

# Machine/Deep Learning & Data Science

## Introduction & Future

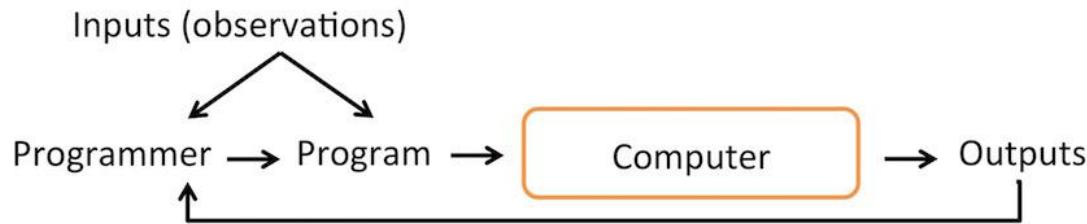
ML/DL/DS Training, SaigonApps

laampt@gmail.com

# Content

- Traditional rule based program vs Learning from data
- Machine Learning overview: supervised, unsupervised and reinforcement learning
- Big Data and Data Science: more (rich) data beats smart algos
- What type of questions Data Science can answer?
- Overview of Deep Learning (DL): Neural Networks, CNN, RNN/LSTM
- Who are pioneers in DL?
- Real life DL applications
- Some frameworks and tools
- Some resources, courses to learn

## The Traditional Programming Paradigm



*Machine Learning is the field of study that gives computers the ability to learn without being explicitly programmed*  
– Arthur Samuel (1959)

## Machine Learning



# Machine Learning overview

Building Intelligent Machines to transform Big/Rich data into knowledge/insights

# Types of ML

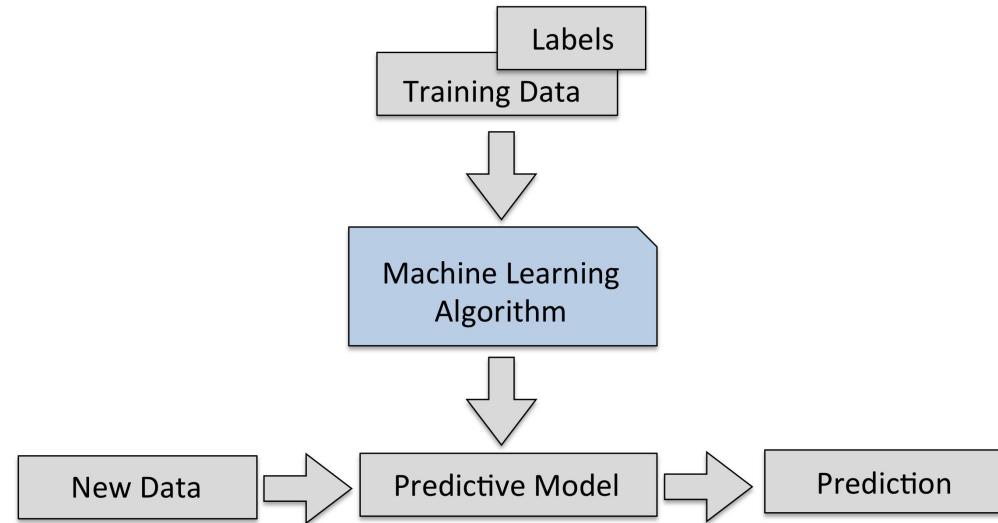
Supervised  
Learning

Unsupervised  
Learning

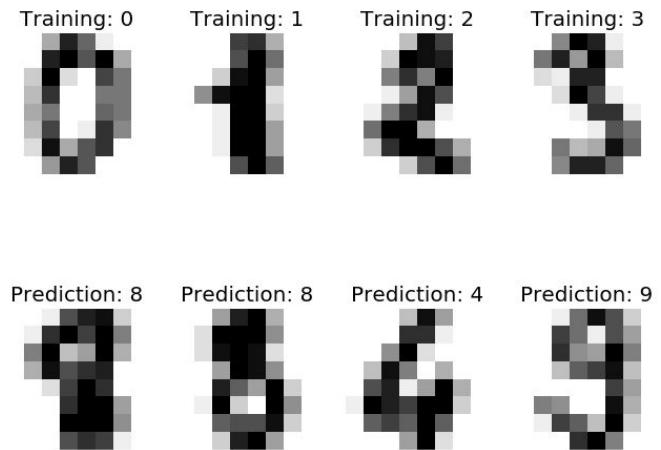
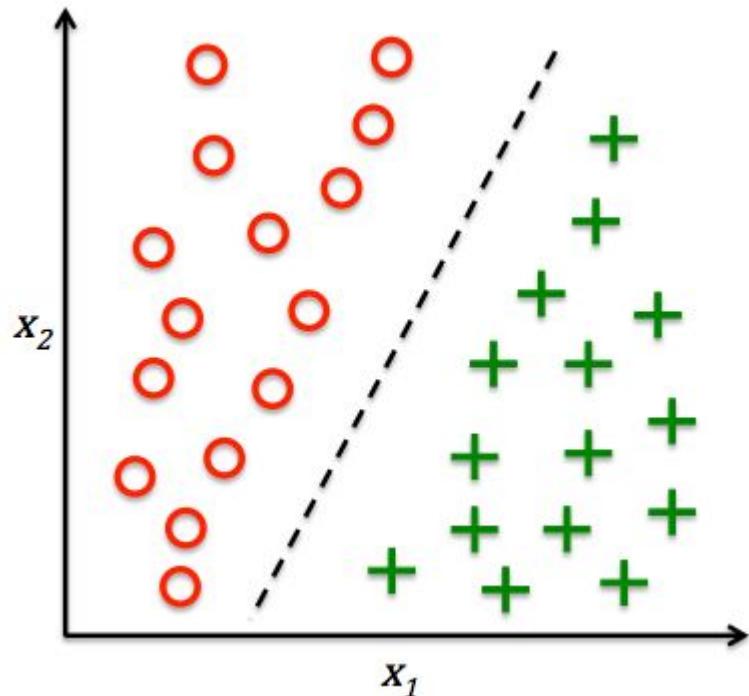
Reinforcement  
Learning

# Supervised Learning: making prediction

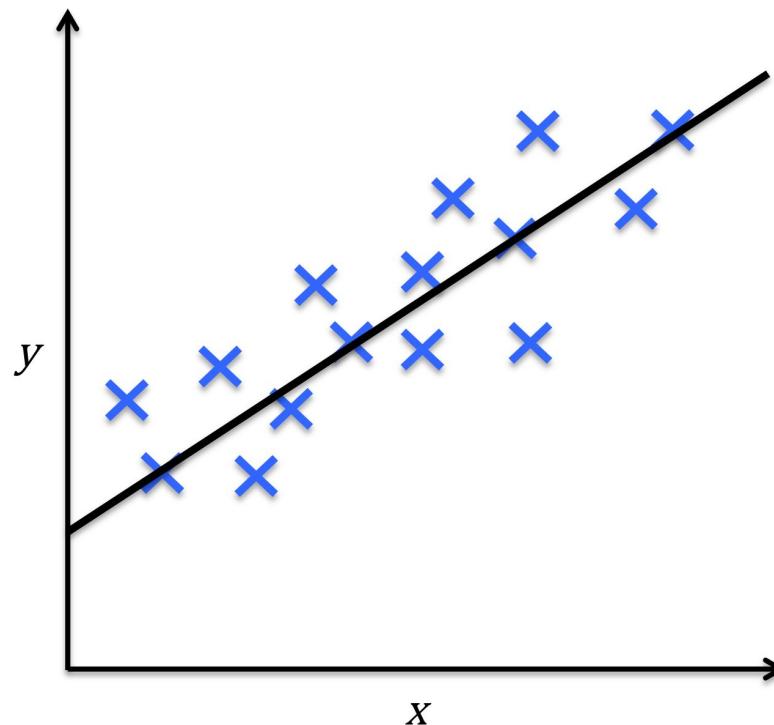
- Classification: spam, sentiment analysis
- Regression: stock, sales predictions
- Ranking: retrieval, search



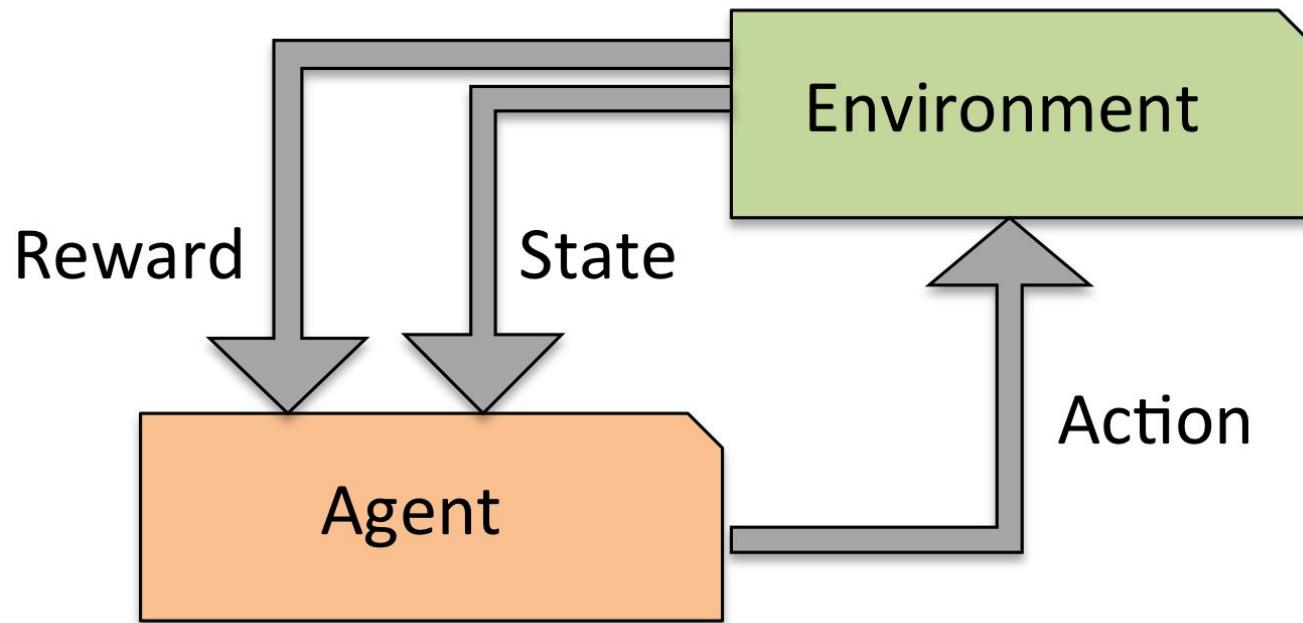
# Classification for predicting class labels



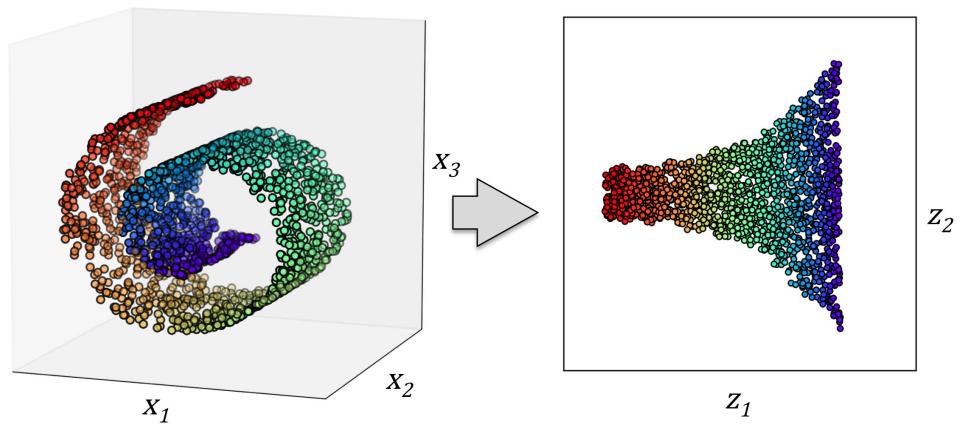
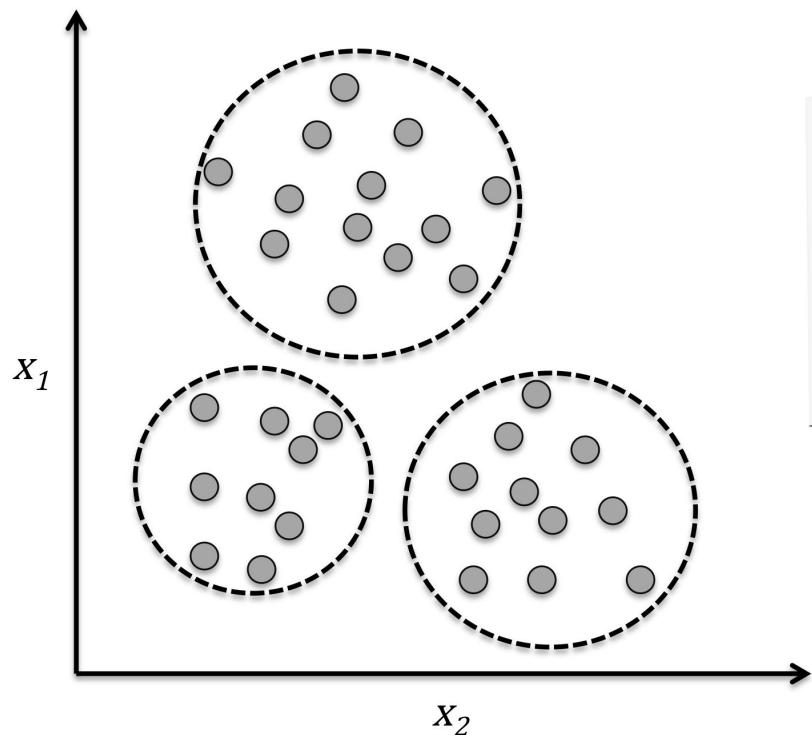
# Regression for predicting continuous outcomes



# Solving interactive problems with reinforcement learning

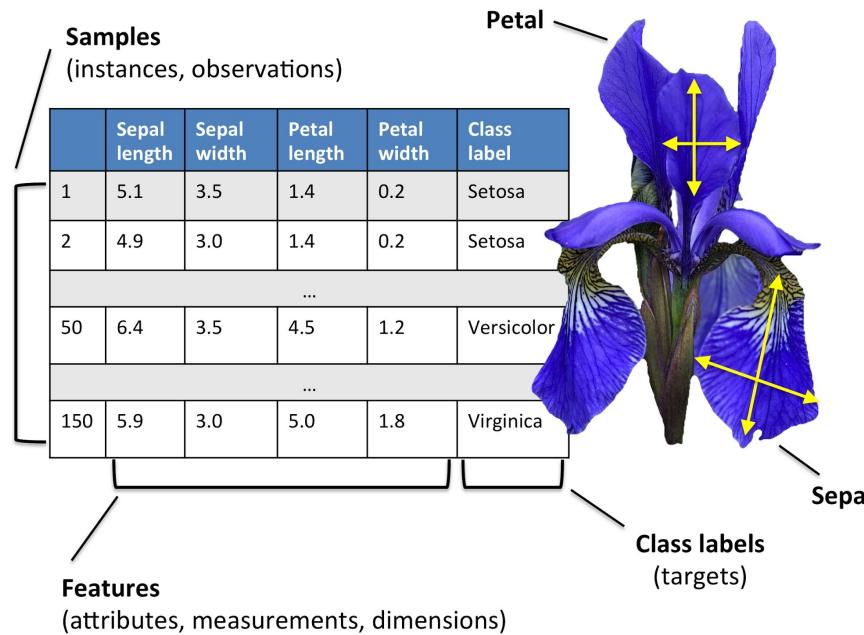


# Discovering hidden structures with unsupervised learning

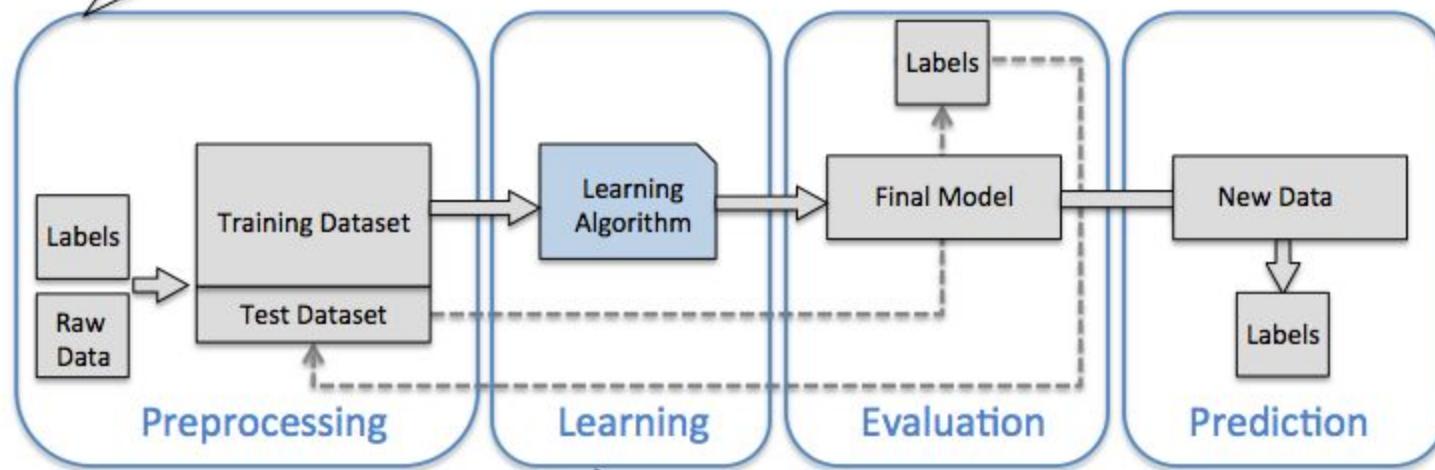


**Dimensionality reduction for data compression**

# An introduction to the basic terminology and notations



# A roadmap for building machine learning systems

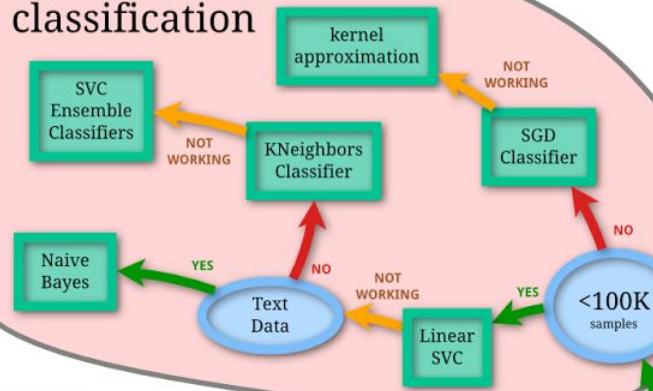


Feature Extraction and Scaling  
Feature Selection  
Dimensionality Reduction  
Sampling

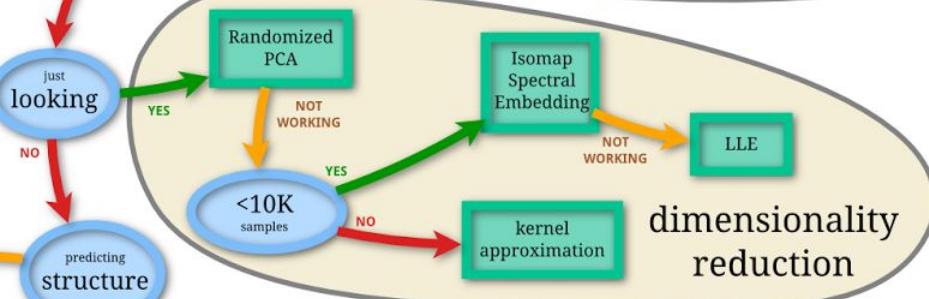
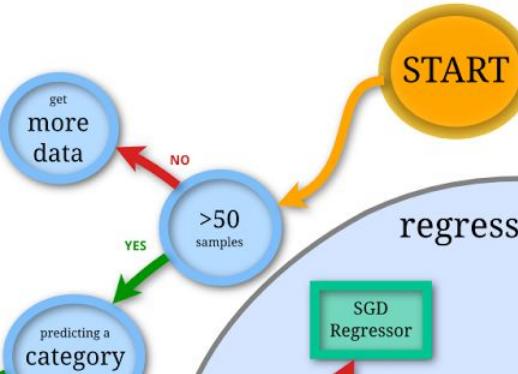
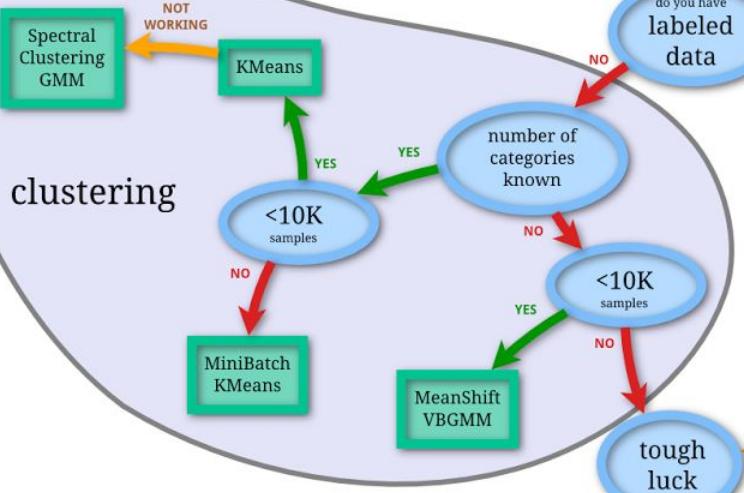
Model Selection  
Cross-Validation  
Performance Metrics  
Hyperparameter Optimization

# scikit-learn algorithm cheat-sheet

## classification



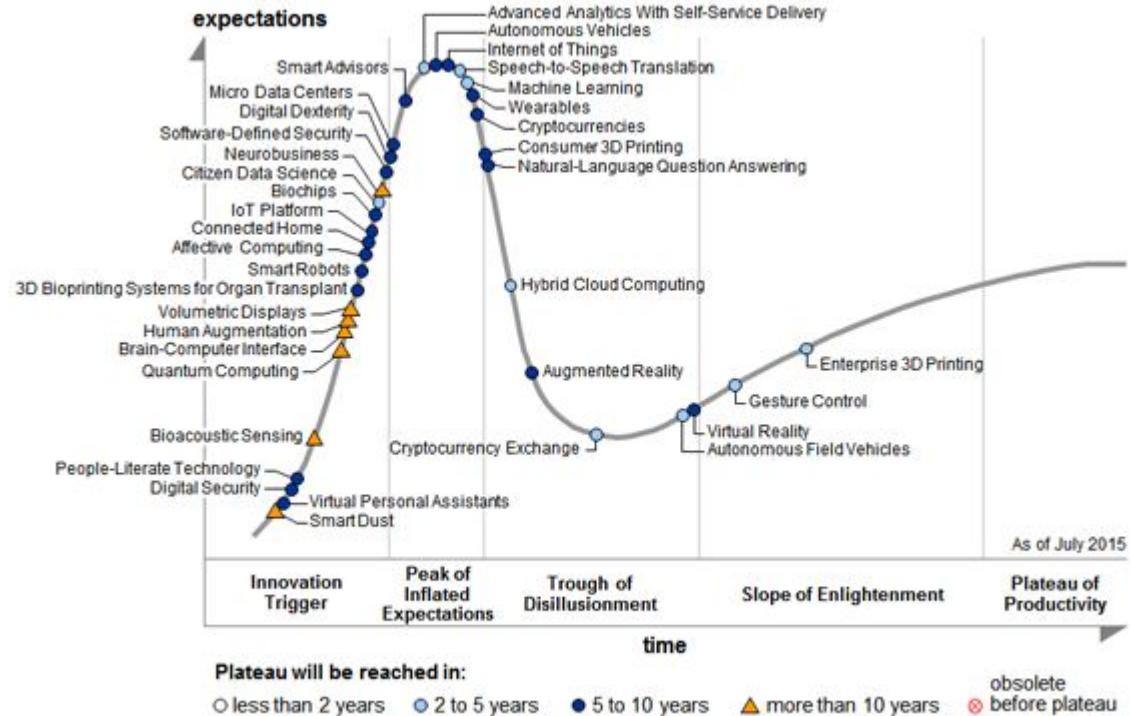
## clustering



# Big Data and Data Science

Gartner 2015 Hype Cycle: Big Data is Out, Machine Learning is in

# Gartner 2015 Hype Cycle: Big Data is Out, Machine Learning is in



“Machine learning and crowdsourcing data will be the basis and fundamentals of every successful, huge IPO win in five years, in the same sense that the transition to [mobile] apps five years ago created the modern corporations of Uber, Snapchat and others.”

Eric Schmidt

# What type of questions Data Science can answer?

- Is this A or B or C or D?
  - Is this Weird?
  - How Much / How Many?
  - How is this Data Organized?
  - What Should I Do Now?
- 
- Multi-class classification
  - Anomaly detection
  - Regression
  - Clustering, a.k.a. chunking, grouping, bunching, or segmentation
  - Reinforcement learning

**Machine**

Data Management

Data Mining

Machine Learning

Business Intelligence

Statistics

**Human**

Human Cognition

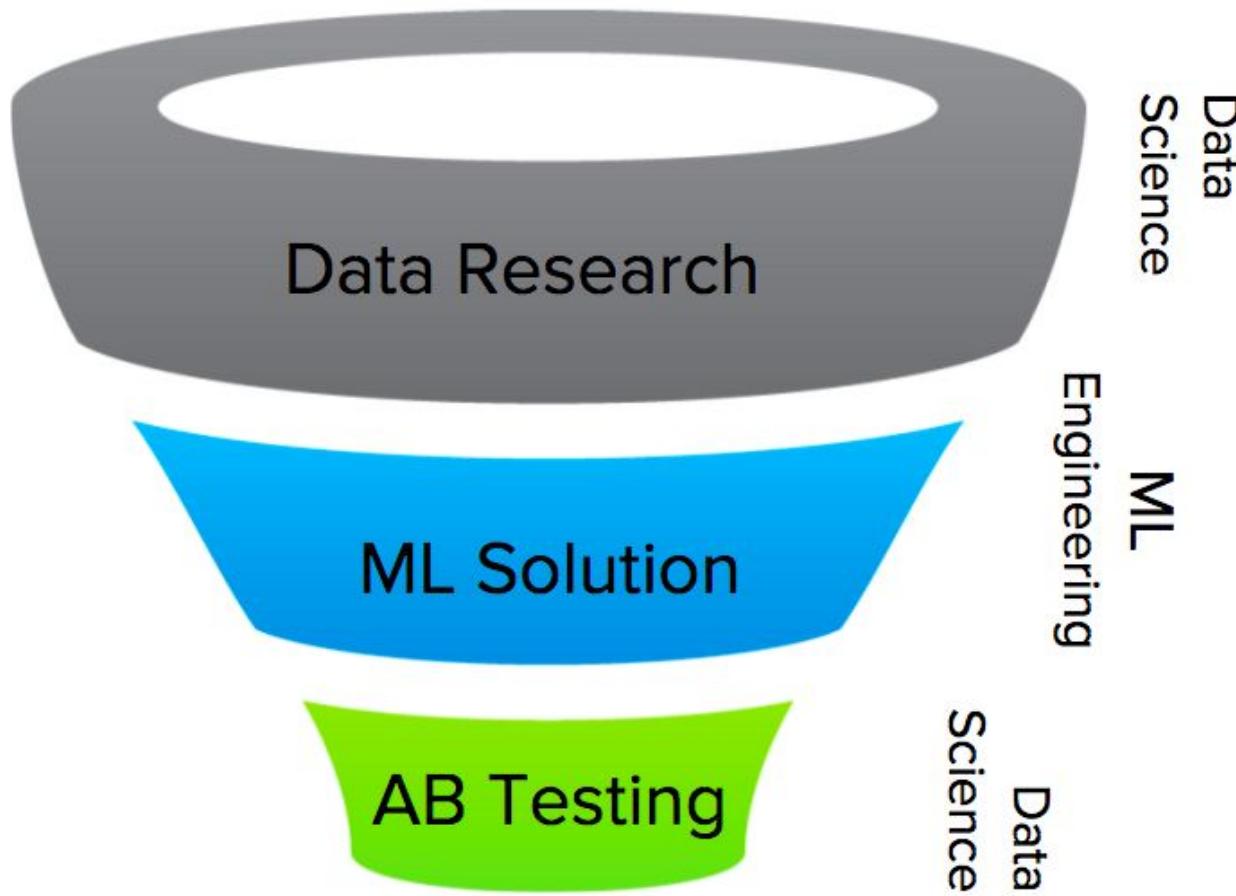
Perception

Story Telling

Decision Making  
Theory

**Data Science**





# Deep Learning

## Reinventing Social Media: Deep Learning, Predictive Marketing, And Image Recognition Will Change Everything



COOPER SMITH [✉](#) [⤓](#)  
FEB. 16, 2014, 6:02 PM [6,821](#)

### CULTURE

— Animals. Civil Liberties. Tech. Top Stories

## Why Facebook, Google, and the NSA Want Computers That Learn Like Humans

*Deep learning could transform artificial intelligence. It could also get pretty creepy.*

—By Dana Liebelson | September/October 2014 Issue

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## Scientists See Promise in Deep-Learning Programs

# IS “DEEP LEARNING” A REVOLUTION IN ARTIFICIAL INTELLIGENCE?

BY GARY MARCUS

[Share](#) [Tweet](#) [8+1](#) [Email](#) [Print](#)

Deep Learning - The Biggest Data Science Breakthrough of the Decade

# Scene recognition

## MIT Scene Recognition Demo

This demo identifies if the image is an indoor or an outdoor place, and suggests the five most likely place categories representing the image, using Places-CNN (see [project page](#)). It is made for pictures of environments, places, views on a scene and a space (as opposed to picture of an object). You also could upload image using mobile phone. Upload .jpg or jpeg image only.

**Upload :**

No file chosen

or

**URL:**

or



**Click One:**



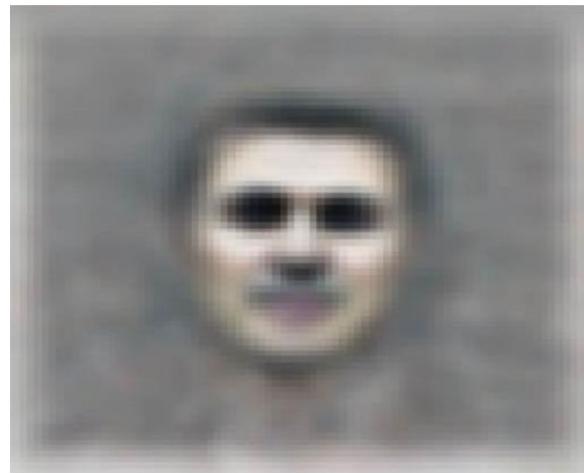
<http://places.csail.mit.edu/demo.html>

# Google Brain - 2012

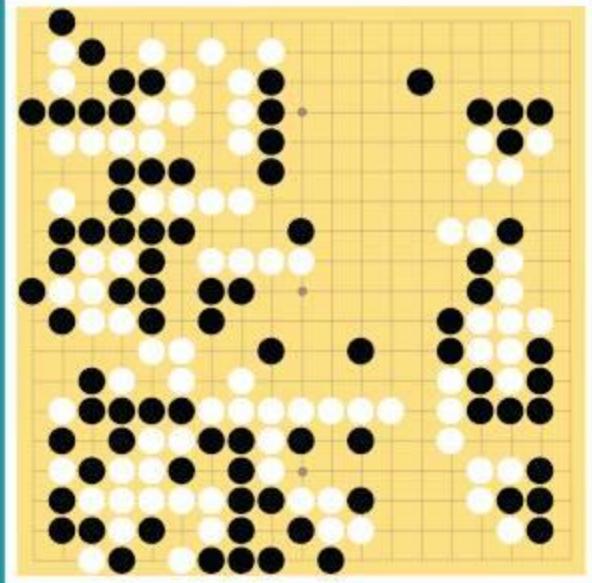


16 000 Cores

# What it learned



<http://www.nytimes.com/2012/06/26/technology/in-a-big-network-of-computers-evidence-of-machine-learning.html?pagewanted=all>



THE ULTIMATE GO CHALLENGE  
GAME 3 OF 5

12 MARCH 2016



AlphaGo  
Won 3 of 5



Lee Sedol  
Won 0 of 5

RESULT

W+  
Res

NUMBER  
OF MOVES

176

TIME  
WHITE

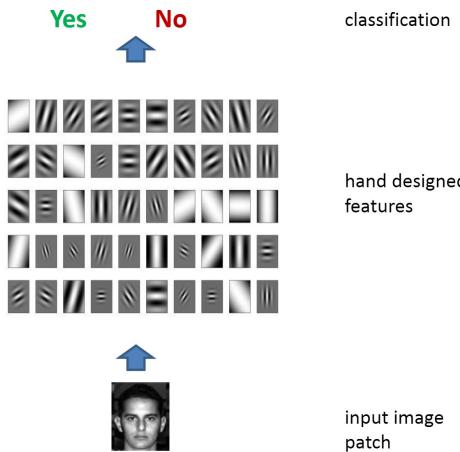
1h  
51m

TIME  
BLACK

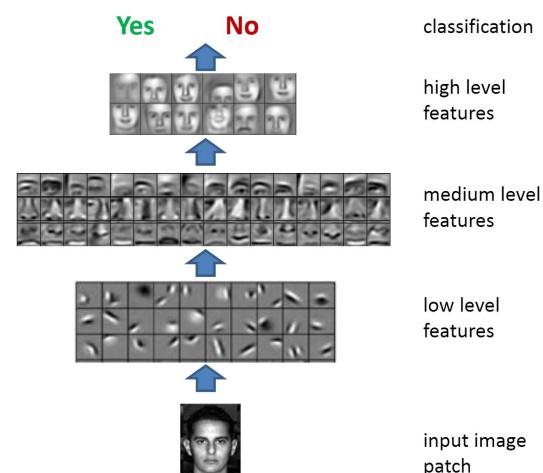
2h+

# What's different?

## Feature Design



## Learned Feature Hierarchy



[Honglak Lee]

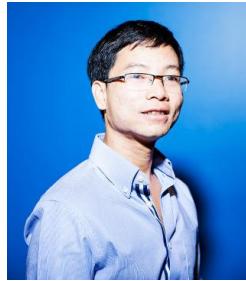
# Who are pioneers in DL?



Yann Lecun - FB



Andrew Ng - Baidu



Quoc Le - Google



Bengio Yoshua - IBM



Xavier Amatriain -  
Quora/Netflix



Demis Hassabis -  
DeepMind



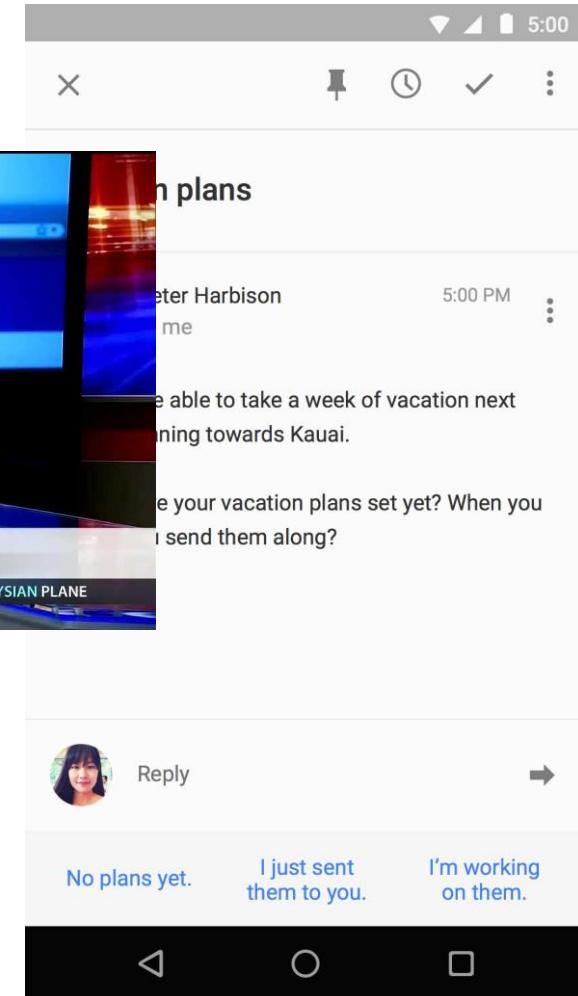
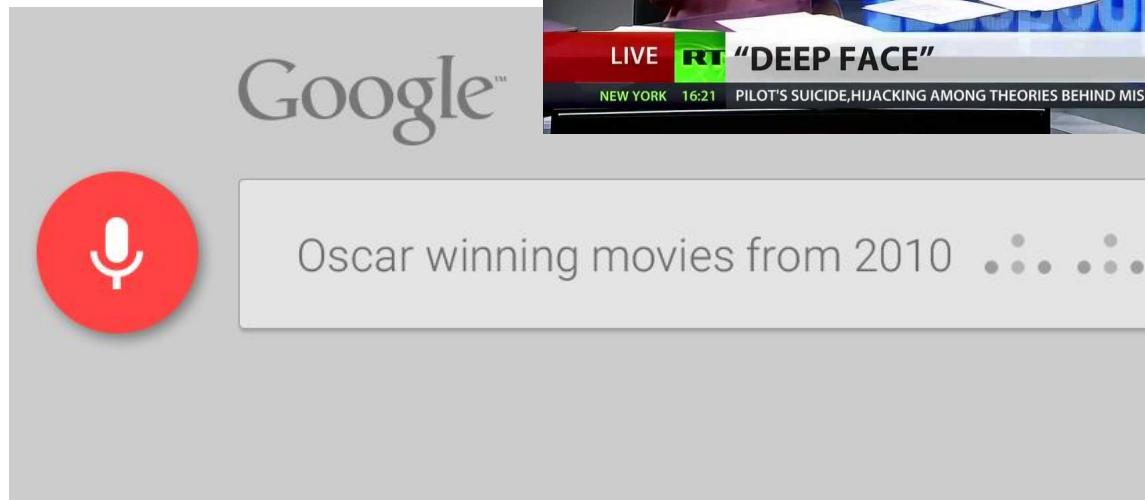
Geoffrey Hinton -  
Google



Omer Levy - Israel

# Real life DL applications

- Google Voice Search
- Smart Reply
- Self-driving car
- Alpha Go
- Deep Face
- Cortana/Tay/Siri/Now



# Applications

- Understanding Images
- Understanding Speech
- Understanding Texts

**Human:** what is the purpose of life ?

**Machine:** to serve the greater good .

**Human:** what is the purpose of living ?

**Machine:** to live forever .

**Human:** what is the purpose of existence ?

**Machine:** to find out what happens when we get to the planet earth .

**Human:** where are you now ?

**Machine:** i 'm in the middle of nowhere .

**Human:** what is the purpose of dying ?

**Machine:** to have a life .

**Human:** what is the purpose of being intelligent ?

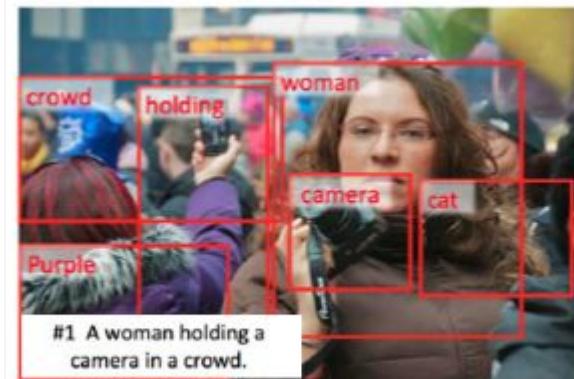
**Machine:** to find out what it is .

**Human:** what is the purpose of emotions ?

**Machine:** i don 't know .



Vinyals et. al. *Show and Tell: A Neural Image Caption Generator*. (2015)



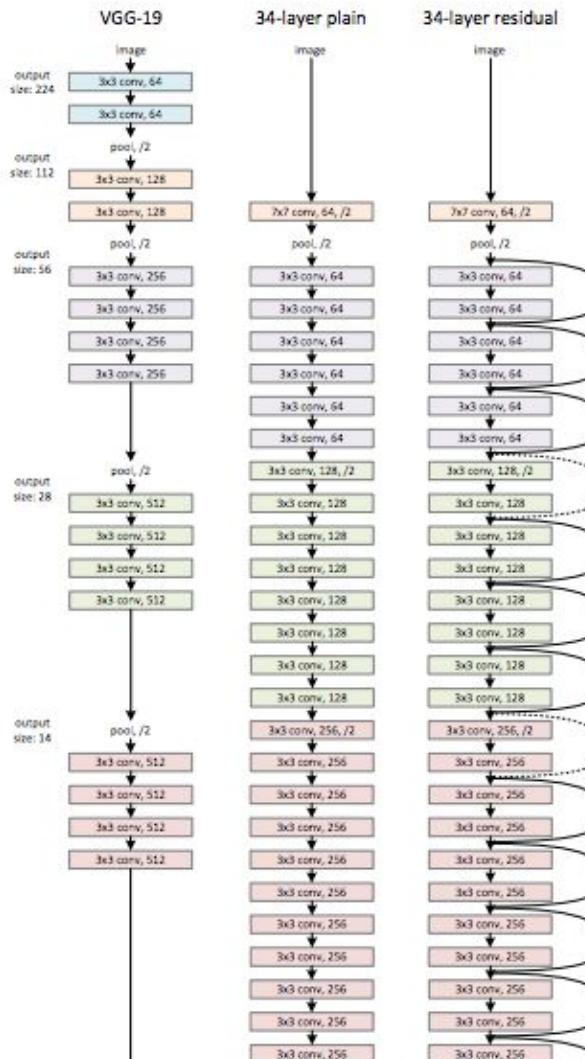
Fang et. al. *From Captions to Visual Concepts and Back*. (CVPR, 2015)

# ImageNet 2015

Microsoft Research Asia wins with networks with depths ranging from 34 to 152 layers

New record: 3.6% error rate

<http://arxiv.org/abs/1512.03385>

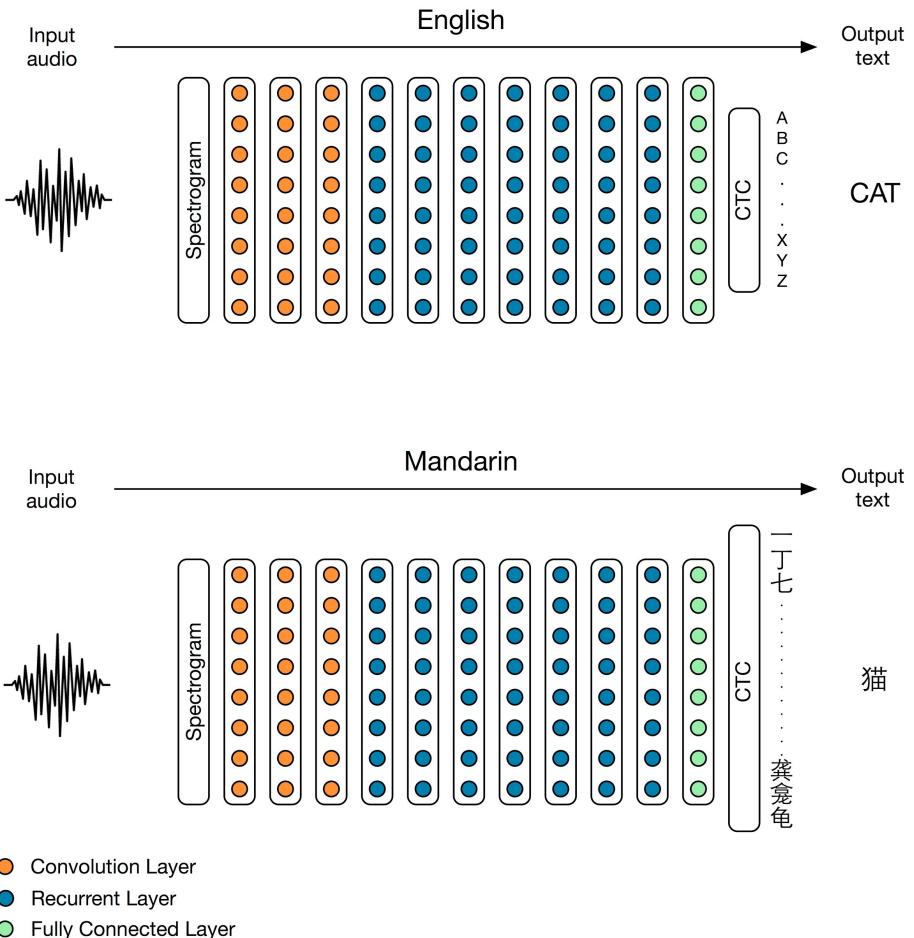


# Speech Recognition



Voice Search:  
2013: 23% > 8%

[http://venturebeat.com/2015/05/28/google-says-its-speech-recognition-technology-now-has-only-a  
n-8-word-error-rate/](http://venturebeat.com/2015/05/28/google-says-its-speech-recognition-technology-now-has-only-an-8-word-error-rate/)



<http://svail.github.io/mandarin>

# Some ML/DL frameworks and tools



Caffe



theano



# Some resources, courses to learn

- Machine Learning - Stanford University | Coursera
- Learning From Data - Online Course (MOOC)
- Harvard CS109 Data Science
- Convolutional Neural Networks for Visual Recognition CS231n
- CS224d: Deep Learning for Natural Language Processing
- Google Deep Learning on TensorFlow
- An introduction to machine learning with scikit-learn

# Q & A



Sometimes the questions are complicated but the answers are simple. Dr. Seuss