Facial Emotion Detection

WHY?

Drownsiness of Drivers/Pilots
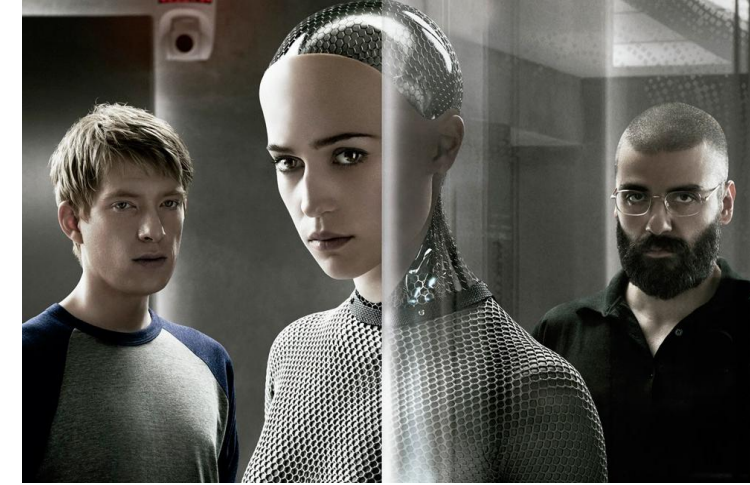
Students / Lack of interest

Kidnapping or loss of a person

Lie detector (examination)

Behavior of psychopaths

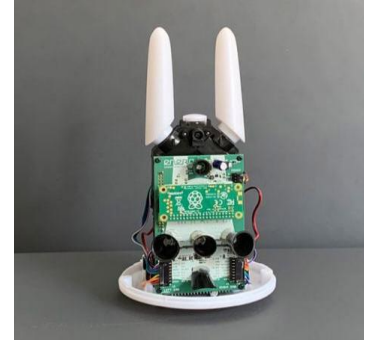Children with communication disabilities

CHALLENGES

Real | **Virtual**

Ethics_Domains	Time_Cost
Capture	Model complexity
Light, reflections...	Data representation, Preprocessing...

RECOGNIZE

 Happy
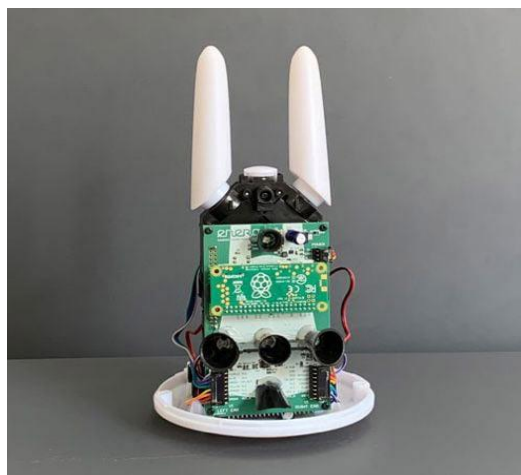
 Neutral

 Sad

 Surprise

GOAL
The most efficient model in terms of time and cost. The most suitable for the real world.

PROBLEM TO SOLVE:
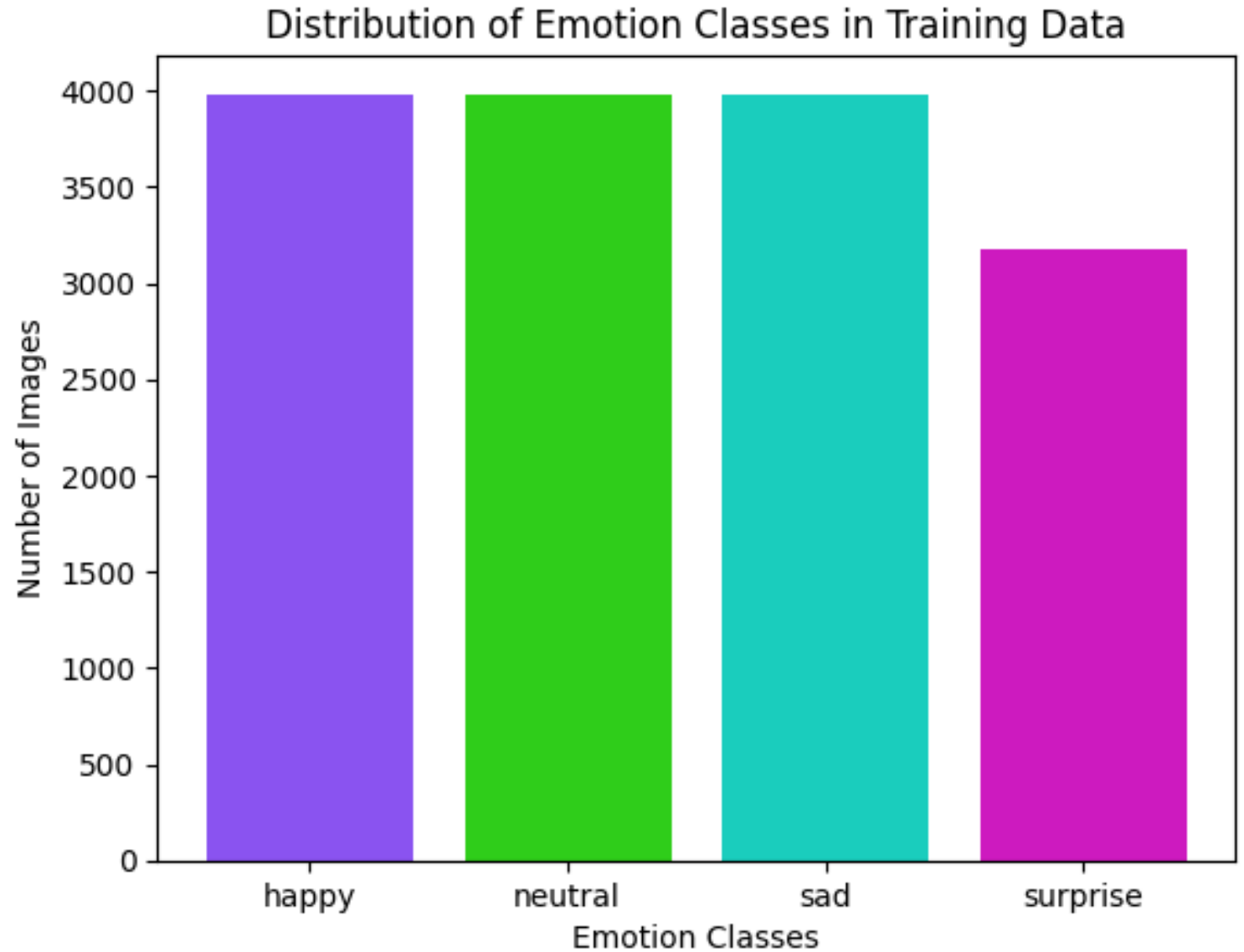
**Data representation
& preprocessing**

Quality & Diversity of the dataset

Features Extraction

Labeled Emotion & Annotation

Performance Model

Distribution of Emotion Classes in Training Data
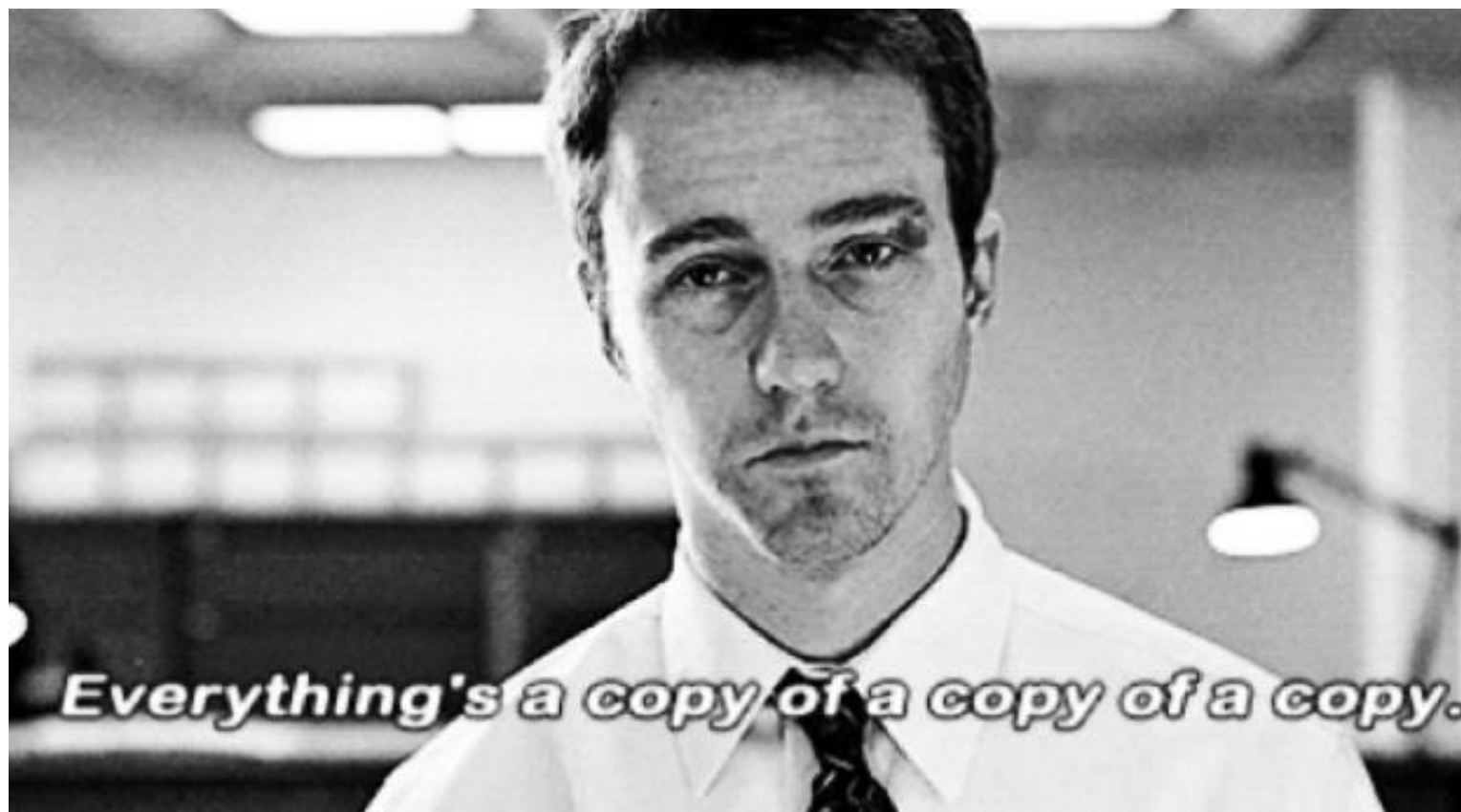
In gray

48*48*3 =

1 Channel = Faster = Cheaper!

Ok, but

ANN (Artificial Neural Nerwork) alone for feature detection = BAD

Everything's a copy of a copy of a copy.

41%

```
Epoch 20/20
473/473 - 35s - 75ms/step - accuracy: 0.4138 - loss: 1.2599 - val_accuracy: 0.4794 - val_loss: 1.1777
```
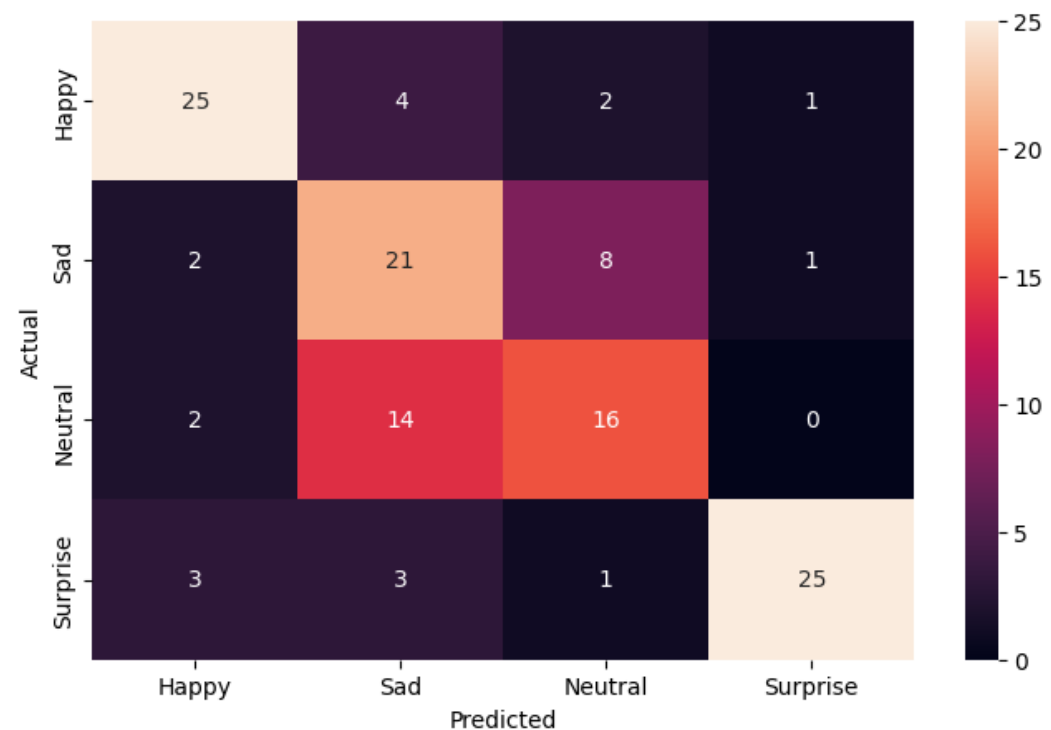
CNN
(Convolutional Neural Networks)

	precision	recall	f1-score	support
Happy	0.78	0.78	0.78	32
Sad	0.50	0.66	0.57	32
Neutral	0.59	0.50	0.54	32
Surprise	0.93	0.78	0.85	32
accuracy			0.68	128
macro avg	0.70	0.68	0.68	128
weighted avg	0.70	0.68	0.68	128

From scratch

+ Full control: Design the architecture

+ Lighter model

74%

- **Data:** Needs a LOT
- **Settings:** Longer training time

```
Epoch 20/20
473/473 - 137s - 289ms/step - accuracy: 0.7447 - loss: 0.6334 - val_accuracy: 0.7338 - val_loss: 0.6887
```

Transfer Learning

EfficientNet

TIME?
MONEY?
to invest in the final project

"TARGET"?
is static or moving.

❄️ **Freezing layers before the `Flatten` (or `GlobalAveragePooling`) layer > feature extractor**.

77% (only 5 Epoch)

```
Epoch 5/5
473/473 - 194s - 410ms/step - accuracy: 0.7703 - loss: 0.5741 - val_accuracy: 0.1605 - val_loss: 1.9668
```

- ❄️ **Freezing layers before the `Flatten` (or `GlobalAveragePooling`) layer > feature extractor**.

- **Keeping the classifier layers trainable. Here, overfitting but has one of the best potentials**

PROPOSED
MODEL SOLUTION

A CNN MODEL from Scratch

Flexible, Adaptative, Personalized

Widespread use in the future

TRANSFER LEARNING (EfficientNet)

Freezing base layers and
fine-tune only the top (head) layers

Fast and lightweight (especially B0–B3)
Captures complex features with fewer parameters

Final proposal based on

ANN accuracy: 0.4233 val_accuracy: 0.46177 test:accuracy: 0.5490

CNN1 accuracy: 0.6943 val_accuracy: 0.6710 test:accuracy: 0.7604

CNN2 accuracy: 0.7505 val_accuracy: 0.7372 test:accuracy: 0.7812

CNN3 accuracy: 0.6329 val_accuracy: 0.7812 test:accuracy: 0.0860

VGG16 model accuracy: 0.6380 val_loss: 0.8290 test:accuracy: 0.6865

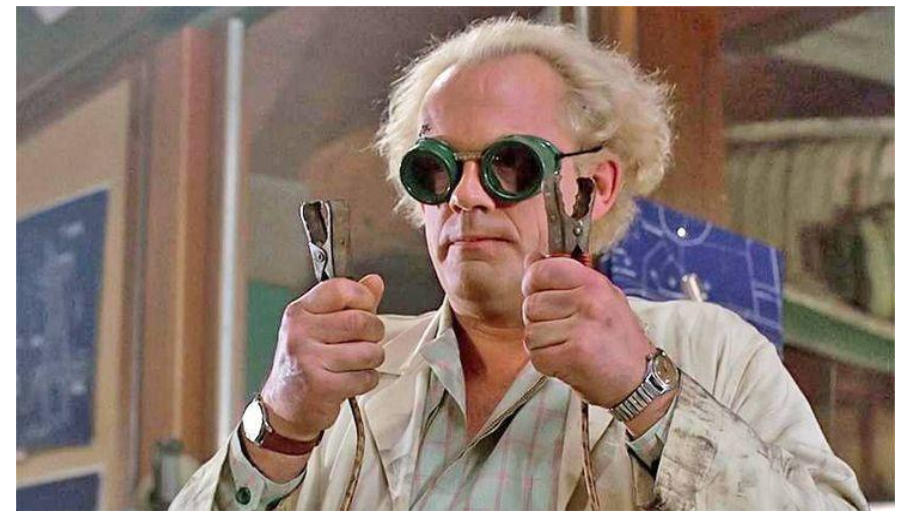**ResNet V2** w/ GAP accuracy: 0.5424 val_accuracy: 0.5843 test:accuracy: 0.5552

EfficientNet w/ GAP accuracy: 0.7703 val_accuracy: 0.1605 test:accuracy: 0.6427

Complex CNN accuracy: 0.6740 val_accuracy: 0.7366 test:accuracy: 0.7510

"Emotion is the key to Human experience."
— Carl Jung

THANK YOU

Psychological Aspects of the Mother Archetype, Volume 9, Part 1 of *The Collected Works of C.G. Jung*.

Joe_Wild