APPLIED MACHINE LEARNING

PLAYER LOOK-A-LIKE

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PLAYER LOOK-A-LIKE USE CASE

Develop an app prototype 📱 that captures a selfie 🤳 and match it to a soccer player ⚽ using machine learning 🤖.

HERE WE GO...

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- 7300 labeled player images

WHAT IS MACHINE LEARNING?

Machine Learning is ...

... the field of study that gives computers the ability to learn without being explicitly programmed.

~ Arthur Samuel (1959)

... a 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.

~ Tom Mitchell (1998)

... the scientific study of algorithms and statistical models that computer systems use to effectively perform a specific task without using explicit instructions, relying on patterns and inference instead.

~ Wikipedia (2019)

ARTIFICIAL INTELLIGENCE

Agents that can sense, reason, act and adapt to make decissions to maximize the chances of achieving their goal.

- Computer Vision
- Robotics
- Natural Language Processing
- Planning
- Reasoning
- Logical Systems
- Knowledge based systems
- Descission Trees
- …

MACHINE LEARNING

Methods that computer systems use to effectively perform a specific task without using explicit instructions, relying on patterns and inference instead.

SUPERVISED LEARNING

- Classification
- Regression
- Support Vector Machines (SVMs)
- …

UNSUPERVISED LEARNING

- Clustering
- Dimensionality Reduction
- Anomaly Detection
- Recommender Systems
- ...

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DEEP LEARNING

- Multi-layered Neural Networks
- CNNs
- …

TRAINING

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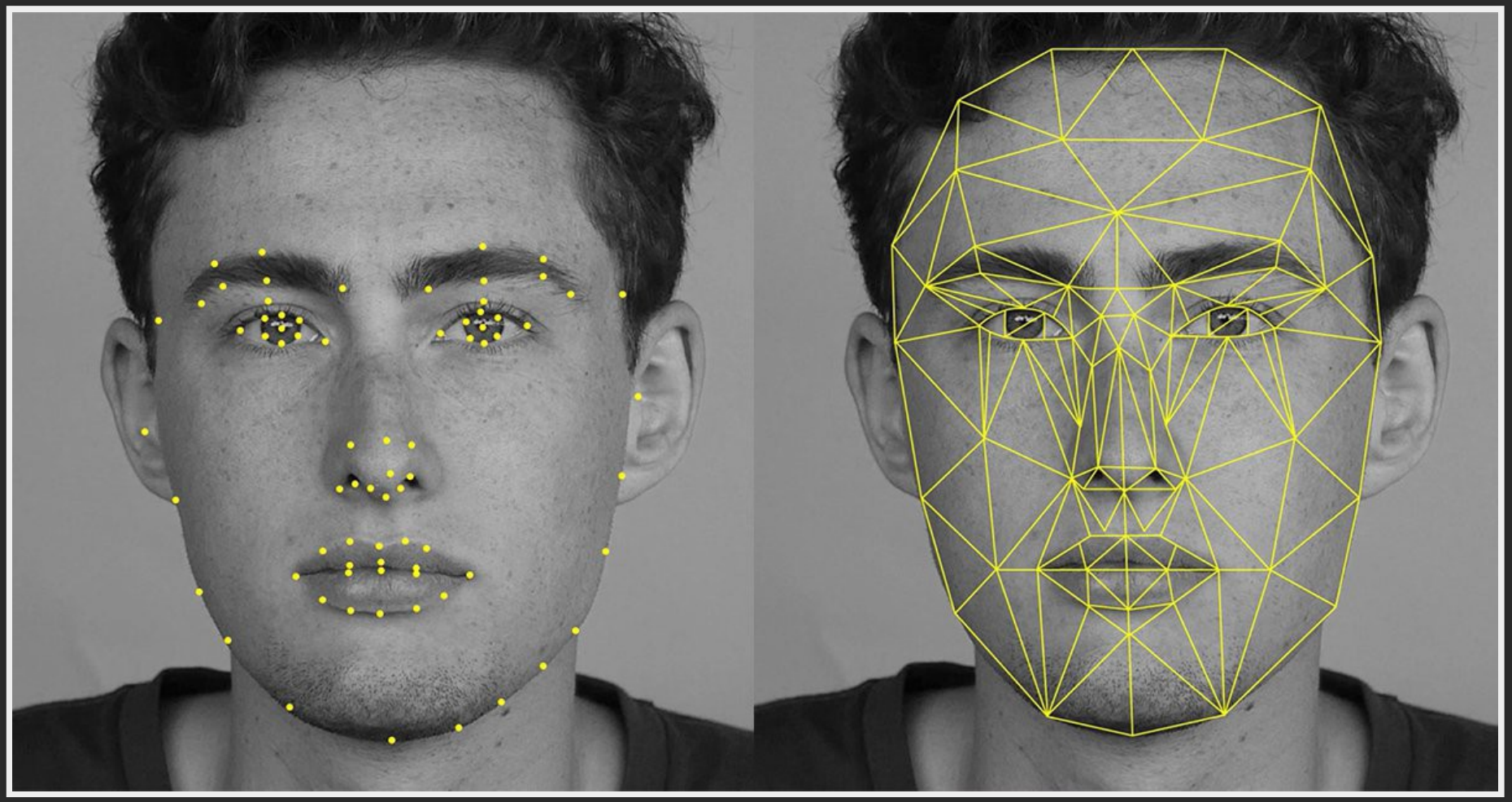
FACIAL FEATURES



DETECTION

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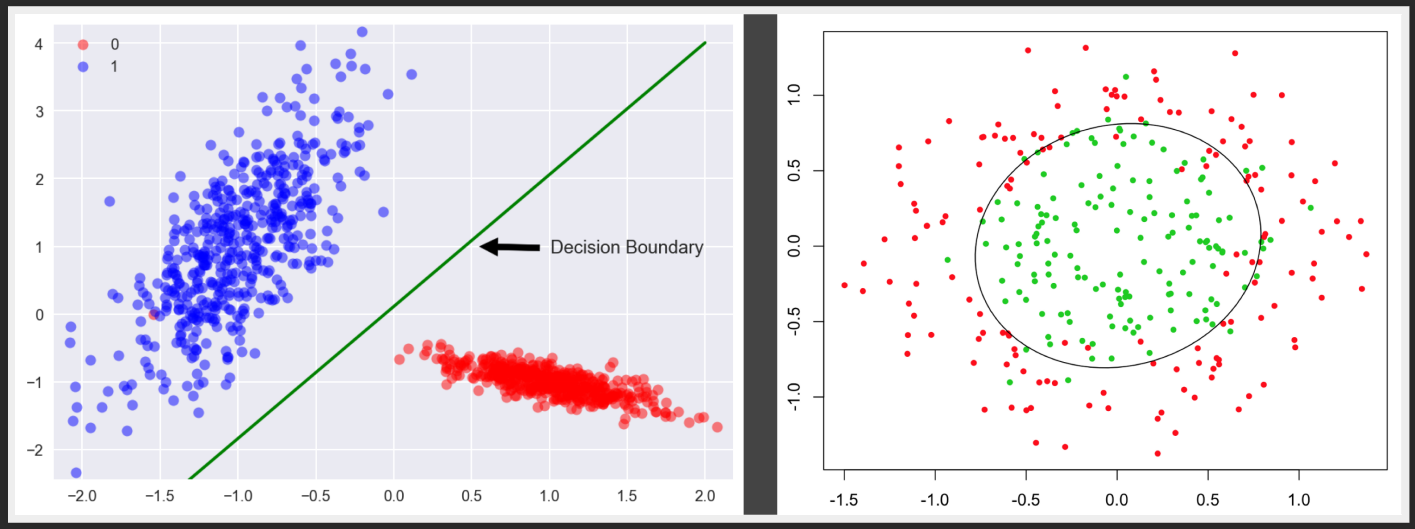
LOGISTIC REGRESSION



- Classification
  - Email: Spam / Not Spam?
  - Online Transactions: Fraudulent Yes/No?
  - Tumor: Malignant/Benign?

COST FUNCTION & GRADIENT DESCENT

$$J(\theta) = -\frac{1}{m}[\sum_{i=1}^{m} y^{(i)} \log h_\theta(x^{(i)}) + (1 - y^{(i)}) \log (1 - h_\theta(x^{(i)}))]$$

Want $\min_\theta J(\theta)$:

Repeat $\{$

$$\theta_j := \theta_j - \alpha \frac{\partial}{\partial \theta_j} J(\theta)$$

$\}$

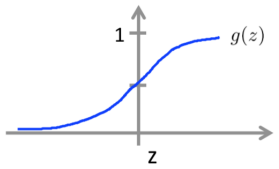
(simultaneously update all θ_j)

$$\frac{\partial}{\partial \theta_j} J(\theta) = \frac{1}{m} \sum_{i=1}^{m} (h_\theta(x^{(i)}) - y^{(i)}) x_j^{(i)}$$

Logistic regression

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

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



Suppose predict "$y = 1$" if $h_\theta(x) \geq 0.5$

$\theta^T x \geq 0$

$g(z) \geq 0.5$ when $z \geq 0$

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

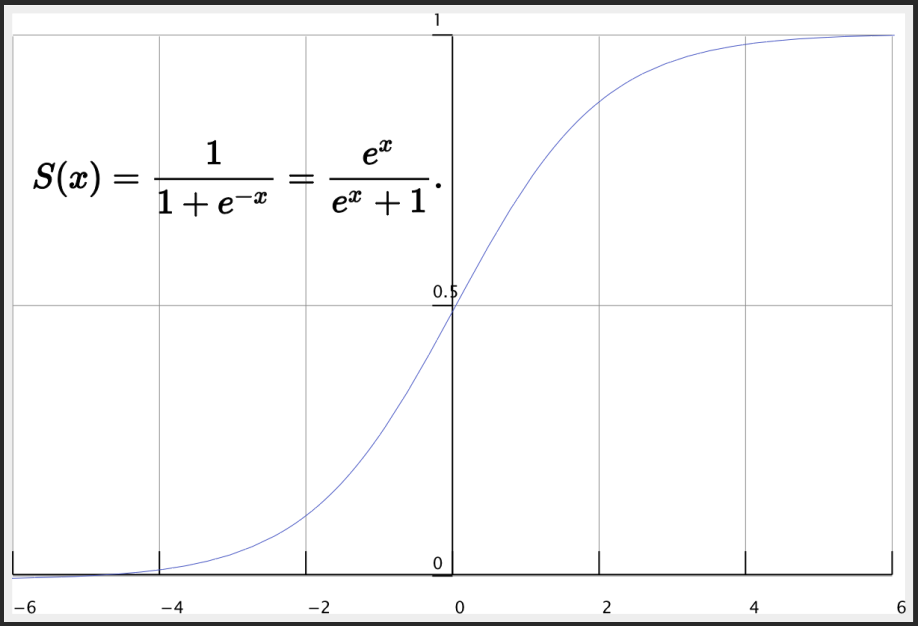
predict "$y = 0$" if $h_\theta(x) < 0.5$

$\theta^T x < 0$

$g(z) < 0.5$ when $z < 0$

SIGMOID FUNCTION

$$S(x) = \frac{1}{1 + e^{-x}} = \frac{e^x}{e^x + 1}.$$

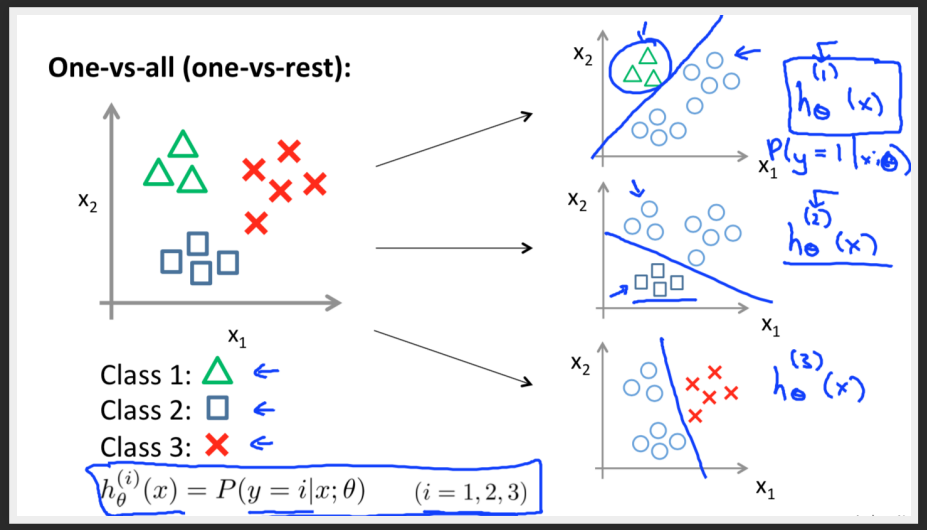


$y \in \{0, 1\}$

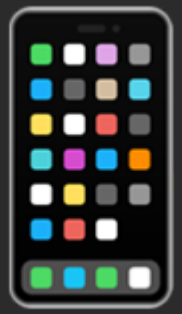
0: “Negative Class” (e.g., benign tumor)

1: “Positive Class” (e.g., malignant tumor)

MULTI-CLASS CLASSIFICATION: ONE-VS-ALL



- Classification with multiple segments
  - Email tagging: Work, Friends, Family, Hobby
  - Medical diagrams: Not ill, Cold, Flu
  - Weather: Sunny, Cloudy, Rain, Snow



DEMO

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 QUESTIONS?