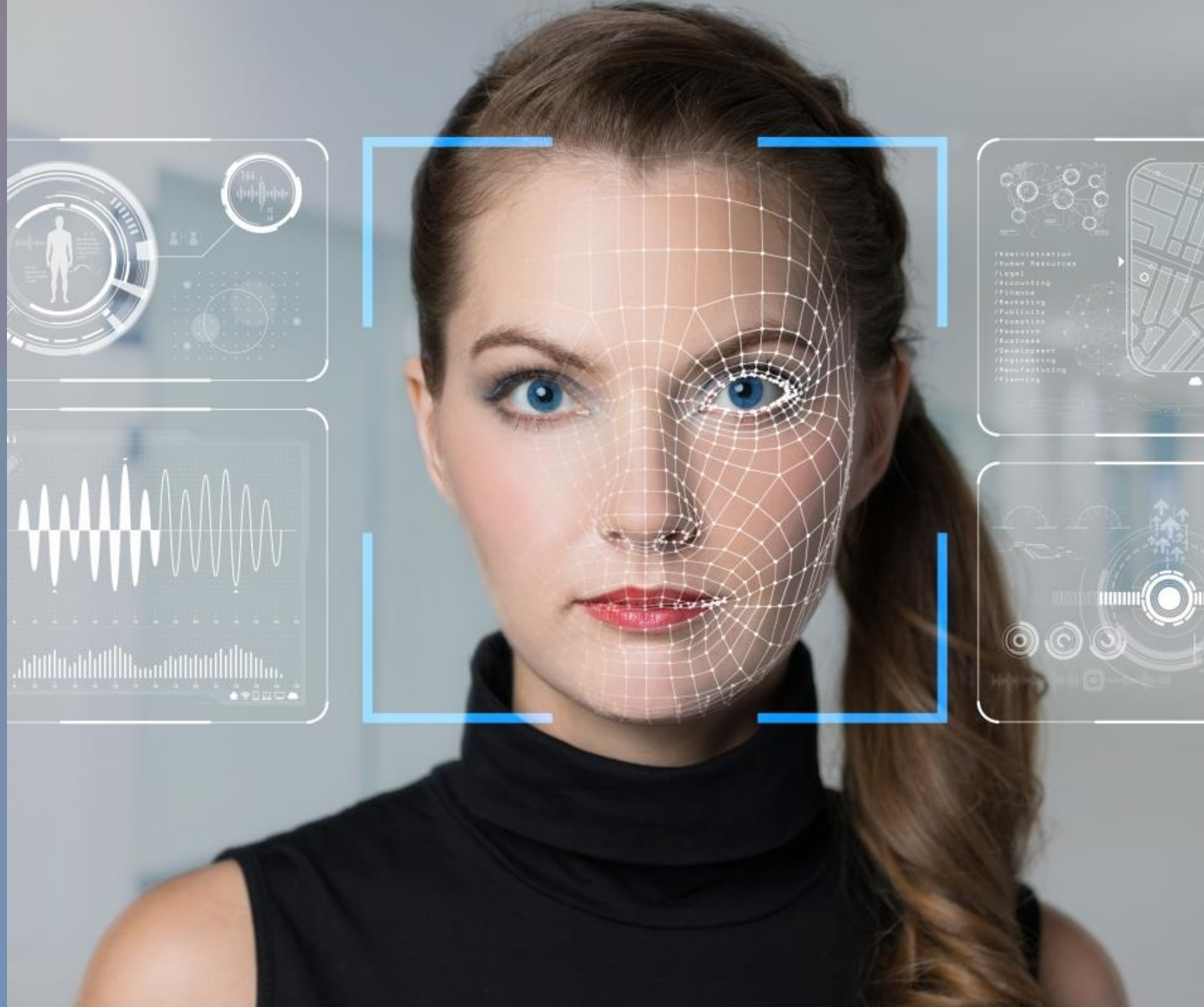ELENA CAMUFFO
1234370

PROJECT #3
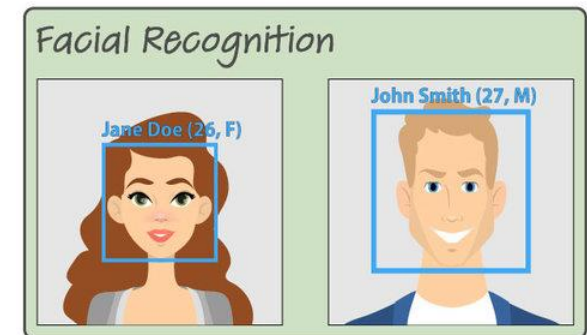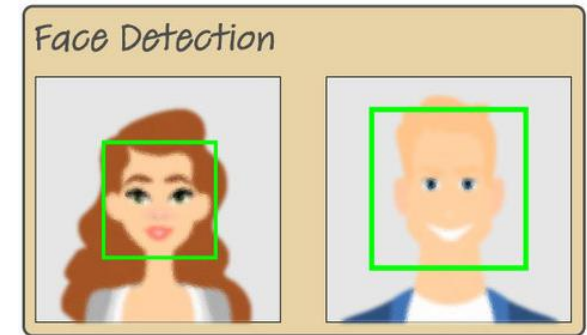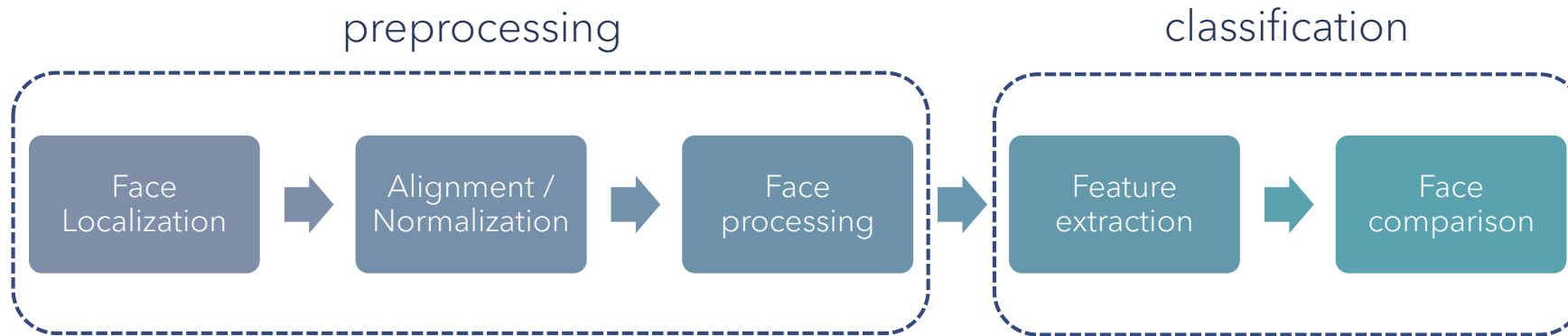
FACE
RECOGNITION

INTRODUCTION

- FACE DETECTION AND RECOGNITON TASK:
  - Very spread and known technology.
  - Used in many applications, e.g.:
    - Video Sourveillance
    - Smartphones' applications

- OBJECTIVE OF THIS PROJECT:
  - Build a face recognition system
  - Dataset of 13 people from Hollywood provided
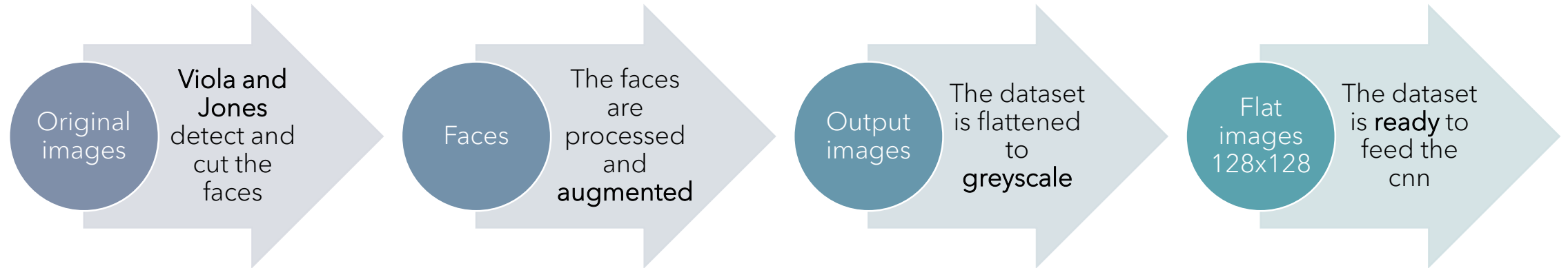
OVERVIEW

- The project is developed following the standard workflow. The involved phases are:

- PRE-PROCESSING
  - Matlab + Python
  - Greyscale 128x128
  - Base and Modified

- TRAINING
  - Base CNN
  - Extended CNN
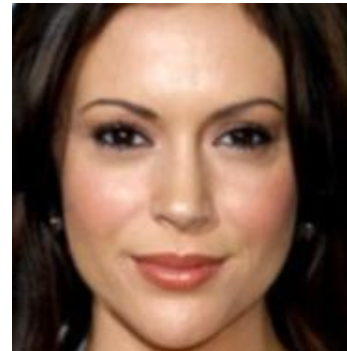
- TESTING
  - Images
  - Modified images
  - Videos

preprocessing

classification

Face Localization → Alignment / Normalization → Face processing → Feature extraction → Face comparison

PRE-PROCESSING

Original images → **Viola and Jones** detect and cut the faces → Faces → The faces are processed and **augmented** → Output images → The dataset is flattened to **greyscale** → Flat images 128x128 → The dataset is **ready** to feed the cnn

Dataset provided

Training and Test sets
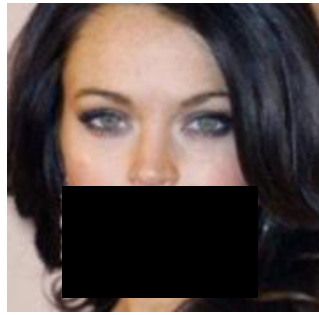
PRE-PROCESSING

- MODIFICATIONS
  - Mask
  - Coronavirus
  - Blurred eyes
  - Sunglasses

- Also these datasets are divided into **training and test sets**.

- The procedure is the same, carried out using **Matlab and Python**.
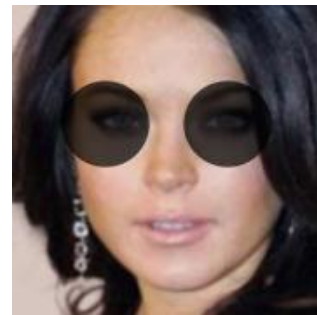

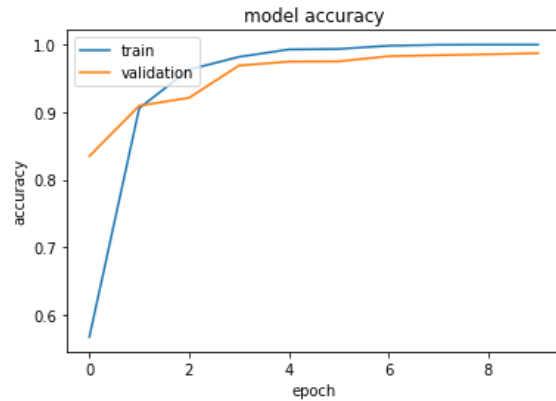(a) Original   (b) Masked mouth   (c) Masked   (d) Blurred eyes   (e) Darken eyes

TRAINING

model accuracy

- The CNN is composed of 2 convolutional layers + 2 flat layers.

- Training + Validation split (0.2)

- **10 epochs** are enough to achieve good accuracy on the training (almost 100%) and validation (98%) sets.

Training Set x10 → CNN → Model
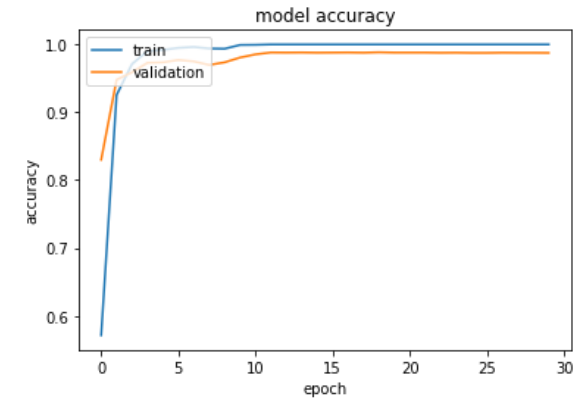
TRAINING EXTENDED

- The procedure is repeated with the **extended dataset**:
  - Training set augmented
  - Modified training sets

- **30 epochs** are here needed to achieve good results.

Training Set
x10

Modified
Training Sets

CNN

Model

RESULTS – IMAGES

- ORIGINAL TEST SET

  - Good results for both the models.

- MODIFIED TEST SETS

  - Bad results base model.

  - Good results extended model.

| Test Set	Base		Extended	
	Accuracy	**Loss**	**Accuracy**	**Loss**
Original	93.15%	0.3863	92.71%	0.5127
Blurred Eyes	63.76%	2.2732	89.68%	0.7752
Sun Glasses	50.21%	5.7826	88.53%	0.7614
Masked mouth	37.78%	8.1835	90.83%	0.7505
Coronavirus	28.82%	17.6496	86.51%	0.7636

RESULTS – VIDEOS

- The **pre-processing** of the face is performed in Real-Time.

- REAL-TIME PREDICTION
  - on **all the faces**
  - of **each frame** of the video

- PREDICTION ON ENTIRE VIDEO considering:
  - Number of **consecutive** frames.
  - Total number of frames w.r.t. length of the video.
  - Threshold on prediction's confidence.
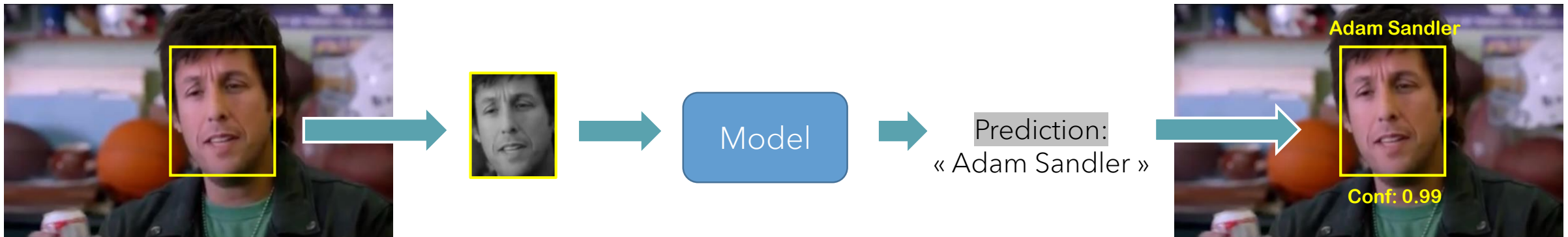
DEMO

Prediction: «Bruce Willis»

CONCLUSIONS

- Simple CNN but good results.

- A **good pre-processing** leads to better results.

- The TRAINING SET impacts the results:
  - Girls of this training set similar, sometimes confused
  - The model trained with the **extended** training set achieves better results.
    - It is important to have **high variablity** inside the training set.

- The images **masked** achieve anyway poor results than the original.

- For VIDEOS:
  - Better high definition, with few people.
  - Viola and Jones detect in many cases non-faces.
  - Best predictions for frontal faces.