

# Image Processing & Vision

## Week 5 & 6



# Content

- What is Machine Learning? (week5)
- Computer Vision (week6)
  - Face Recognition
  - Demo:
    - Face Detection and Tracking Using Live Video Acquisition

# What is Machine Learning?

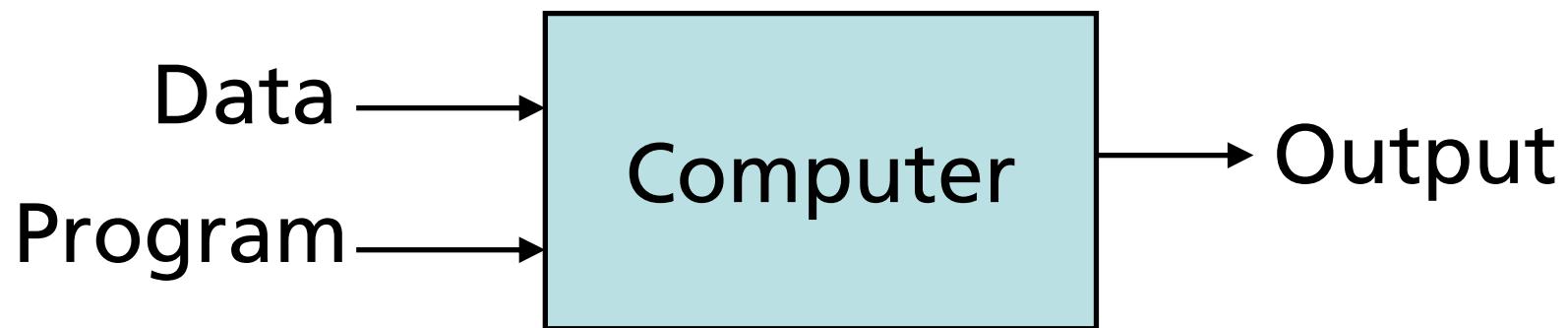


- Machine learning is about the construction and study of systems that can learn from data.
  - This is very different than traditional computer programming.
- The complexity in traditional computer programming is in the code (programs that people write). In machine learning, algorithms (programs) are in principle simple and the complexity (structure) is in the data. **Is there a way that we can automatically learn that structure?** That is what is at the heart of machine learning.

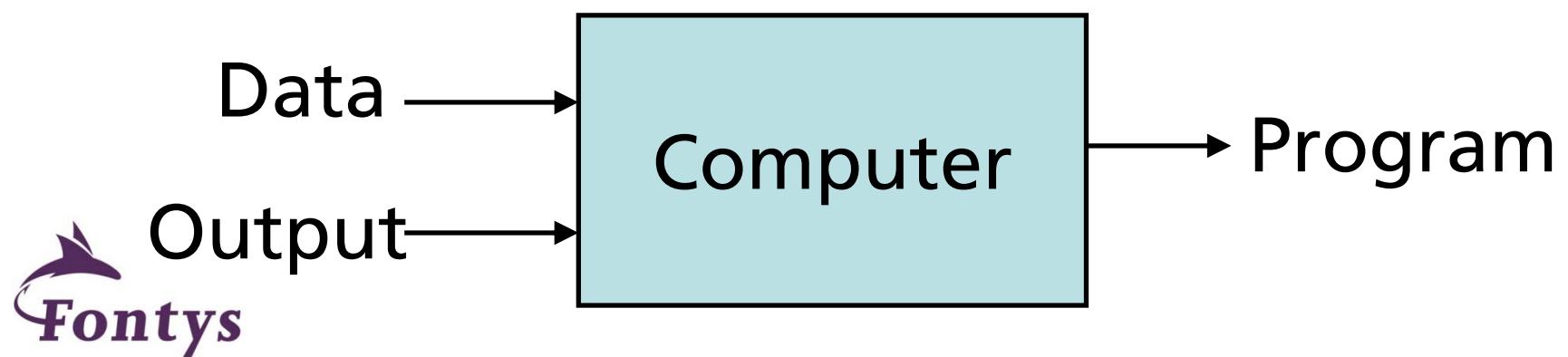
-- Andrew Ng

- **Is Leaving Baidu in Search of a Big New AI Mission**
- Co-Chairman and Co-Founder of Coursera
- Adjunct Professor at Stanford University

## Traditional Programming



## Machine Learning

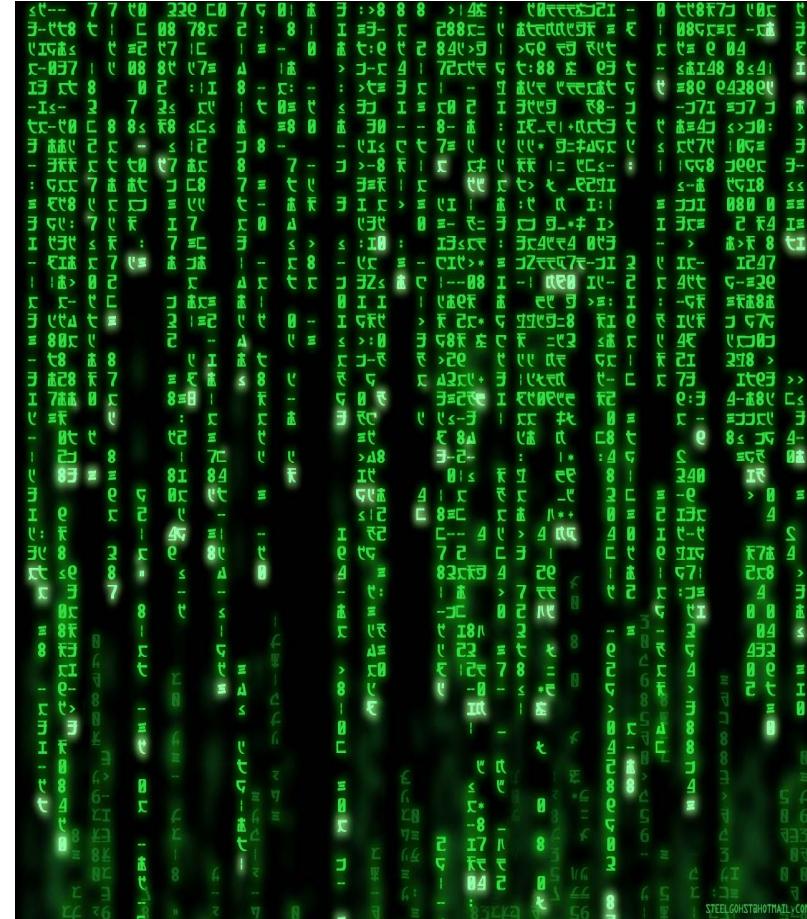


# Why Machine Learning is Hard

You See



Your ML Algorithm Sees



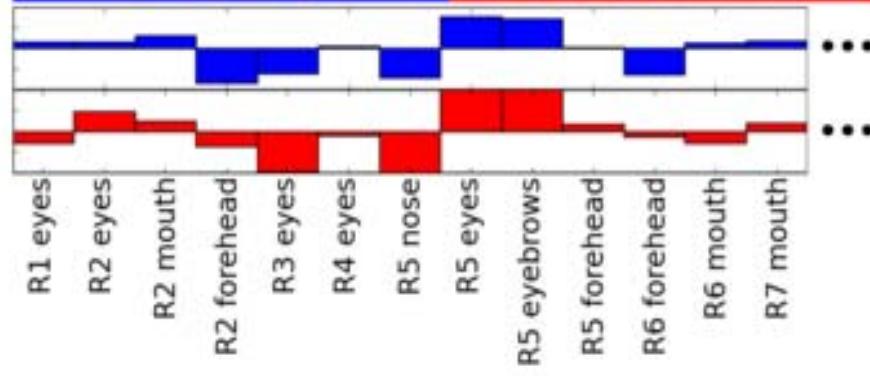
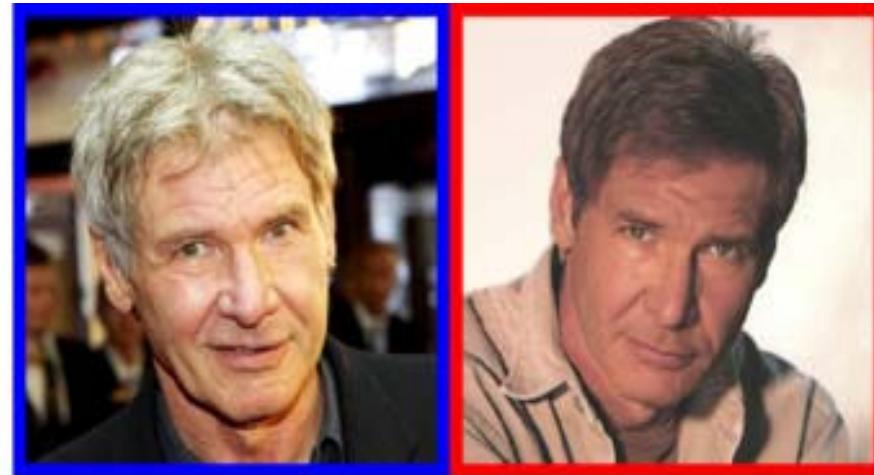
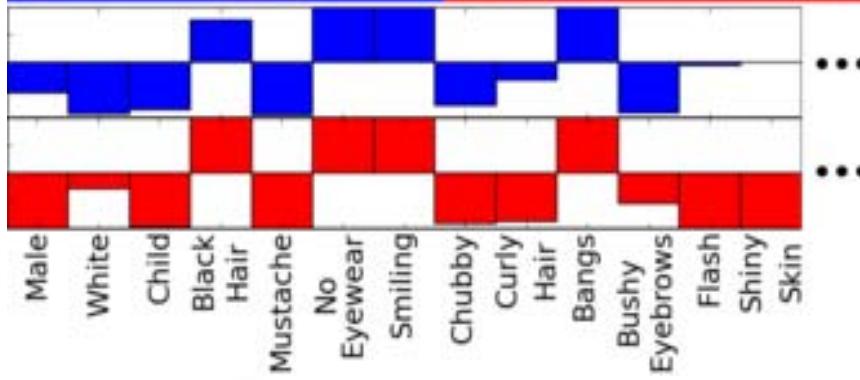
# When Would We Use Machine Learning?

- When patterns exist in our data--Even if we don't know what they are
- Machine Learning is heavily focused on implementability
  - Frequently using well known numerical optimization techniques
  - Lots of open source code available
- Video: Machine learning and Big Data
  - <https://www.youtube.com/watch?v=W3dvfrGotzs>
- Video: A Friendly Introduction to Machine Learning
  - <https://www.youtube.com/watch?v=IpGxLWOI Zy4>
- Machine Learning Made Easy
  - [https://nl.mathworks.com/videos/machine-learning-with-matlab-100694.html?elqsid=1496059982844&potential\\_use=Education](https://nl.mathworks.com/videos/machine-learning-with-matlab-100694.html?elqsid=1496059982844&potential_use=Education)



“essentially, all models are wrong,  
but some are useful”  
– George Box

# Computer Vision: Face Recognition



# Face Recognition

## Attributes for training

Attribute	Positive Examples	Negative Examples
Asian	  	  
Blond Hair	  	  
Child	  	  
Male	  	  

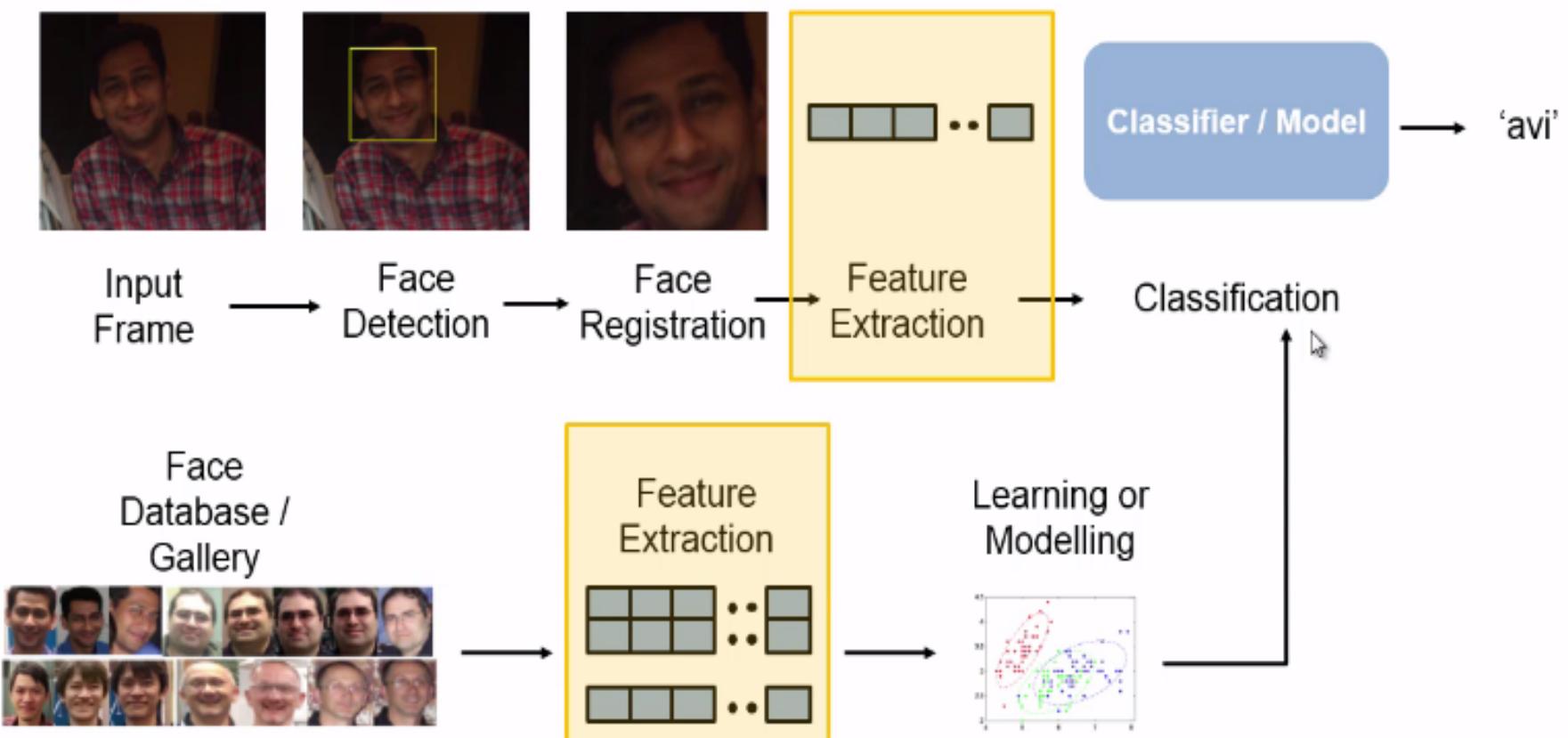
## Similes for training

Simile	Positive Examples	Negative Examples
R1 Eyebrows	  	  
R1 Eyes	  	  
R1 Nose	  	  
R1 Mouth	  	  
R2 Eyebrows	  	  
R2 Eyes	  	  
R2 Nose	  	  
R2 Mouth	  	  

# Video

- <https://nl.mathworks.com/videos/face-recognition-with-matlab-98076.html>

## Face Recognition Workflow



# **TED: How we're teaching computers to understand pictures**

[https://www.ted.com/talks/fei\\_fei\\_li\\_how\\_we\\_re\\_teaching\\_computers\\_to\\_understand\\_pictures](https://www.ted.com/talks/fei_fei_li_how_we_re_teaching_computers_to_understand_pictures)

**"Artificial Intelligence(AI) can understand a photo and write description", Google's Fei-Fei Li**

<https://www.youtube.com/watch?v=Jyai2fUflos>



**TED Speaker**

*As Director of Stanford's Artificial Intelligence Lab and Vision Lab, Fei-Fei Li is working to solve AI's trickiest problems — including image recognition, learning and language processing.*

# Demo

- **Face Detection and Tracking Using Live Video Acquisition**
  - [https://nl.mathworks.com/help/vision/examples/face-detection-and-tracking-using-live-video-acquisition.html?searchHighlight=face%20detection&s\\_tid=doc\\_srcTitle](https://nl.mathworks.com/help/vision/examples/face-detection-and-tracking-using-live-video-acquisition.html?searchHighlight=face%20detection&s_tid=doc_srcTitle)

# Question?

