Facial Emotion Detection

MIT Applied Data Science Program
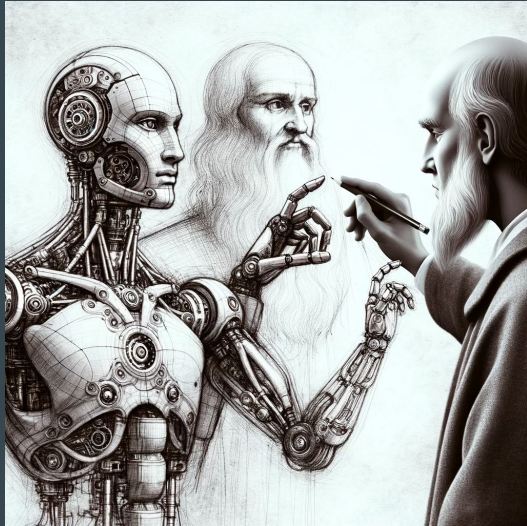## By Michal Dusik

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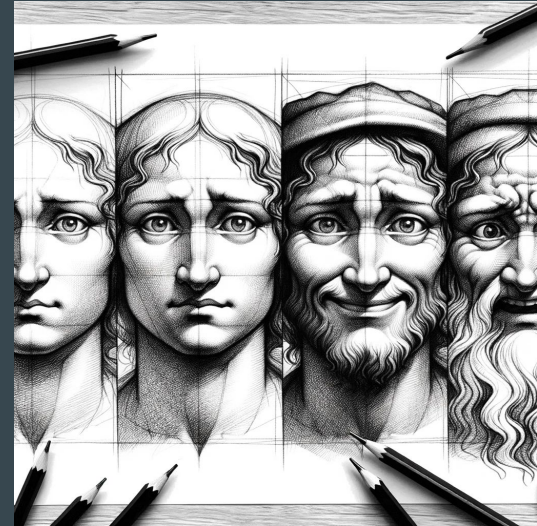September 2023 Cohort
Submitted on December 15, 2023.

Main Question

Facial Emotion recognition for the non computer savvy.

How can a machine (like a PC computer with a camera) recognize not only a human face but the emotion the face is showing.
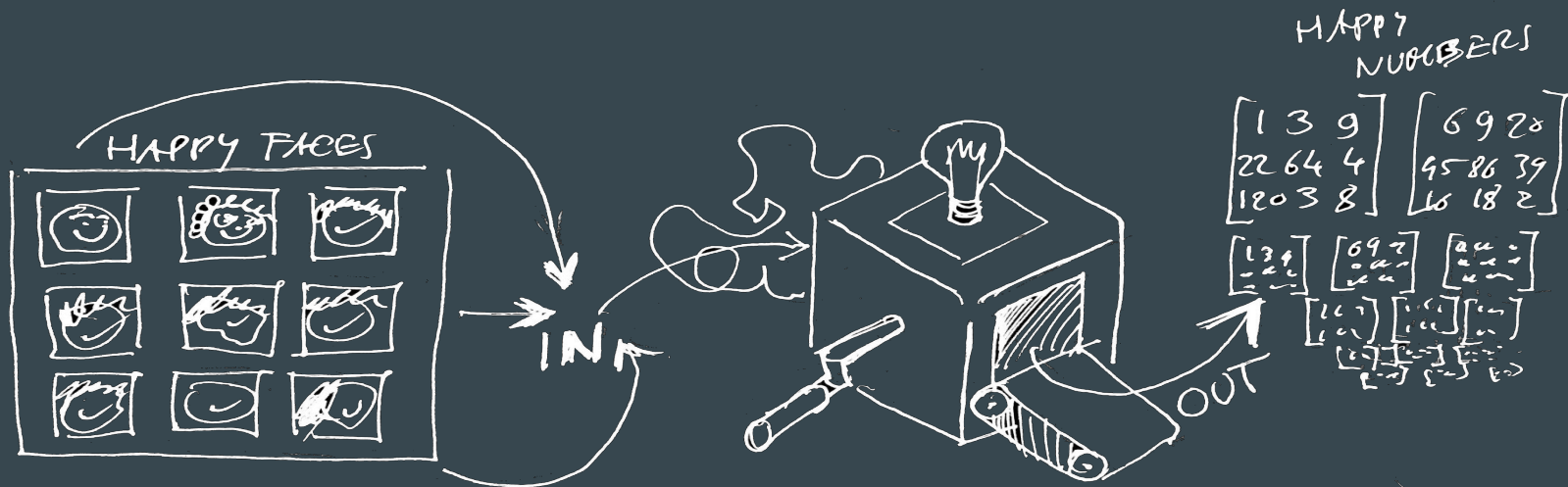

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How to turn a face image into a mathematical object (array)

Computers only understand numbers, so the first task is to turn an image of a face into
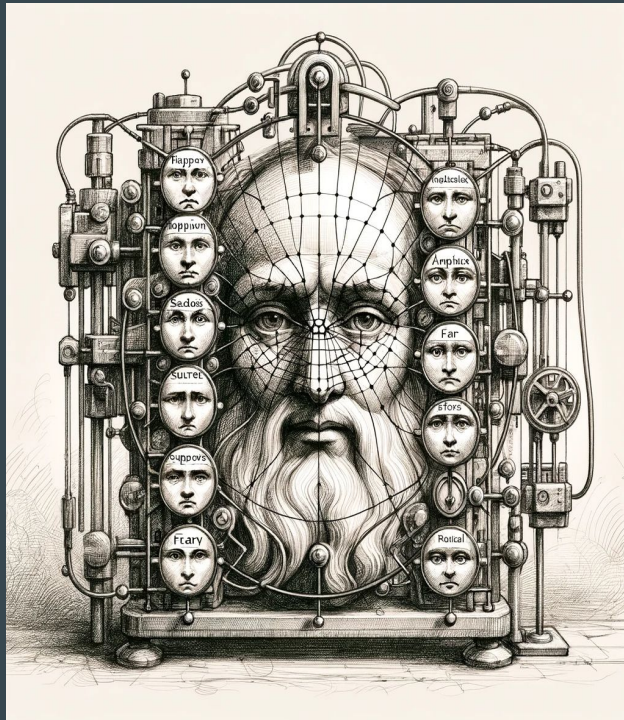

We can accomplish this with python and specific libraries like numpy

This task is possible with Deep Learning.

Deep Learning

This is the method through which a machine can learn to recognize anything.

By feeding thousands of pictures to the machine and "nudging" the machine in the right direction.
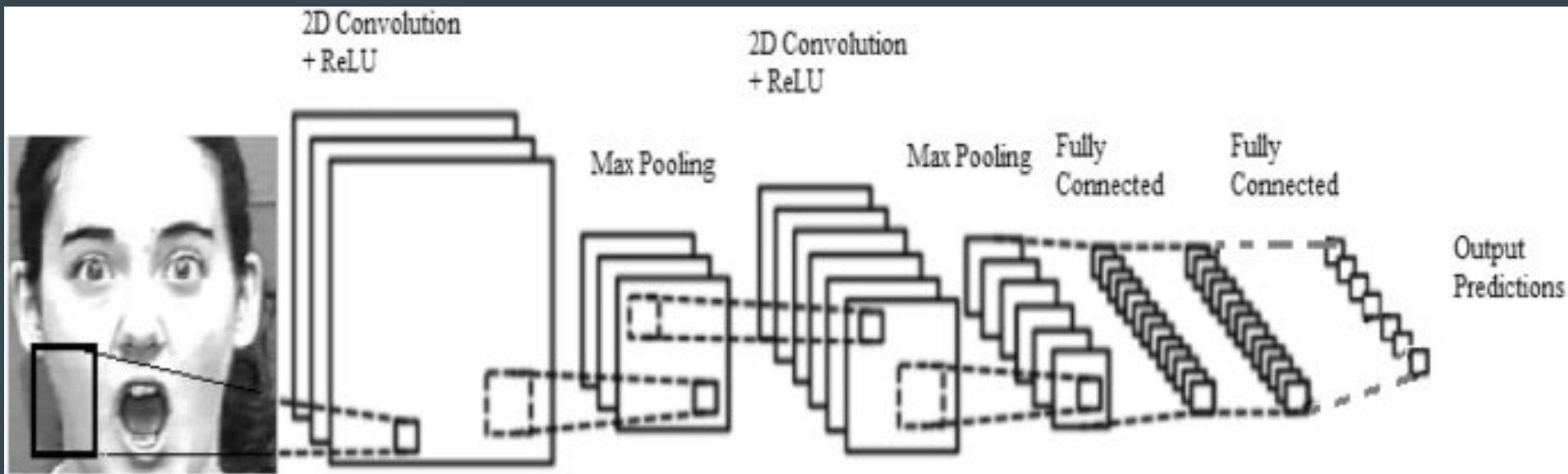

Machine Learning

A machine such as a high power computer, can be taught how to recognize emotions.

The process utilizes millions of mathematical operations that the machine can process in real time.

Anatomy of a Deep Learning Model.

Target: 70%+
correctly recognized emotions

- Like humans, machines can also be trained over and over again and improve their performance.
We call this:
Convolutional Networks

- Unlike humans, they can be "fed" a pre-learned amount of data so that further learning will be easier.
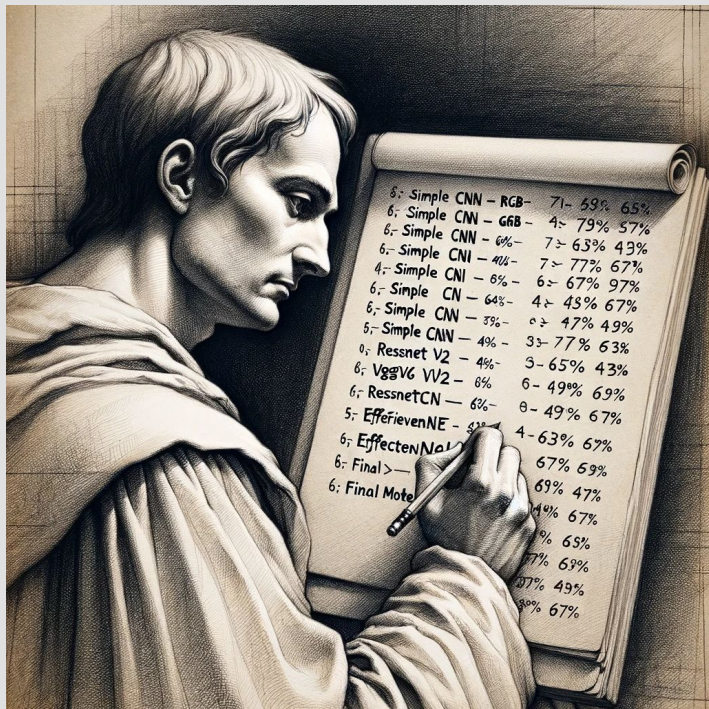We call this:
Transfer Learning

- **We used both methodologies.**

All models used for learning
(we tried it all)

Convolutional Networks CNN
Simple CNN RGB - 64%
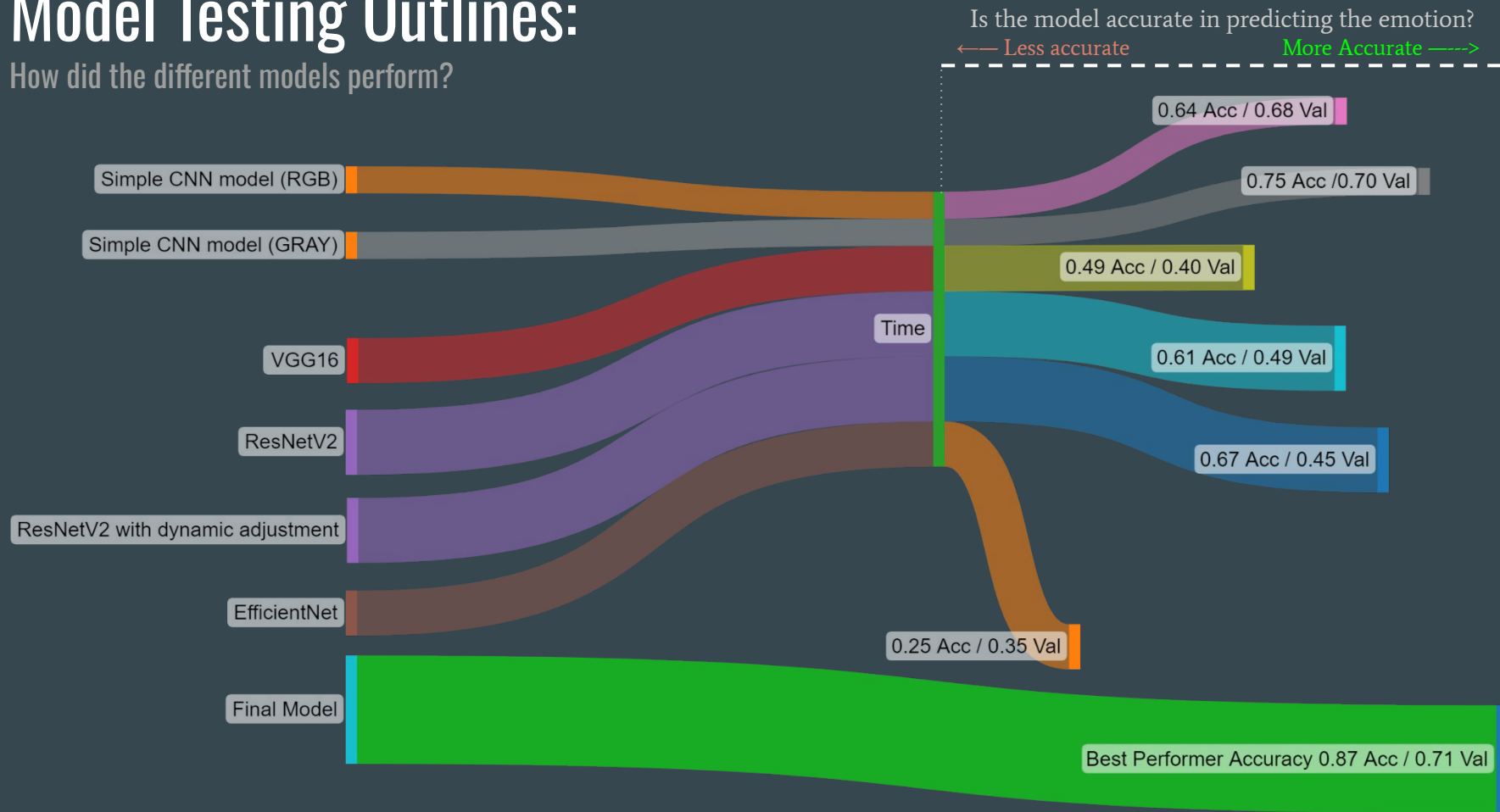**Simple CNN GRAY- 75%**

Transfer Learning Networks
VGG16- 49%
ResNetV2- 61%
EfficientNet- 67%

Final CNN Model- 87%

Model Testing Outlines:

How did the different models perform?

Is the model accurate in predicting the emotion?

←— Less accurate   More Accurate ——-->

Simple CNN model (RGB)

Simple CNN model (GRAY)

VGG16

ResNetV2

ResNetV2 with dynamic adjustment

EfficientNet

Final Model

Time

0.64 Acc / 0.68 Val

0.75 Acc /0.70 Val

0.49 Acc / 0.40 Val

0.61 Acc / 0.49 Val

0.67 Acc / 0.45 Val

0.25 Acc / 0.35 Val

Best Performer Accuracy 0.87 Acc / 0.71 Val

Made with SankeyMATIC

Proposed next steps:

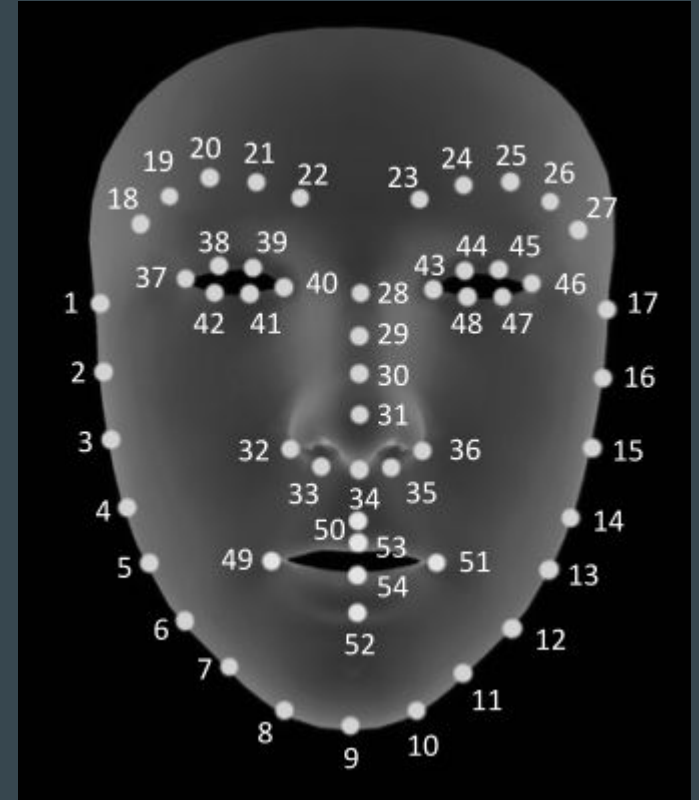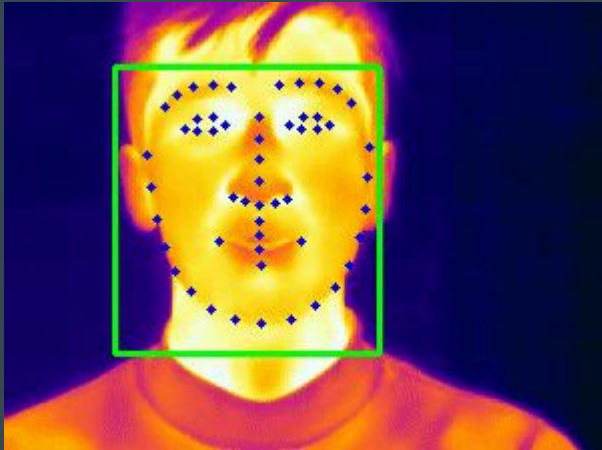|	
Adopt a production Environment (IDE)	• PyCharm, VSCode... • Set up a testing environment on a linux server
CV2 - MediaPipe - MMpose - OpenPose	• Set up several unittest environments • Gather results
Select the best model	• Make a selection based on performance • Rebuild the model
Production	• Create an app for facial Emotion Recognition • Deploy the app (phone preferred or web)

This takes TIME, TIME, TIME...

FaceMesh Model (by MediaPipe Google)

Google Library that allows access to Developers and with the use of CV2 library, able to detect faces by creating a mesh of points.

Once the mesh is established, coding emotions in it is a simple classification task.

Thank you!

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