

Machine Learning

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Machine Learning (ML)

- What is the feature of machine learning?
- Where is machine learning applied?
- What is the trend of machine learning?

Overview of events in the world

- January 9, 2020 – World Health Organization
- January 6, 2020 – USA

Overview of events in the world

- December 31, 2019 – BlueDot (Canada)

Use of data for machine learning:

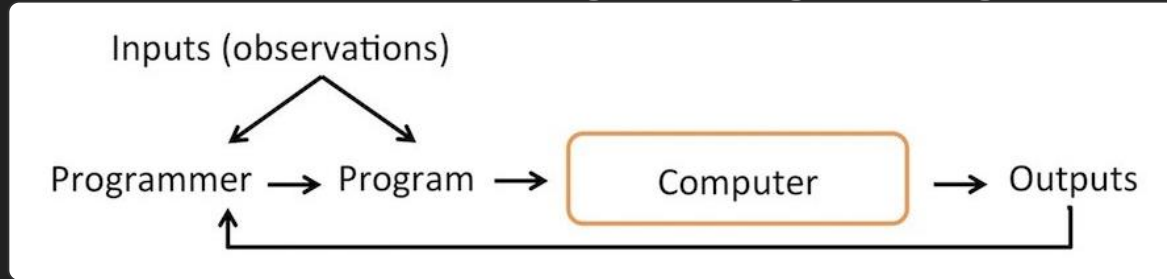
- news;
- airlines data;
- posts on social networks and so on.



What is Machine Learning?

Machine Learning is a sub-sector of Artificial Intelligence (AI), which gives computers the ability to learn without being explicitly programmed.

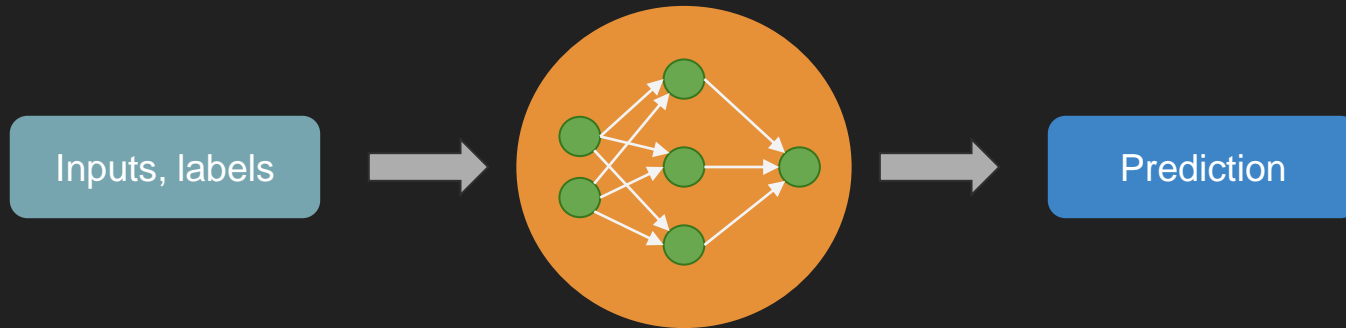
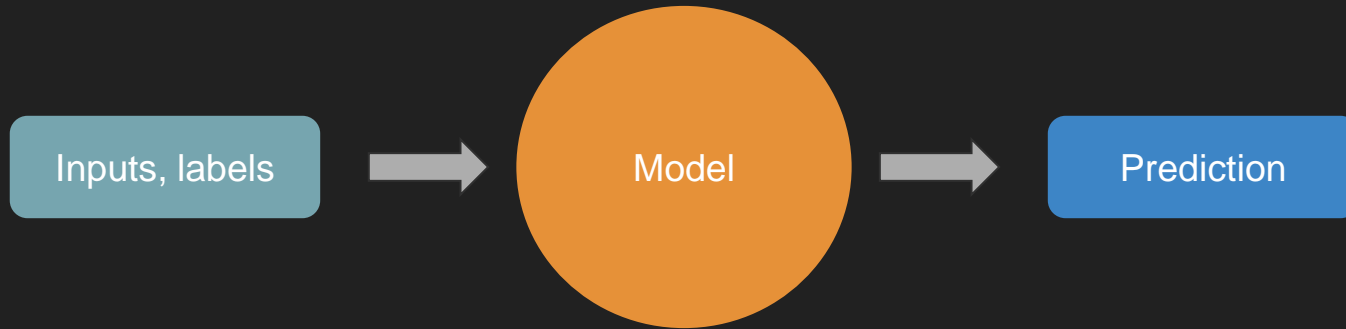
The Traditional Programming Paradigm



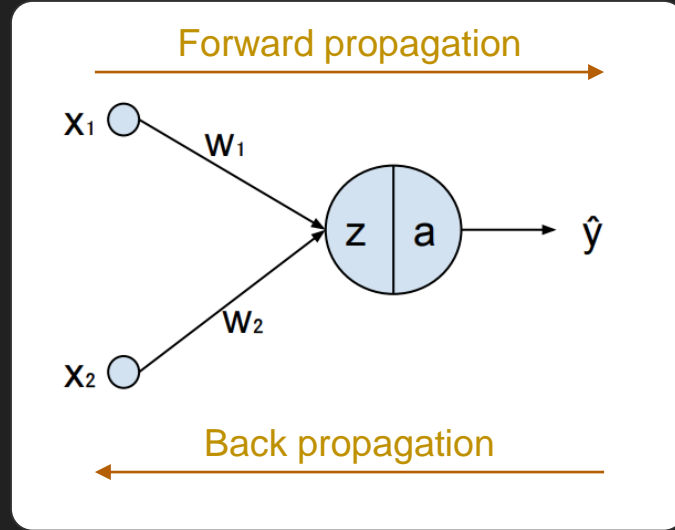
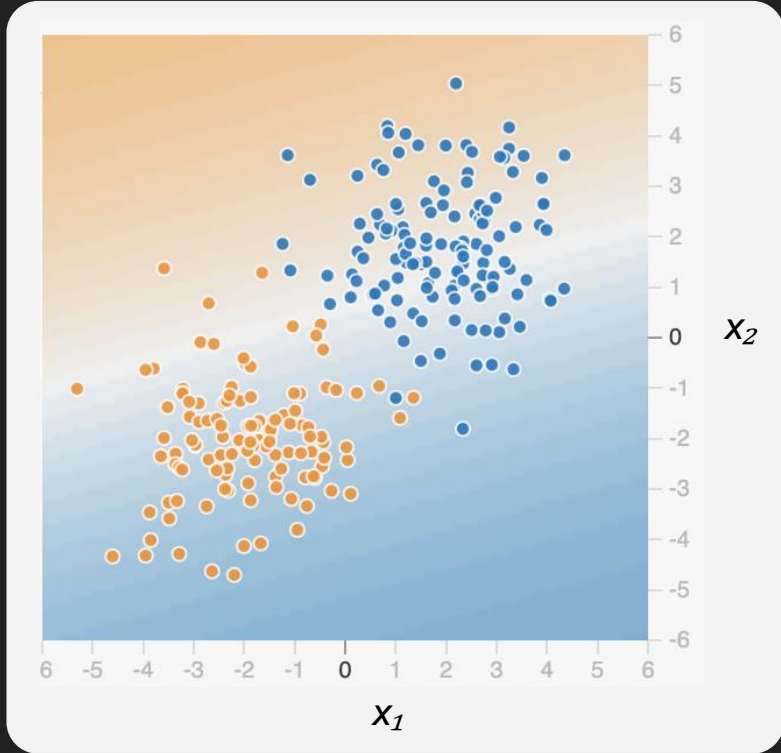
Machine Learning



What is Machine Learning (ML)?



Building a model using ML



Model:

$$z = w_1x_1 + w_2x_2 + b$$

$$a = g(z)$$

Building a model using ML



Epoch
000,616

Learning rate
0.001

Activation
Sigmoid

DATA

Ratio of training to test data: 50%



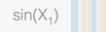
Noise: 15



REGENERATE

FEATURES

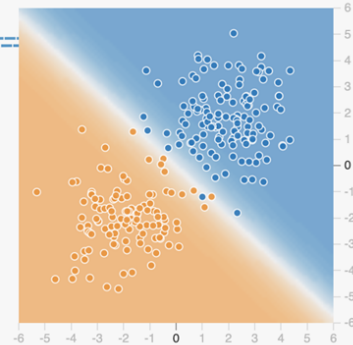
Which properties do you want to feed in?



0 HIDDEN LAYERS

OUTPUT

Test loss 0.038
Training loss 0.019



Colors shows data, neuron and weight values.

Building a model using ML



Epoch
001,701

Learning rate
0.03

Activation
Sigmoid

DATA

Ratio of training to test data: 50%

REGENERATE

FEATURES

Which properties do you want to feed in?

- X_1
- X_2
- X_1^2
- X_2^2
- X_1X_2
- $\sin(X_1)$
- $\sin(X_2)$

1 HIDDEN LAYER

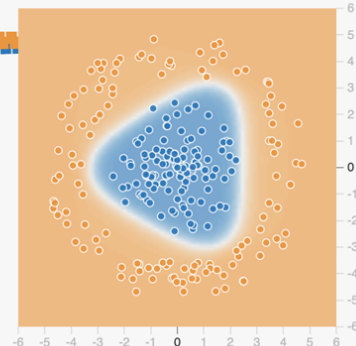
+ -

3 neurons

This is the output from one neuron. Hover to see it larger.

OUTPUT

Test loss 0.008
Training loss 0.006



Colors shows data, neuron and weight values.

Building a model using ML



Epoch
001,007

Learning rate
0.03

Activation
ReLU

DATA

Ratio of training to
test data: 50%

REGENERATE

FEATURES

Which properties do
you want to feed in?

X_1

X_2

X_1^2

X_2^2

$X_1 X_2$

$\sin(X_1)$

$\sin(X_2)$

3 HIDDEN LAYERS

+

-

8 neurons

+

-

8 neurons

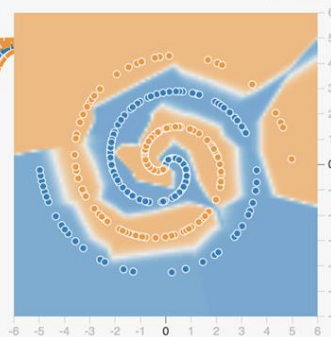
+

-

5 neurons

OUTPUT

Test loss 0.058
Training loss 0.000

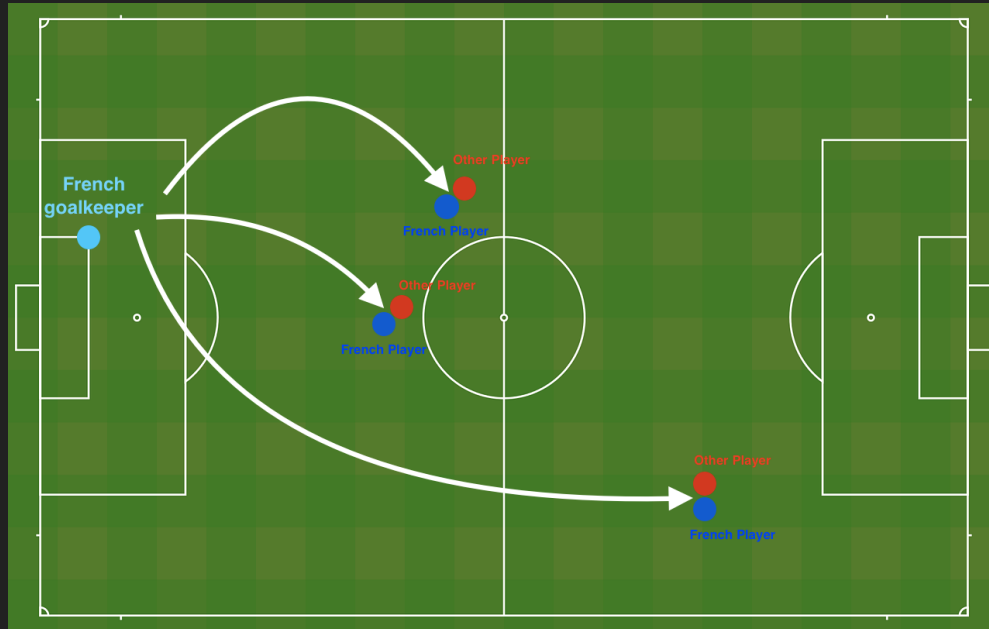


Colors shows
data, neuron and
weight values.

Show test data

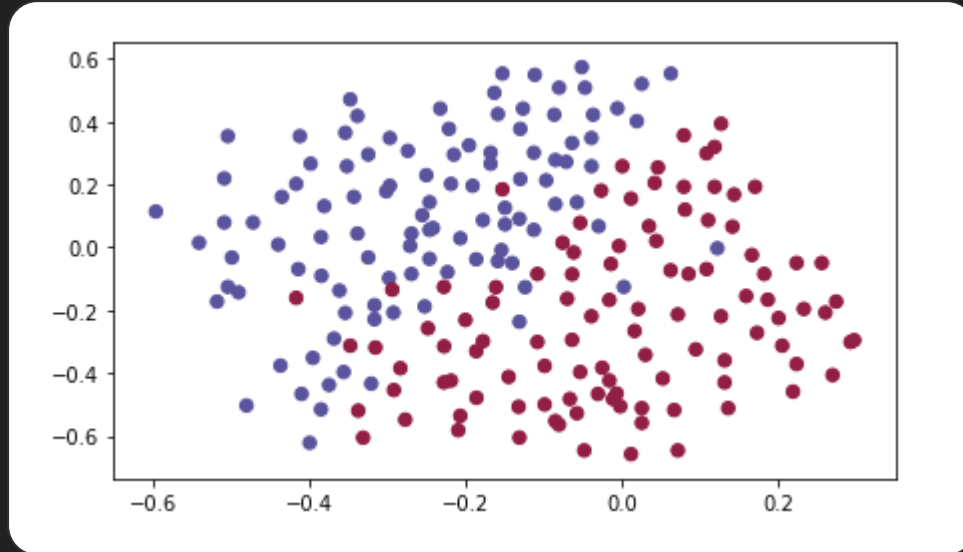
Demo: Football Manager

Problem: The manager needs to recommend positions where France's goalkeeper should kick the ball so that the French team's players can then hit it with their head.



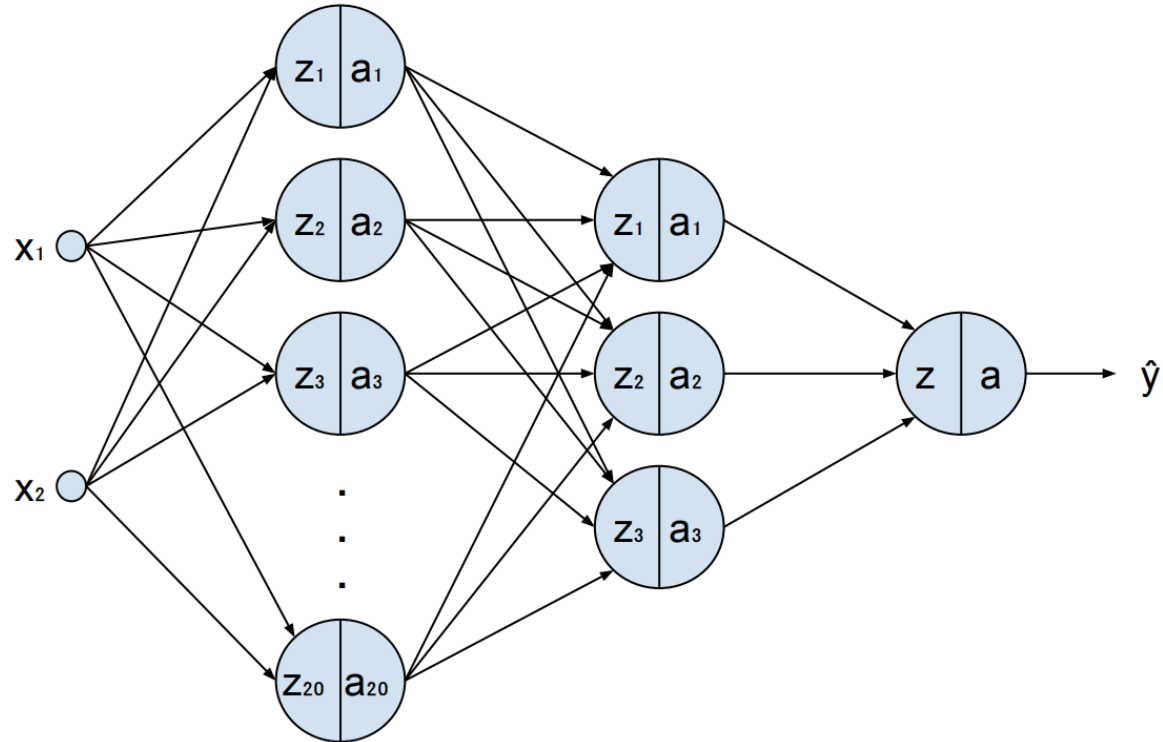
Demo: Football Manager

Dataset: We have the following 2D dataset from France's last 10 games.



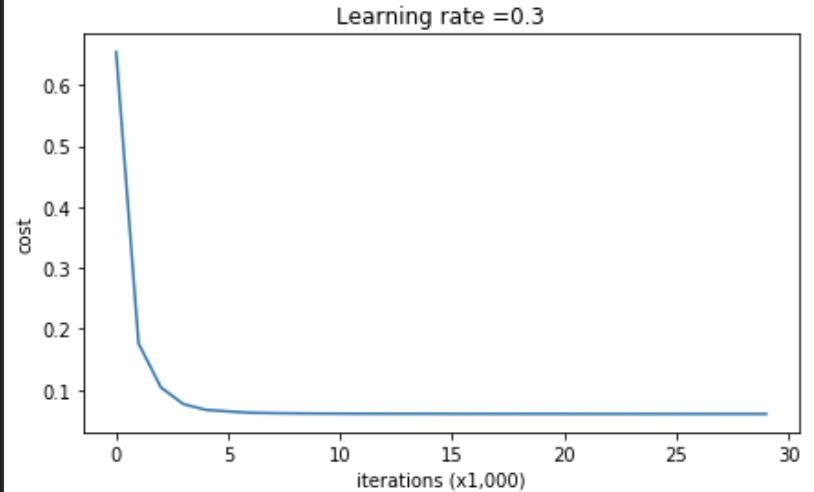
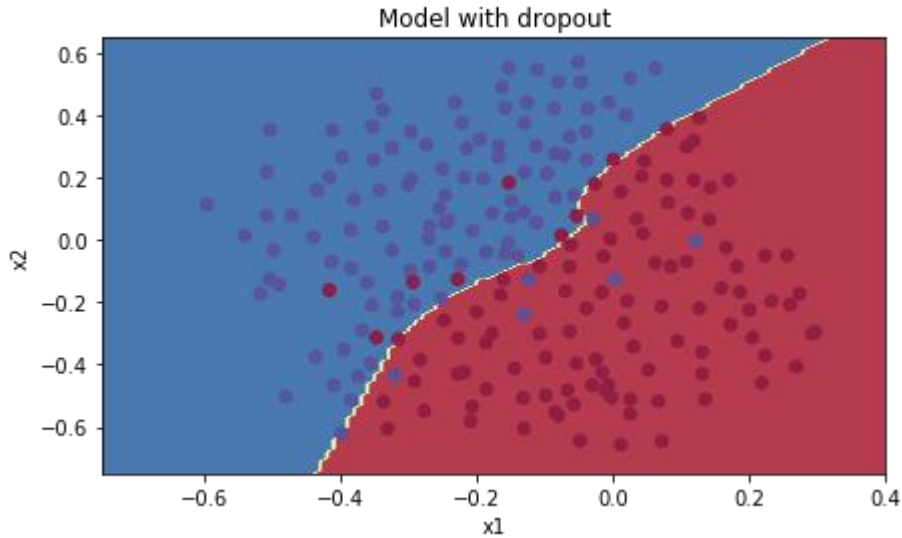
Description: If the dot is blue, it means the French player managed to hit the ball with his head. If the dot is red, it means the other team's player hit the ball with their head.

Neural Network Architecture



Demo: Football Manager

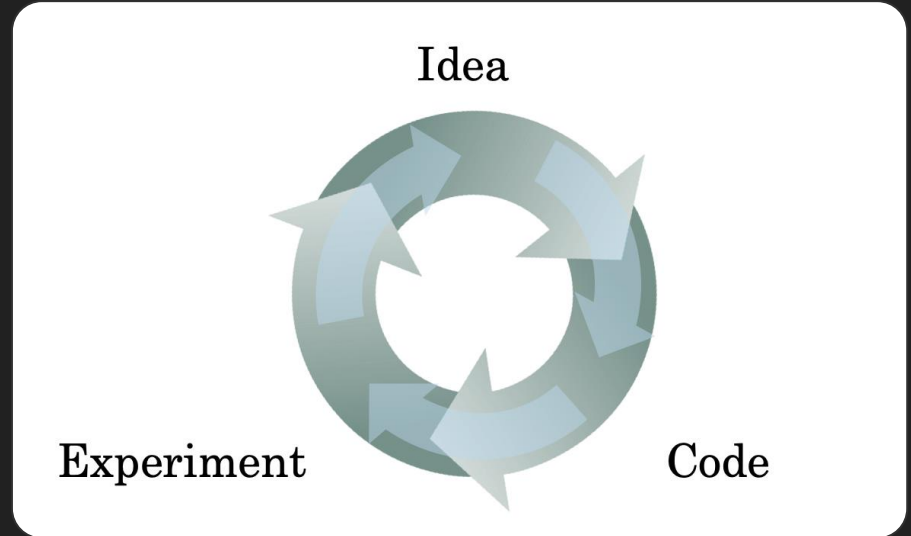
The train accuracy is **92.8%** while the test accuracy is **95%**. Our model is not overfitting the training set and does a great job on the test set.



Applied ML is a highly iterative process.

We need to change the following hyperparameters:

- # layers
- # hidden units
- learning rates
- activation functions
- ...



ML on Google Cloud Platform (GCP) or AWS

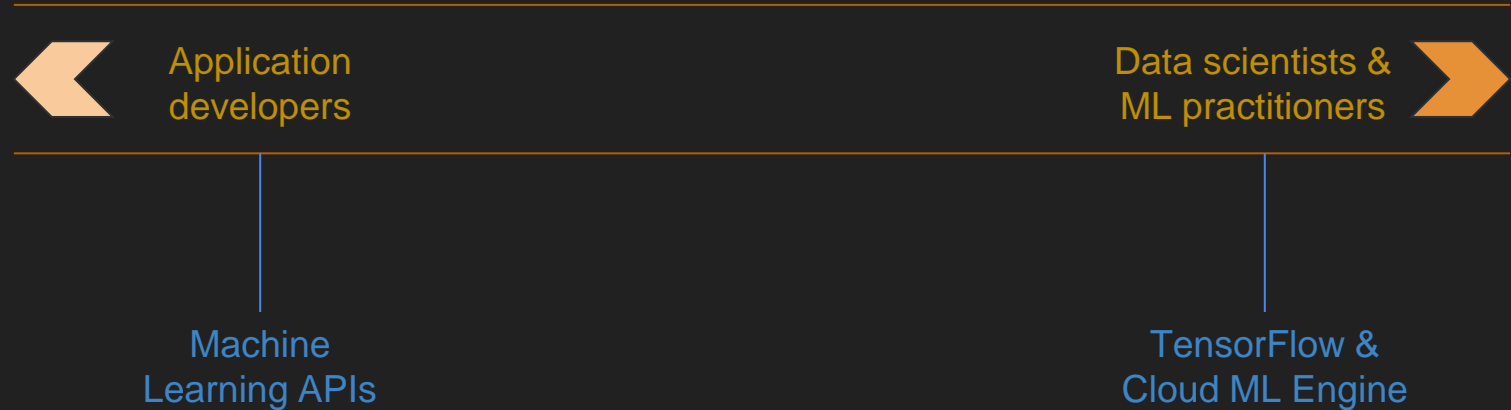


Application
developers

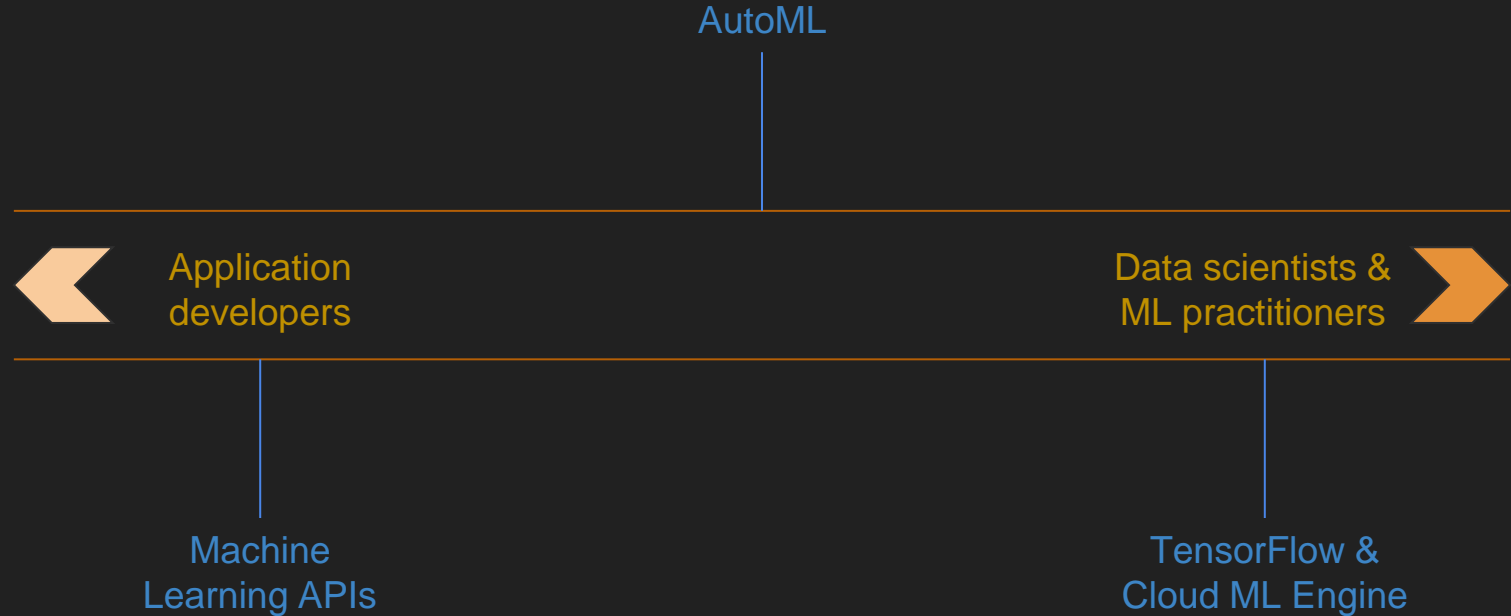
Data scientists &
ML practitioners



ML on Google Cloud Platform (GCP) or AWS



ML on Google Cloud Platform (GCP) or AWS



Machine Learning on AWS

Object and scene detection

Rekognition automatically labels objects, concepts and scenes in your images, and provides a confidence score.



Choose a sample image



Use your own image

Image must be .jpeg or .png format and no larger than 5MB. Your image isn't stored.

 Upload or drag and drop

Use image URL

Go

Done with the demo?

[Learn more](#)

▼ Results

Transportation	98.8 %
Car	98.8 %
Vehicle	98.8 %
Automobile	98.8 %
Human	98.3 %
Person	98.3 %
Pedestrian	97.1 %
Sports	94.3 %
Sport	94.3 %
Skateboard	94.3 %
Road	92.4 %

Machine Learning on AWS

```
In [1]: import boto3
import requests
from pprint import pprint
```

```
In [2]: def get_image_from_url(image_url):
response = requests.get(image_url)
image_bytes = response.content
return image_bytes
```

```
In [3]: client = boto3.client('rekognition')

image_url = "https://d1cbe14be5894c8dcc3d-8a742a0d46bf003746b2a98abb2fa3cf.ssl.cf2.rackcdn.com/wp-content/uploads/2013/05/012983091175556183.jpg"
image_bytes = get_image_from_url(image_url)
response = client.detect_labels(Image={'Bytes': image_bytes})

pprint(response)

{'LabelModelVersion': '2.0',
 'Labels': [{'Confidence': 99.55706787109375,
              'Instances': [],
              'Name': 'Human',
              'Parents': []},
            {'Confidence': 99.55706787109375,
              'Instances': [{'BoundingBox': {'Height': 0.9842696785926819,
                                             'Left': 0.2730826139450073,
                                             'Top': 0.012983091175556183,
                                             'Width': 0.4459109604358673},
                           'Confidence': 98.89303588867188}],
              'Name': 'Person',
              'Parents': []}]}
```

Machine Learning on AWS

Facial analysis

Get a complete analysis of facial attributes, including confidence scores.



Choose a sample image



Use your own image

Image must be .jpeg or .png format and no larger than 5MB. Your image isn't stored.

 **Upload** or drag and drop

Use image URL

Go

Done with the demo?

[Learn more](#)

▼ Results

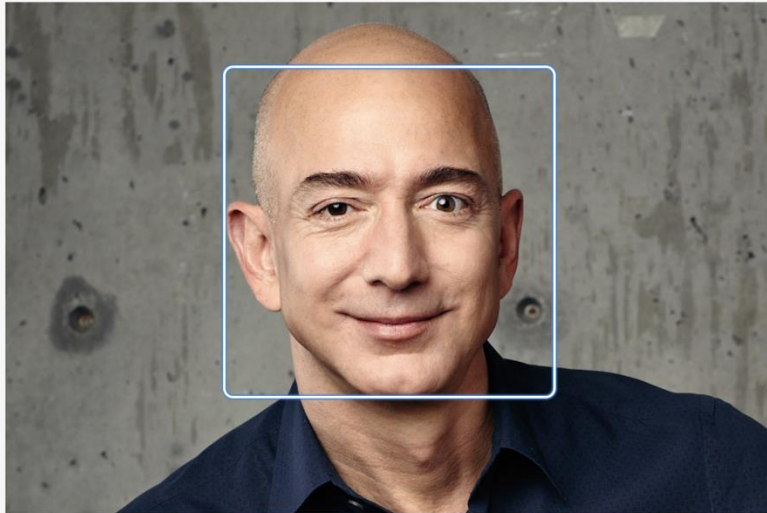


looks like a face	99.9 %
appears to be female	99.9 %
age range	17 - 29 years old
smiling	91.7 %
appears to be happy	99.5 %
wearing glasses	99.8 %
wearing sunglasses	92.2 %
eyes are open	99.9 %

Machine Learning on AWS

Celebrity recognition

Rekognition automatically recognizes celebrities in images and provides confidence scores.



Choose a sample image



Use your own image

Image must be .jpeg or .png format and no larger than 5MB. Your image isn't stored.



or drag and drop

Use image URL

Go

Done with the demo?

[Learn more](#)

▼ Results



Jeff Bezos

[Learn More](#)

Match confidence

100 %

▶ Request


▶ Response

Machine Learning on AWS


Face comparison

Compare faces to see how closely they match based on a similarity percentage.

Reference face









Comparison faces





Done with the demo?
[Learn more](#)



▼ Results

	=	
Similarity		99.9 %
<hr/>		
	≠	
<hr/>		
	≠	

Choose a sample image



Choose a sample image



Machine Learning on AWS

Text in image

Rekognition automatically detects and extracts text in your images. [Learn More](#)



Choose a sample image



Use your own image

Image must be .jpeg or .png format and no larger than 5MB. Your image isn't stored.

 Upload

or drag and drop

Use image URL

Go

Done with the demo?

[Learn more](#)

Results

US English only

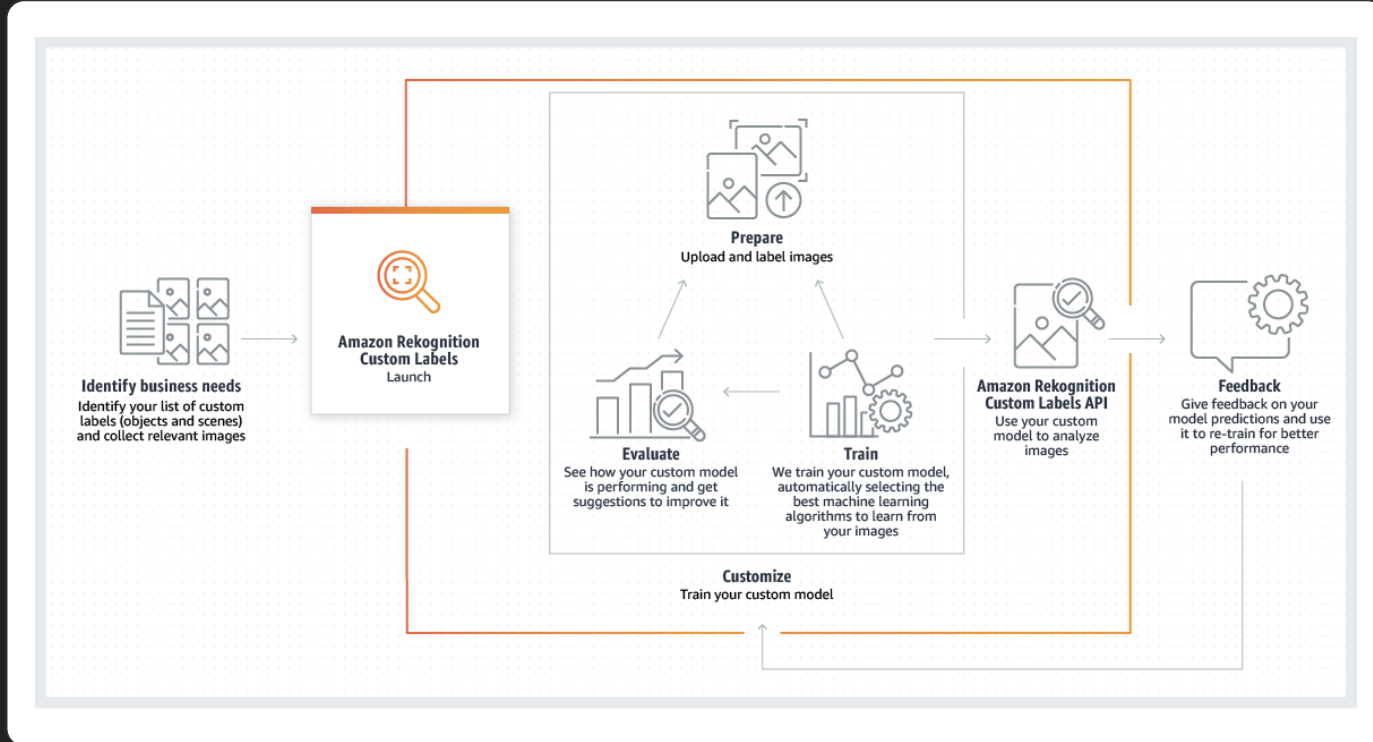
| IT'S |
| MONDAY |
| but | keep |
| Smiling |

Request

Response

```
{
  "TextDetections": [
    {
      "DetectedText": "IT'S",
      "Type": "LINE",
      "Id": 0,
      "Confidence": 99.91668701171875,
      "Geometry": {
        "BoundingBox": {
          "Width": 0.14000000059604645,
          "Height": 0.10000000149011612,
          "Left": 0.6700000166893005,
          "Top": 0.18000000715255737
        }
      }
    },
    ...
  ]
}
```

Machine Learning on AWS



Machine Learning on GCP

Objects

Labels

Logos

Web

Text

Properties

Safe Search



2018-AUDI-A4.jpg

Wheel 94%

Wheel 94%

Tire 94%

Car 93%

Tire 69%

License plate 61%

Machine Learning on GCP

Objects

Labels

Logos

Web

Text

Properties

Safe Search



2018-AUDI-A4.jpg


Audi

91%



Machine Learning on GCP

Objects Labels Logos Web **Text** Properties Safe Search



2018-AUDI-A4.jpg

+Page 1

+Block 1

AVT 849

The image shows a user interface for a machine learning application. At the top, there are navigation tabs: 'Objects', 'Labels', 'Logos', 'Web', 'Text' (which is selected and highlighted with a blue underline), 'Properties', and 'Safe Search'. Below the tabs, on the left, is a photograph of a black Audi A4 sedan. The car is parked on a paved surface in front of a building with large glass windows. The license plate of the car is 'AVT 849'. Below the image is the caption '2018-AUDI-A4.jpg'. On the right side of the interface, there is a panel showing the results of a text search. It displays a red button '+Page 1', a blue button '+Block 1', and a green box containing the text 'AVT 849' which is underlined, indicating a match with the license plate in the image.

Thank you for attention!