Introduction to Computer Vision

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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 !

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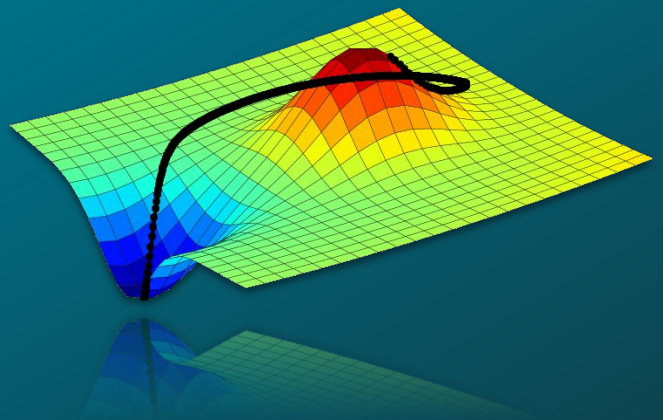


Quick Intro to Machine Learning

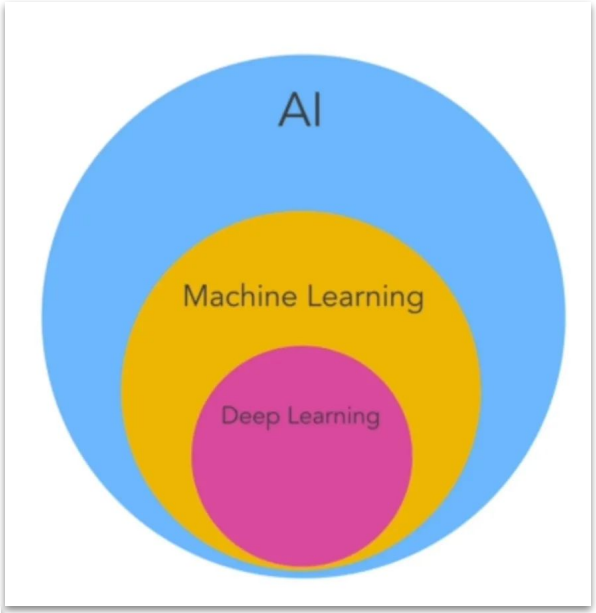
Definitions

Introduction Outline

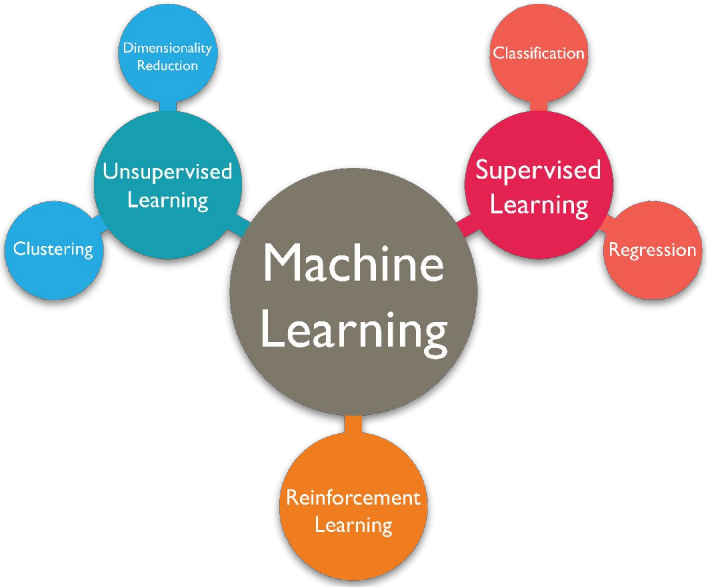
- What is AI ?
- What is Machine Learning ?
- Supervised Learning
- Unsupervised Learning
- Reinforcement Learning
- Deep Learning
- 8 Core ML Concepts

What is AI ?

- Mimic Human Behavior

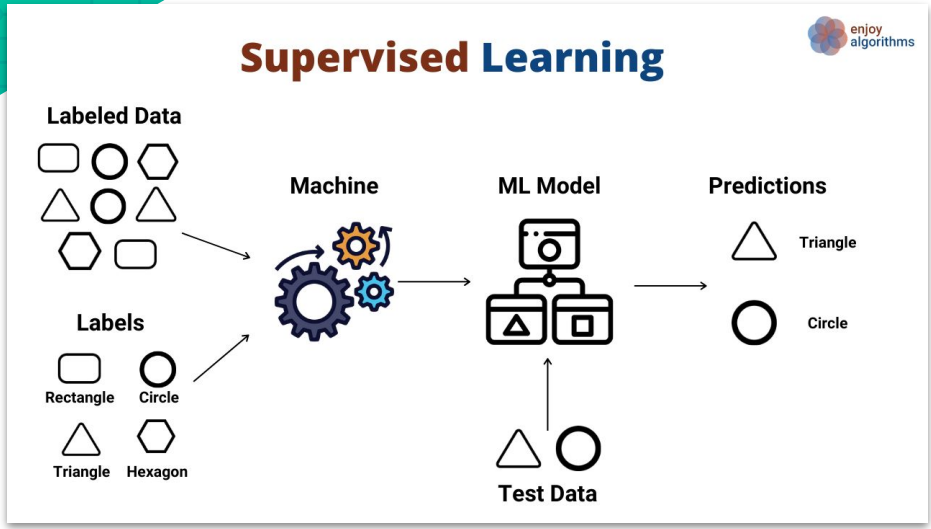


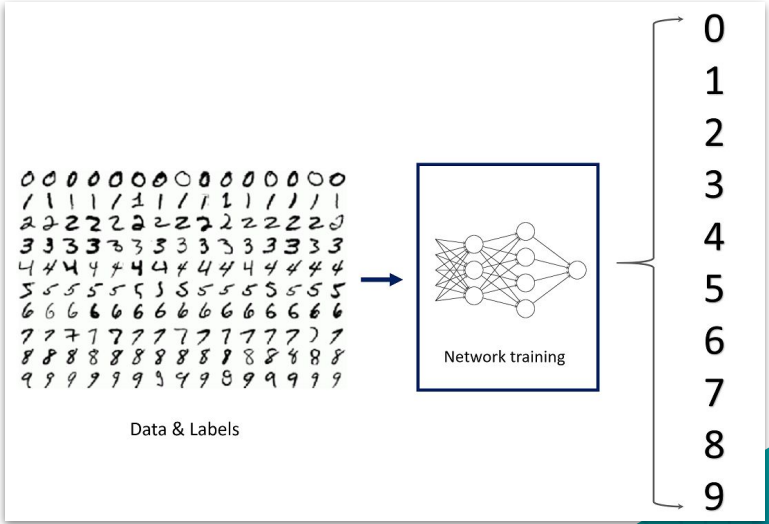
What is Machine Learning ?



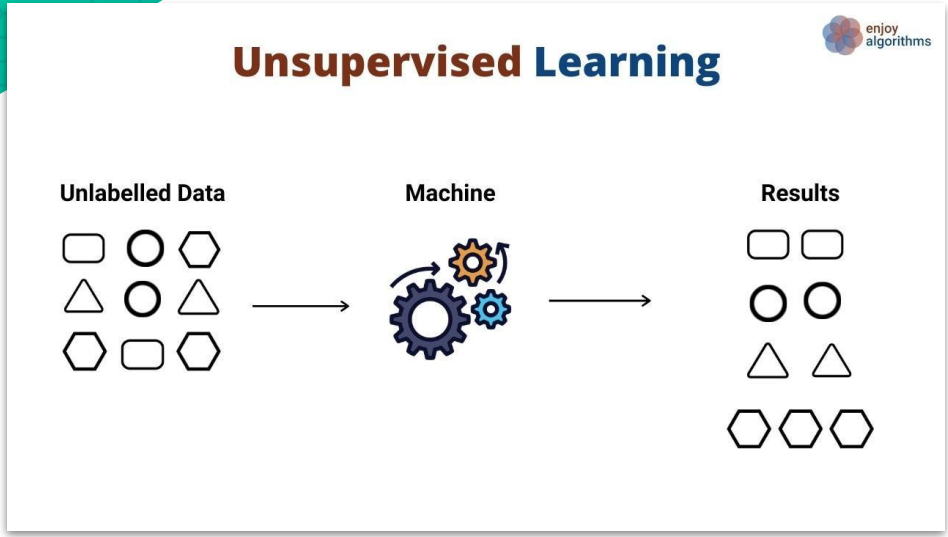
Supervised Learning

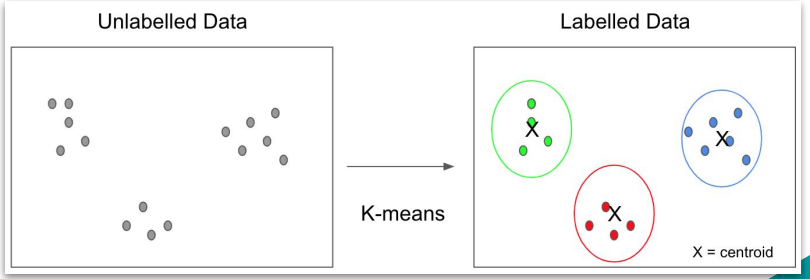
Value	Label
🍎	0
🍌	1
🍎	0
🍌	1
🍎	0



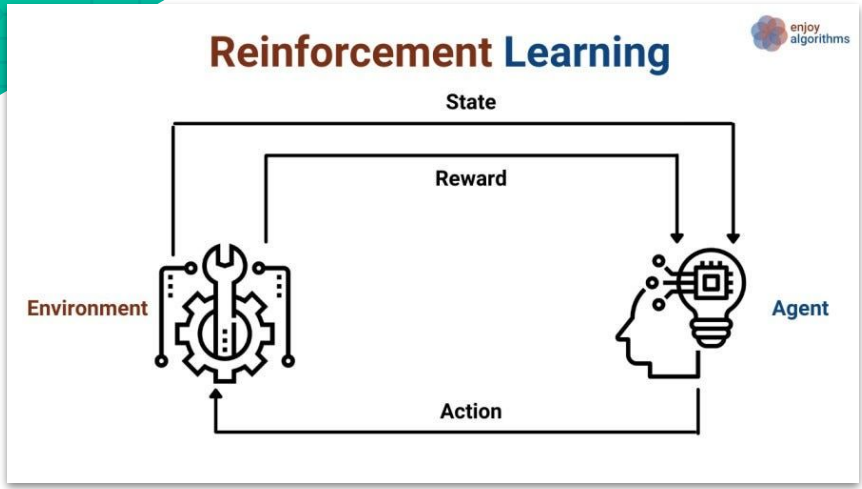


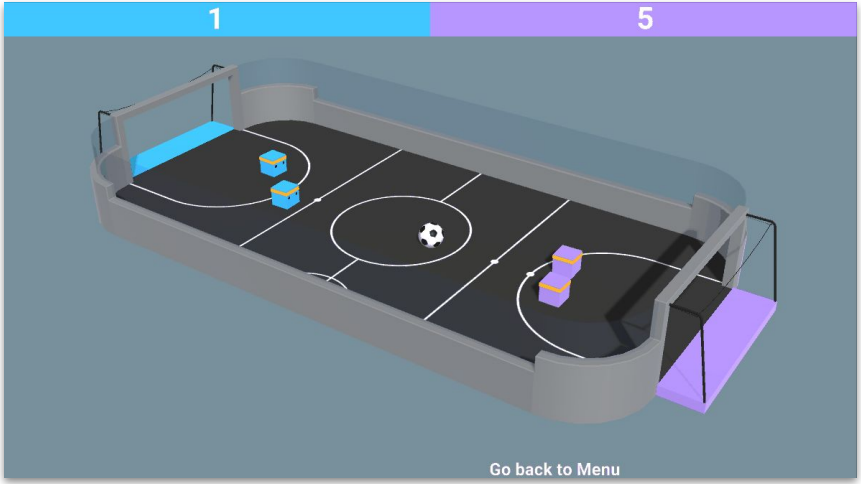
Unsupervised Learning



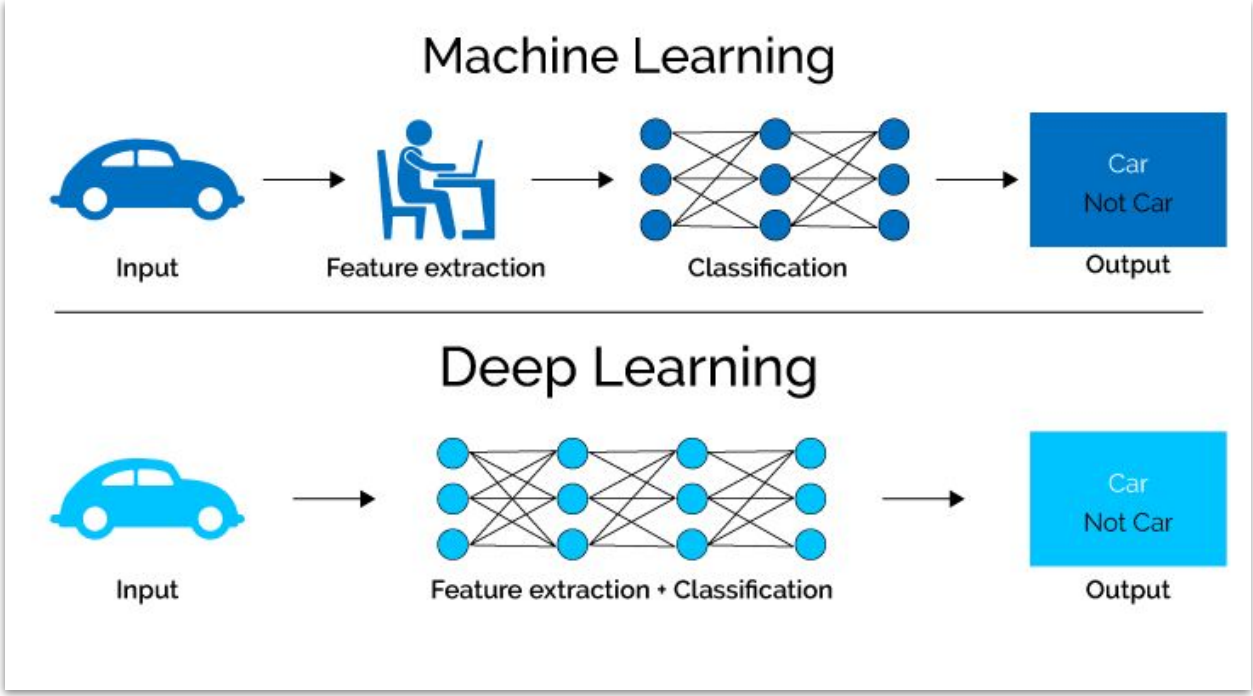


Reinforcement Learning





Deep Learning



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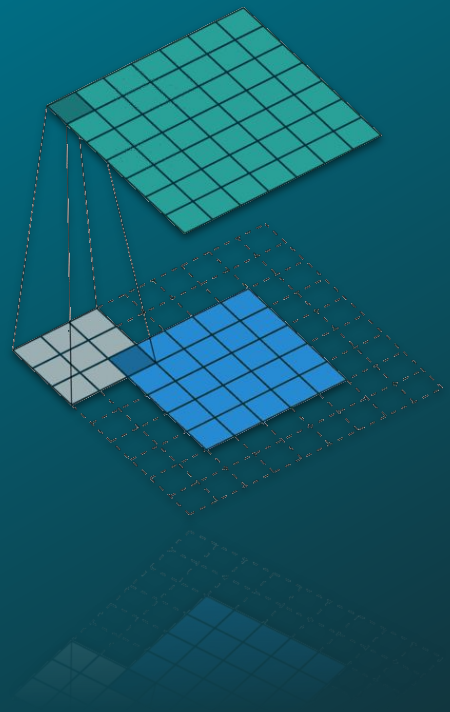
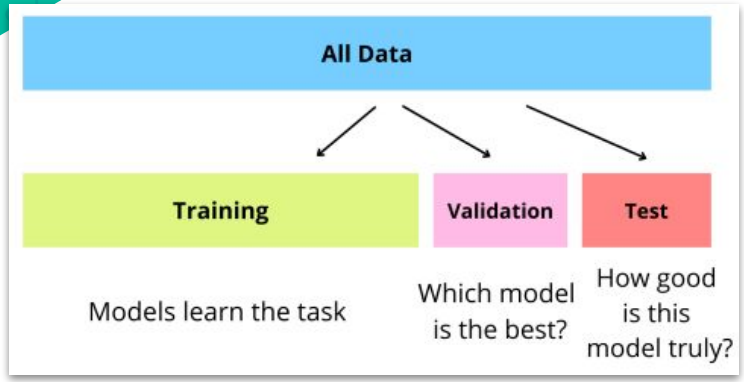
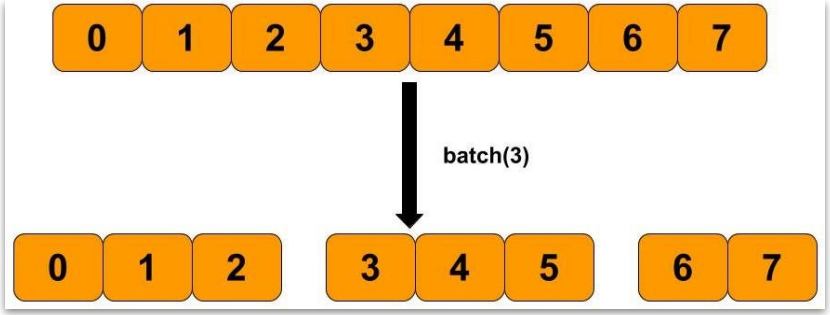
Core ML Concepts

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		

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

- Spatial Context

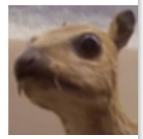
Kernels

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

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

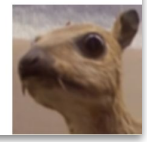
$\begin{bmatrix} 0 & 1 & 0 \\ 1 & -4 & 1 \\ 0 & 1 & 0 \end{bmatrix}$

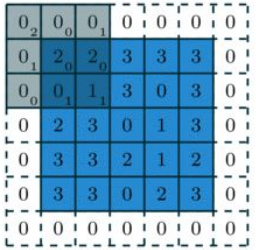
Average Blur $\frac{1}{9}\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$



Edge Detection $\begin{bmatrix} -1 & -1 & -1 \\ -1 & 8 & -1 \\ -1 & -1 & -1 \end{bmatrix}$

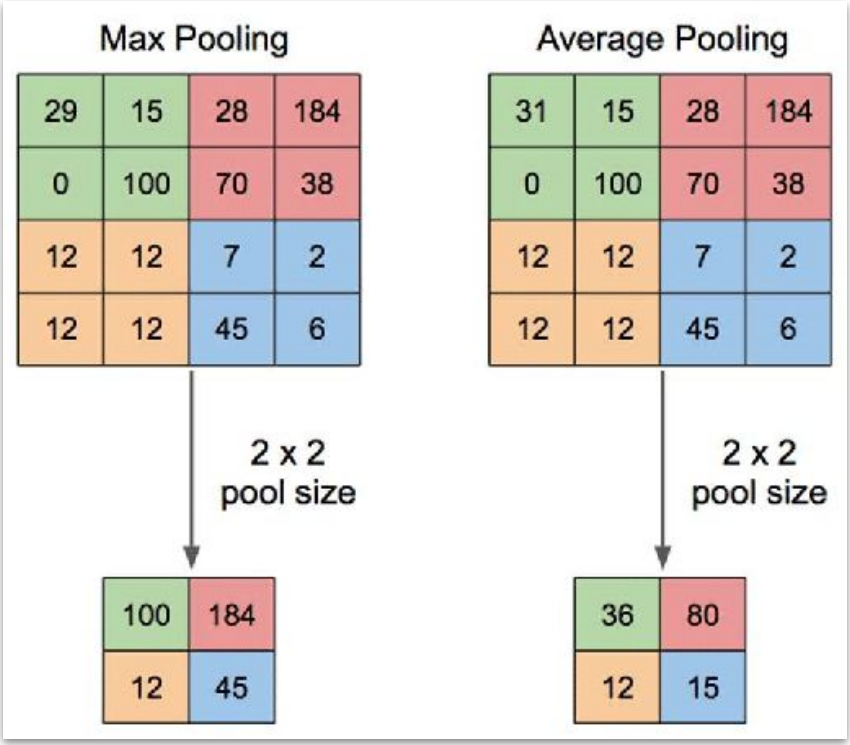
Gaussian Blur $\frac{1}{16}\begin{bmatrix} 1 & 2 & 1 \\ 2 & 4 & 2 \\ 1 & 2 & 1 \end{bmatrix}$



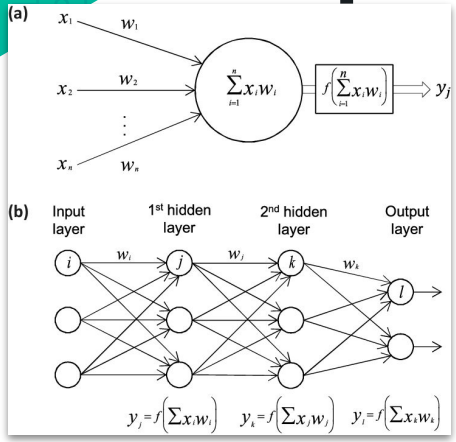


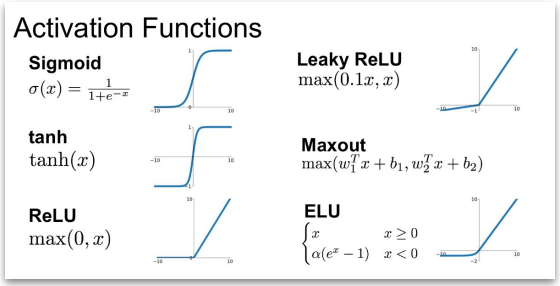
1	6	5
7	10	9
7	10	8

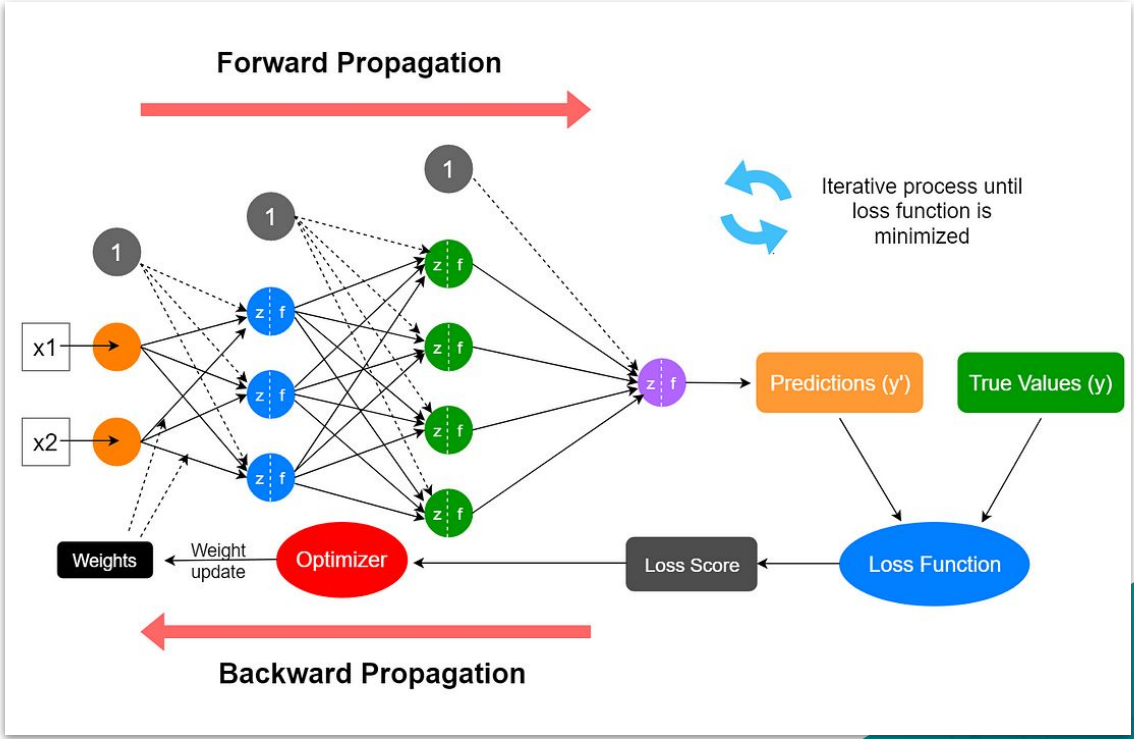
ML Concepts : Pooling



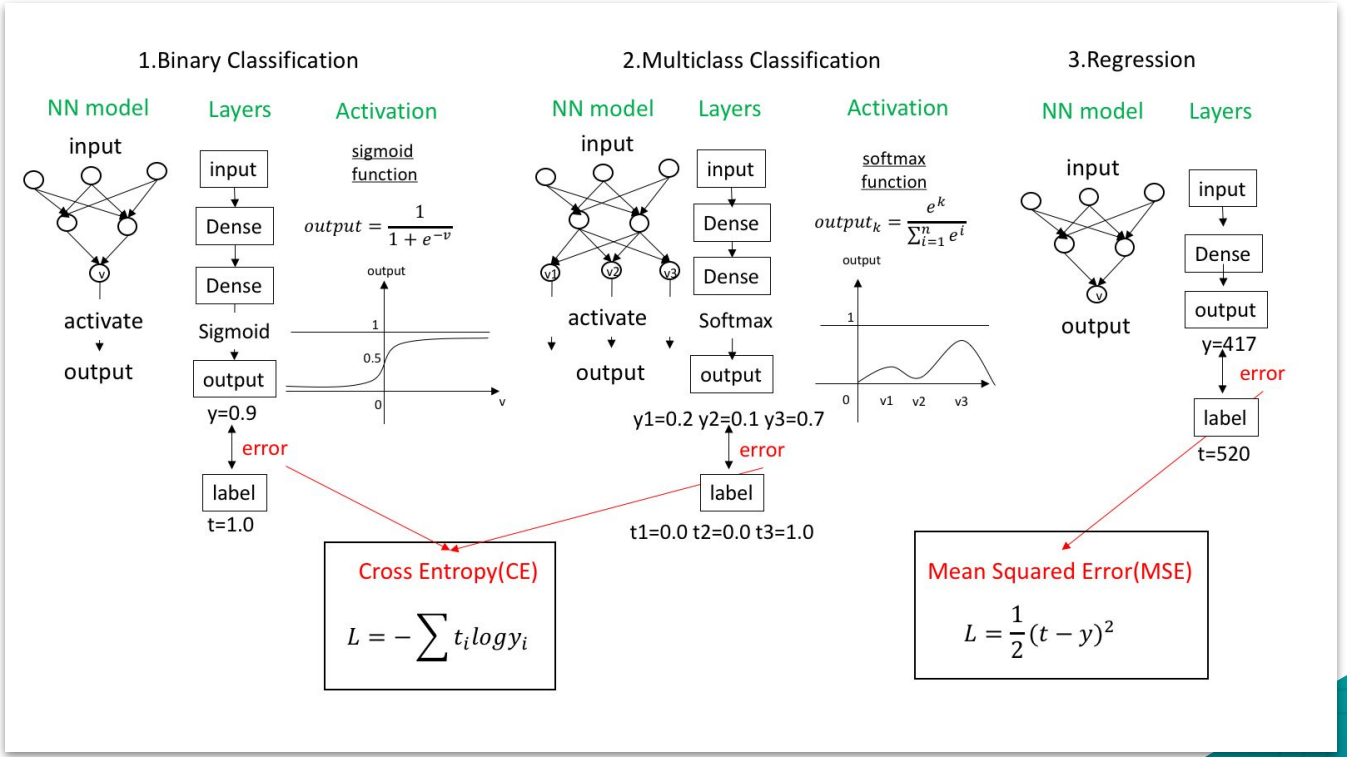
ML Concepts : Neural Networks



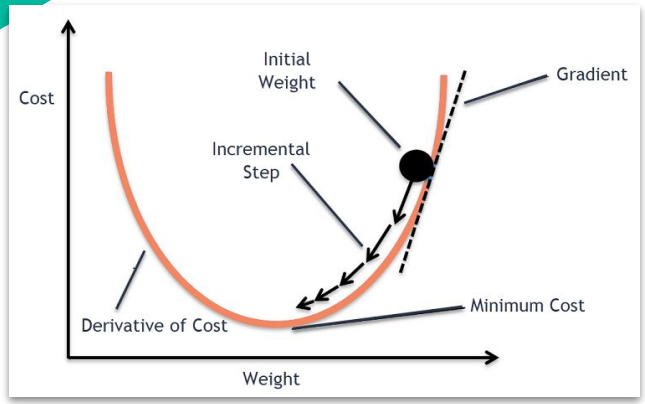


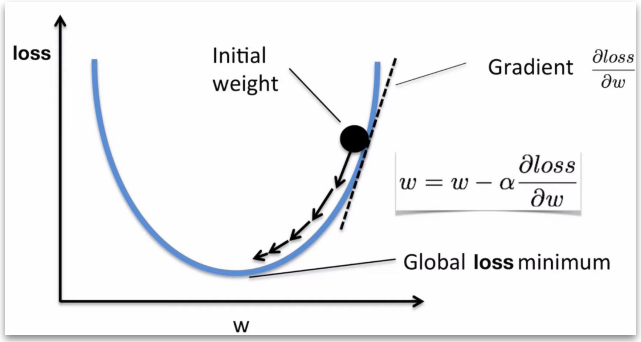


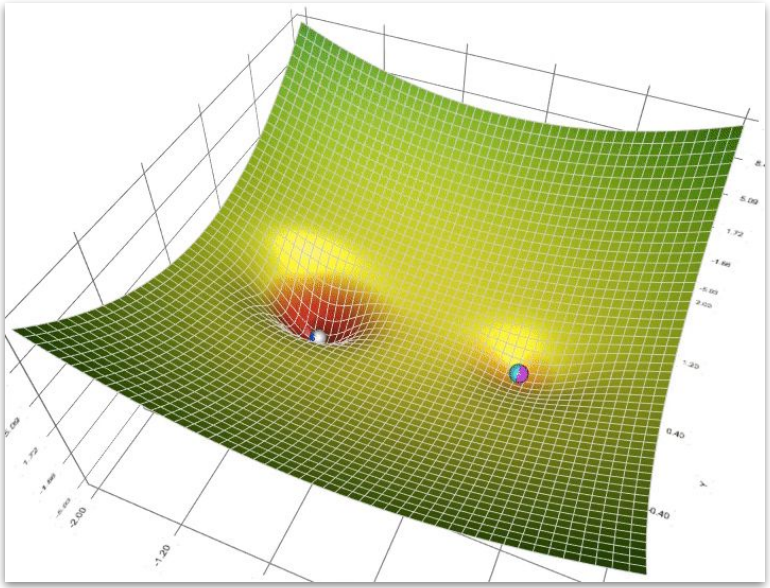
ML Concepts : Loss Function



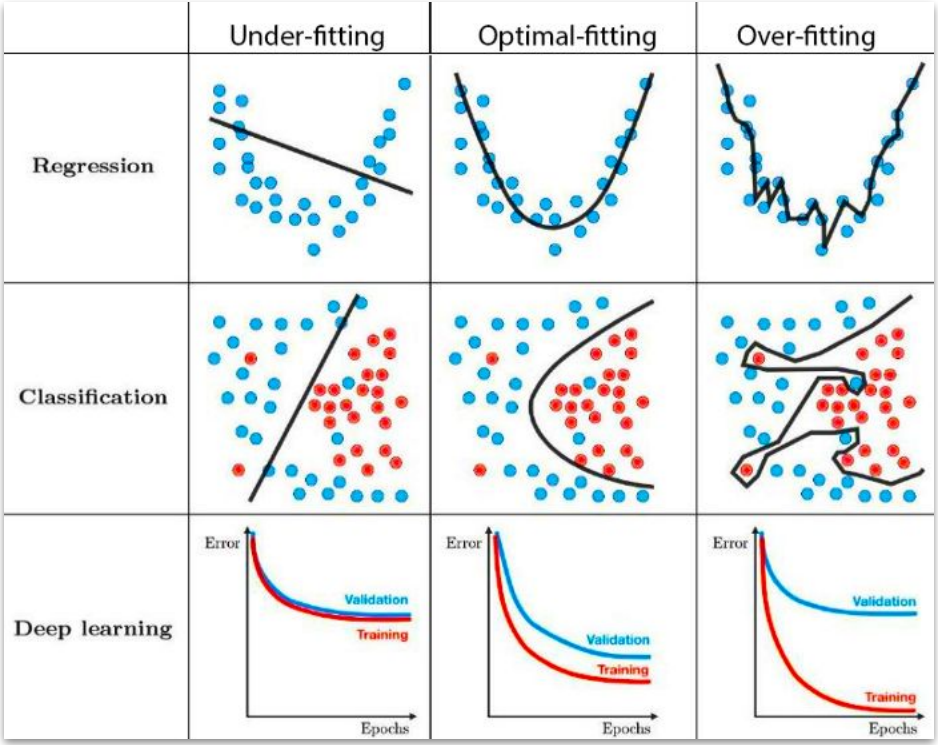
ML Concepts : Gradient Descent



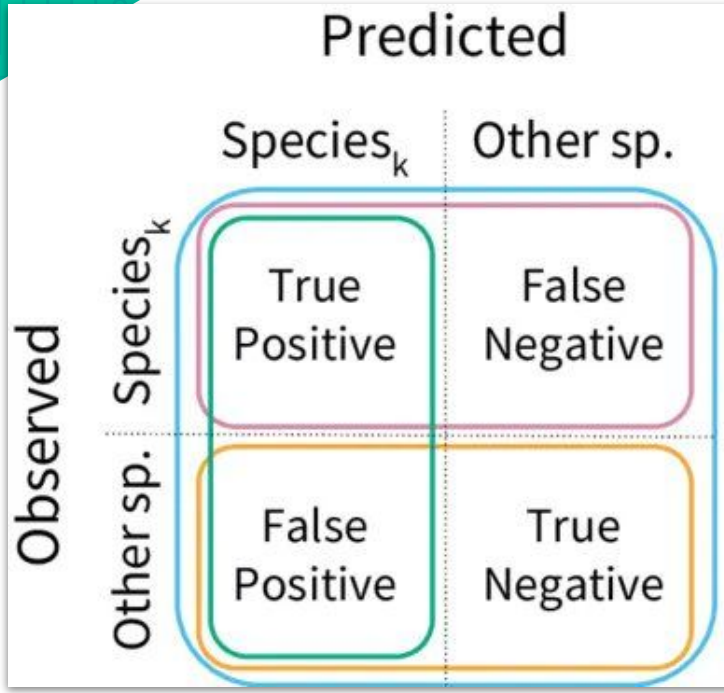




ML Concepts : Overfitting & Underfitting



ML Concepts : Metrics



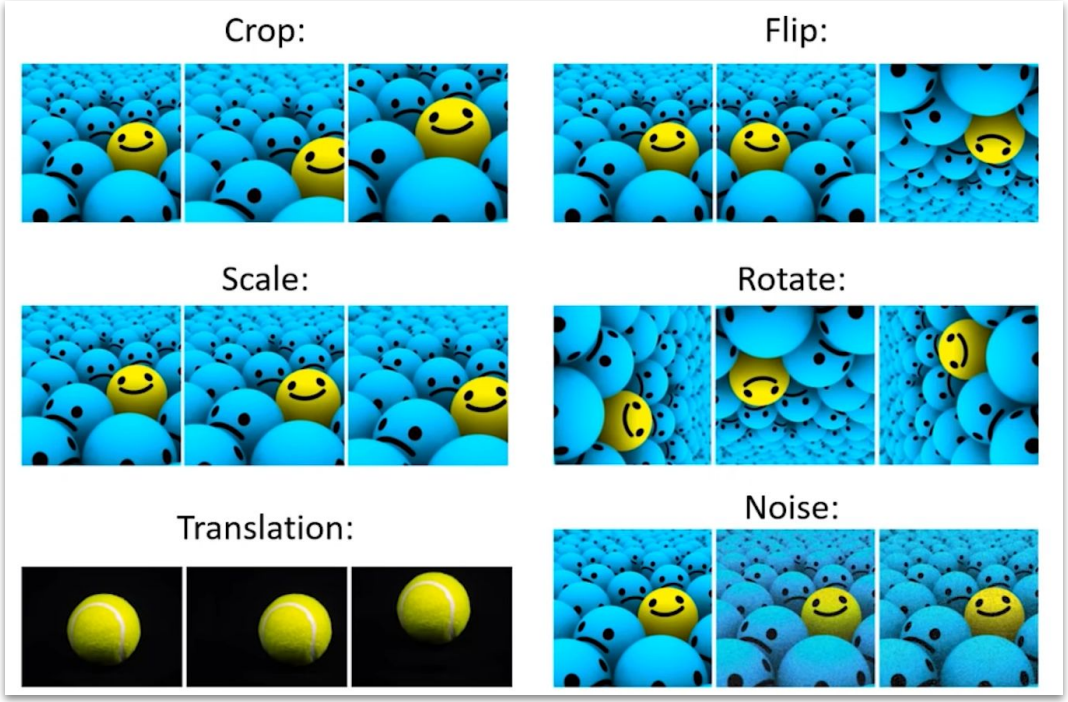
Accuracy $= \frac{TP + TN}{TP + TN + FP + FN}$

Specificity $= \frac{TN}{TN + FP}$

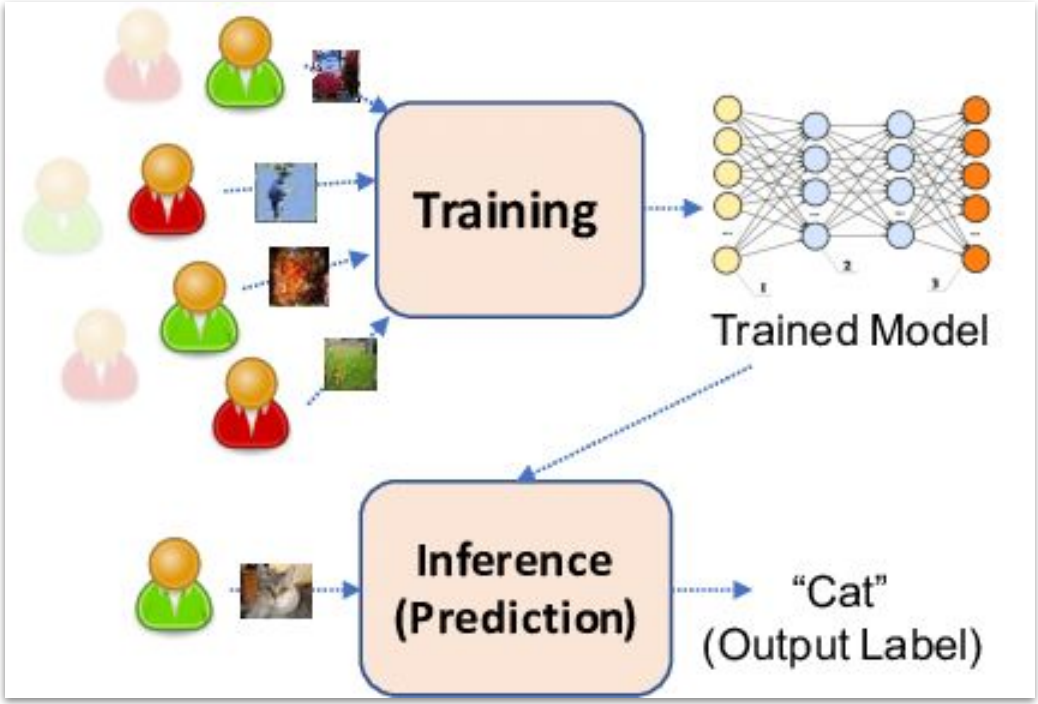
Precision $= \frac{TP}{TP + FP}$

Recall $= \frac{TP}{TP + FN}$

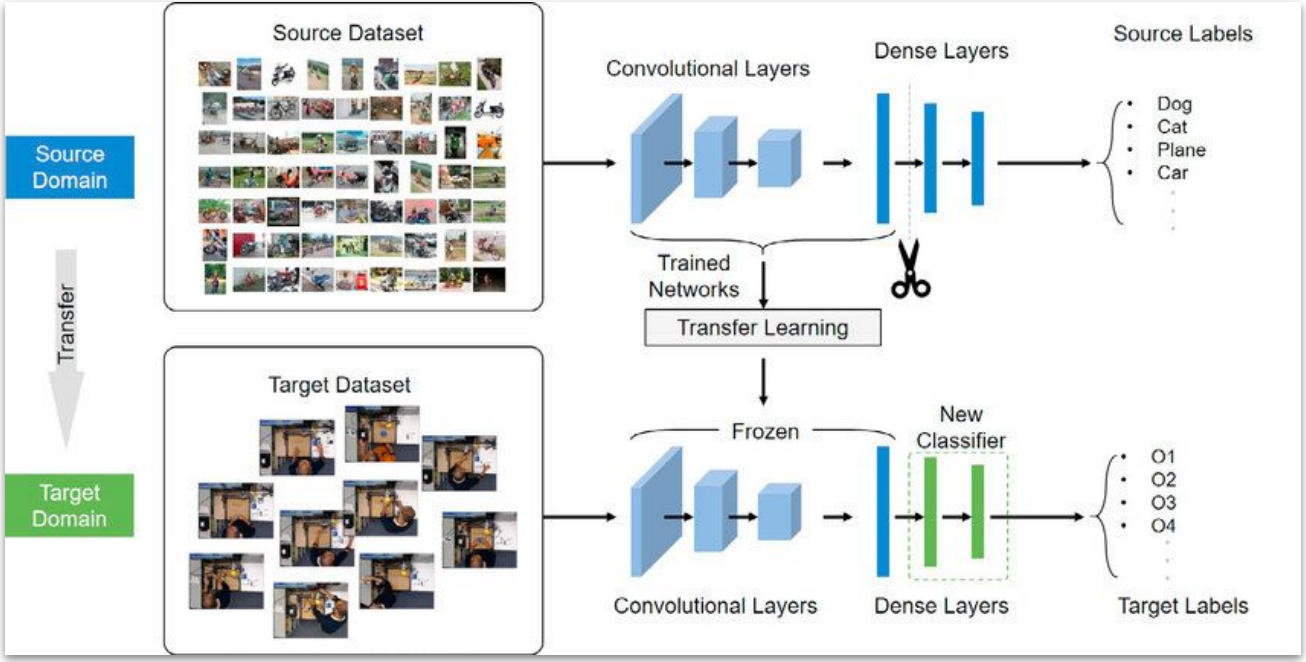
ML Concepts : Data Augmentation



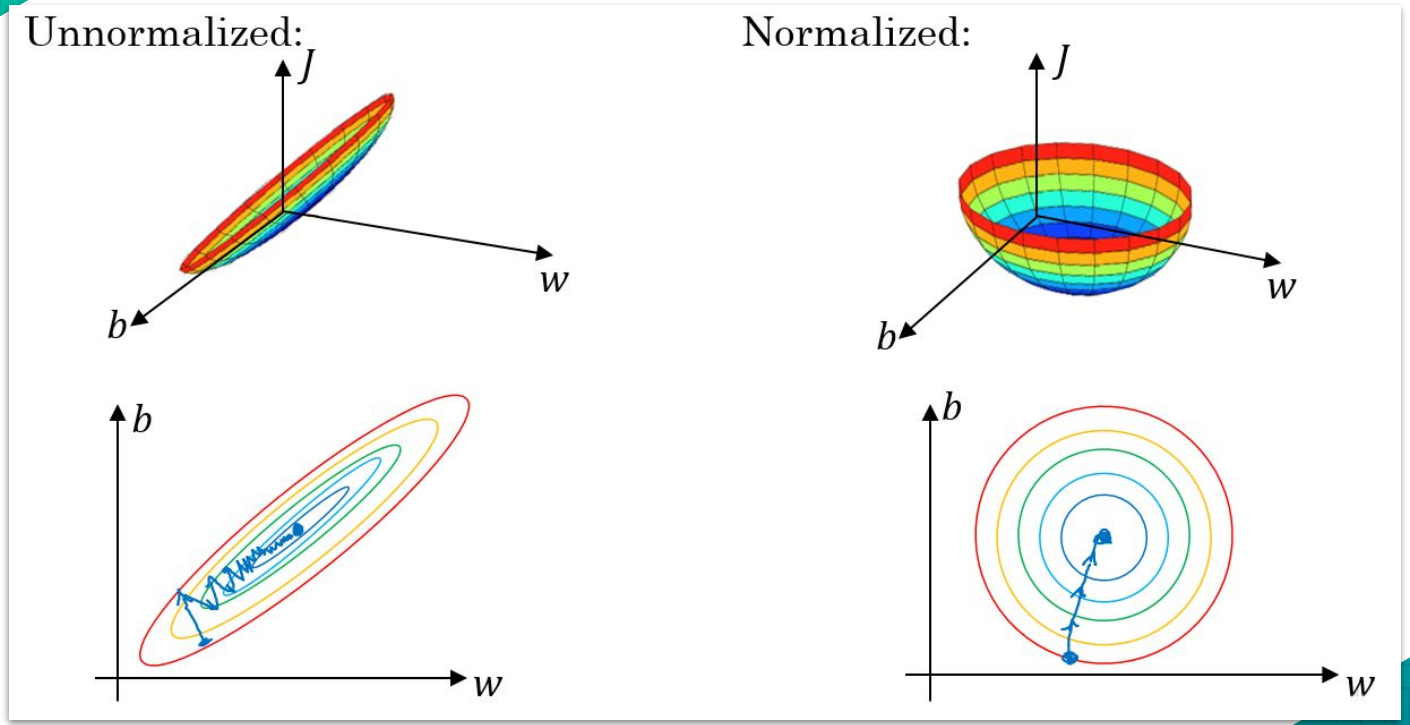
ML Concepts : Post Training Usage



ML Concepts : Transfer Learning



ML Concepts : Normalization



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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.

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

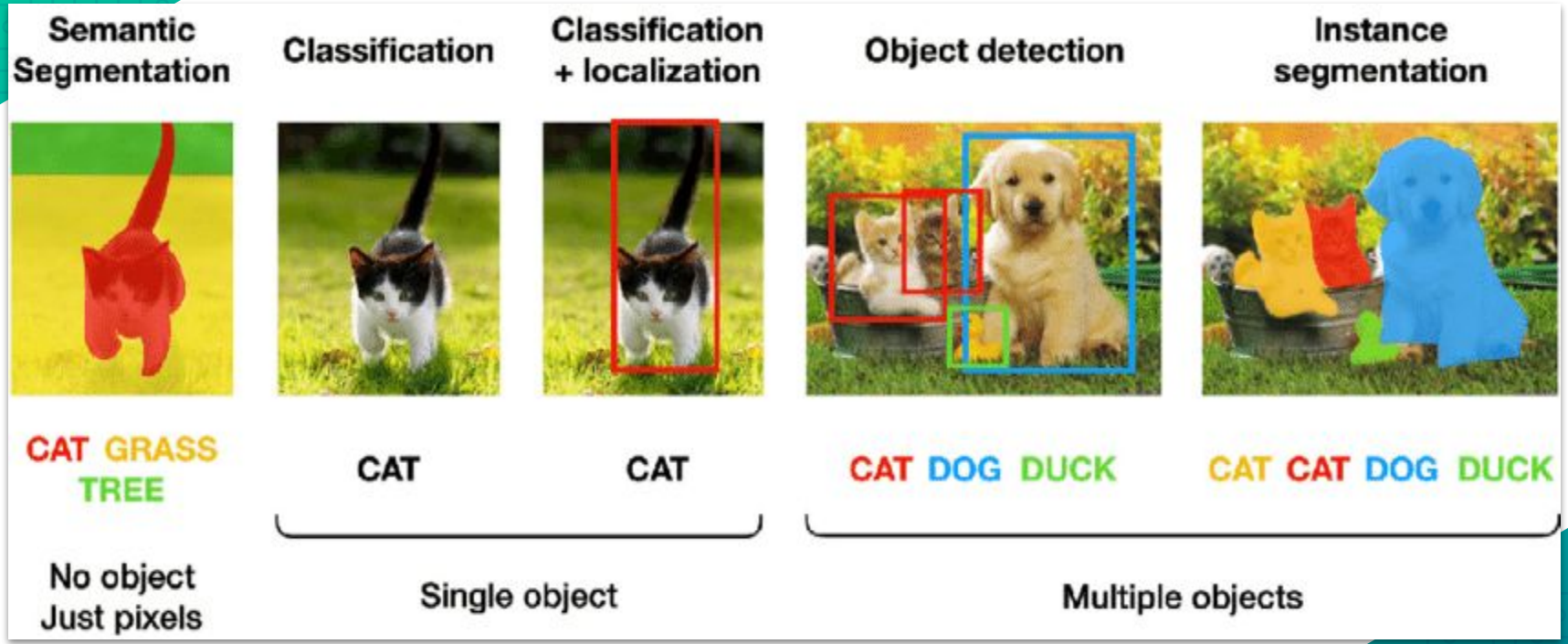
2001 – Two researchers at MIT introduced the first face detection framework (Viola-Jones) that works in real-time.

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

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

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

Computer Vision Subfields



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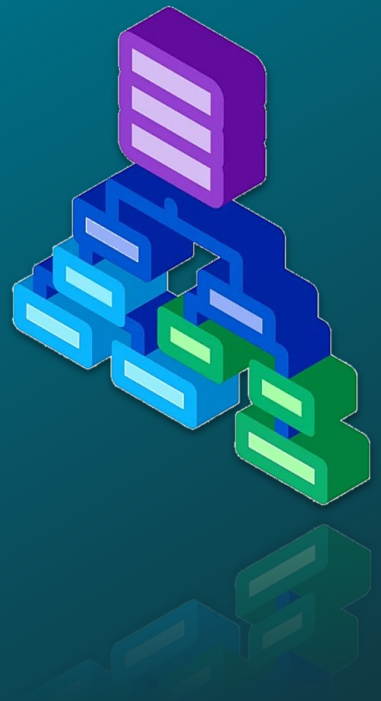
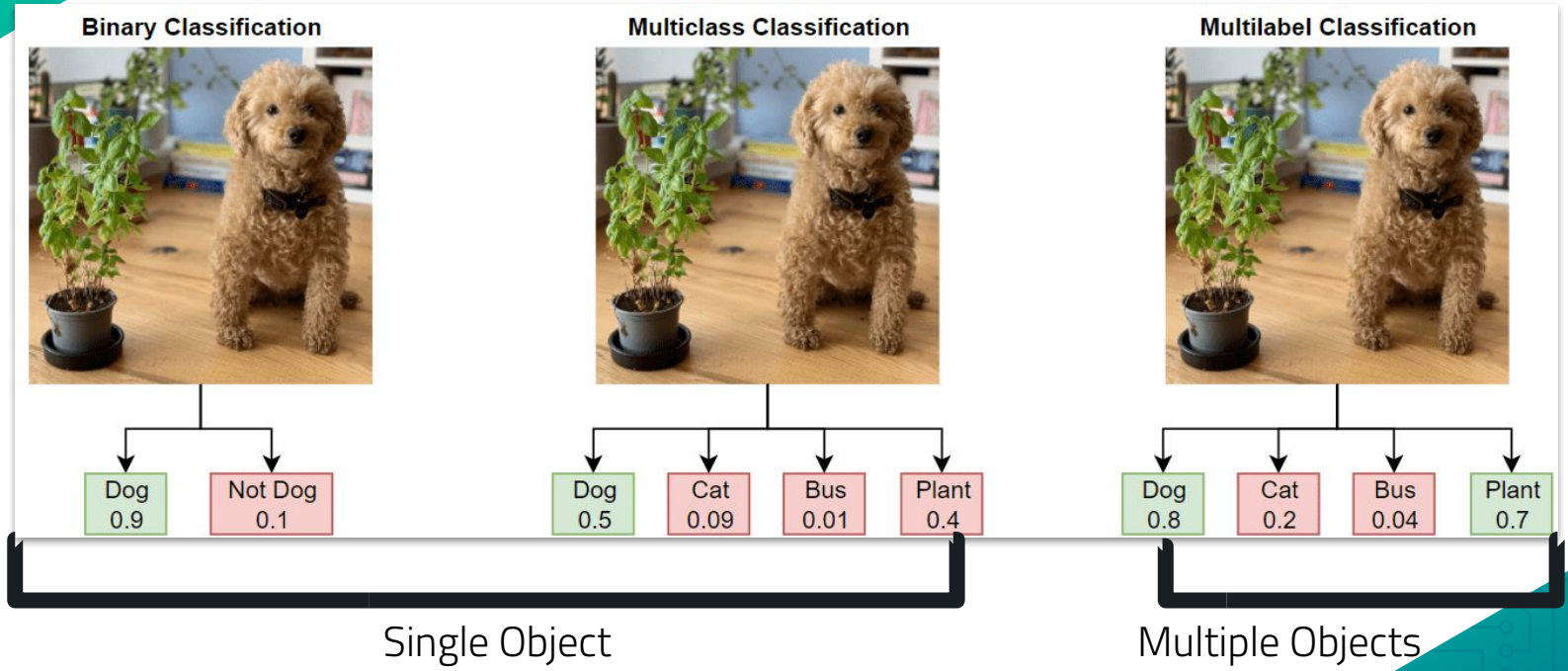
Computer Vision : Classification

Definition, Applications and Examples

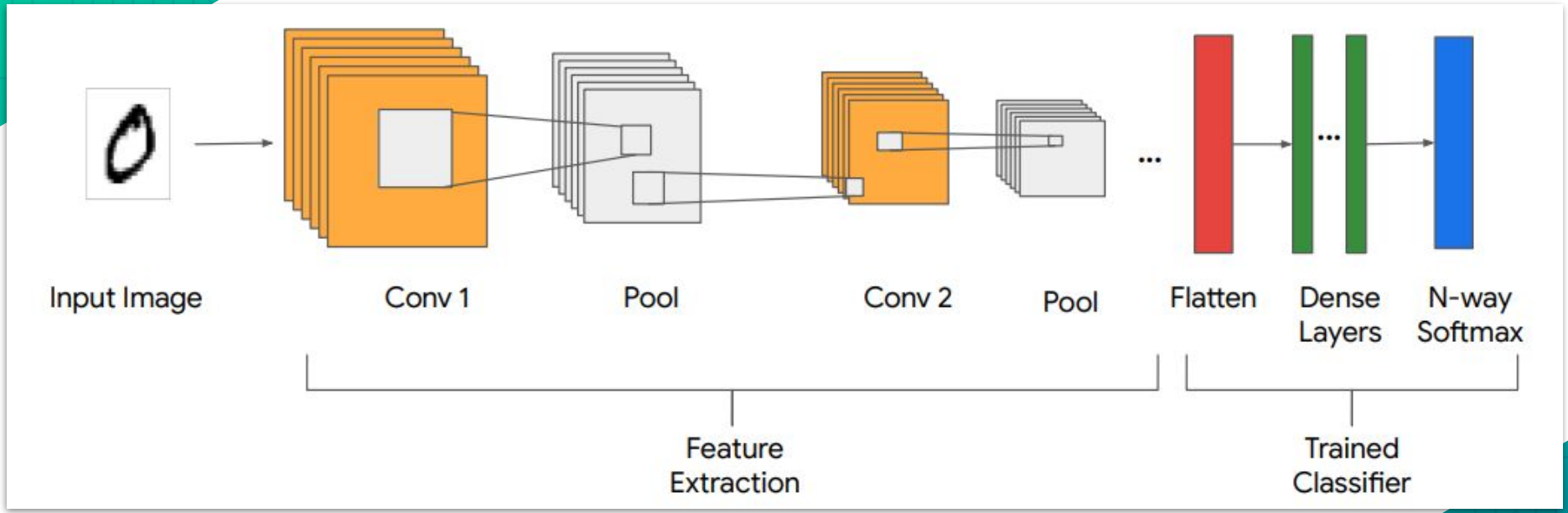


Classification Types



Classification Example

Classification Model Example



Classification Example Loss

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

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

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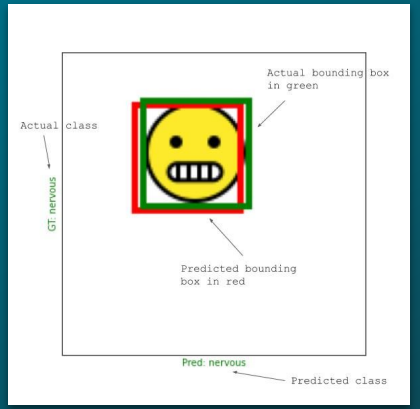
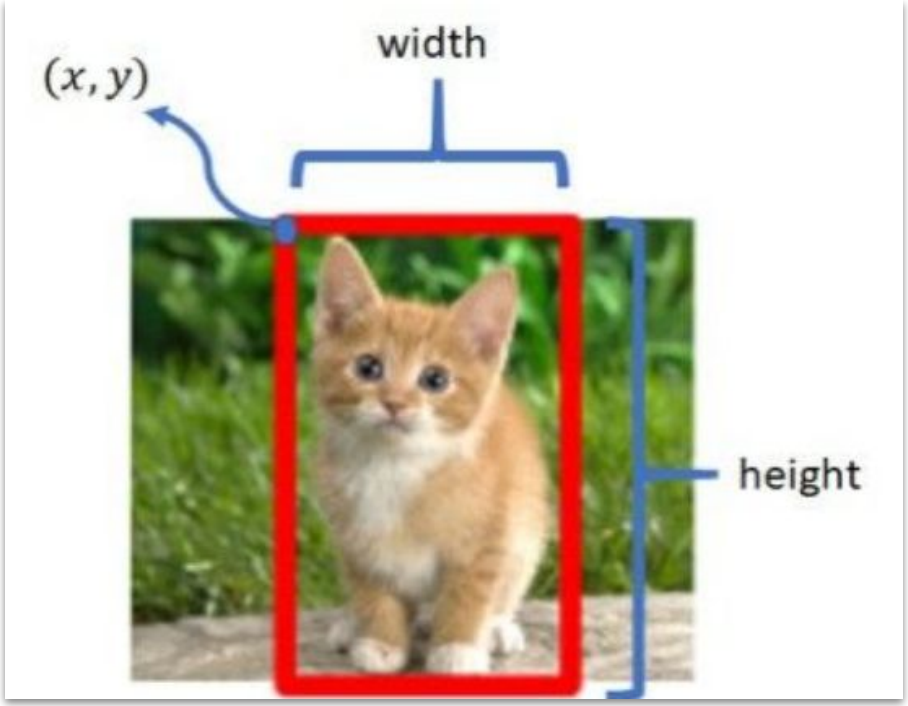
Computer Vision : Localization

Definition, Applications and Examples

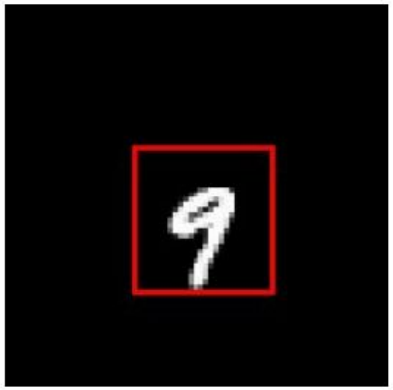


Localization



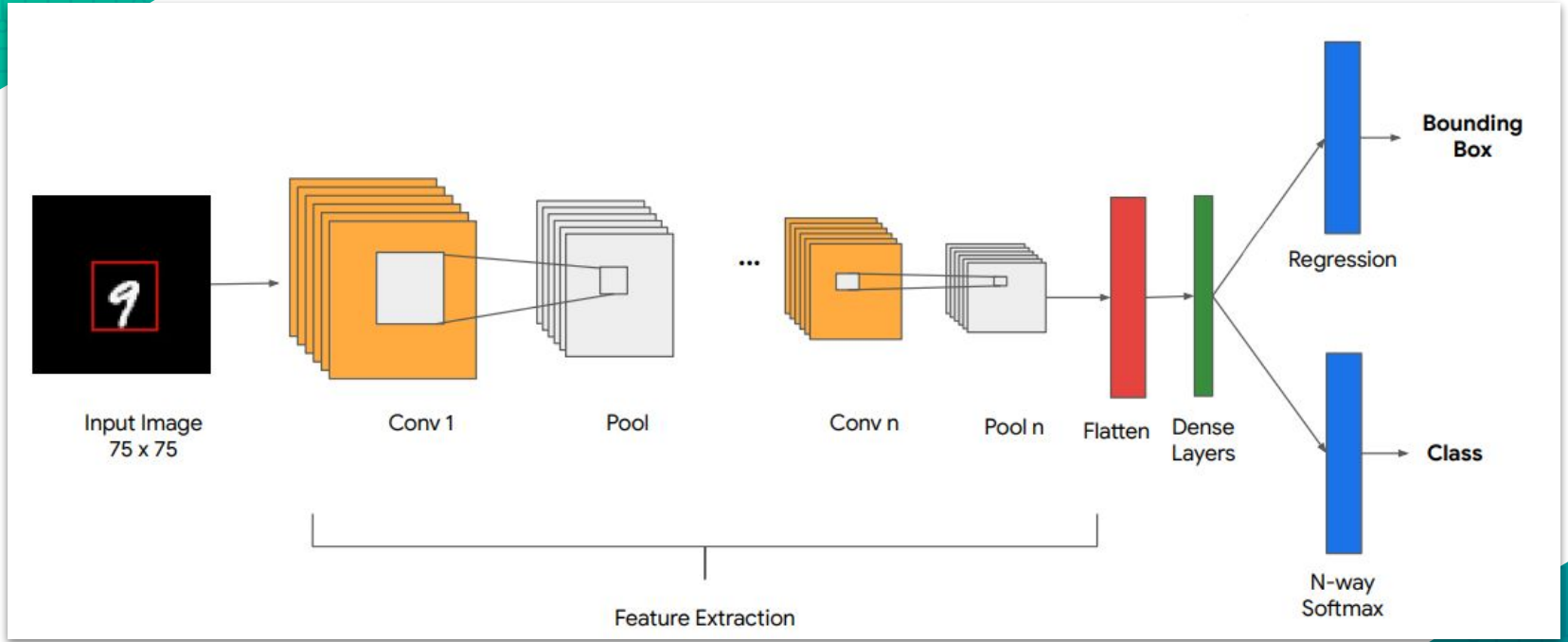
Localization Example

A sample from MNIST

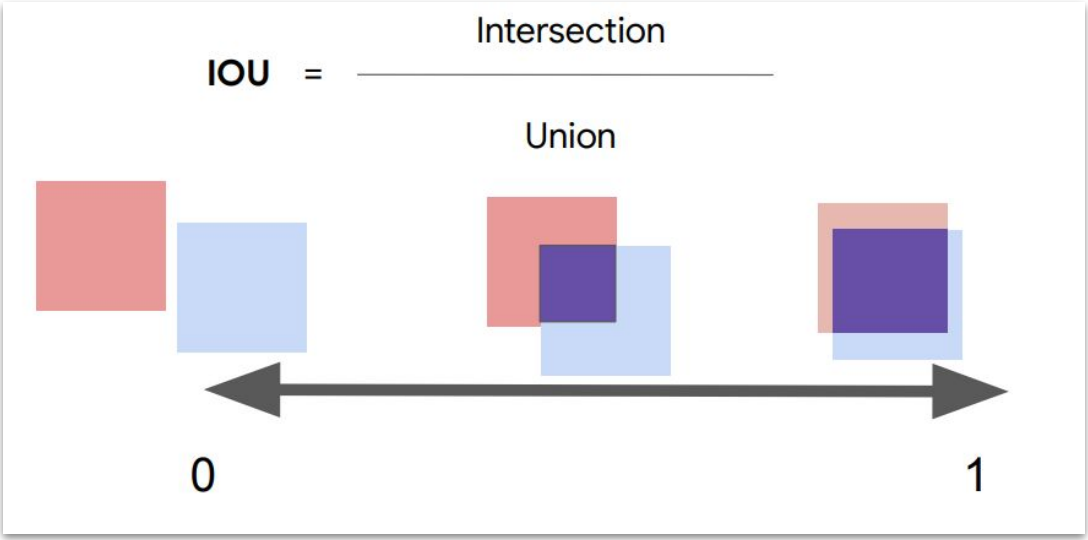


Sample pasted on a 75 x 75 black canvas

Localization Model Example



Localization Example Loss



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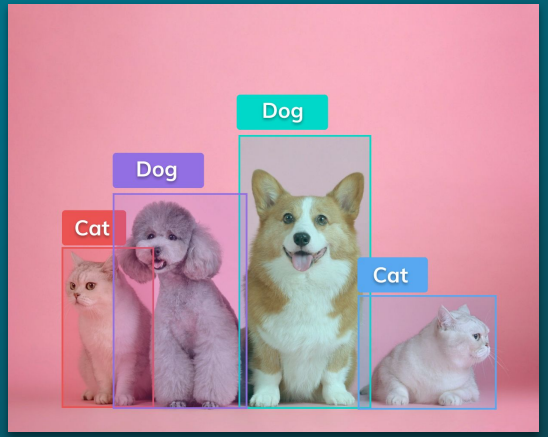
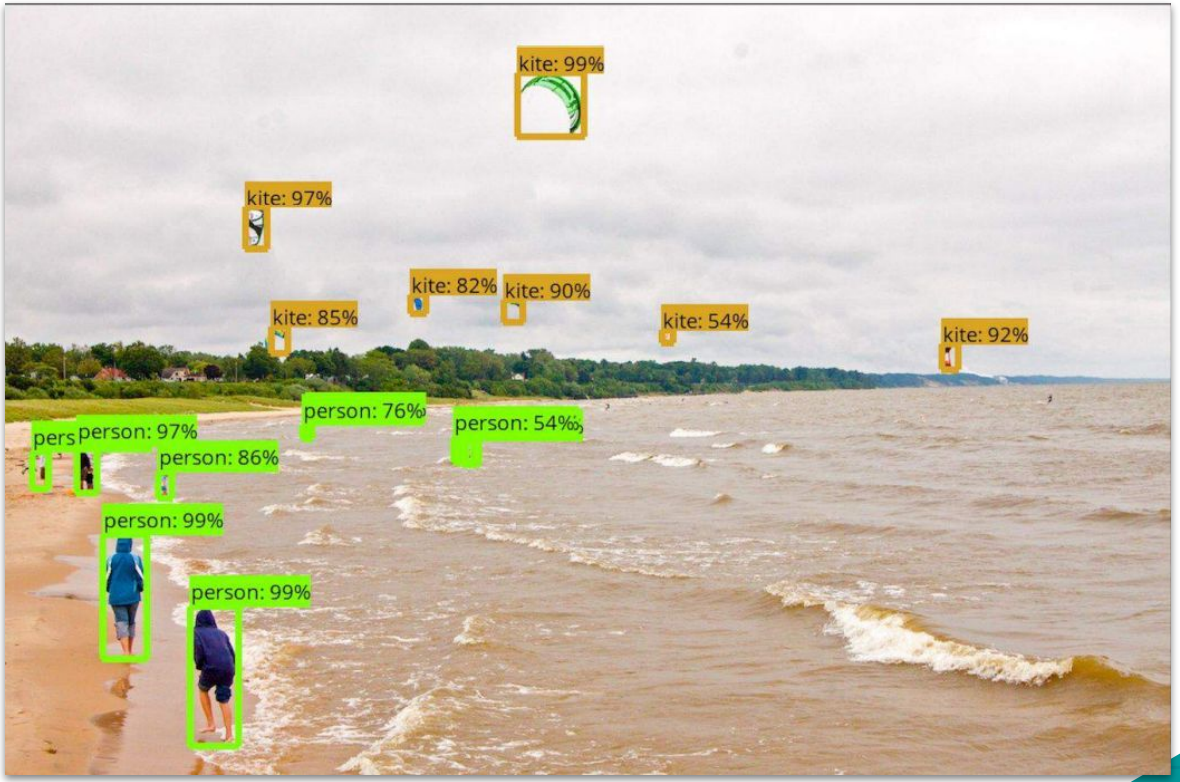
Computer Vision : Object Detection

Definition, Applications and Examples



Object Detection

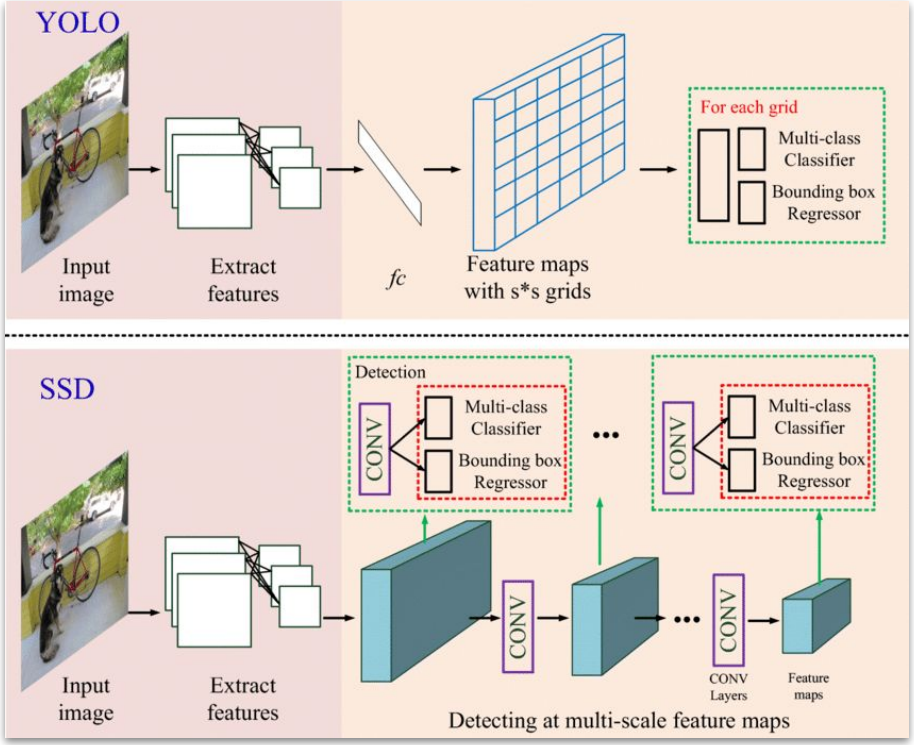


Object Detection Steps

Two phases :

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

Object Detection Model Examples



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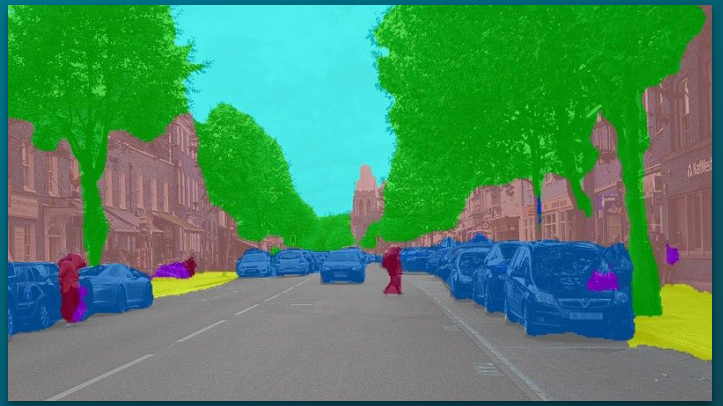


Computer Vision : Segmentation

Definition, Applications and Examples

Segmentation Architecture

224 x 224 x 3 (RGB image)

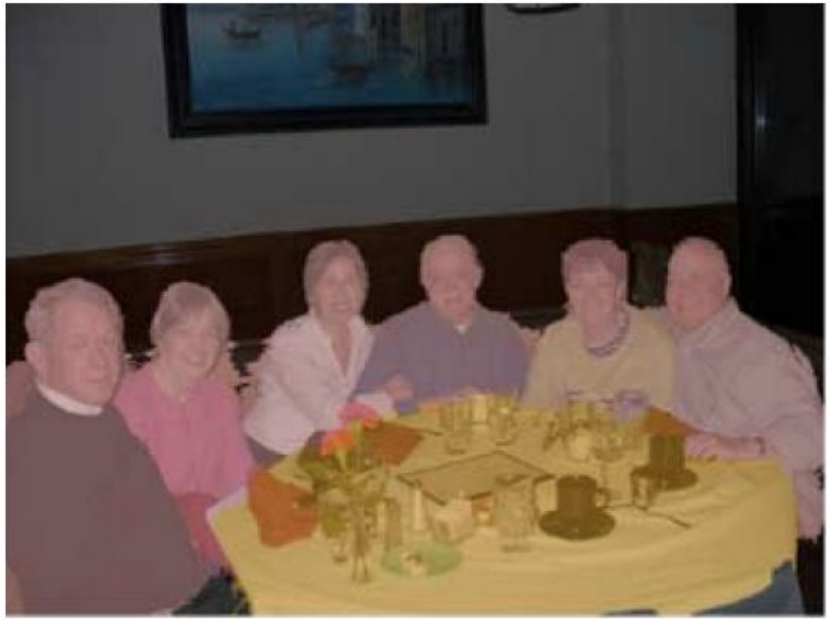
Encoder
(Feature Extractor, Down samples Image)

Downsampled Feature Map

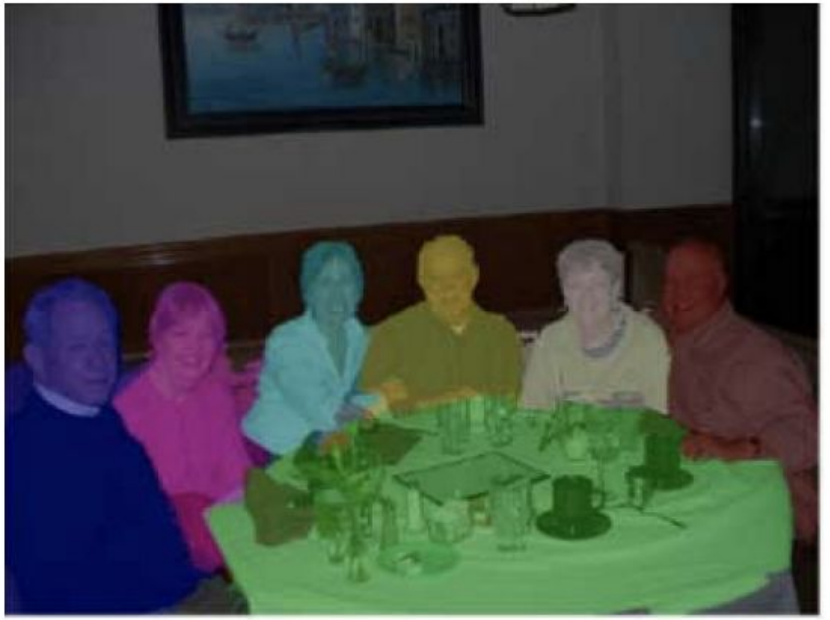
Decoder
(Up samples feature map, generates pixel-wise label map

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

Semantic Segm. VS Instance Segm.

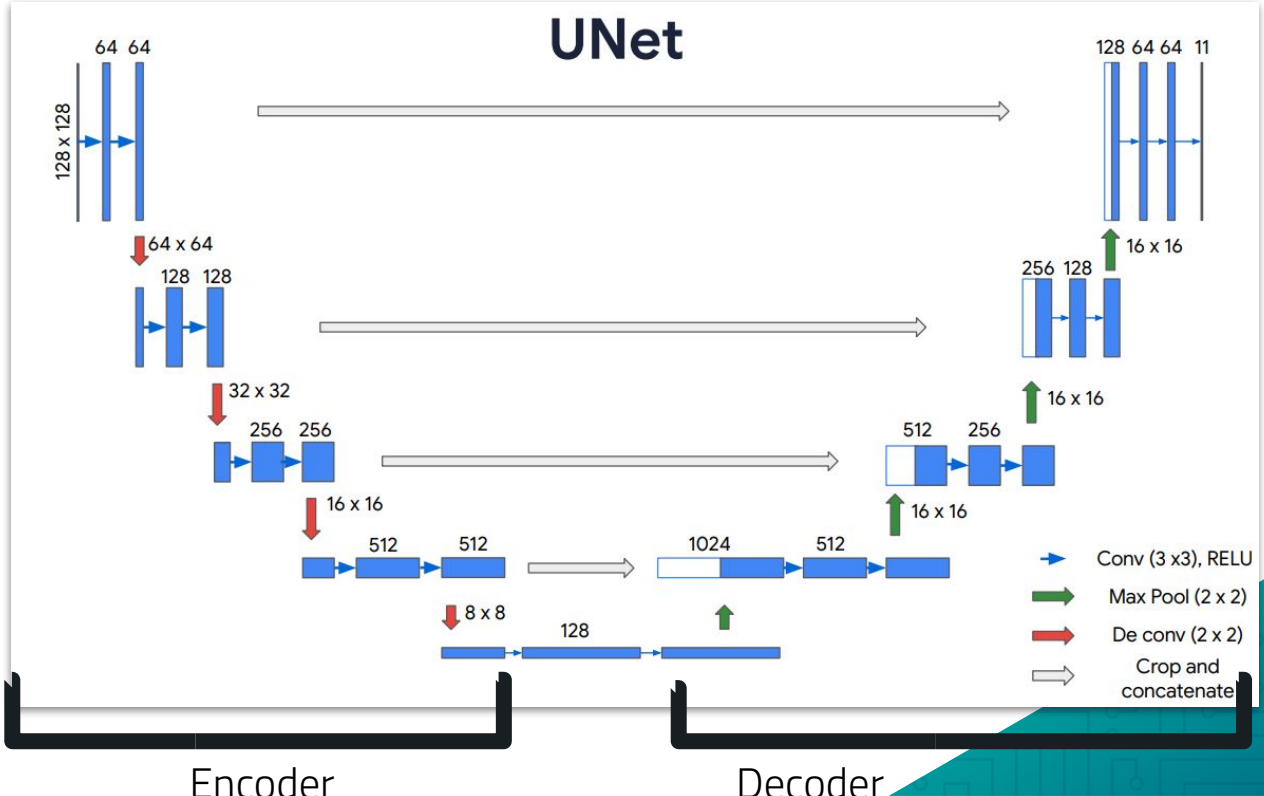


Semantic Segmentation

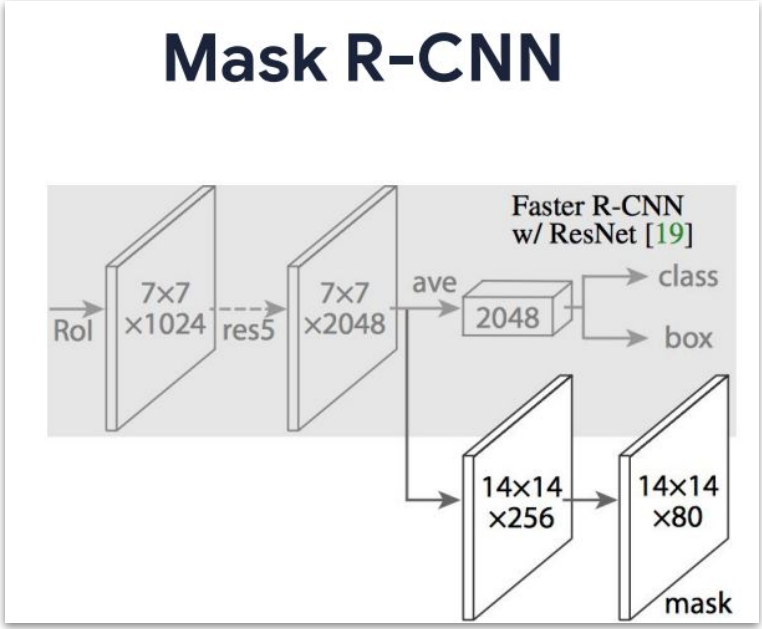


Instance Segmentation

Semantic Segmentation Model Example



Instance Segmentation Example Model

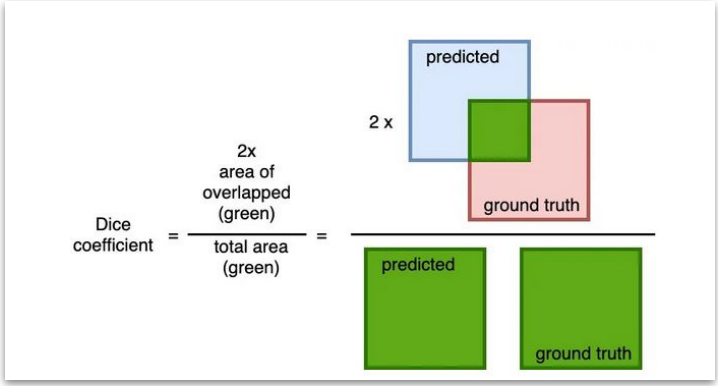


Segmentation Example Loss

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

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

Or



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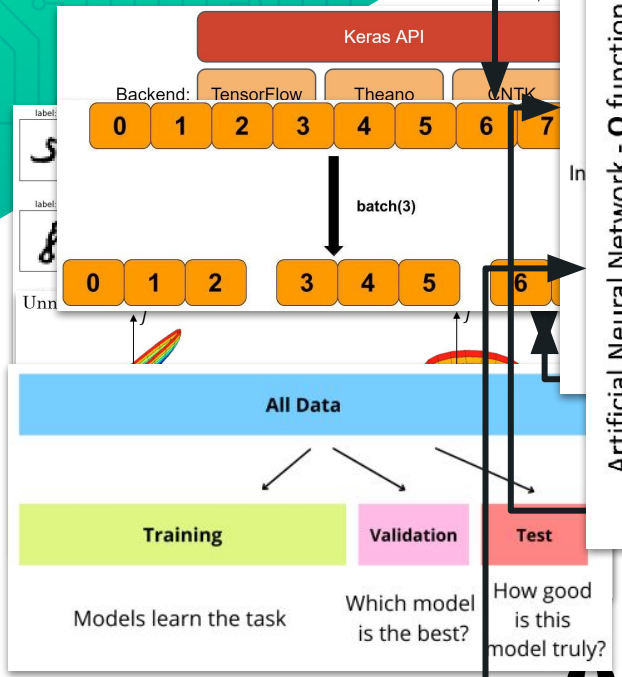
Workshop Presentation

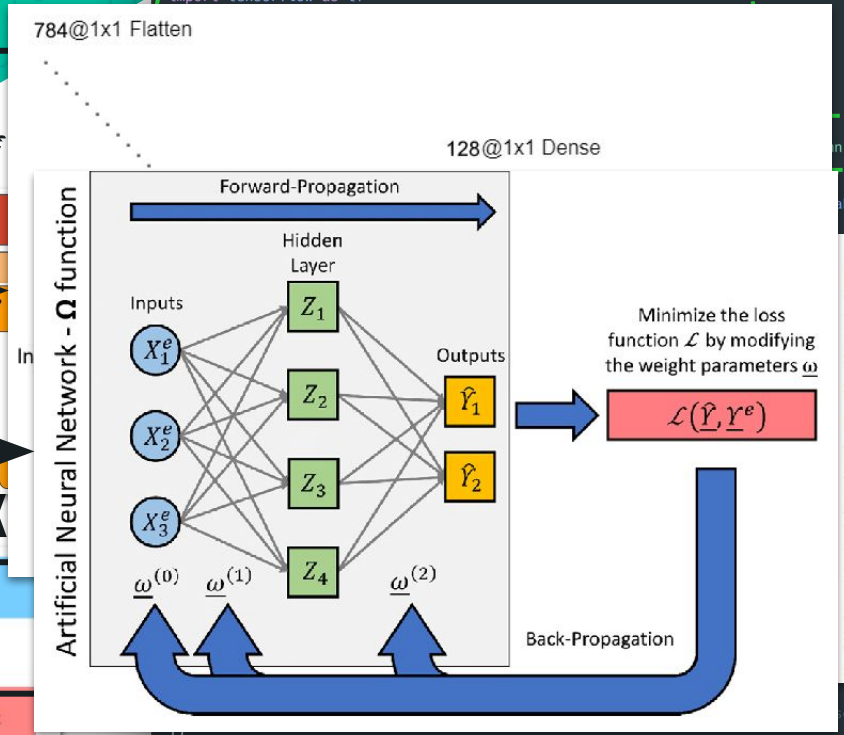
Explanation of the workshop

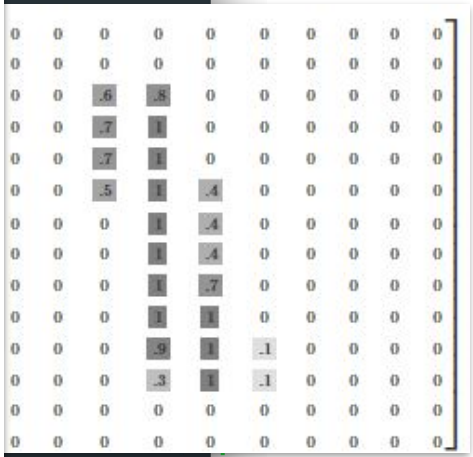
TensorFlow

Google’s open-source library for machine learning

TensorFlow Example

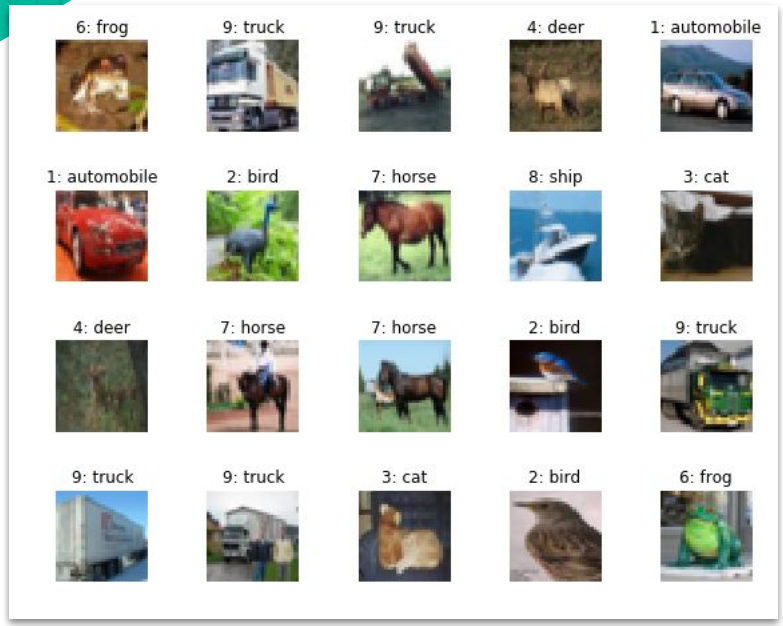






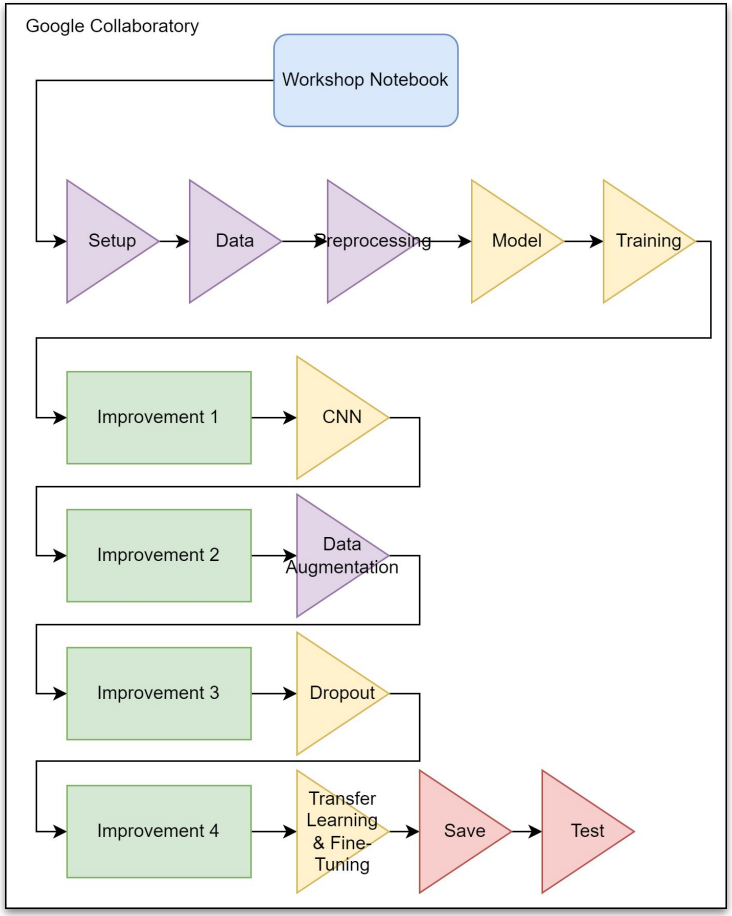
```
import tensorflow as tf
                                                    nist.load_data()
                                                    abels))
                                                    es) and softmax AF
# Define the loss function, the optimizer, and the metrics
model.compile(optimizer=Adam(),
              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

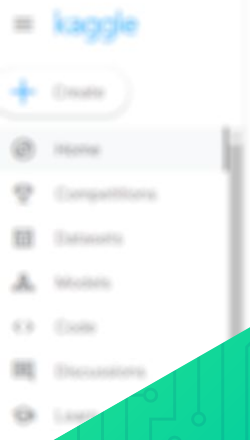


10

k

Kaggle Contest

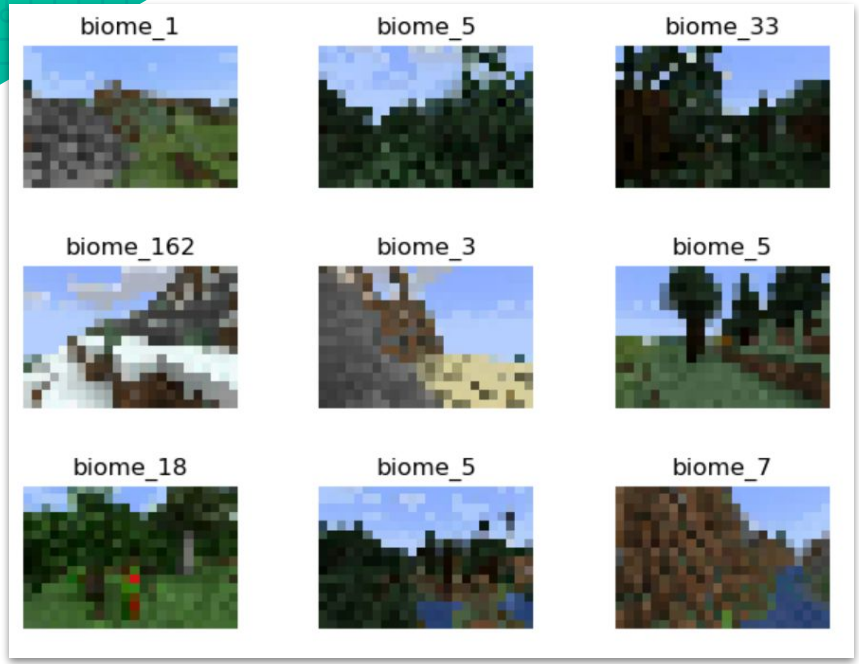
Contest subject & rules



Kaggle

Google's platform for data science competitions

Contest Subject



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

Xth July Competition Starts

2023

JULY AUGUST

Xth July Competition Ends

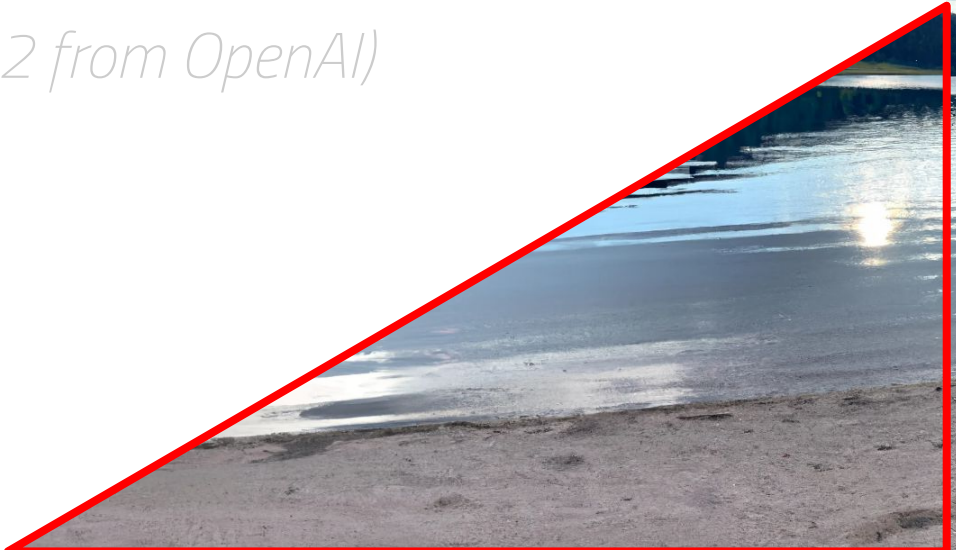
Contest Tips

- 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**

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

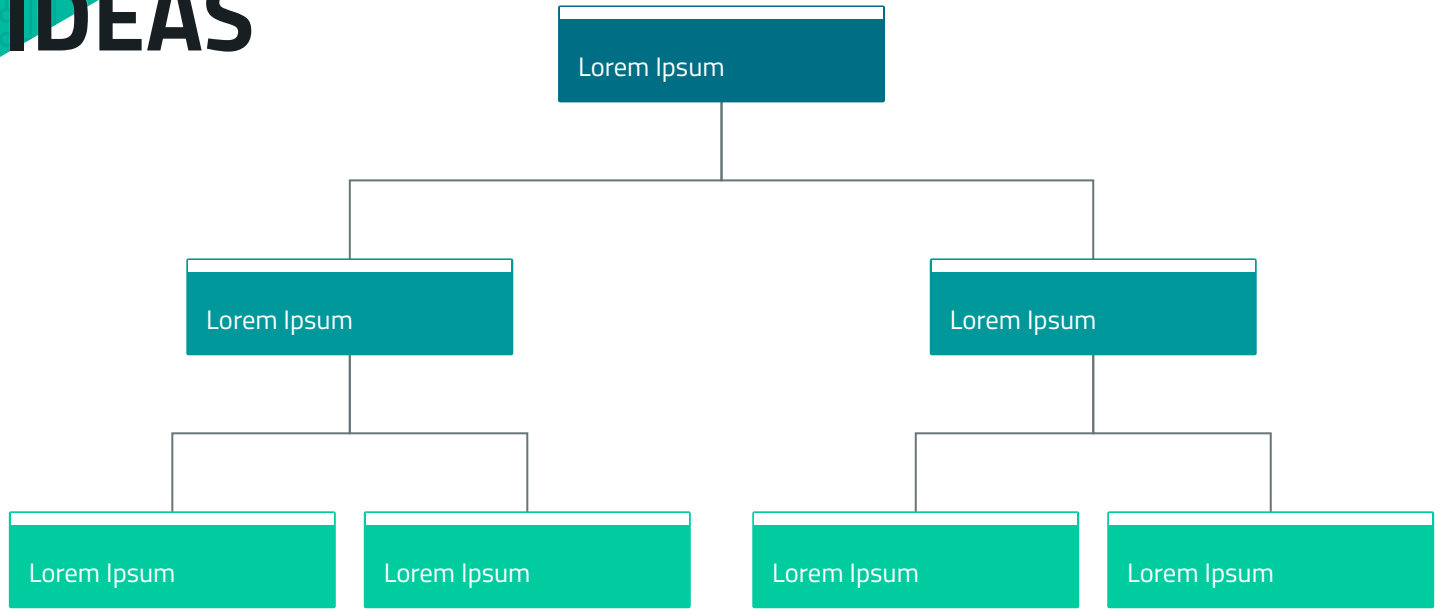
Is the color of blood, and because of this it has historically been associated with sacrifice, danger and courage.

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.

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/extra-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

Vestibulum congue tempus

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor. Donec facilisis lacus eget mauris.

Vestibulum congue tempus

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor. Donec facilisis lacus eget mauris.

Vestibulum congue tempus

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor. Donec facilisis lacus eget mauris.

LET'S REVIEW SOME CONCEPTS

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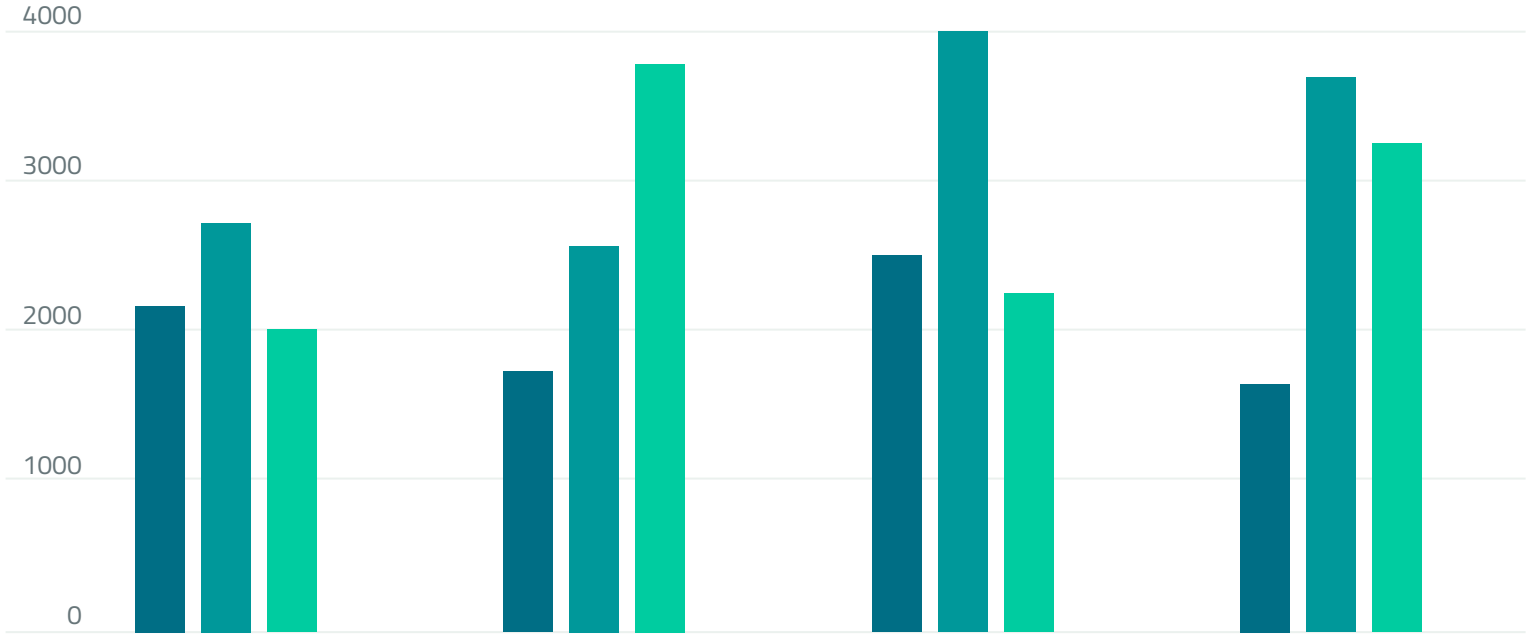

You can insert graphs from Excel or Google Sheets

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

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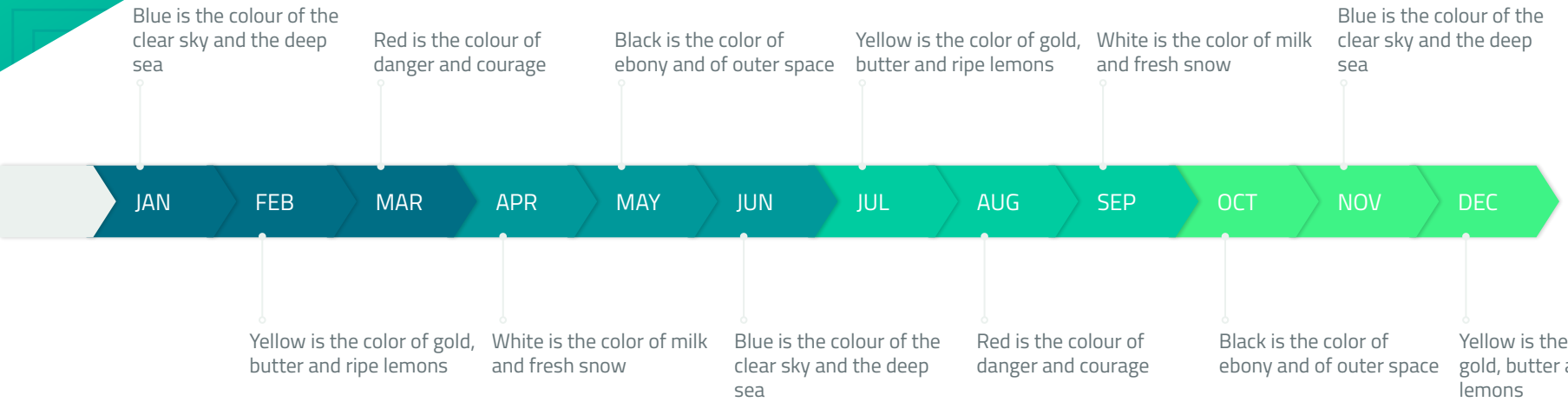
You don't need to keep this slide in your presentation. It's only here to serve you as a design guide if you need to create new slides or download the fonts to edit the presentation in PowerPoint®

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

1
Blue is the colour of the clear sky and the deep sea

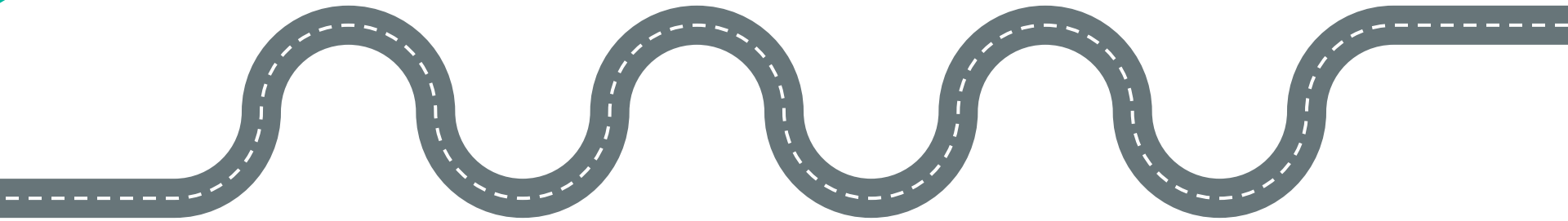
2
Yellow is the color of gold, butter and ripe lemons

3
Red is the colour of danger and courage

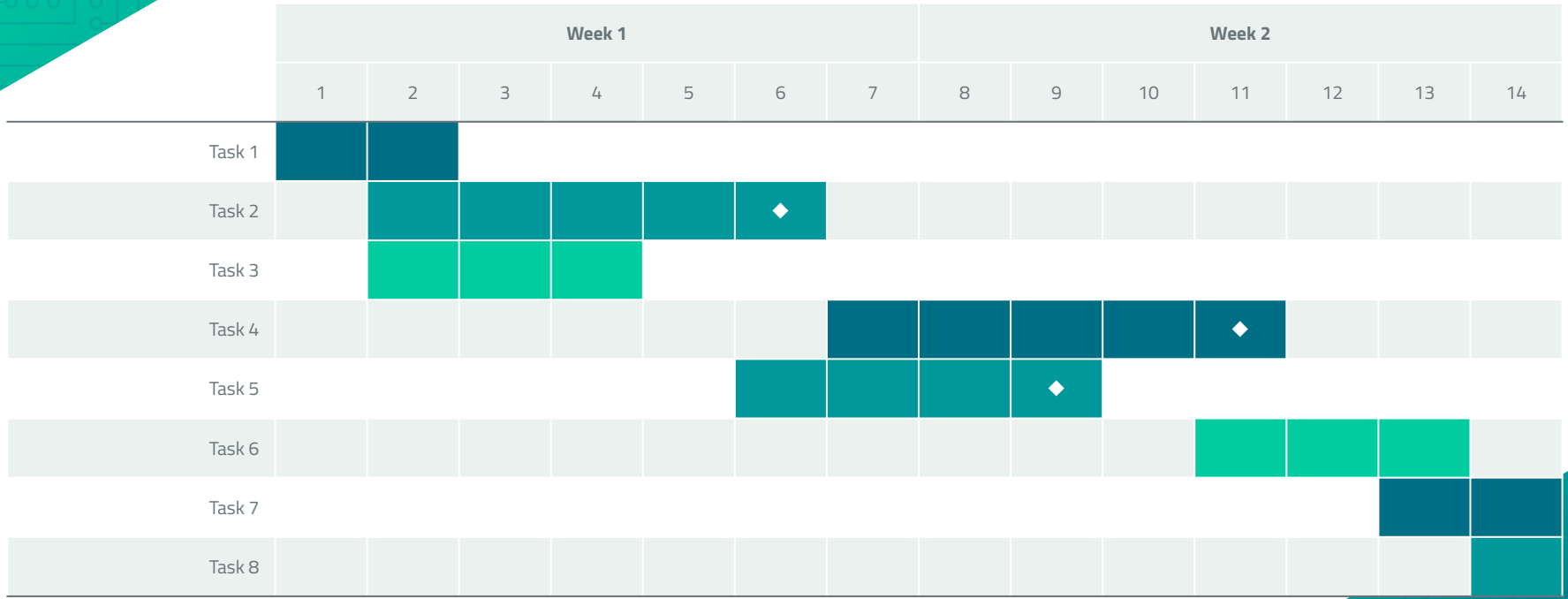
4
White is the color of milk and fresh snow

5
Black is the color of ebony and of outer space

6
Blue is the colour of the clear sky and the deep sea



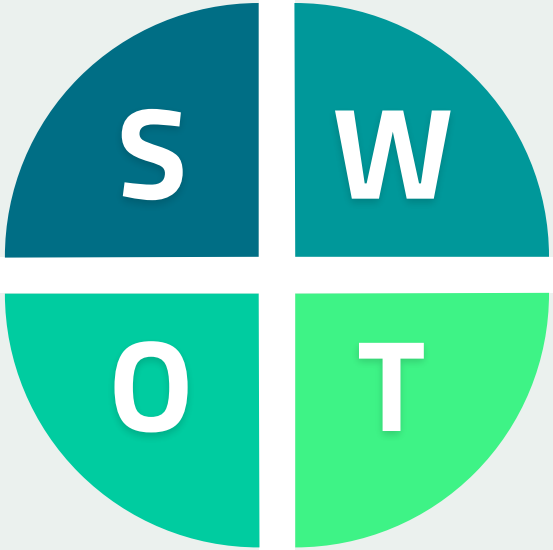
GANTT CHART


Week 1
Week 2
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Task 1
Task 2
Task 3
Task 4
Task 5
Task 6
Task 7
Task 8

SWOT ANALYSIS

STRENGTHS

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



WEAKNESSES

Yellow is the color of gold, butter and ripe lemons

Black is the color of ebony and of outer space

OPPORTUNITIES

White is the color of milk and fresh snow

THREATS

BUSINESS MODEL CANVAS

Key Partners

Insert your content

Key Activities

Insert your content

Key Resources

Insert your content

Value Propositions

Insert your content

Customer Relationships

Insert your content

Channels

Insert your content

Customer Segments

Insert your content

Cost Structure

Insert your content

Revenue Streams

Insert your content

FUNNEL

Insert your content

Insert your content

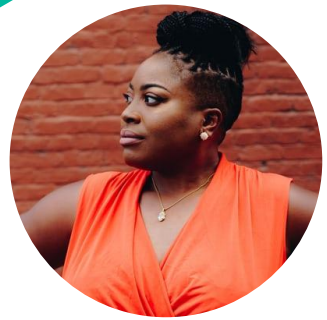
Insert your content

Insert your content

Insert your content

Insert your content

TEAM PRESENTATION



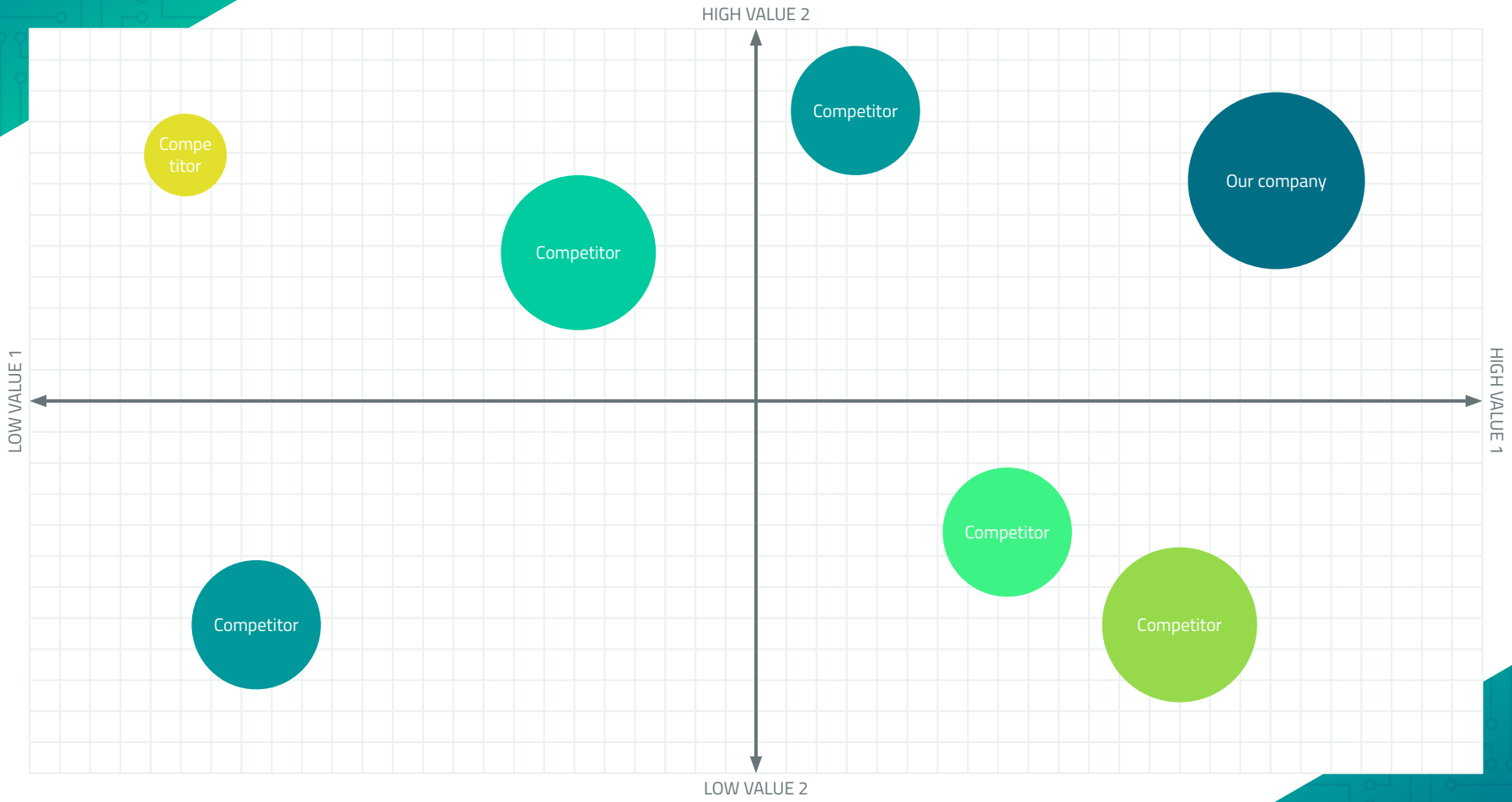
Imani Jackson
JOB TITLE
Blue is the colour of the clear sky and the deep sea

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	Task	Task	Task	Task	Task	Task
10:00 - 10:45	Task	Task	Task	Task	Task	Task	Task
11:00 - 11:45	Task	Task	Task	Task	Task	Task	Task
12:00 - 13:15	✔ Free time	✔ Free time	✔ Free time	✔ Free time	✔ Free time	✔ Free time	✔ Free time
13:30 - 14:15	Task	Task	Task	Task	Task	Task	Task
14:30 - 15:15	Task	Task	Task	Task	Task	Task	Task
15:30 - 16:15	Task	Task	Task	Task	Task	Task	Task

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- Resize them without losing quality.
- Change fill color and opacity.
- Change line color, width and style.

Isn't that nice? :)

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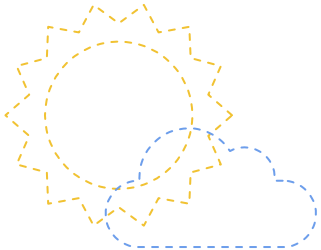

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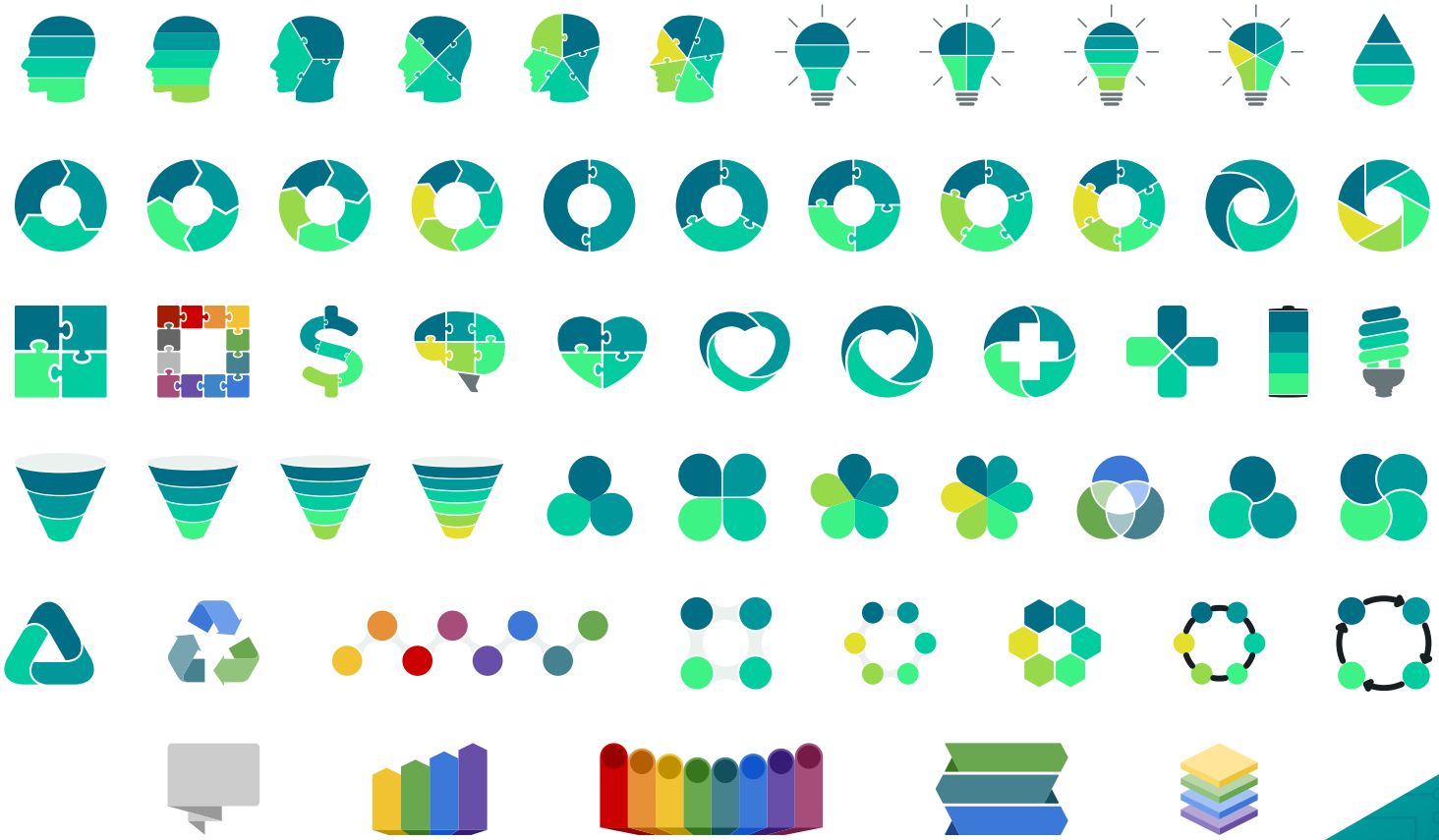
slidescarnival.com/extra-free-resources-icons-and-maps

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...

Slides Carnival

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