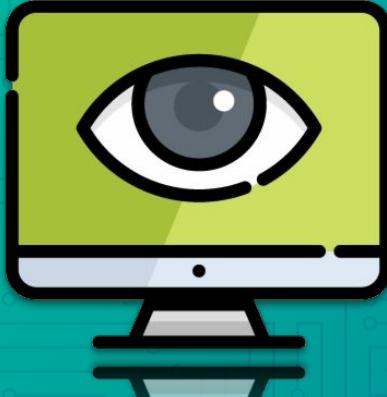


Introduction to Computer Vision



1

Introduction

Presentation of myself, Outline and Subject



Welcome!

I am Tom Genlis

EPITA (2024) ING2

SCIA Major - CV Speciality

tom.genlis@gmail.com



Presentation Outline

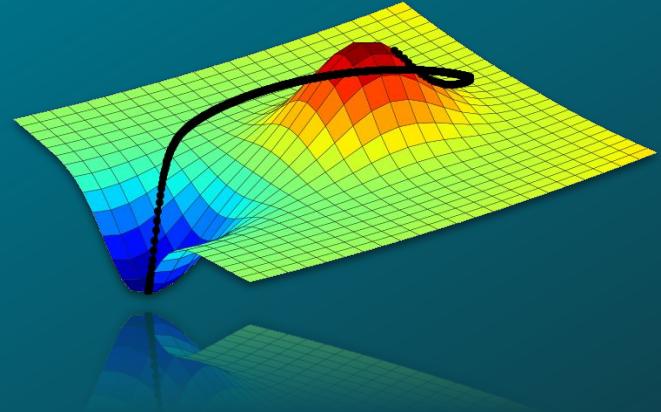
- Quick Intro to Machine Learning & ML Concepts
- General Conference over Computer Vision
- Presentation of the available workshop (TensorFlow)
- Kaggle Contest

Feel free to **ask any questions** regarding this presentation !

2

Quick Intro to Machine Learning

Definitions

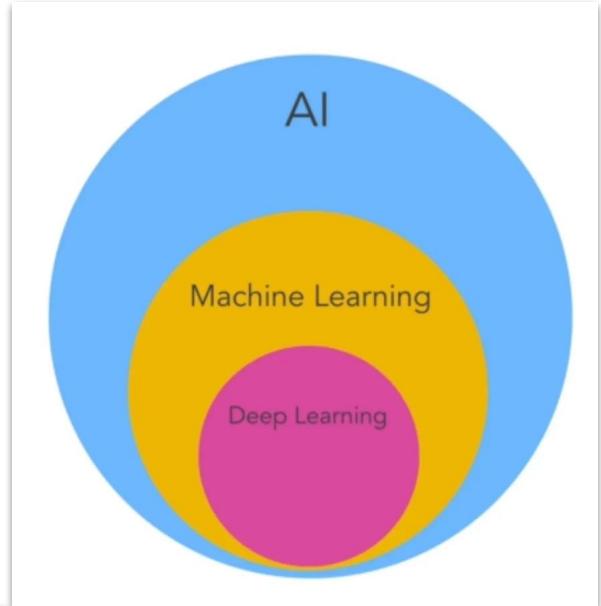


Introduction Outline

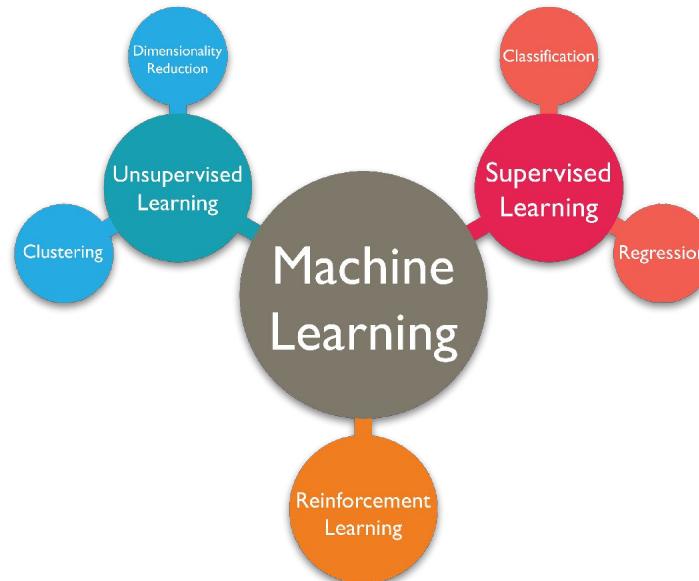
- What is AI ?
- What is Machine Learning ?
- Supervised Learning
- Unsupervised Learning
- Reinforcement Learning
- Deep Learning
- 8 Core ML Concepts

What is AI ?

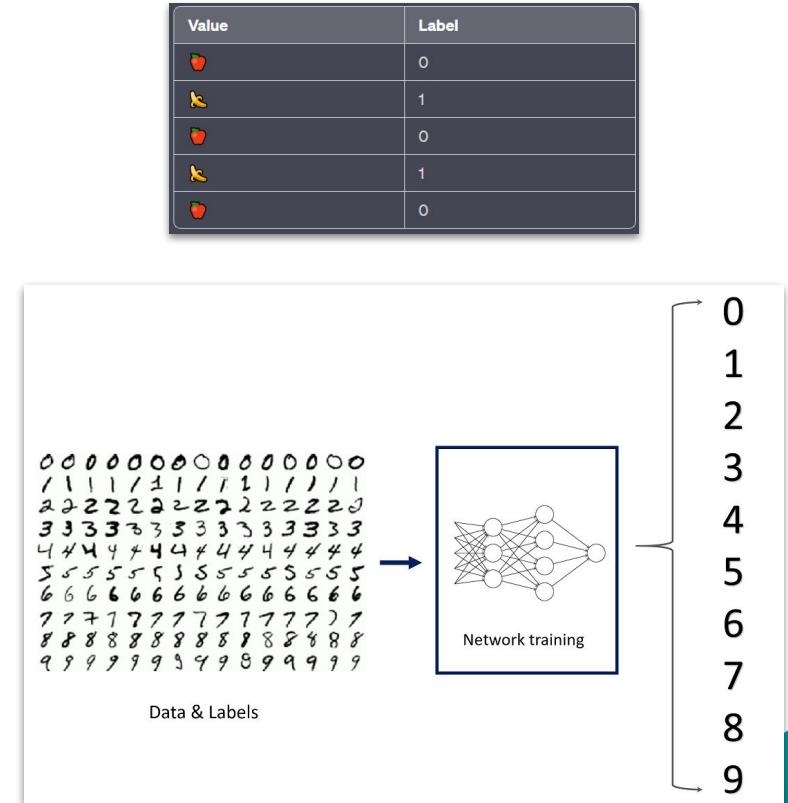
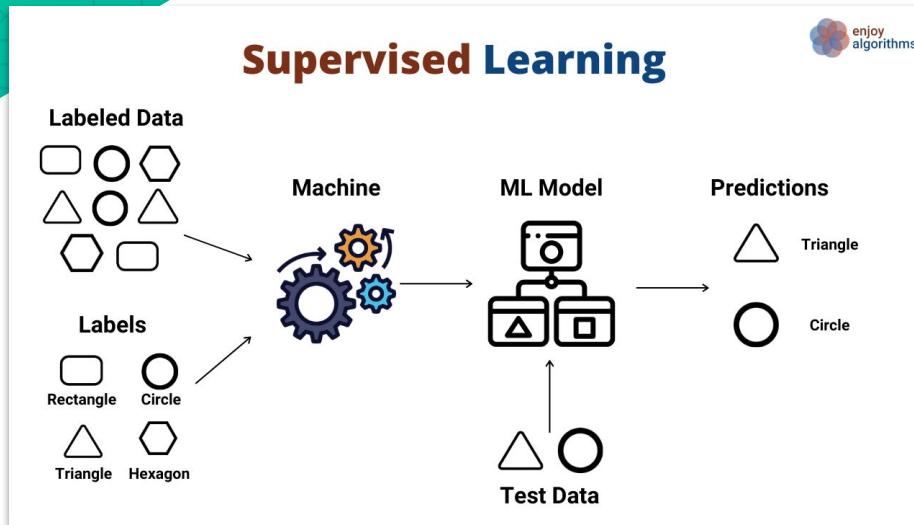
- Mimic Human Behavior



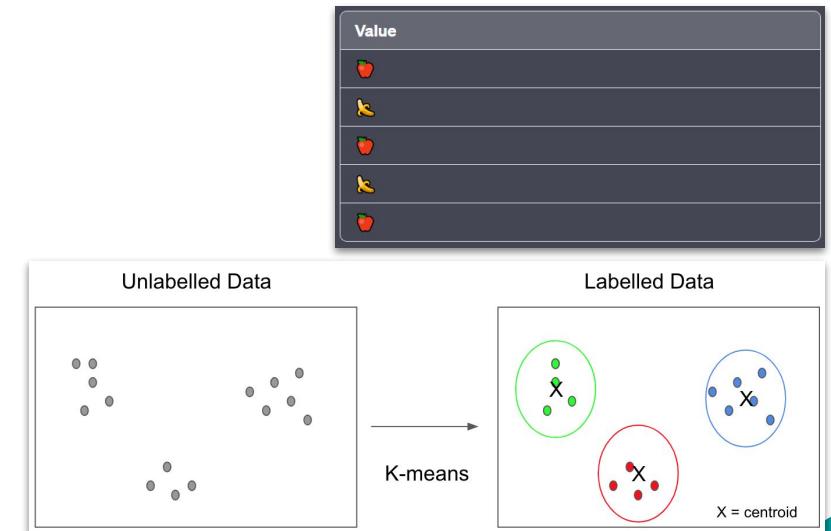
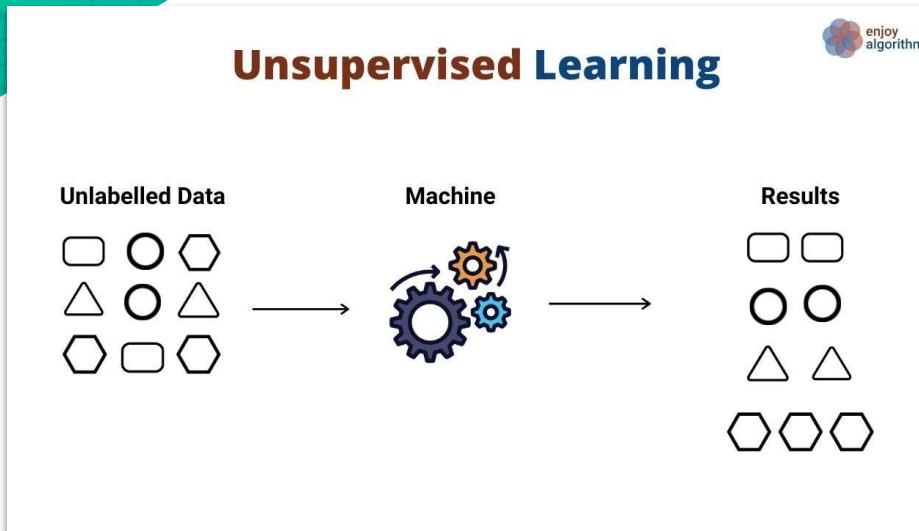
What is Machine Learning ?



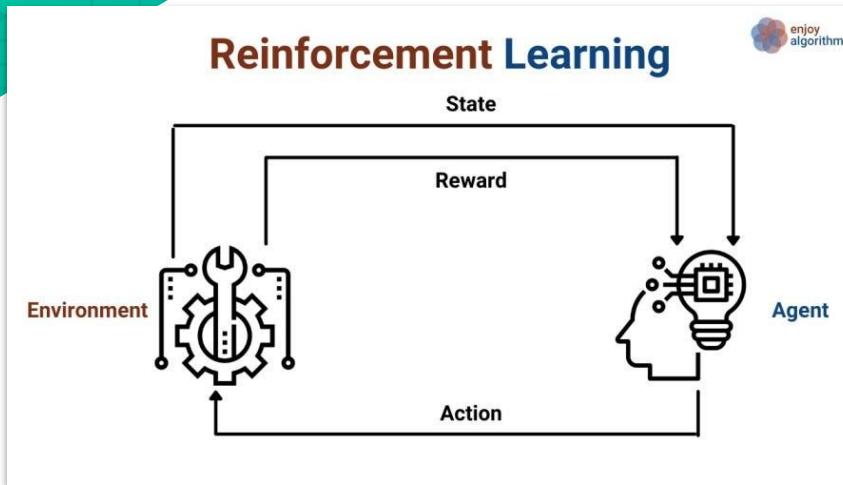
Supervised Learning



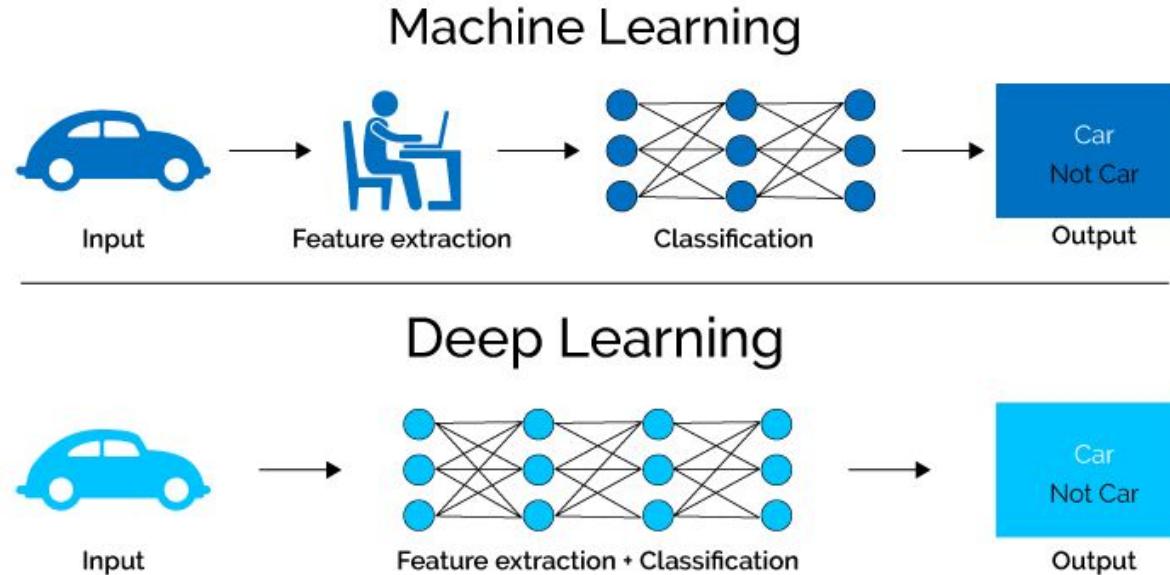
Unsupervised Learning



Reinforcement Learning



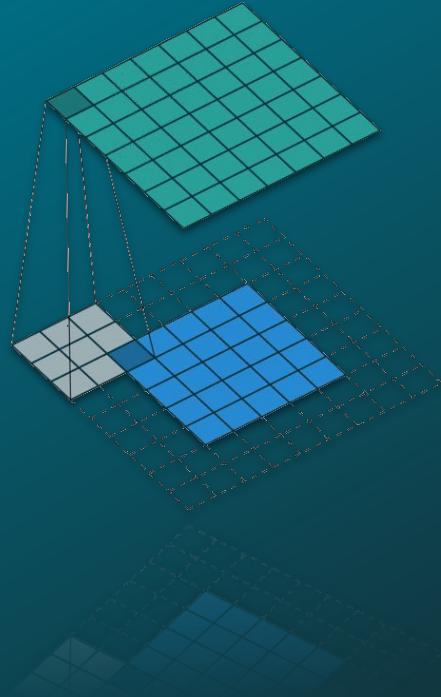
Deep Learning



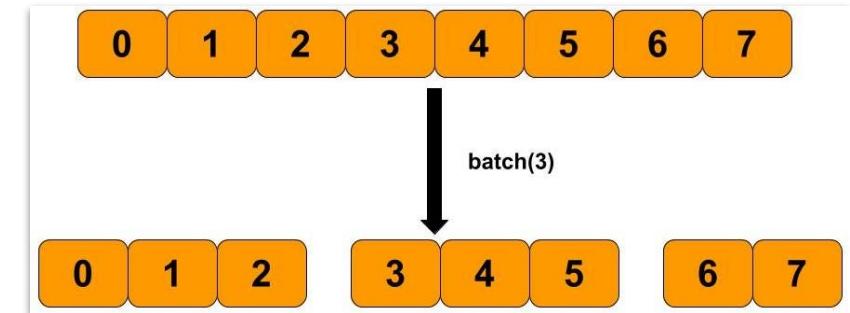
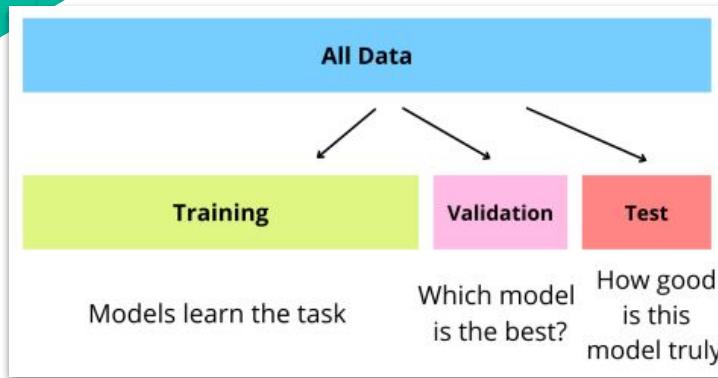
3

Core ML Concepts

Definitions, Examples



ML Concepts : Datasets & Batching



ML Concepts : Convolutions

Convolution

1x1	1x0	1x1	0	0
0x0	1x1	1x0	1	0
0x1	0x0	1x1	1	1
0	0	1	1	0
0	1	1	0	0

Result

4		

Kernels

Identity

$$\begin{bmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$



Sharpen

$$\begin{bmatrix} 0 & -1 & 0 \\ -1 & 5 & -1 \\ 0 & -1 & 0 \end{bmatrix}$$



Average
Blur

$$\frac{1}{9} \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$$



Edge
Detection

$$\begin{bmatrix} 0 & 1 & 0 \\ 1 & -4 & 1 \\ 0 & 1 & 0 \end{bmatrix}$$



Gaussian
Blur

$$\frac{1}{16} \begin{bmatrix} 1 & 2 & 1 \\ 2 & 4 & 2 \\ 1 & 2 & 1 \end{bmatrix}$$



0 ₂	0 ₀	0 ₁	0	0	0	0	0
0 ₁	2 ₀	2 ₀	3	3	3	3	0
0 ₀	0 ₁	1 ₁	3	0	3	0	0
0	2	3	0	1	3	0	0
0	3	3	2	1	2	0	0
0	3	3	0	2	3	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0

1	6	5
7	10	9
7	10	8

- Kernel size (in ex :(3, 3))
- Strides (in ex : (1, 1))
- Padding (in ex : none)
- Spatial Context

ML Concepts : Pooling

Max Pooling

29	15	28	184
0	100	70	38
12	12	7	2
12	12	45	6

Average Pooling

31	15	28	184
0	100	70	38
12	12	7	2
12	12	45	6

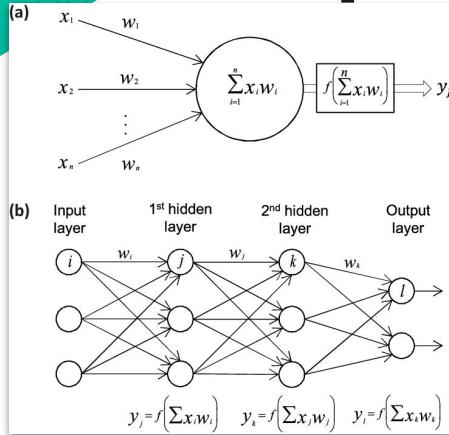
2 x 2
pool size

100	184
12	45

2 x 2
pool size

36	80
12	15

ML Concepts : Neural Networks



Activation Functions

Sigmoid

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



Leaky ReLU

$$\max(0.1x, x)$$



tanh

$$\tanh(x)$$

Maxout

$$\max(w_1^T x + b_1, w_2^T x + b_2)$$

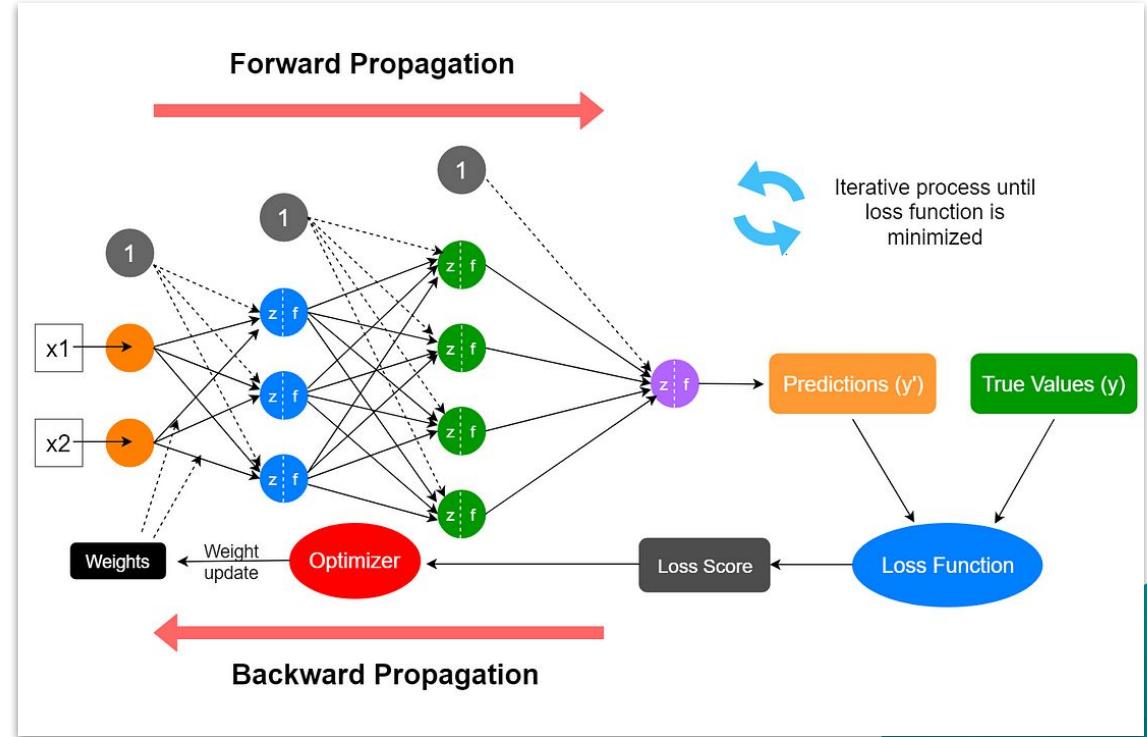


ReLU

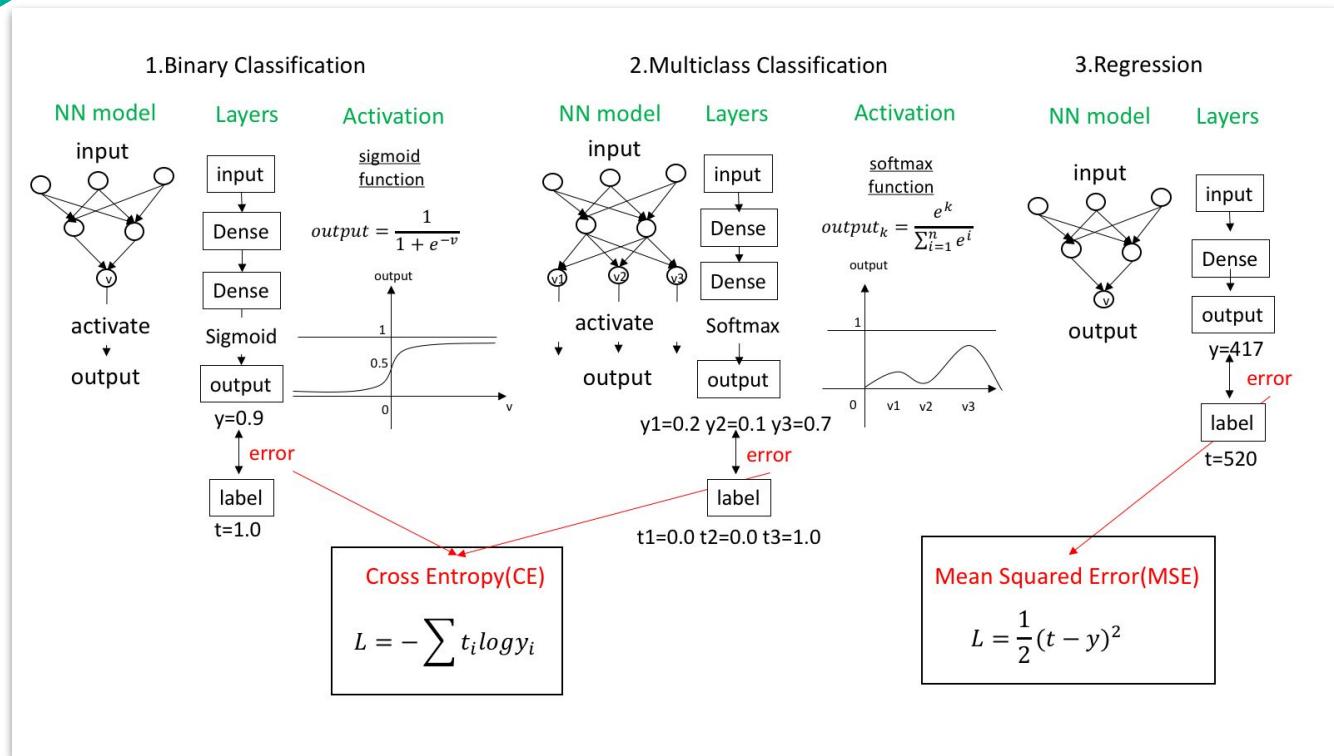
$$\max(0, x)$$

ELU

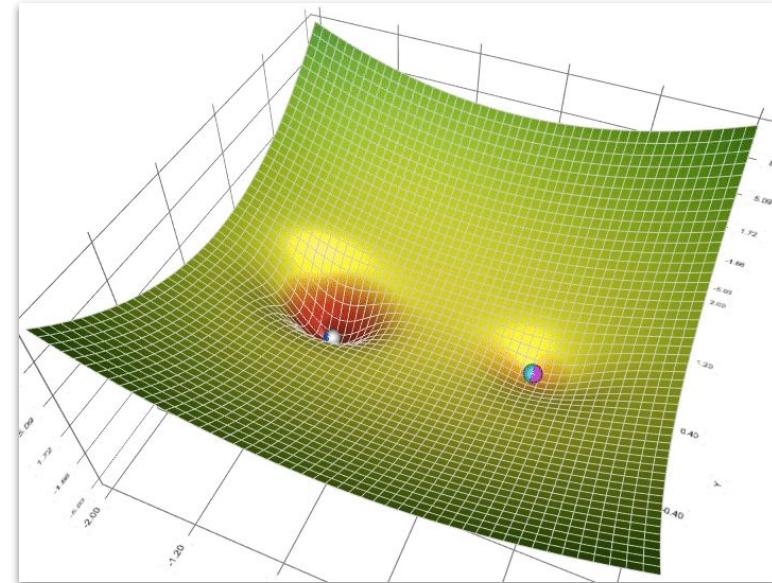
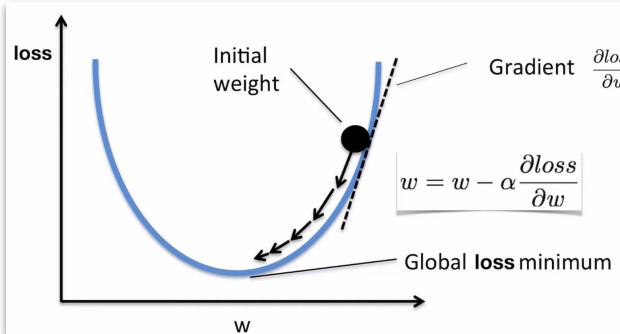
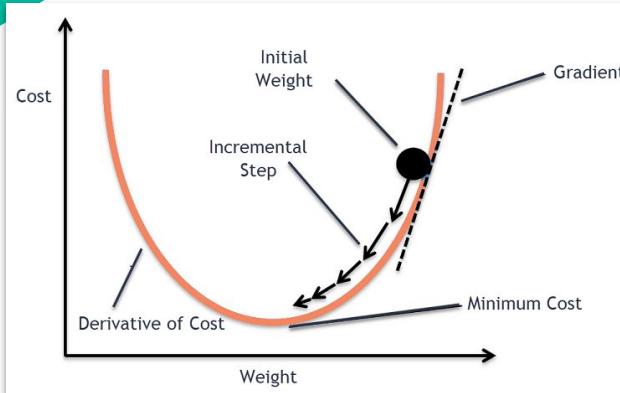
$$\begin{cases} x & x \geq 0 \\ \alpha(e^x - 1) & x < 0 \end{cases}$$



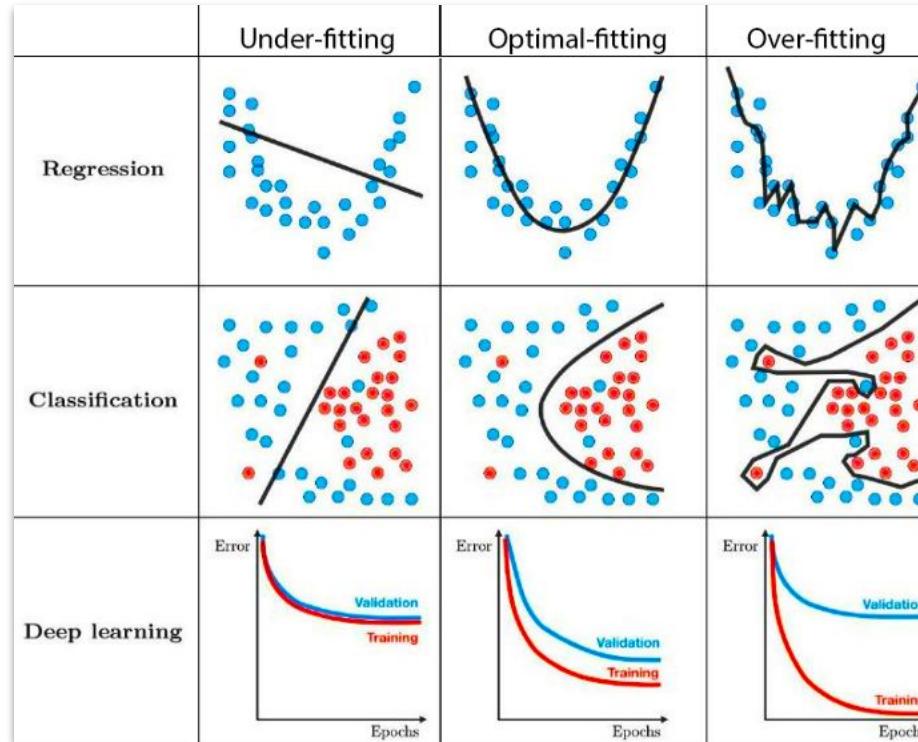
ML Concepts : Loss Function



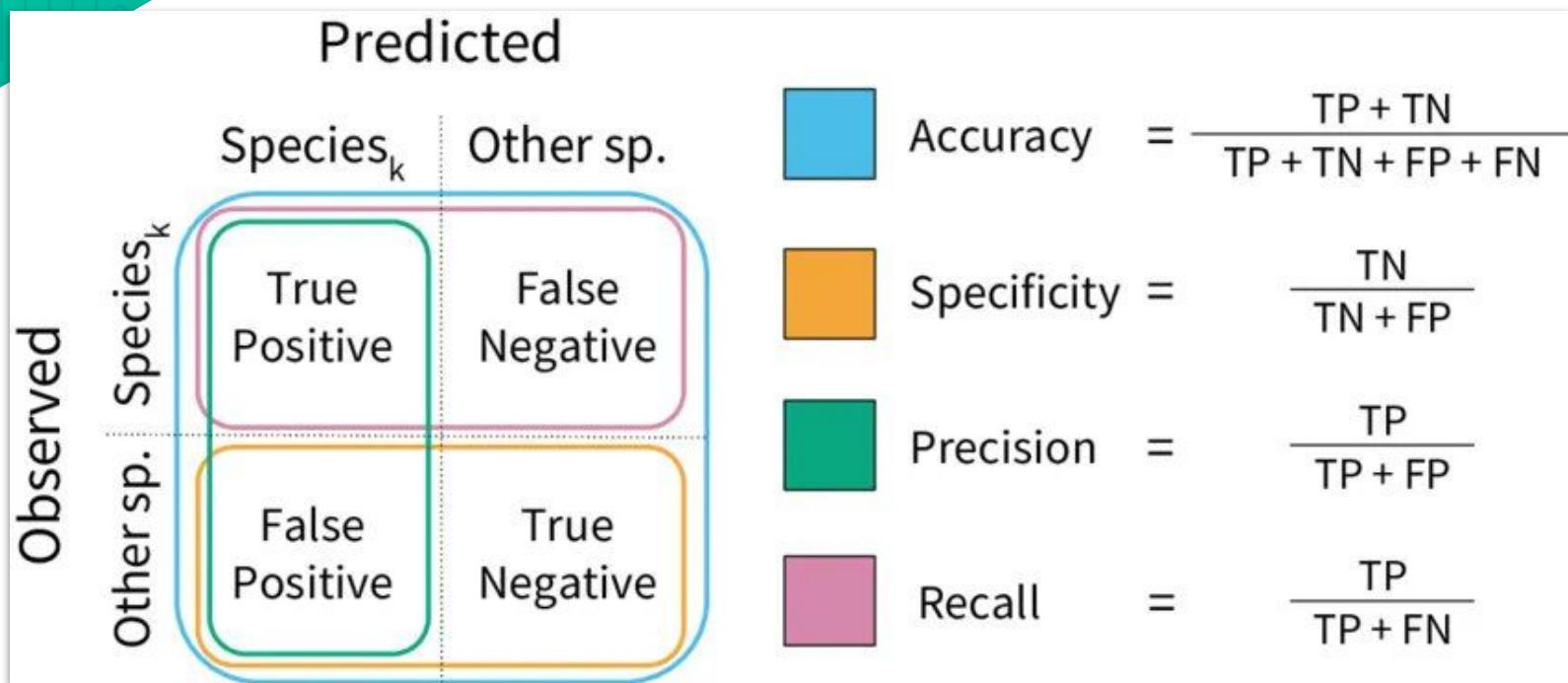
ML Concepts : Gradient Descent



ML Concepts : Overfitting & Underfitting

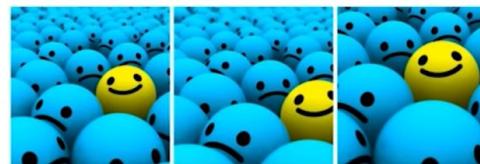


ML Concepts : Metrics

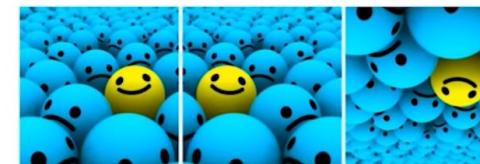


ML Concepts : Data Augmentation

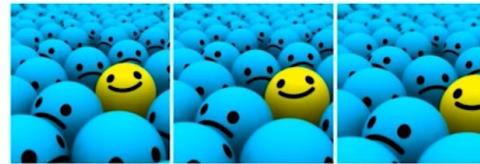
Crop:



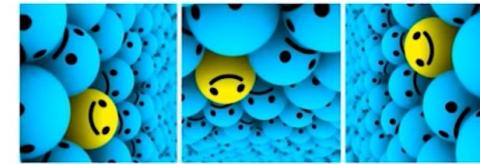
Flip:



Scale:



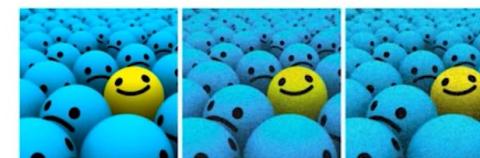
Rotate:



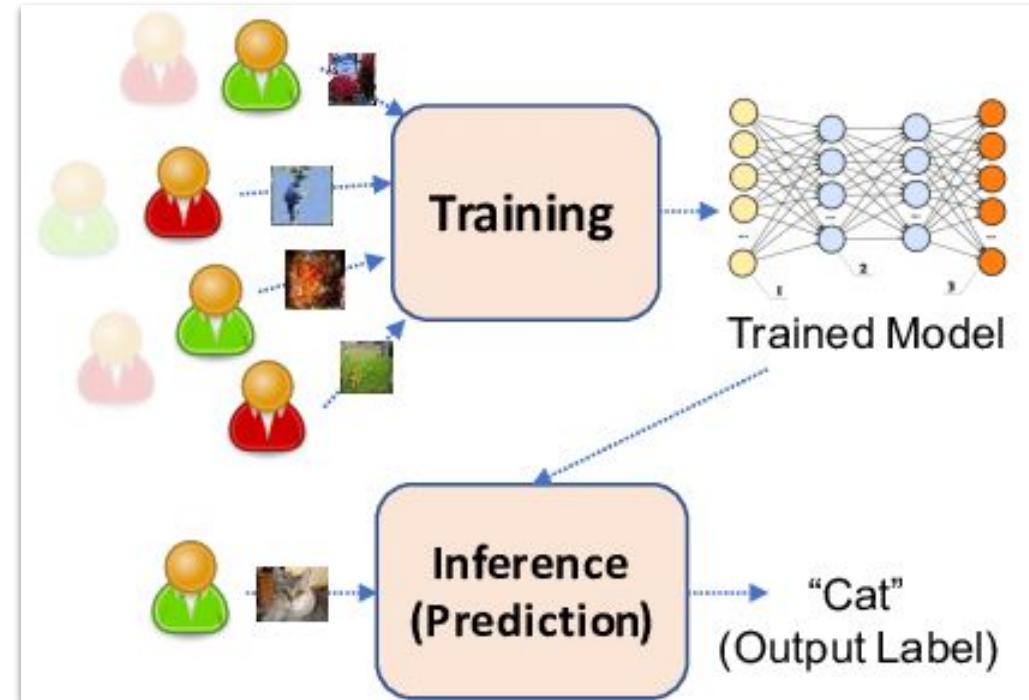
Translation:



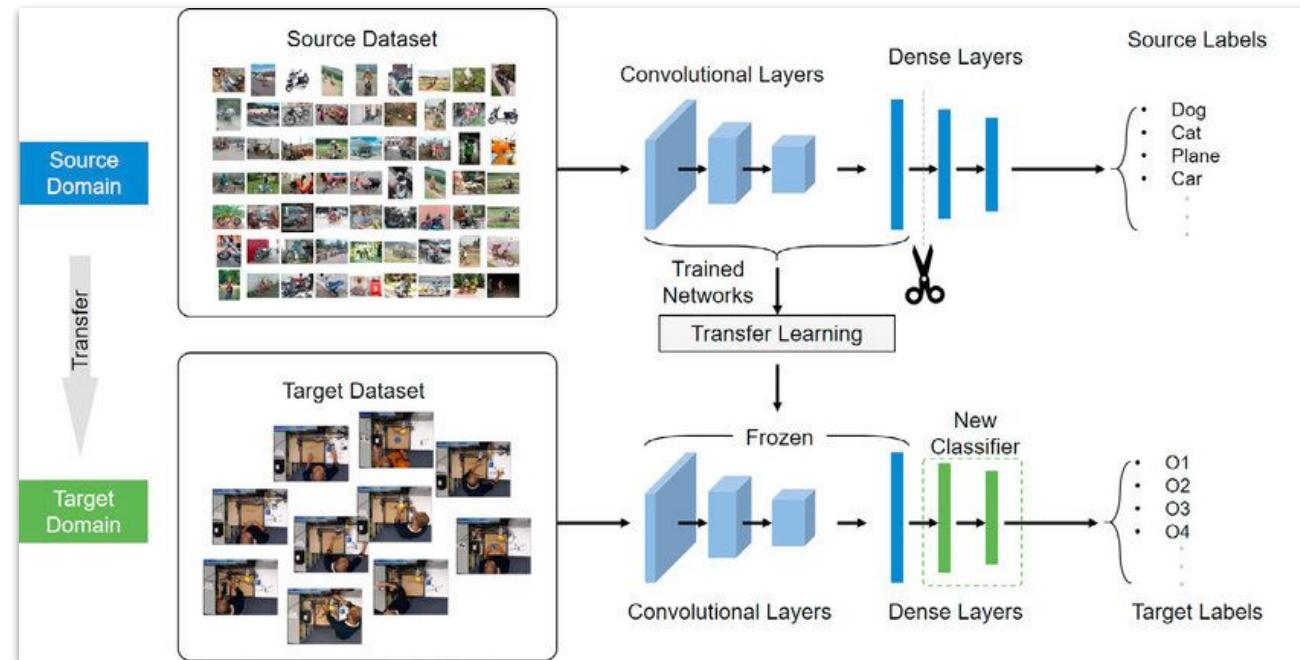
Noise:



ML Concepts : Post Training Usage

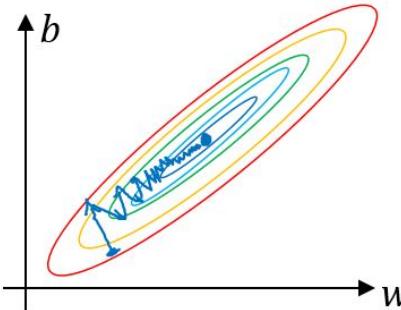
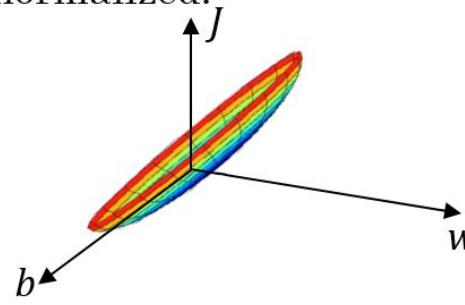


ML Concepts : Transfer Learning

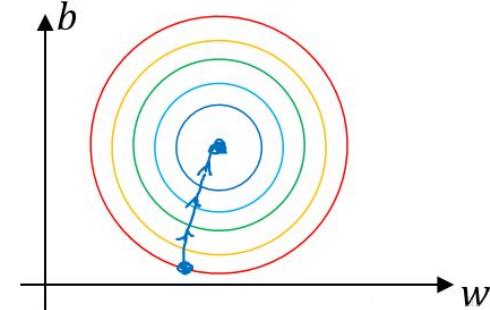
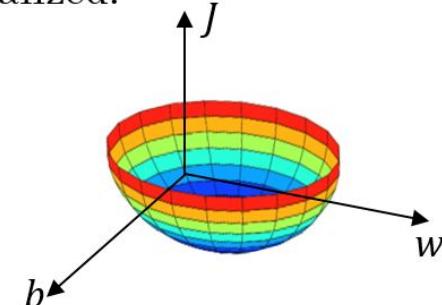


ML Concepts : Normalization

Unnormalized:



Normalized:



4

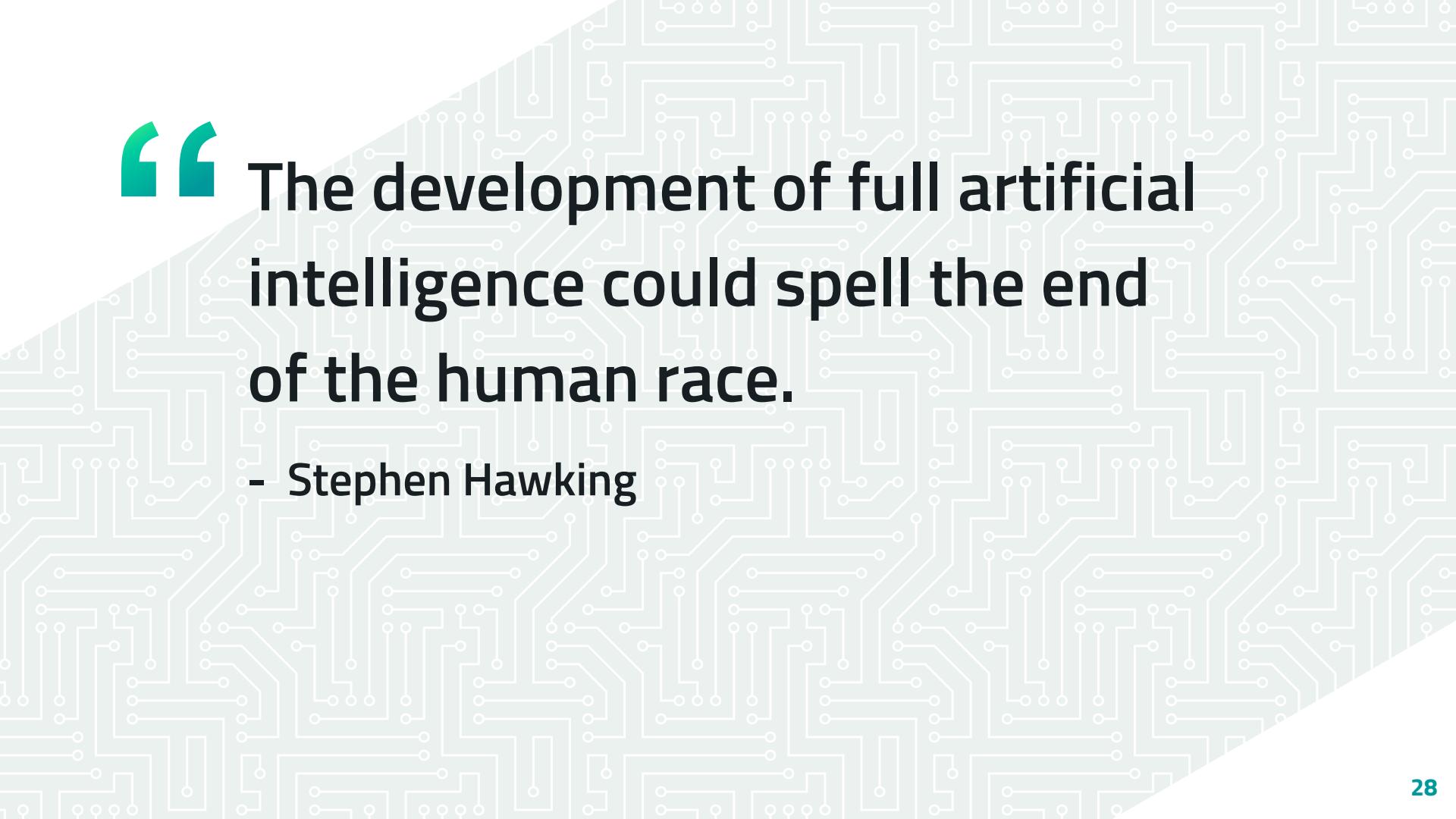
What is Computer Vision ?

Definition, Applications and Progress



Exploration Outline

- History Of Computer Vision
- Computer Vision Subfields
- Classification
- Localization
- Object Detection
- Segmentation



“ The development of full artificial intelligence could spell the end of the human race.

- Stephen Hawking

Computer Vision

Subfield of AI



History of Computer Vision

1963 – Larry Roberts, the father of CV, described the process of deriving 3D info about solid objects from 2D photographs.

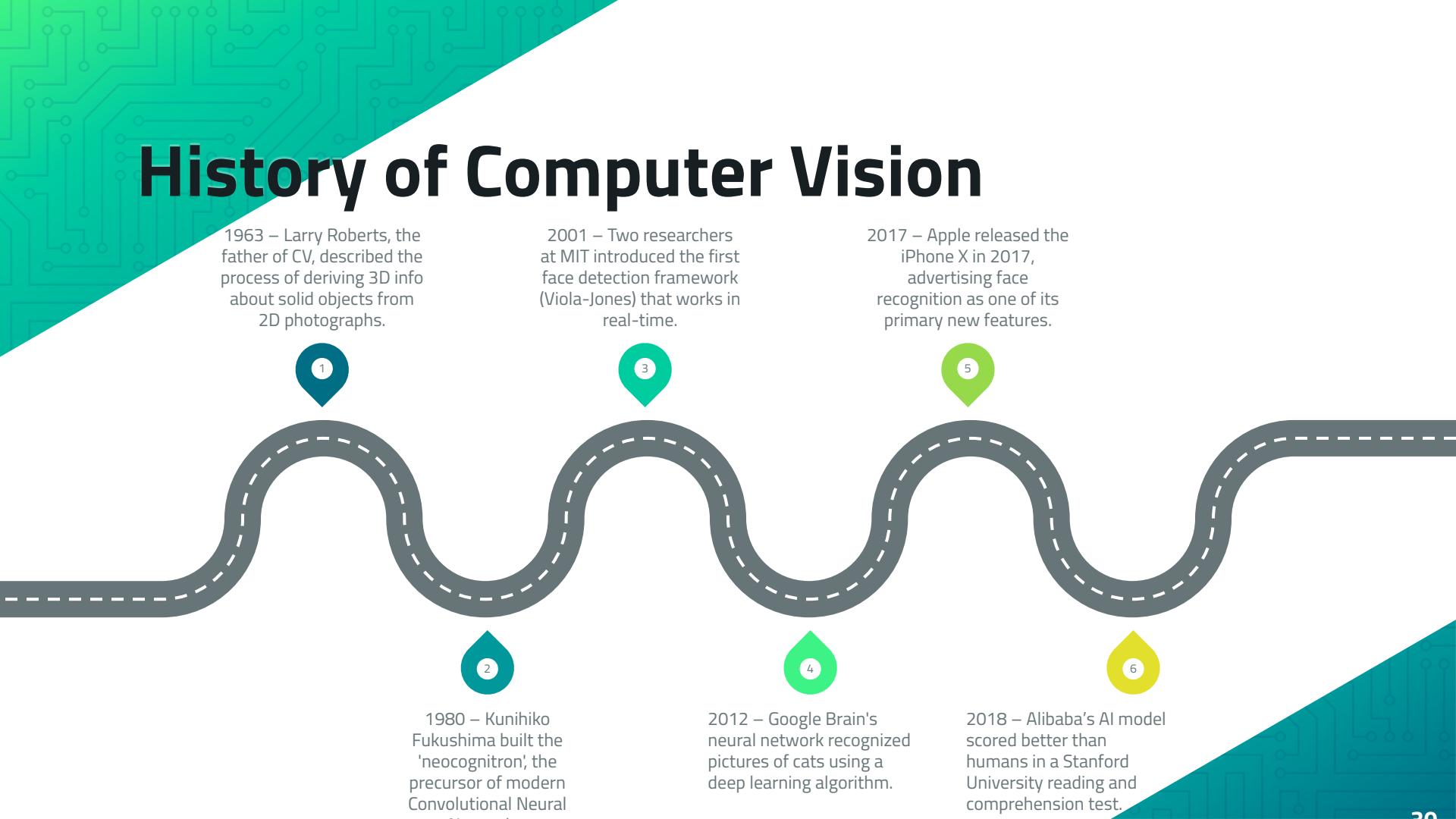
2001 – Two researchers at MIT introduced the first face detection framework (Viola-Jones) that works in real-time.

2017 – Apple released the iPhone X in 2017, advertising face recognition as one of its primary new features.

1980 – Kunihiko Fukushima built the 'neocognitron', the precursor of modern Convolutional Neural Networks.

2012 – Google Brain's neural network recognized pictures of cats using a deep learning algorithm.

2018 – Alibaba's AI model scored better than humans in a Stanford University reading and comprehension test.



Computer Vision Subfields

Semantic
Segmentation



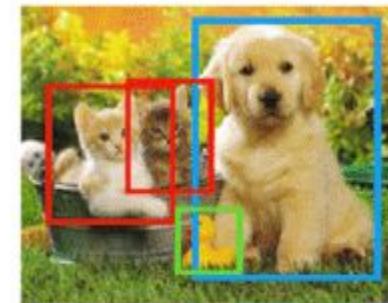
Classification



Classification
+ localization



Object detection



Instance
segmentation



CAT GRASS
TREE

CAT

CAT

CAT DOG DUCK

CAT CAT DOG DUCK

No object
Just pixels

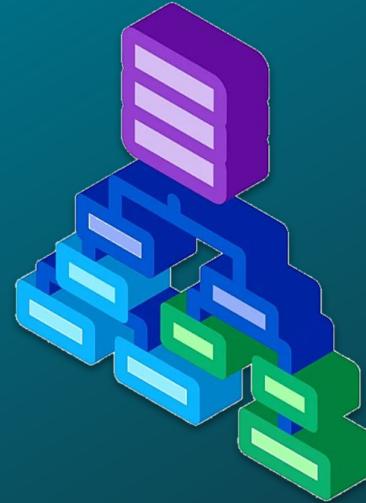
Single object

Multiple objects

5

Computer Vision : Classification

Definition, Applications and Examples



Classification Types

Binary Classification



Dog
0.9

Not Dog
0.1

Multiclass Classification



Dog
0.5

Cat
0.09

Bus
0.01

Plant
0.4

Multilabel Classification



Dog
0.8

Cat
0.2

Bus
0.04

Plant
0.7

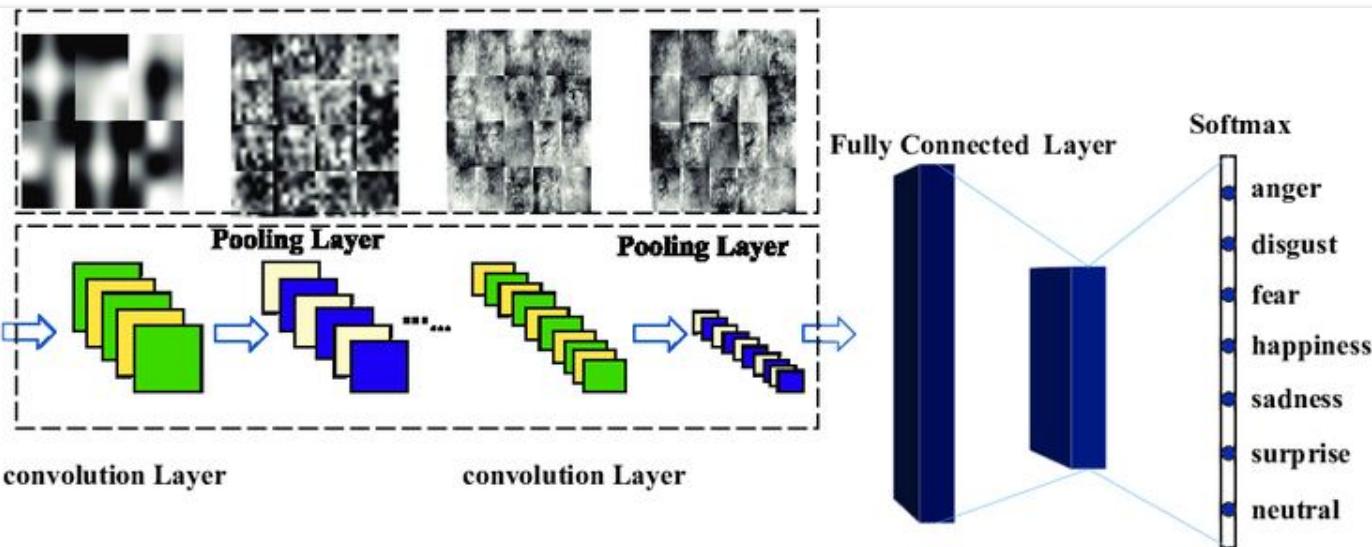
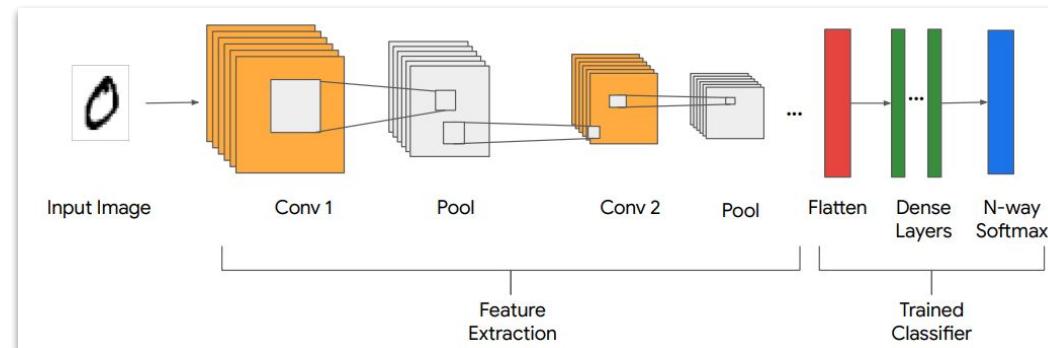
Single Object

Multiple Objects

Classification Example

3	4	2	1	9	5	6	2	1	8
8	9	1	2	5	0	0	6	6	4
6	7	0	1	6	3	6	3	7	0
3	7	7	9	4	6	6	1	8	2
2	9	3	4	3	9	8	7	2	5
1	5	9	8	3	6	5	7	2	3
9	3	1	9	1	5	8	0	8	4
5	6	2	6	8	5	8	8	9	9
3	7	7	0	9	4	8	5	4	3
7	9	6	4	7	0	6	9	2	3

Classification Model Example



Classification Example Loss

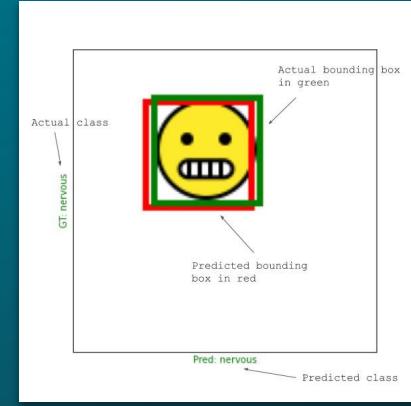
$$L_{\text{CE}} = - \sum_{i=1}^n t_i \log(p_i), \text{ for } n \text{ classes,}$$

where t_i is the truth label and p_i is the Softmax probability for the i^{th} class.

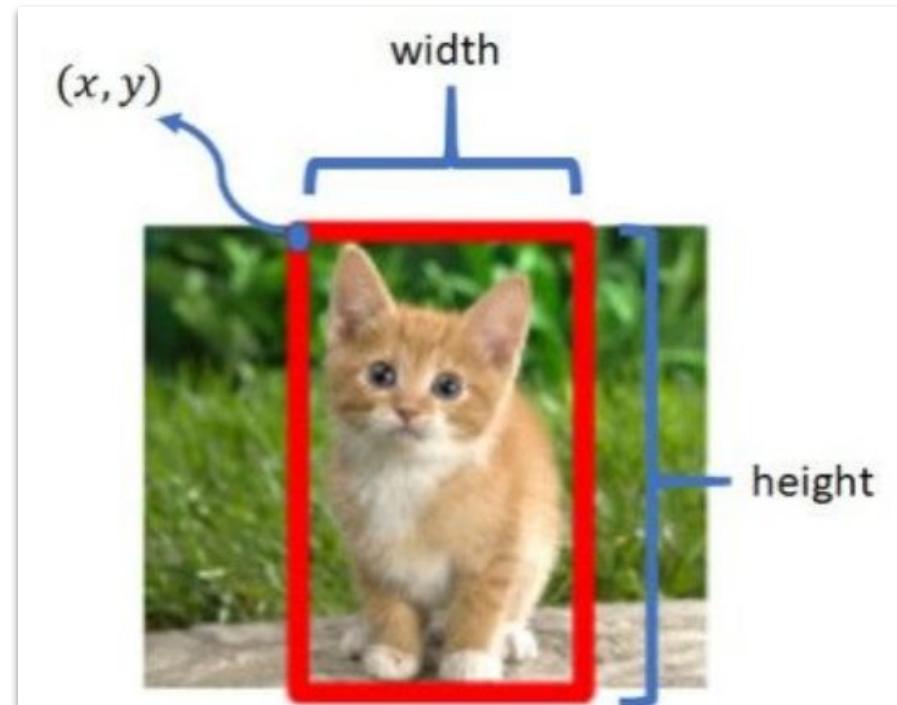
6

Computer Vision : Localization

Definition, Applications and Examples



Localization



Localization Example

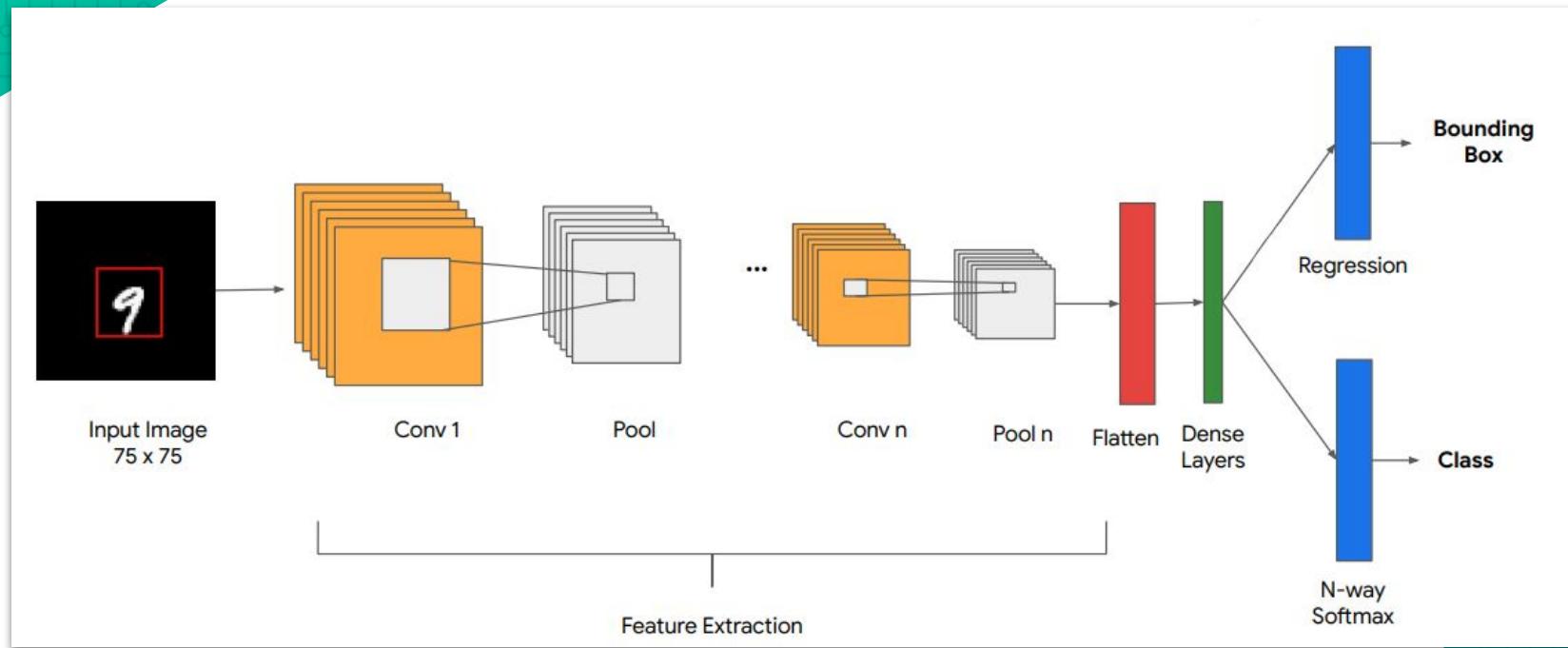


A sample from MNIST

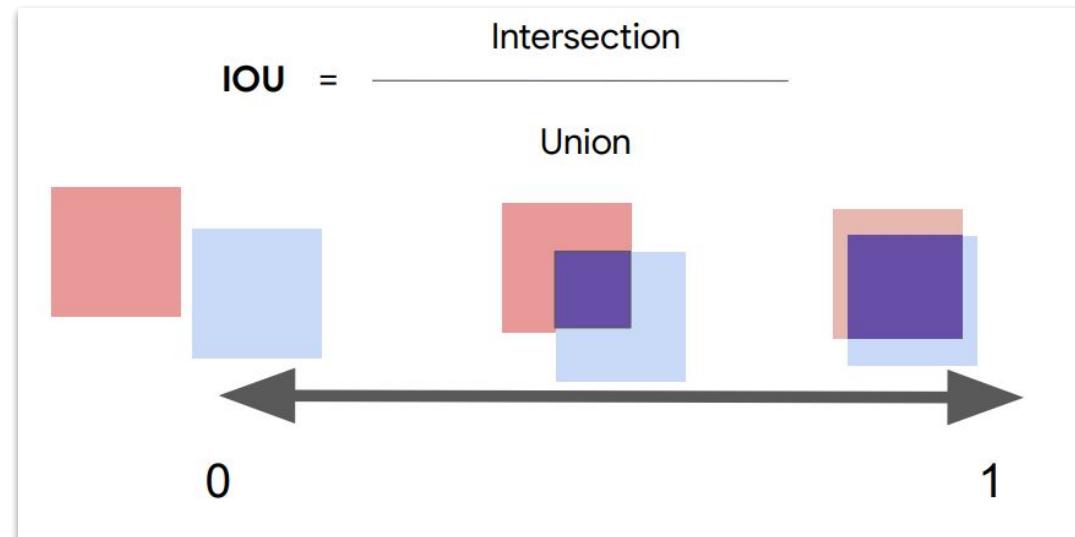


Sample pasted on a 75 x 75
black canvas

Localization Model Example



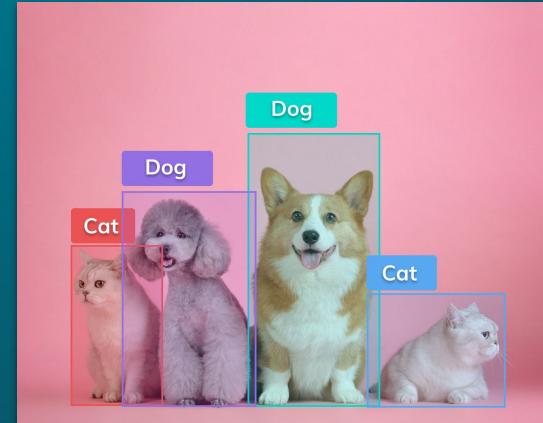
Localization Example Loss



7

Computer Vision : Object Detection

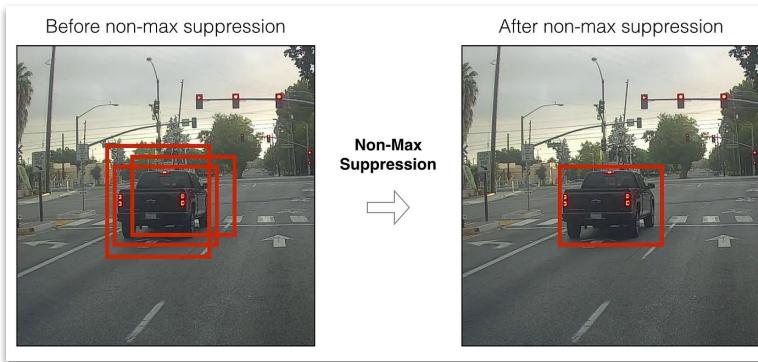
Definition, Applications and Examples



Object Detection



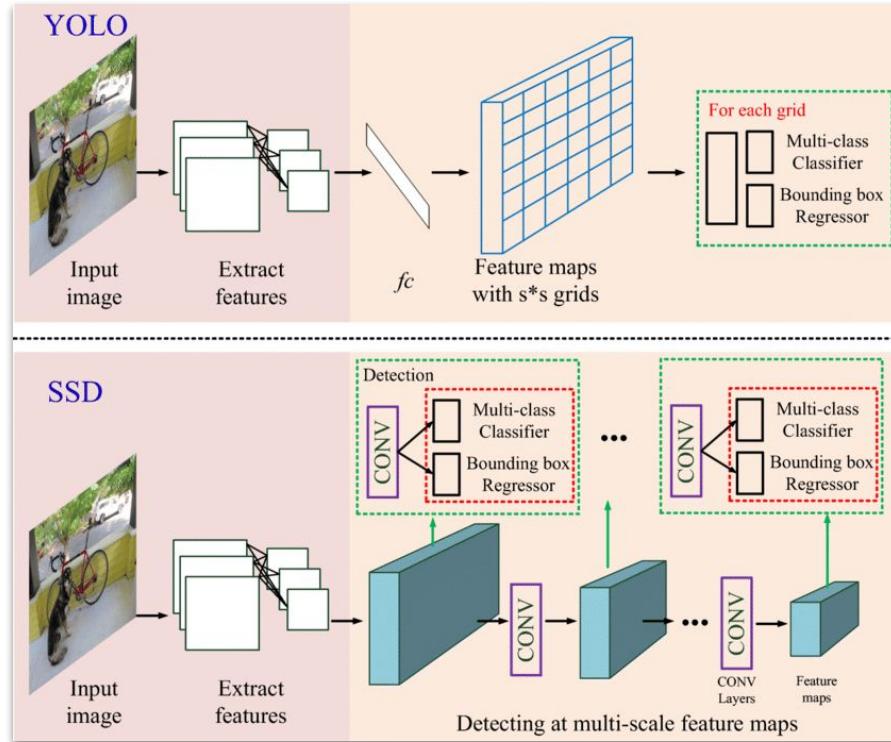
Object Detection Steps



Two phases :

- Sliding Window & Non-Maximum Suppression
- Object Detection & Classification

Object Detection Model Examples

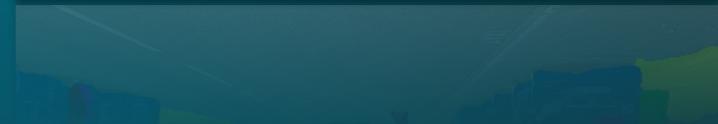
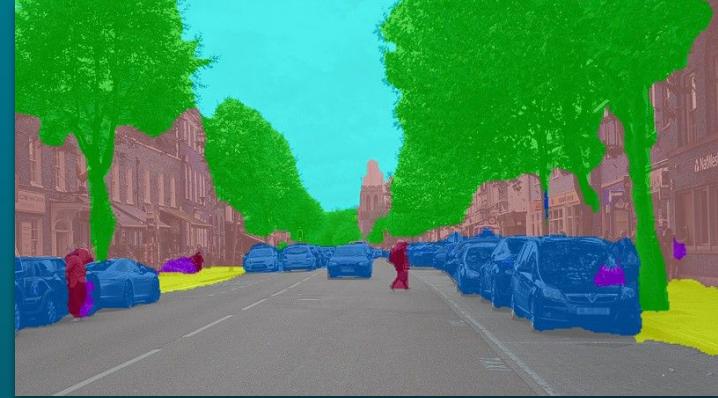


1. [YOLOv5 GitHub](#)
2. [SSD Paper](#)

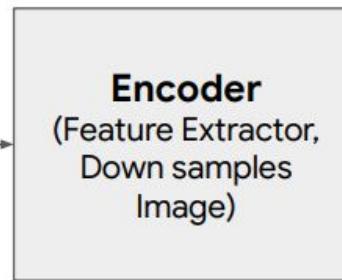
8

Computer Vision : Segmentation

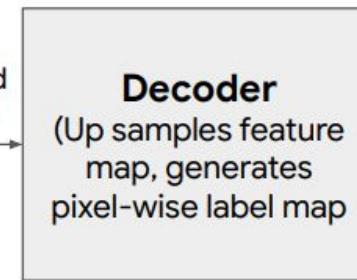
Definition, Applications and Examples



Segmentation Architecture



Downsampled
Feature Map



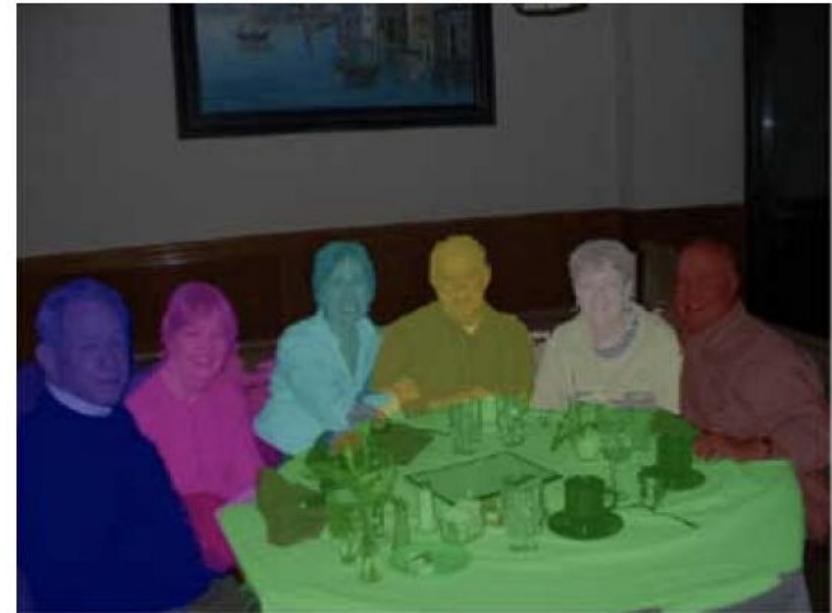
224 x 224 x 3 (RGB image)

224 x 224 x n (Pixel map)
n = number of classes

Semantic Segm. VS Instance Segm.



Semantic Segmentation

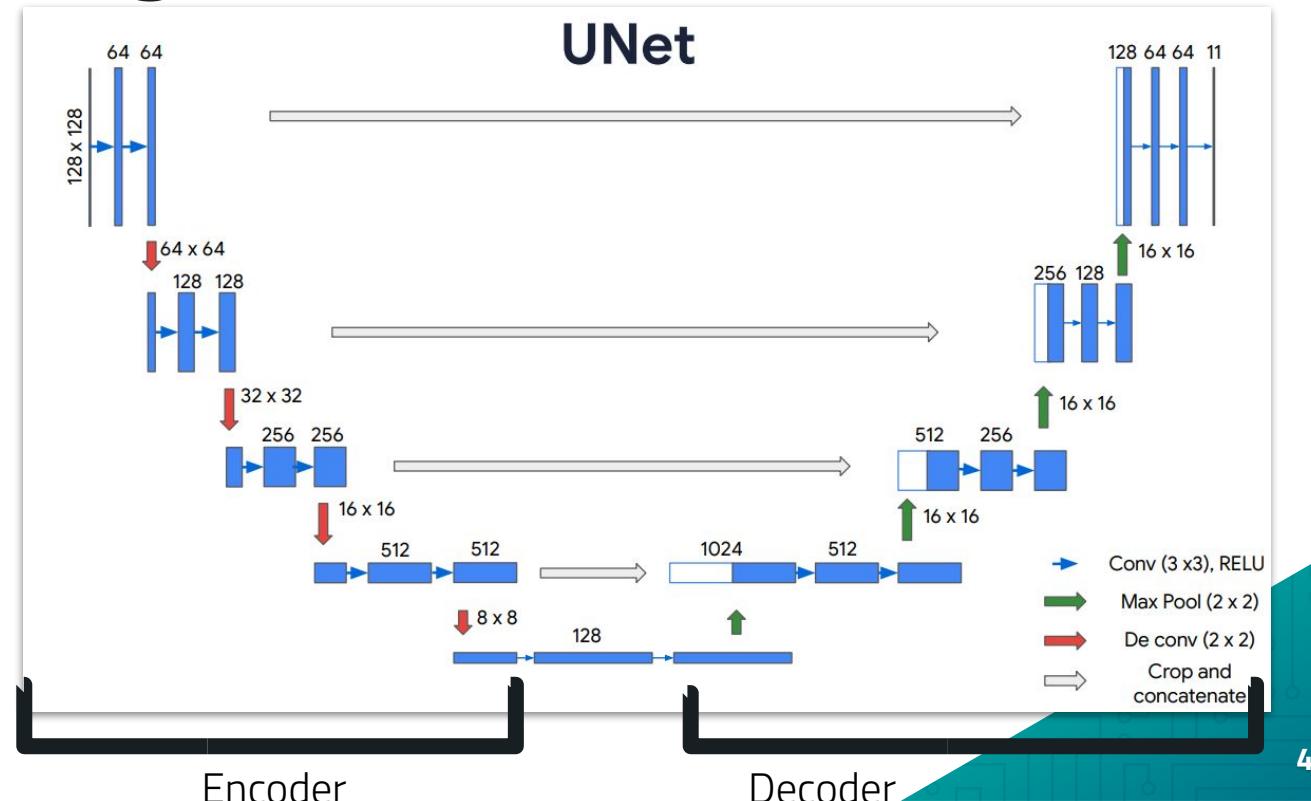


Instance Segmentation

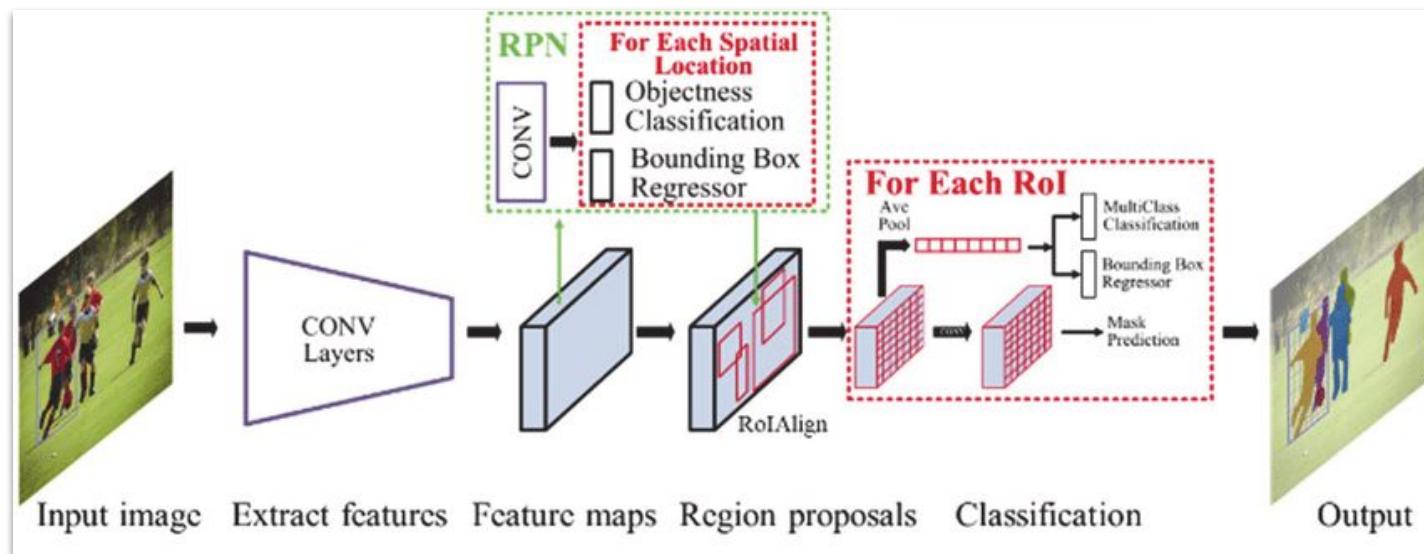
Semantic Segmentation Model Example



The diagram illustrates a UNet architecture. On the left, a small image labeled 'Input' shows a scene with a blue sky, white clouds, and green trees. An arrow points from this input to a larger diagram representing the model's internal structure. The diagram features a central vertical column of three blue rectangles, each labeled '64 64'. To the left of this column is a single blue rectangle labeled '111'. To the right of the central column is a large blue rectangle labeled 'UNet'.



Instance Segmentation Example Model

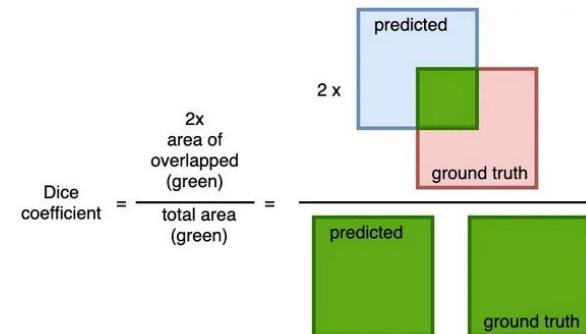


Segmentation Example Loss

$$L_{CE} = - \sum_{i=1}^n t_i \log(p_i), \text{ for } n \text{ classes,}$$

where t_i is the truth label and p_i is the Softmax probability for the i^{th} class.

Or

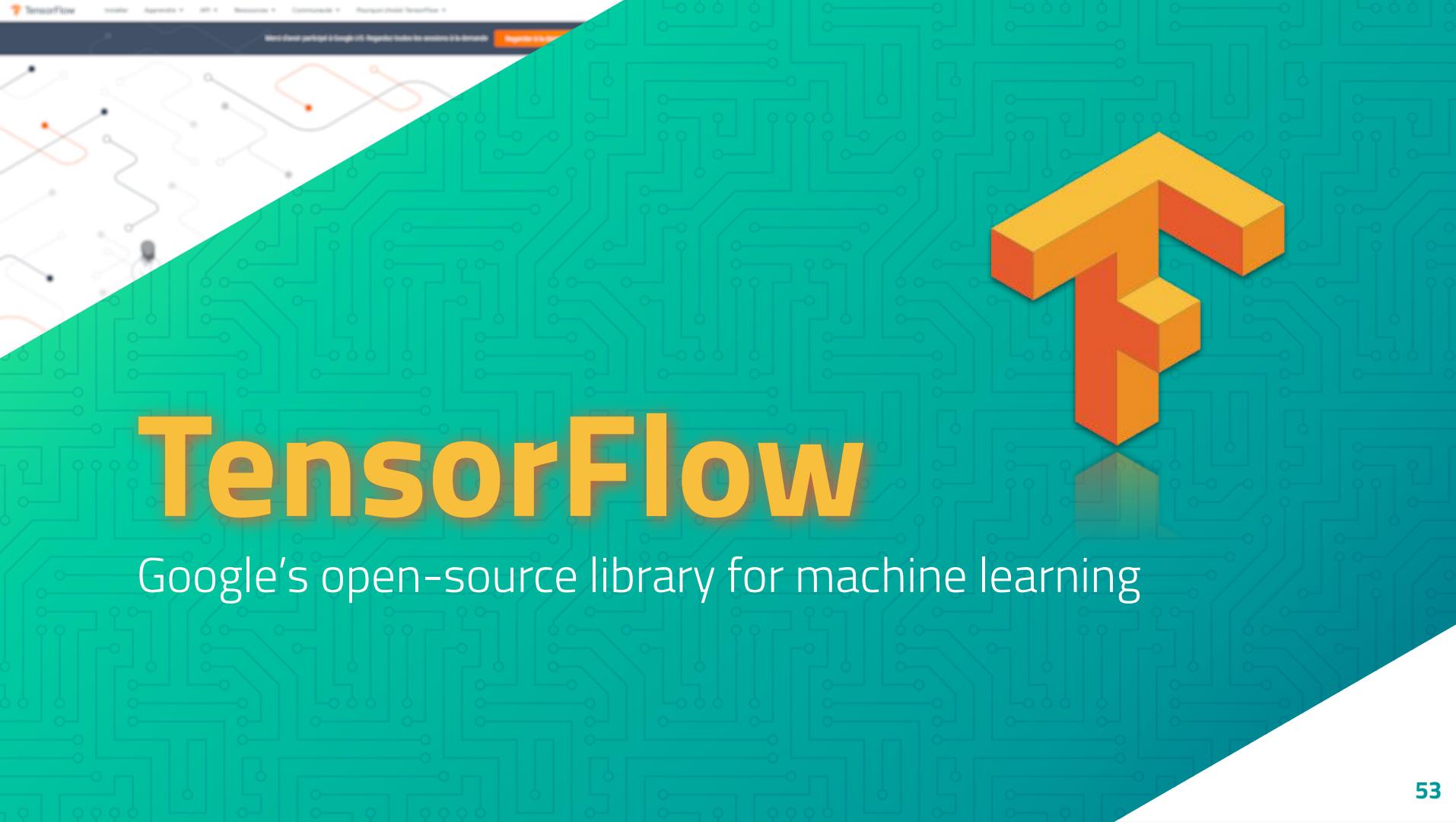


9



Workshop Presentation

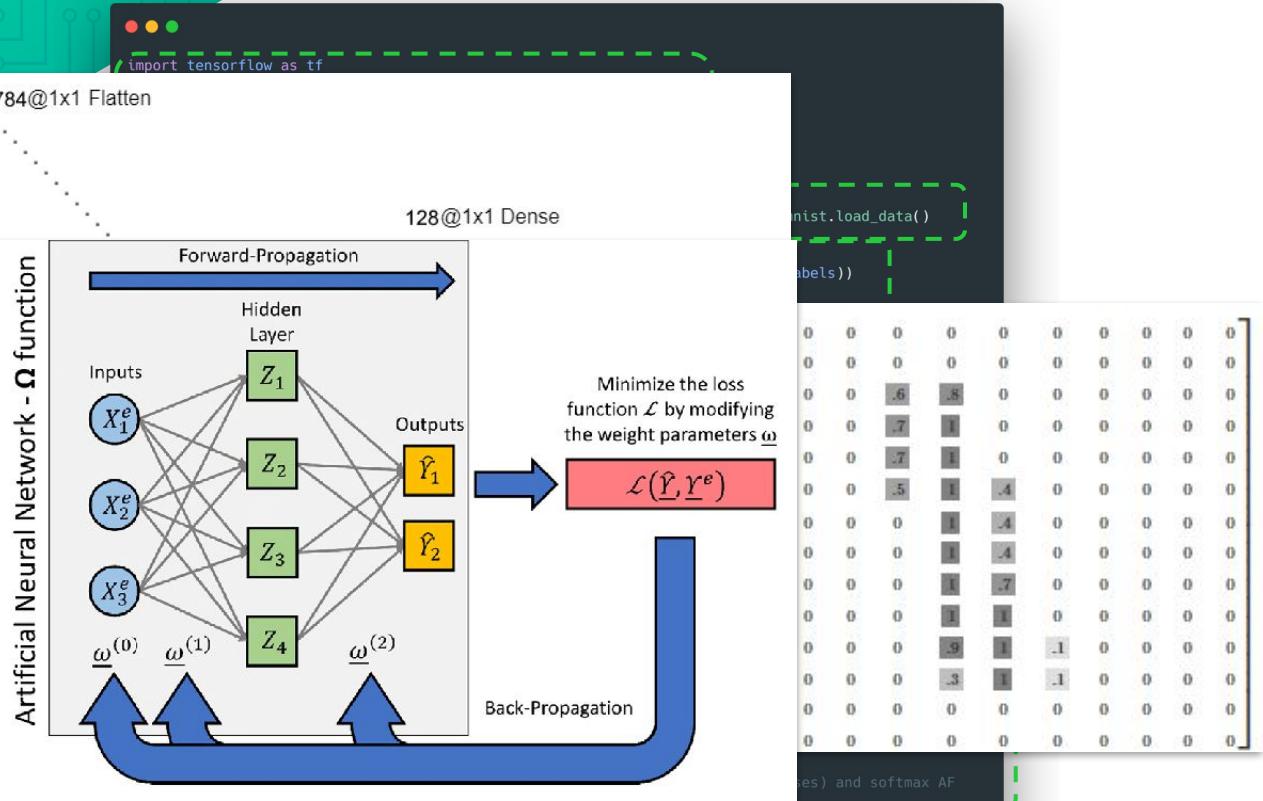
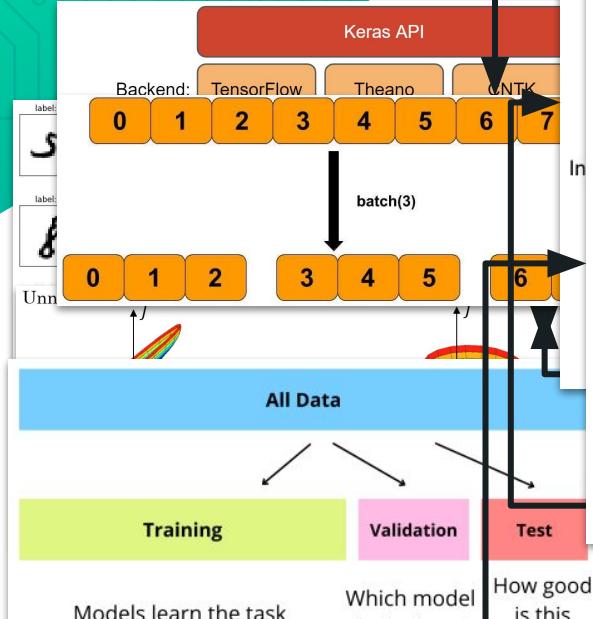
Explanation of the workshop



TensorFlow

Google's open-source library for machine learning

TensorFlow Example



8
9
10

```
# Define the loss function, the optimizer, and the metrics
model.compile(optimizer=Adam(),
                loss=SparseCategoricalCrossentropy(),
                metrics=[SparseCategoricalAccuracy()])

# Train the model
model.fit(train_dataset, epochs=5, validation_data=validation_dataset)

# Evaluate the model
test_loss, test_acc = model.evaluate(test_dataset)

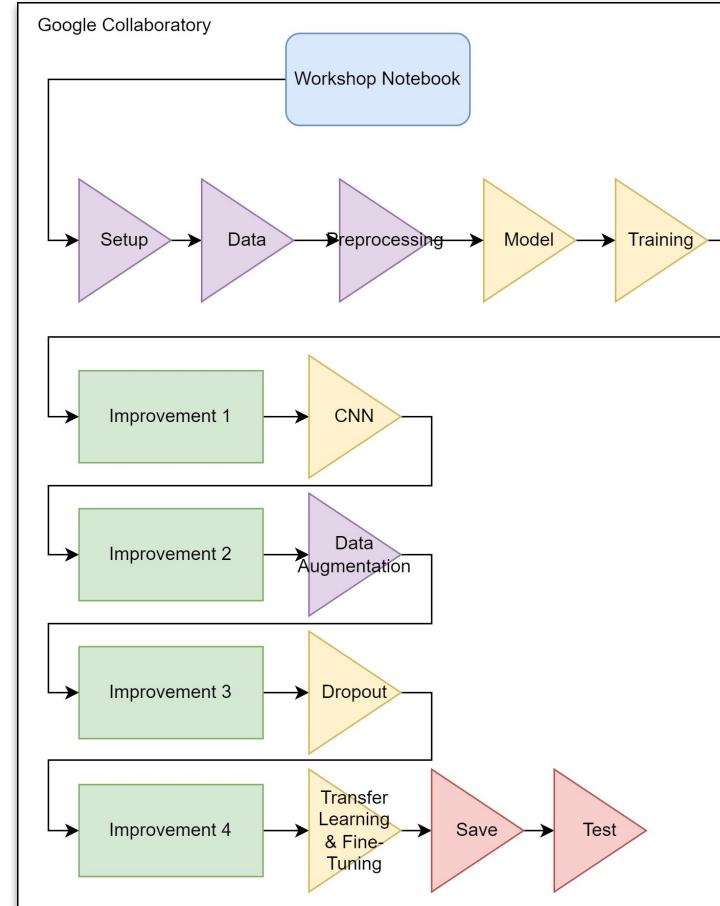
print(f'Test accuracy: {test_acc}')
```

Workshop Subject



- Classification problem
- Model improvements
- Data improvements
- Model testing
- Model exporting

Workshop Relationships

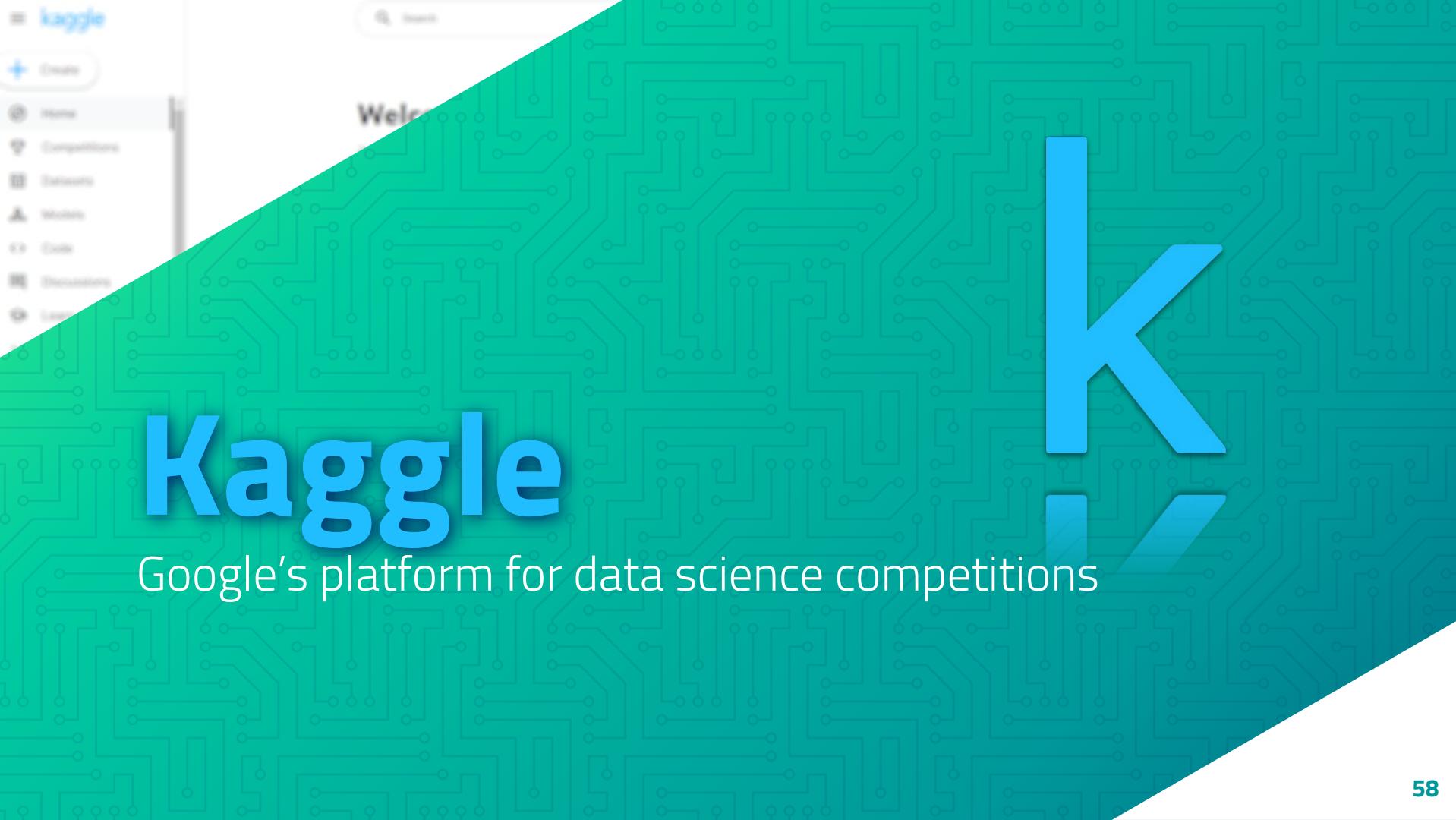


10



Kaggle Contest

Contest subject & rules



Contest Subject



- Classification problem
- Minecraft Biome Dataset
- No transfer learning
- Maximum 42 layers
- Skeleton provided
- (Prize ?)



Contest Tips

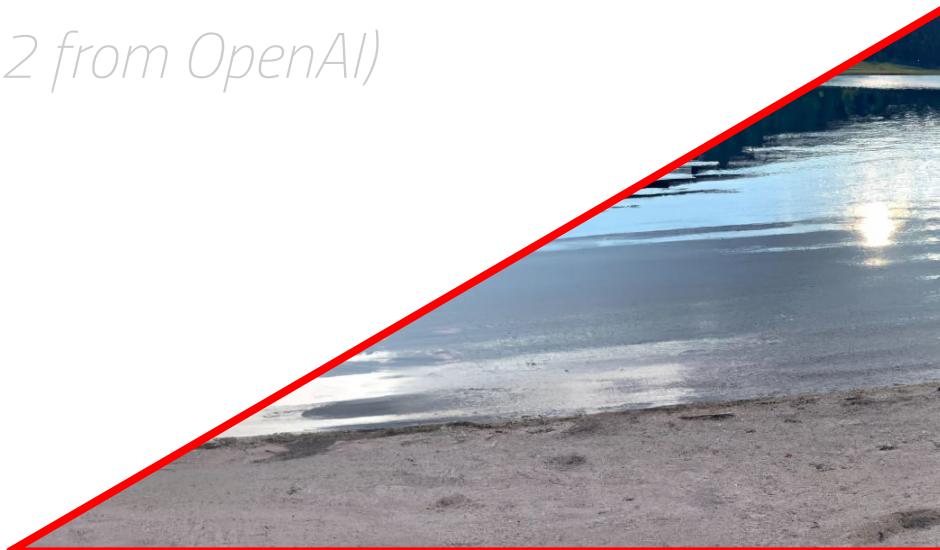
- Use **successive convolutions**
- Take a look at the architecture of **VGG**
- **Validation dataset** is closest to reality
- Data is very **unbalanced**
- Don't **overfit** too much !
- Don't forget to create your **CSV submission** during execution !
- Inspire yourself from the **workshop**
- Don't hesitate **to contact or participate with** SCIA folks !



Did you notice ?

**20% of the photo is
computer generated !**

(DALLE-2 from OpenAI)



THANKS!

Any questions?

You can find me at:

- OrdinaryDev83 
- tom.genlis@gmail.com
- Tom Genlis 
- OrdinaryDev83#9338 



YOU CAN ALSO SPLIT YOUR CONTENT

White

Is the color of milk and fresh snow, the color produced by the combination of all the colors of the visible spectrum.

Black

Is the color of ebony and of outer space. It has been the symbolic color of elegance, solemnity and authority.

IN TWO OR THREE COLUMNS

Yellow

Is the color of gold, butter and ripe lemons. In the spectrum of visible light, yellow is found between green and orange.

Blue

Is the colour of the clear sky and the deep sea. It is located between violet and green on the optical spectrum.

Red

Is the color of blood, and because of this it has historically been associated with sacrifice, danger and courage.

A PICTURE IS WORTH A THOUSAND WORDS

A complex idea can be conveyed with just a single still image, namely making it possible to absorb large amounts of data quickly.

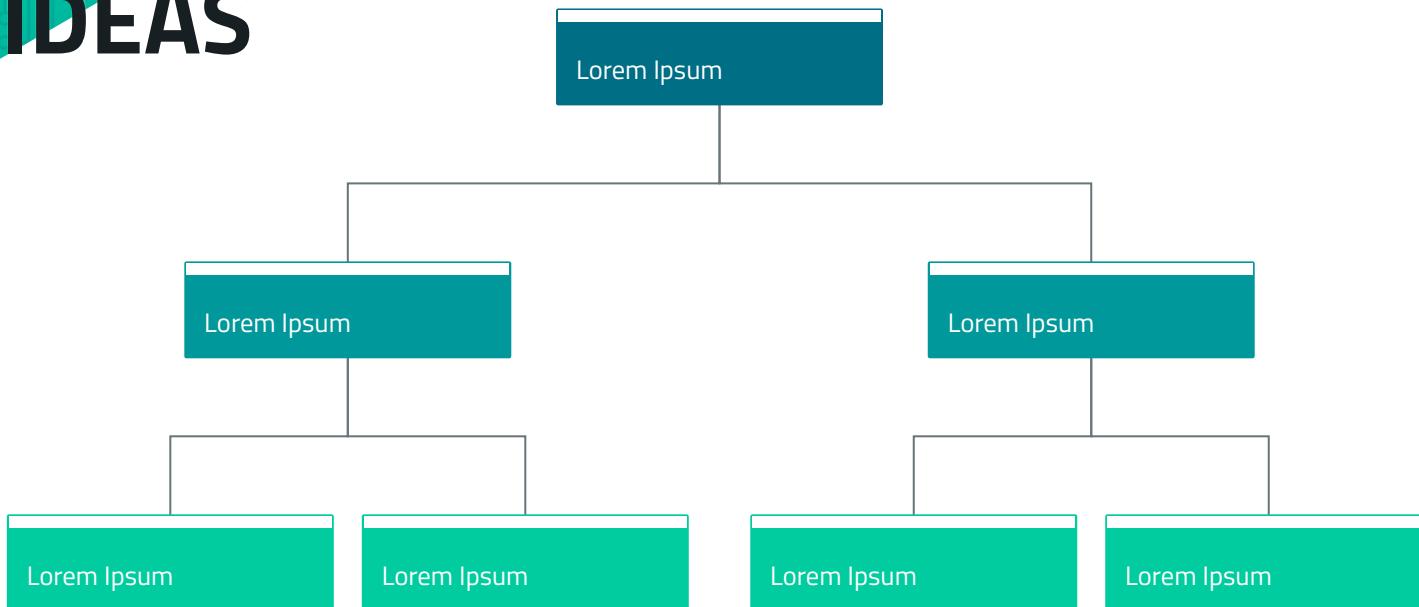




Want big impact?
USE BIG IMAGE.

The image shows a woman sitting cross-legged on a green carpet in a library setting. She is wearing a dark blue floral blouse and black pants. She is looking down at a white laptop screen. Behind her are tall bookshelves filled with books. In front of her are several stacks of books, including titles like "Microsoft SQL Server 2008", "Python", "jQuery in Action", "ASP.NET MVC", and "Ruby Performance Web Sites". The background features large glass doors and a potted plant.

USE DIAGRAMS TO EXPLAIN YOUR IDEAS



AND TABLES TO COMPARE DATA

	A	B	C
Yellow	10	20	7
Blue	30	15	10
Orange	5	24	16

MAPS



Find more maps at slidescarnival.com/extras-free-resources-icons-and-maps



89,526,124

Whoa! That's a big number, aren't you proud?

89,526,124\$

That's a lot of money

185,244 users

And a lot of users

100%

Total success!

OUR PROCESS IS EASY



LET'S REVIEW SOME CONCEPTS

Yellow

Is the color of gold, butter and ripe lemons. In the spectrum of visible light, yellow is found between green and orange.

Yellow

Is the color of gold, butter and ripe lemons. In the spectrum of visible light, yellow is found between green and orange.

Blue

Is the colour of the clear sky and the deep sea. It is located between violet and green on the optical spectrum.

Blue

Is the colour of the clear sky and the deep sea. It is located between violet and green on the optical spectrum.

Red

Is the color of blood, and because of this it has historically been associated with sacrifice, danger and courage.

Red

Is the color of blood, and because of this it has historically been associated with sacrifice, danger and courage.

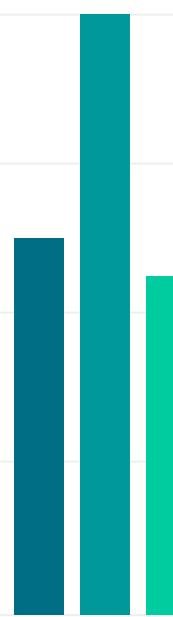
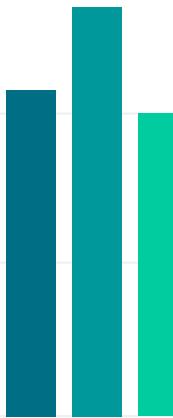
4000

3000

2000

1000

0



You can insert graphs from Excel or Google Sheets

THANKS!

Any questions?

You can find me at:

- @username
- user@mail.me



CREDITS

Special thanks to all the people who made and released these awesome resources for free:

- Presentation template by [SlidesCarnival](#)
- Photographs by [Unsplash](#)
- Circuit background by [Hero Patterns](#)

PRESENTATION DESIGN

This presentation uses the following typographies:

- Titles: Titillium Web Bold
- Body copy: Titillium Web Light

Download for free at:

<https://www.heropatterns.com/>

You don't need to keep this slide in your presentation. It's only here to serve you as a design guide if you need to create new slides or download the fonts to edit the presentation in PowerPoint®



2

EXTRA RESOURCES

For Business Plans, Marketing Plans, Project
Proposals, Lessons, etc

TIMELINE

Blue is the colour of the clear sky and the deep sea

Red is the colour of danger and courage

Black is the color of ebony and of outer space

Yellow is the color of gold, butter and ripe lemons

White is the color of milk and fresh snow

Blue is the colour of the clear sky and the deep sea

JAN

FEB

MAR

APR

MAY

JUN

JUL

AUG

SEP

OCT

NOV

DEC

Yellow is the color of gold, butter and ripe lemons

White is the color of milk and fresh snow

Blue is the colour of the clear sky and the deep sea

Red is the colour of danger and courage

Black is the color of ebony and of outer space

Yellow is the color of gold, butter and ripe lemons

ROADMAP

Blue is the colour of the clear sky and the deep sea



Red is the colour of danger and courage



Black is the color of ebony and of outer space



Yellow is the color of gold, butter and ripe lemons



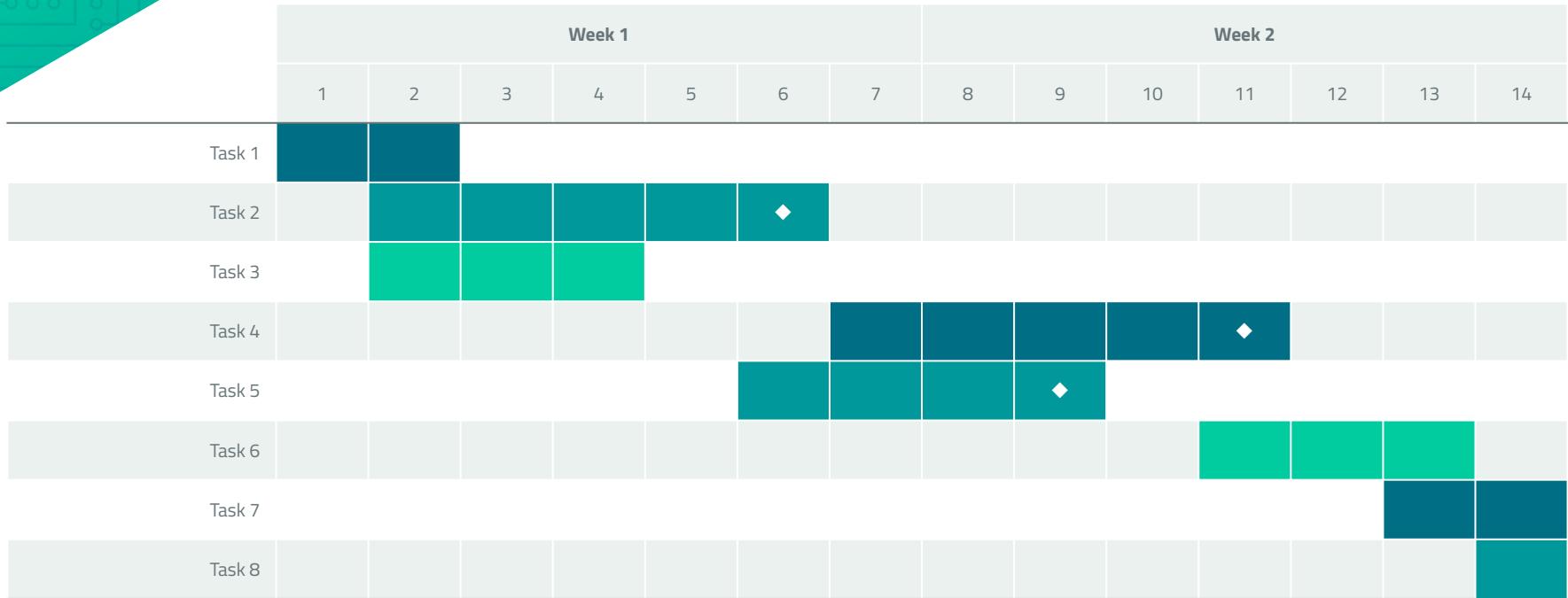
White is the color of milk and fresh snow



Blue is the colour of the clear sky and the deep sea



GANNT CHART



SWOT ANALYSIS

STRENGTHS

Blue is the colour of the clear sky and the deep sea

S

WEAKNESSES

Yellow is the color of gold, butter and ripe lemons

W

Black is the color of ebony and of outer space

O

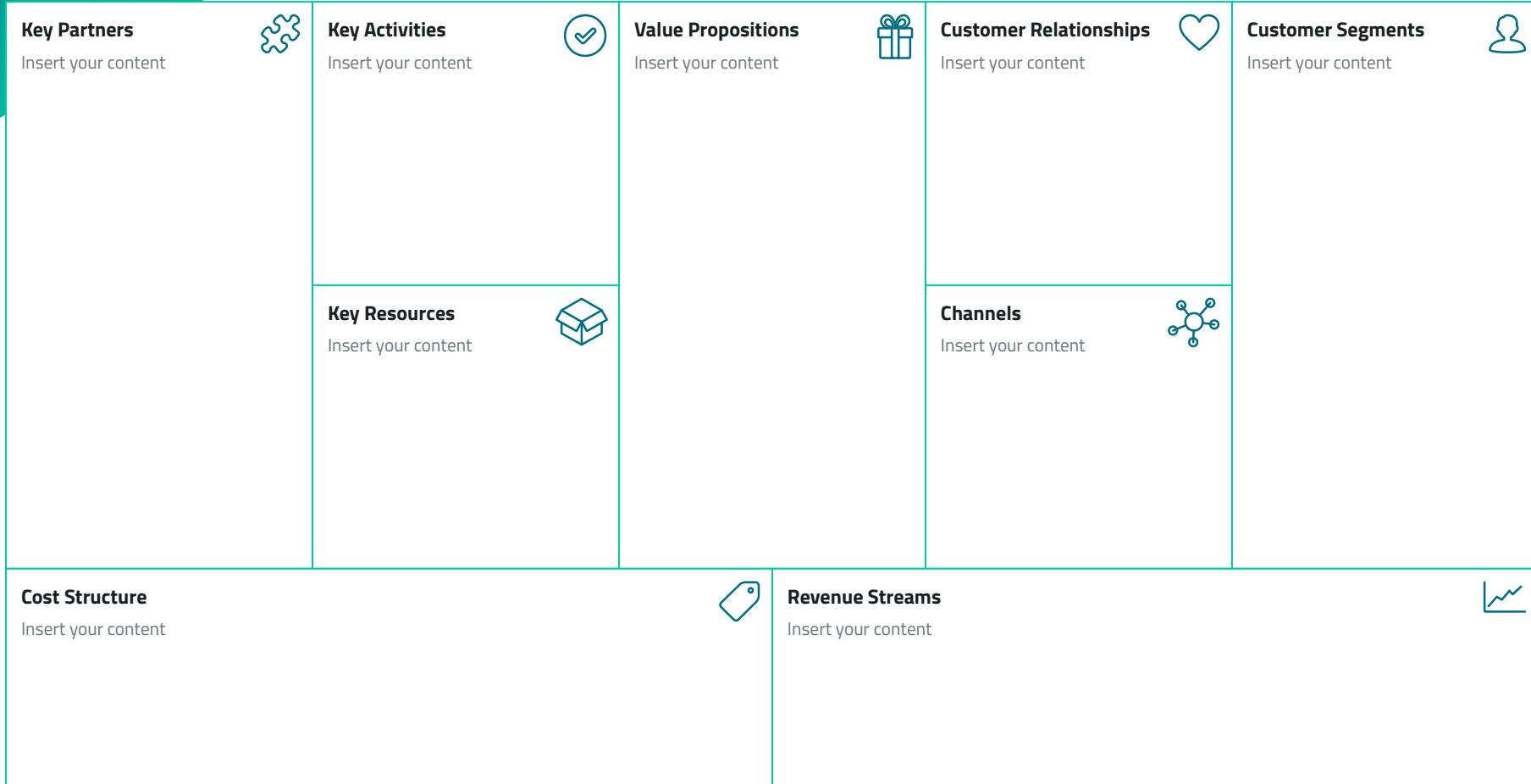
OPPORTUNITIES

T

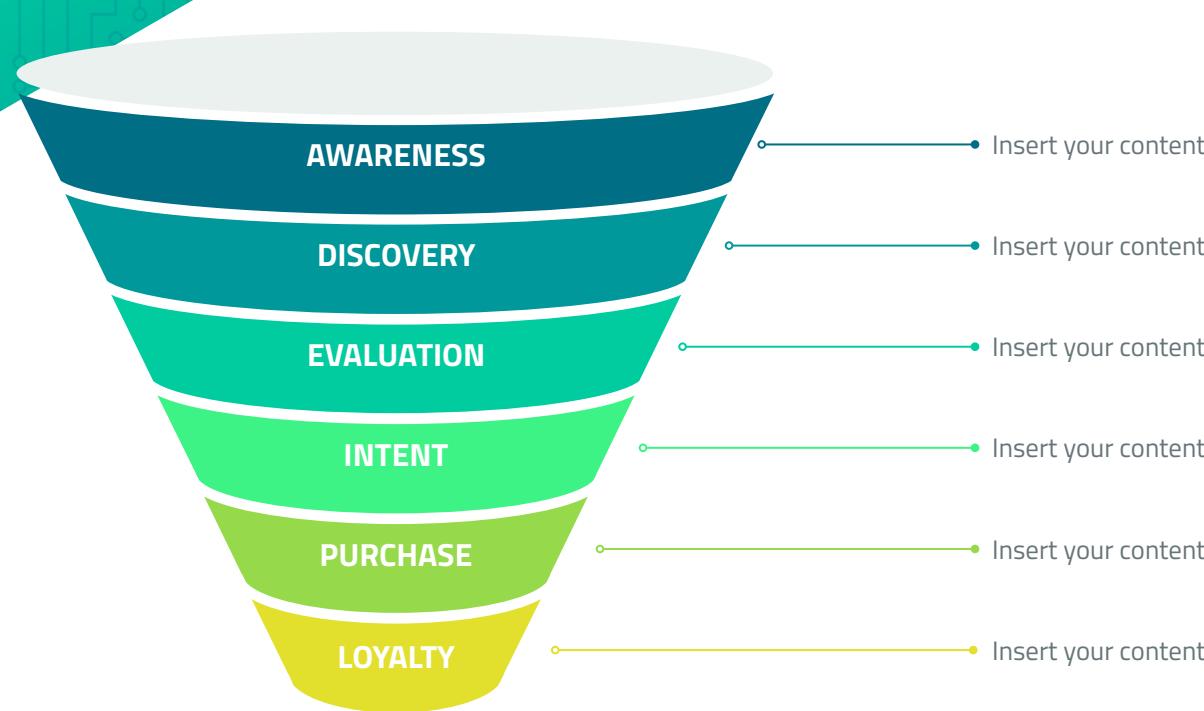
White is the color of milk and fresh snow

THREATS

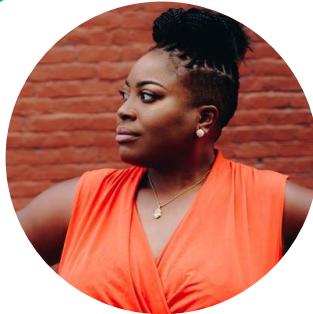
BUSINESS MODEL CANVAS



FUNNEL



TEAM PRESENTATION



Imani Jackson

JOB TITLE

Blue is the colour of the clear
sky and the deep sea



Marcos Galán

JOB TITLE

Blue is the colour of the clear
sky and the deep sea



Ixchel Valdía

JOB TITLE

Blue is the colour of the clear
sky and the deep sea

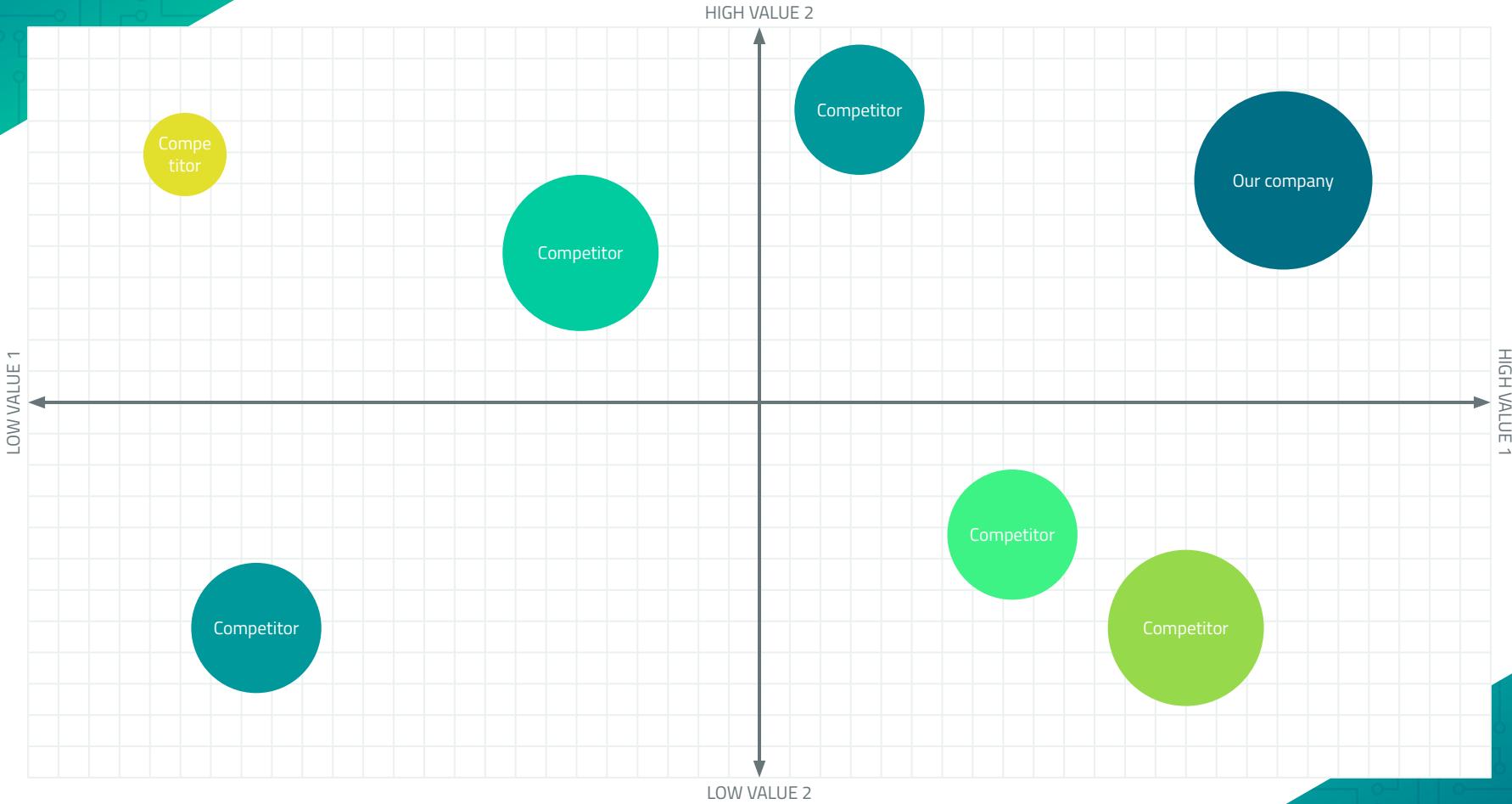


Nils Årud

JOB TITLE

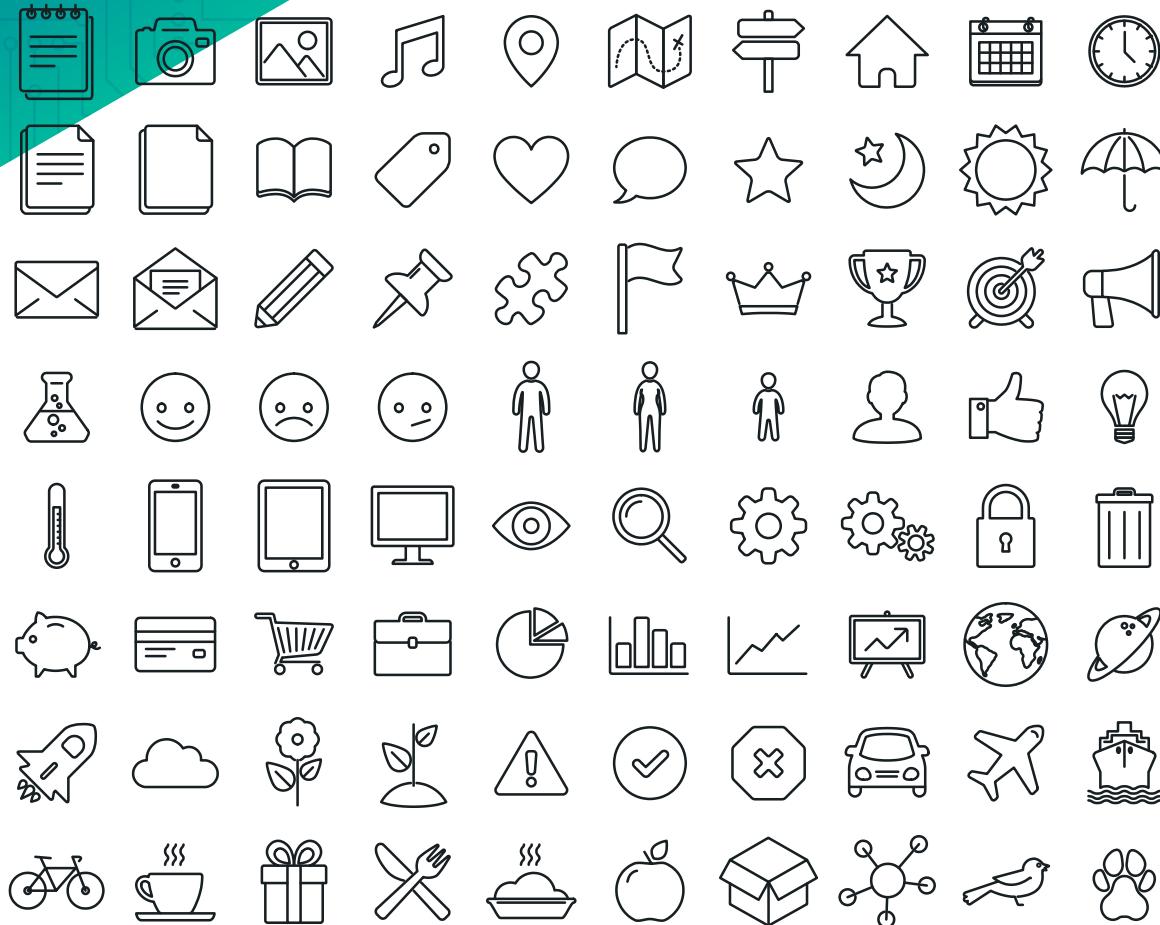
Blue is the colour of the clear
sky and the deep sea

COMPETITOR MATRIX



WEEKLY PLANNER

	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
09:00 - 09:45	Task						
10:00 - 10:45	Task						
11:00 - 11:45	Task						
12:00 - 13:15	✓ Free time						
13:30 - 14:15	Task						
14:30 - 15:15	Task						
15:30 - 16:15	Task						

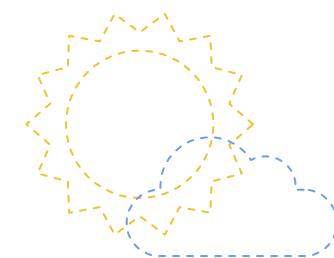


SlidesCarnival icons are editable shapes.

This means that you can:

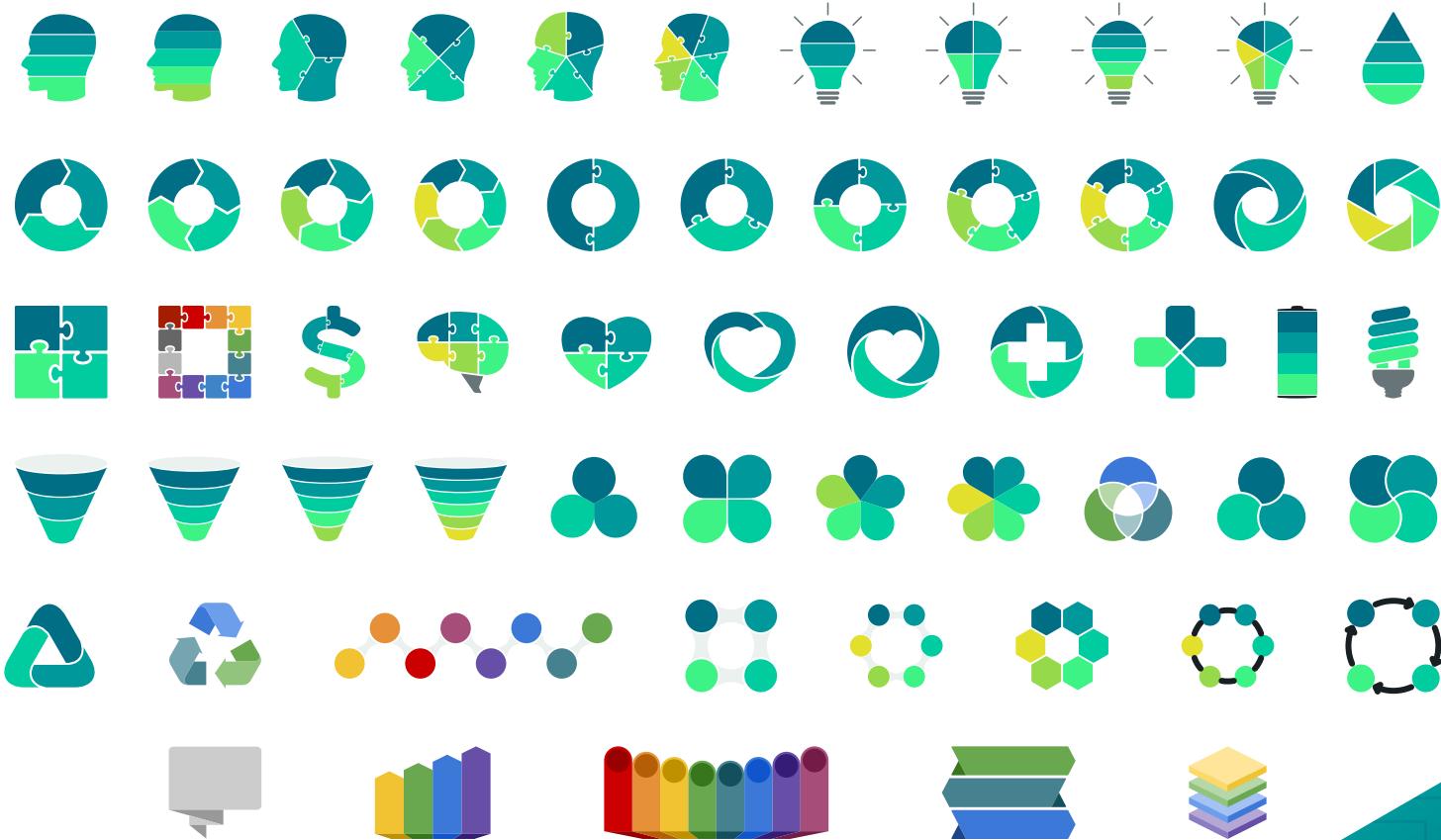
- Resize them without losing quality.
 - Change fill color and opacity.
 - Change line color, width and style.
- Isn't that nice? :)

Examples:



Find more icons at
slidescarnival.com/extra-free-resources-icons-and-maps

DIAGRAMS AND INFOGRAPHICS



You can also use any emoji as an icon!
And of course it resizes without losing quality.

How? Follow Google instructions <https://twitter.com/googledocs/status/730087240156643328>



many more...



Free templates for all your presentation needs



For PowerPoint and
Google Slides



100% free for personal
or commercial use



Ready to use,
professional and
customizable



Blow your audience
away with attractive
visuals