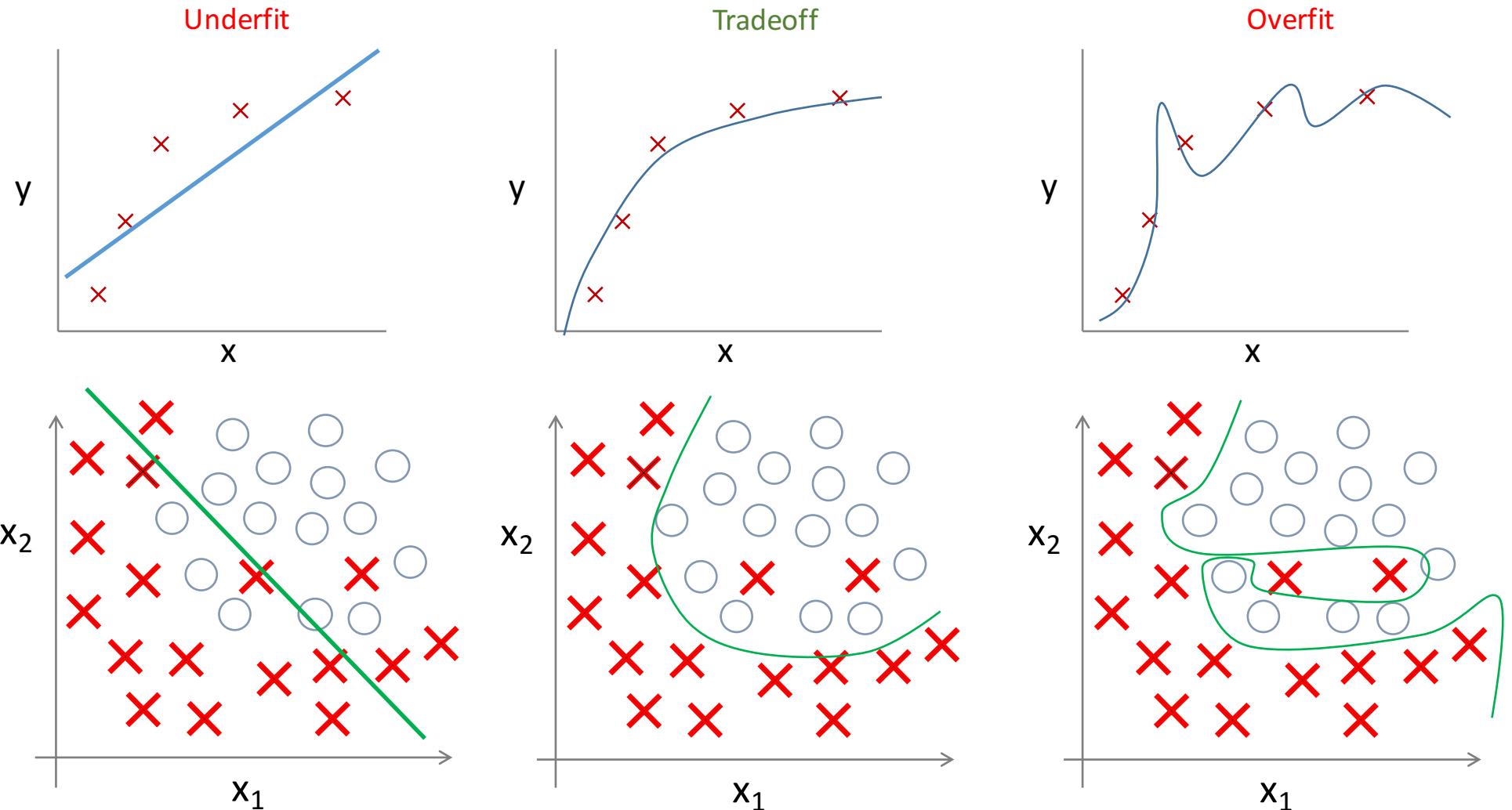
$$\min_{\theta} J(\theta)$$



$$g(z) = \frac{1}{1 + e^{-z}}$$

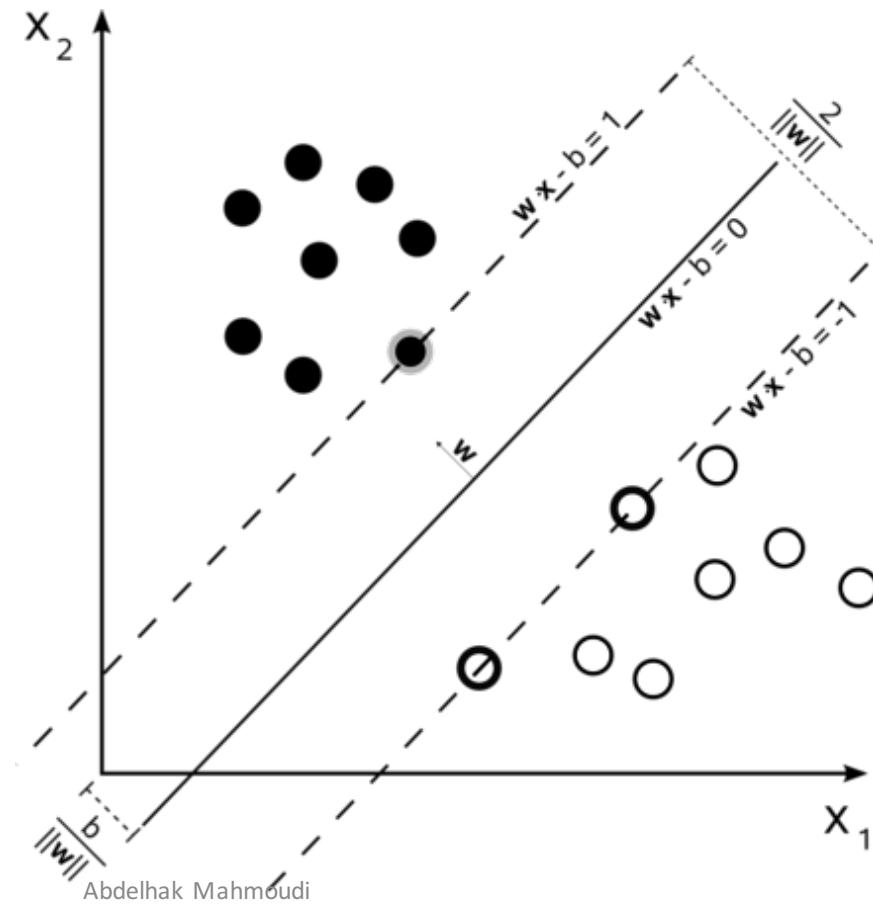
Regularization

Machine Learning: How it Works?



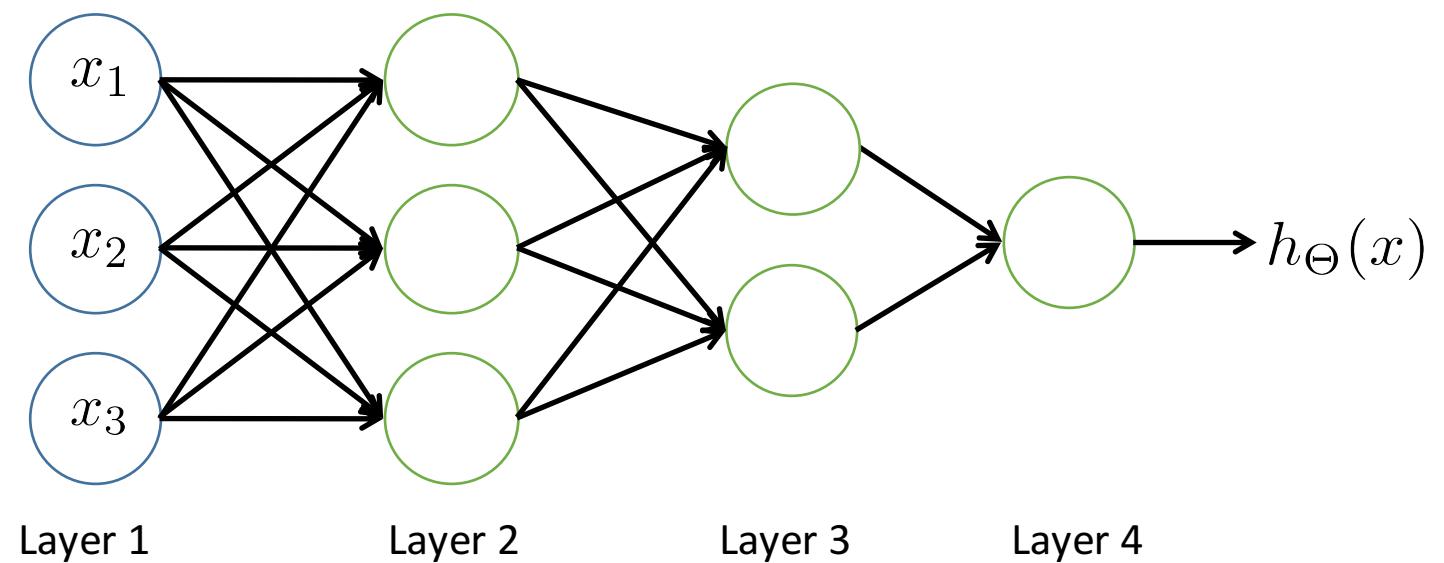
Machine Learning: How it Works?

- SVM Playground



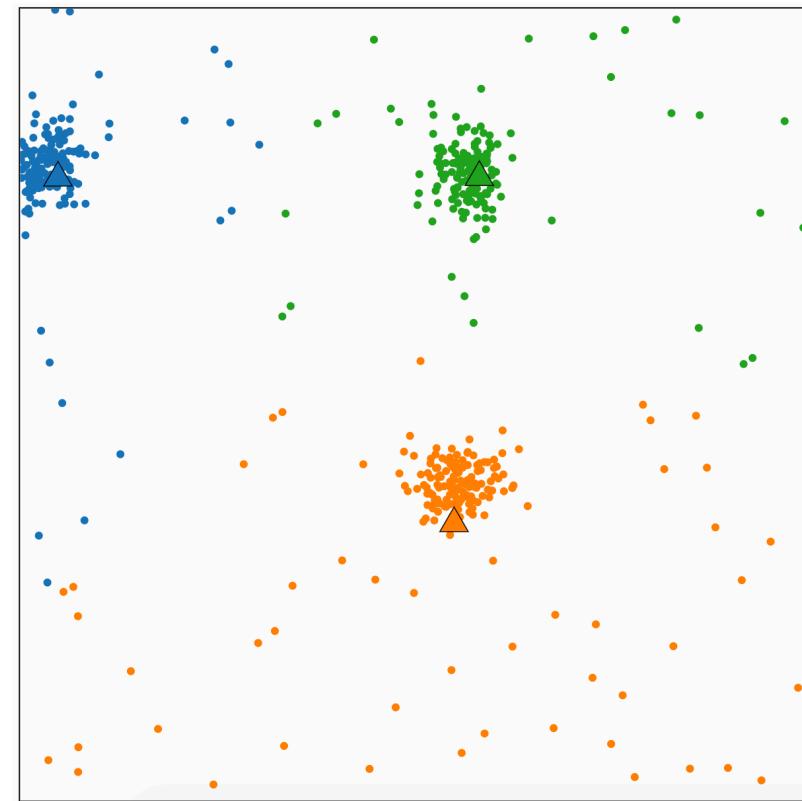
Machine Learning: How it Works?

- ANN playground



Machine Learning: How it Works?

- K-Means Clustering



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Machine Learning: How it Works?

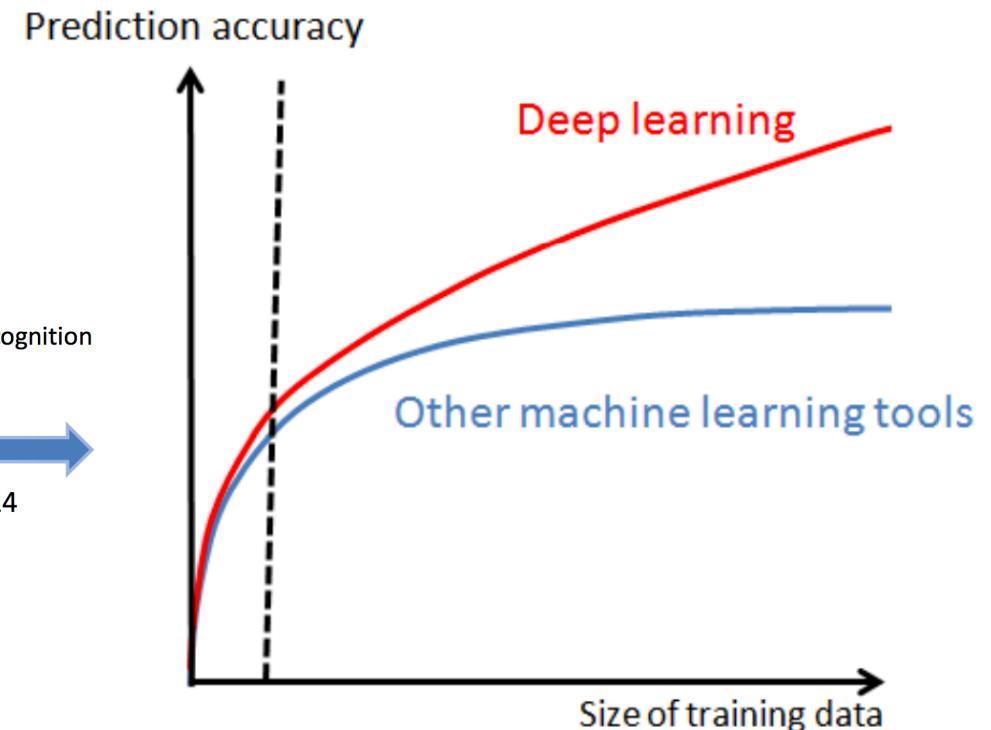
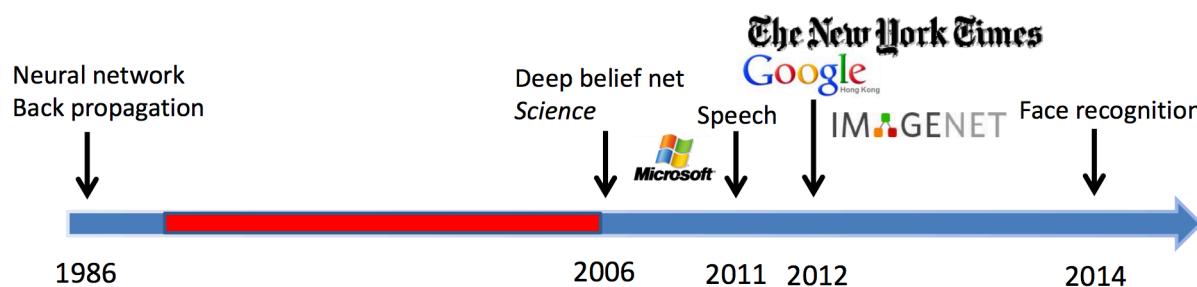
- ML Mindmap



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Machine Learning: How it Works?

- Deep Learning



Terminologies

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Terminologies

- Artificial Intelligence
- Machine Learning
- Statistical Learning
- Data Mining
- Big Data
- Data Science

Terminologies

- Artificial Intelligence (**1943**)
 - "The first work that is now generally recognized as AI was [McCulloch](#) and [Pitts](#)' 1943 formal design for [Turing-complete](#) "artificial neurons". Wikipedia
 - Intelligent Machines mimics Natural Intelligence (NI): "learning" and "problem solving" → Machine Learning
 - Intelligent Agents interacting with their environment → Robotics

Terminologies

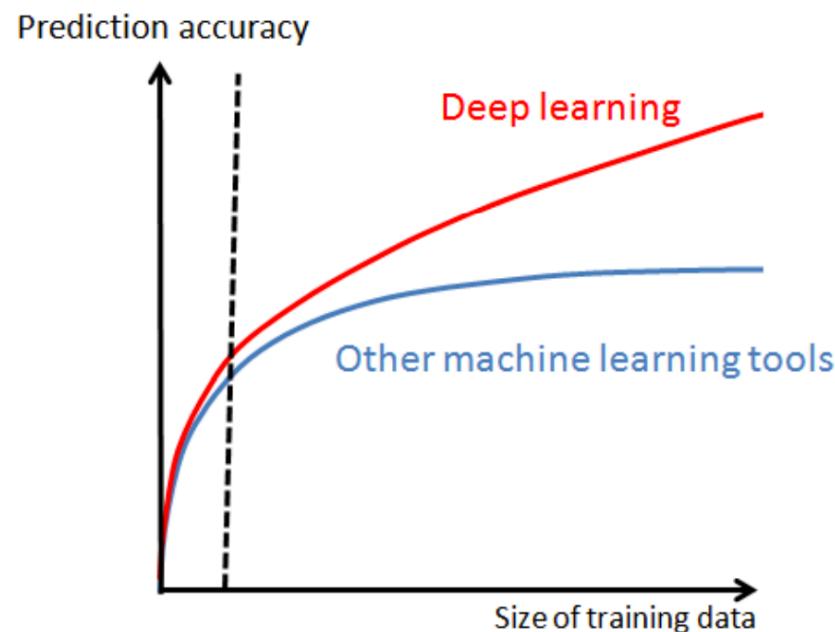
- Machine Learning (**1959**)
 - “[Arthur Samuel](#), an American pioneer in the field of [computer gaming](#) and [artificial intelligence](#), coined the term "Machine Learning" in 1959 while at [IBM](#)”. Wikipedia
 - A subfield of **Computer Science** and **Artificial Intelligence** which deals with building systems that can **learn from data**, instead of explicitly programmed instructions.
- Artificial Neural Networks (**1975**)
 - Begin in 1943, stagnated in 1969, relaunched in 1975 by the Backpropagation algorithm,
 - Deep Learning (**2006**)
 - Much powerful in the Age of Big data and distributed processing

Terminologies

- Statistical Learning (**1968**)
 - VC Theory. "On the Uniform Convergence of Relative Frequencies of Events to Their Probabilities". Vapnik, V. N.; Chervonenkis, A. Ya, 1968
 - A subfield of **Mathematics** which deals with **finding relationship between variables** to predict an outcome
 - Support Vector Machines (**1995**)
 - Much simpler, overtook ANN, Vapnik V. N.
- Data Mining (**1990**)
 - Appeared in the **database and financial** community to recognize customer and products trends.
 - Discovering patterns in data :intersection of ML, Statistics and DB Systems.

Terminologies

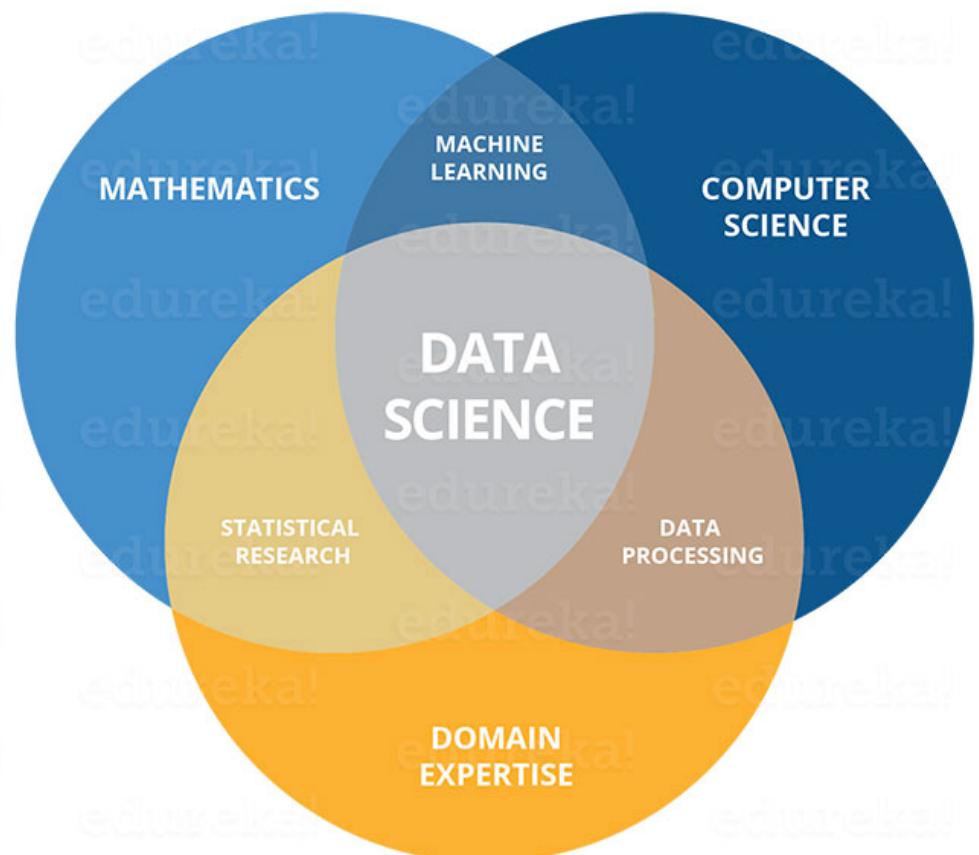
- Big Data (1997)



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Terminologies

- Data Science (**2001**)
 - William Cleveland
"Data Science: An Action Plan for Expanding the Technical Areas of the Field of Statistics".



www.edureka.co

Machine Learning: How Can I Learn?

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Machine Learning: How can I Learn?

- Math
 - Statistics, Probabilistic Graphical Models, Algebra, Optimization
- Programming Languages
 - Python, R,
- Books
 - Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani. “An introduction to statistical learning with applications in R”. 2013.
 - Tom M. Mitchell. “Machine Learning”. 1997
 - [Others](#)

Machine Learning: How can I Learn?

- MOOCs
 - Coursera.org, Udemy.com, ocw.mit.edu, etc.
- StackOverflow
- Research Papers
 - Read and rewrite algorithms from scratch
- Follow People:
 - Andrew Ng, Yann LeCun, Jeff Hinton, Sebastian Thrun, etc.

[... More details](#)

Machine Learning: How Can I Apply?

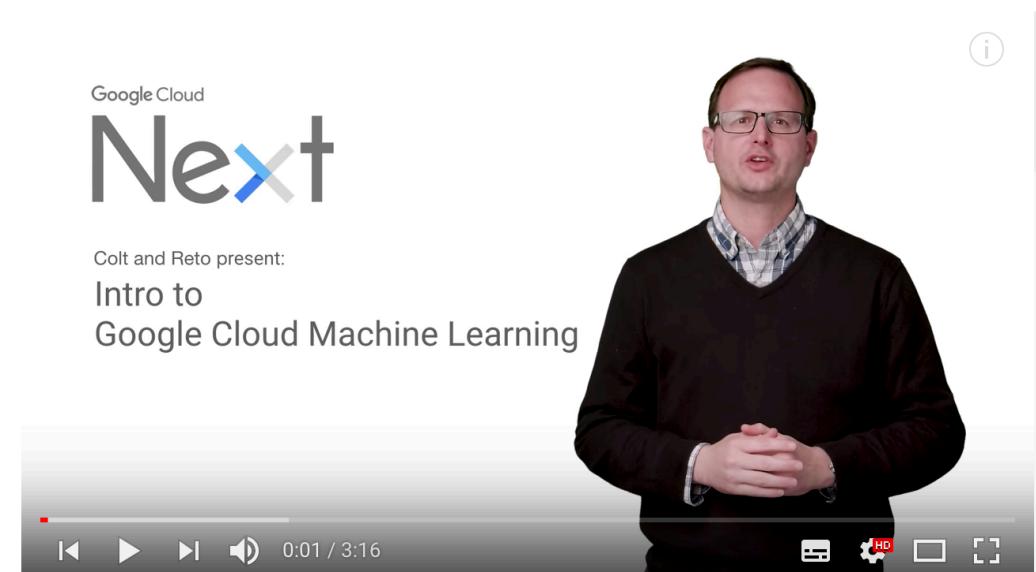
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Machine Learning: How can I Apply?

- Start small projects and use Frameworks
 - [Caffe](#), [Microsoft Cognitive Toolkit](#) (aka CNTK 2), [MXNet](#), [Scikit-learn](#), [Spark MLLib](#), [TensorFlow](#).
- Kaggle, UCI Machine Learning Repo
 - Find data
 - Go for competitions
- Github
 - Find codes
 - Share your code
- Knime
 - open source data analytics (desktop software)

Machine Learning: How can I Apply?

- Google Cloud Plateforme
 - [Google CEO Talk](#)
- Microsoft Azure
- Amazone Web Services



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Machine Learning: How can I Apply?

- Google Cloud Platform ML APIs
 - Vision API
 - Video Intelligence API
 - Speech API
 - Natural Language API
 - Translation API



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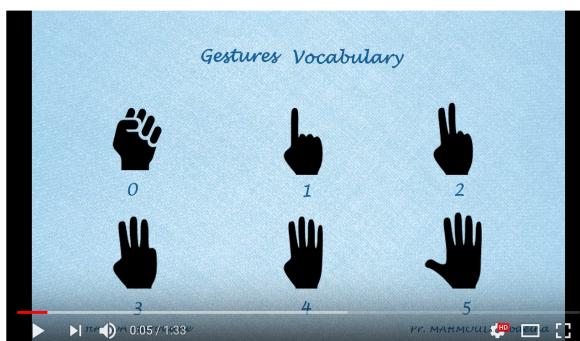
Machine Learning: How can I Apply?

- Students Works

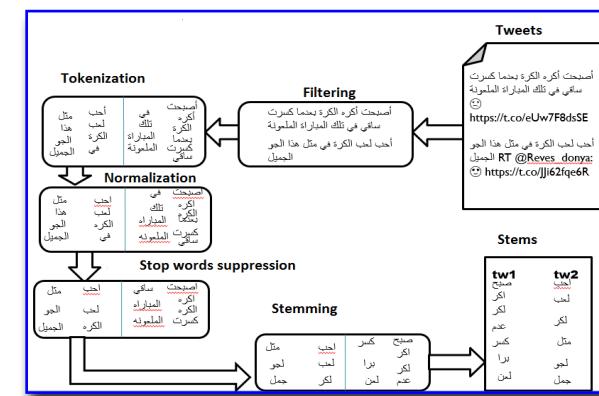
Younes
Choubik



Marouane
Hamda



Abdelhak Mahmoudi



Hicham
Boudkik



Marouane
Benmoussa

THANKS!

Abdelhak Mahmoudi