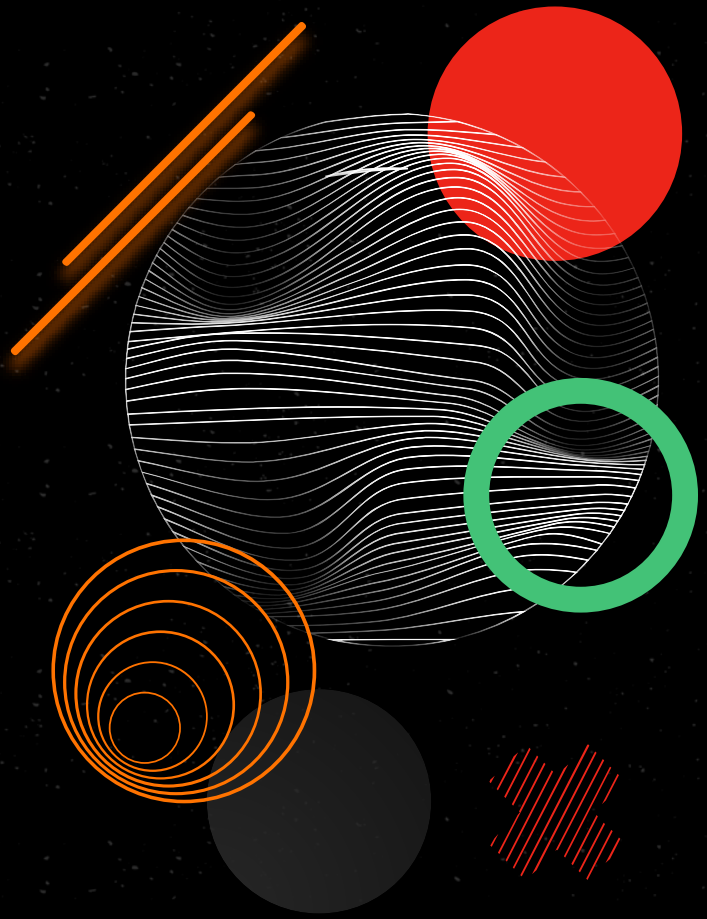


« EMOTION RECOGNITION & GENUINENESS DETECTION »

SAPIENZA
UNIVERSITÀ DI ROMA

TABLE OF CONTENTS

ABOUT THE PROJECT

This project aim to explore two different tasks in the field of facial expression:

- Emotion Recognition: Identifying the emotional state of a person based on their facial expression.
- Genuineness Detection: Determining whether the expressed emotion is genuine or deliberately posed

01

EMOTION RECOGNITION

02

For that task we have built a Convolutional Neural Network (CNN) model to classify facial expressions into one of seven basic emotions: Angry, Disgust, Fear, Happy, Sad, Surprise, and Neutral

The FER-2013 dataset, widely used in the research community for its diversity and complexity, is employed for training and evaluation

MODEL ARCHITECTURE

3 convolutional blocks + 2 fully connected layers

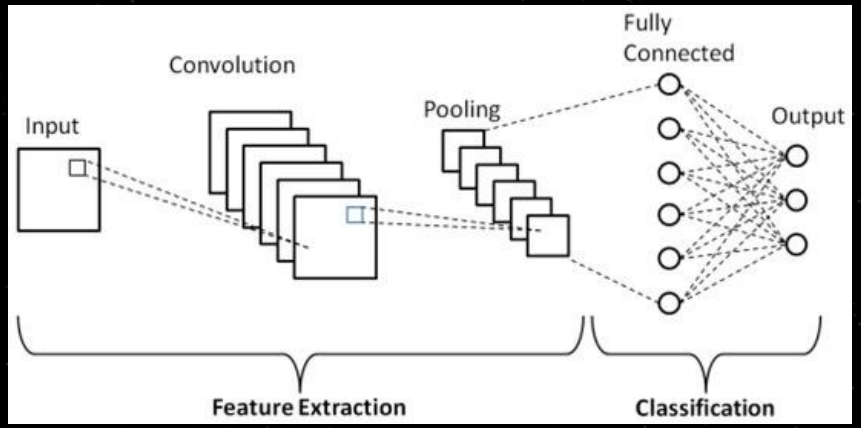
CONVOLUTIONAL LAYER

BATCH NORMALIZATION

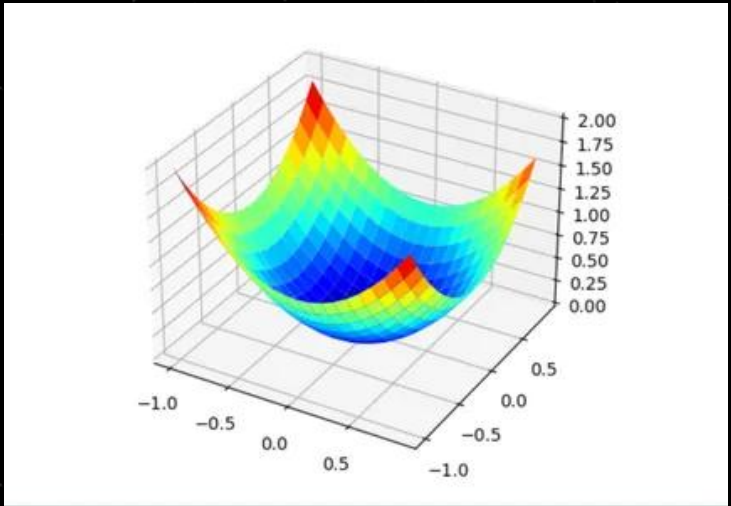
ACTIVATION FUNCTION

MAX POOLING

DROPOUT



MODEL TRAINING AND TESTING



CROSS ENTROPY LOSS

Applies softmax and compute negative log-likelihood, ideal for multiclass classification

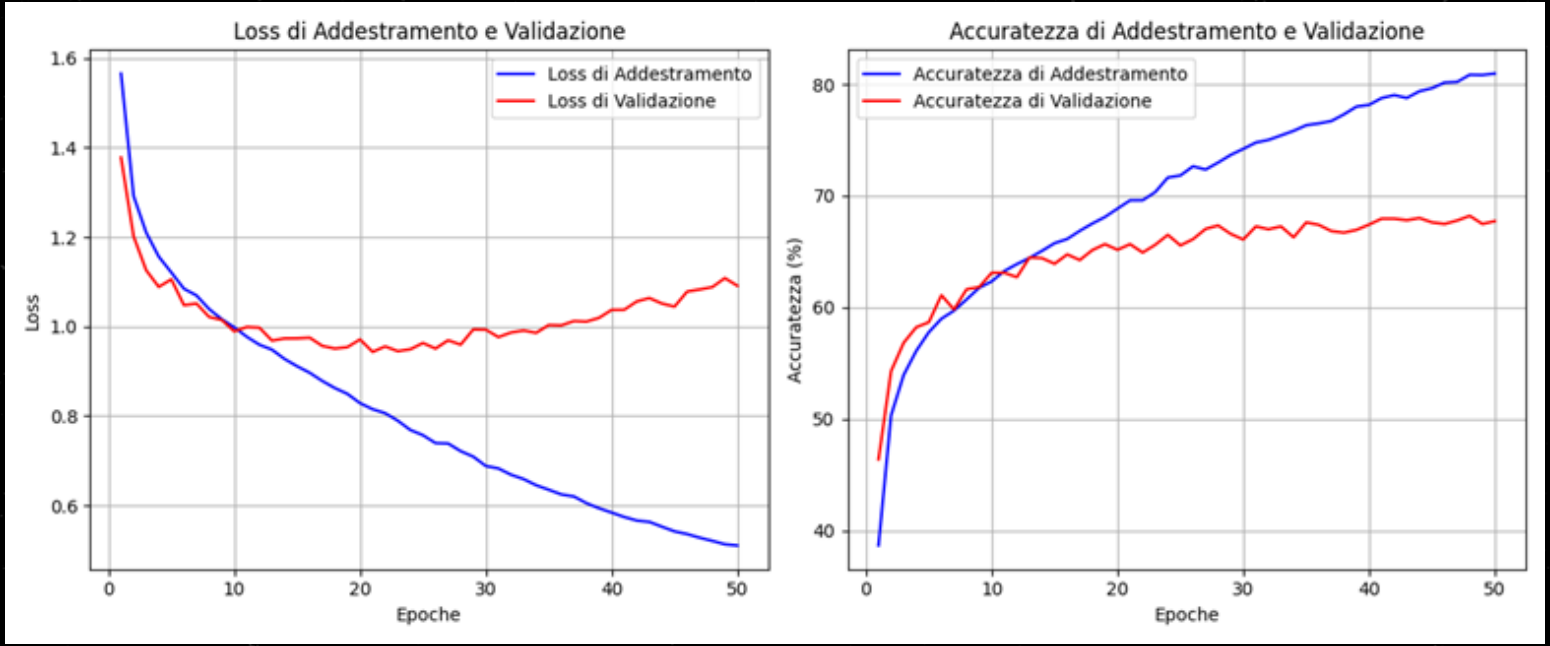
ADAM

Standard optimizer, used with a 0.001 learning rate

DATASET

Is splitted into train_dataset, val_dataset and test_dataset

ACCURACY AND LOSS PLOTS



03

GENUINENESS DETECTION

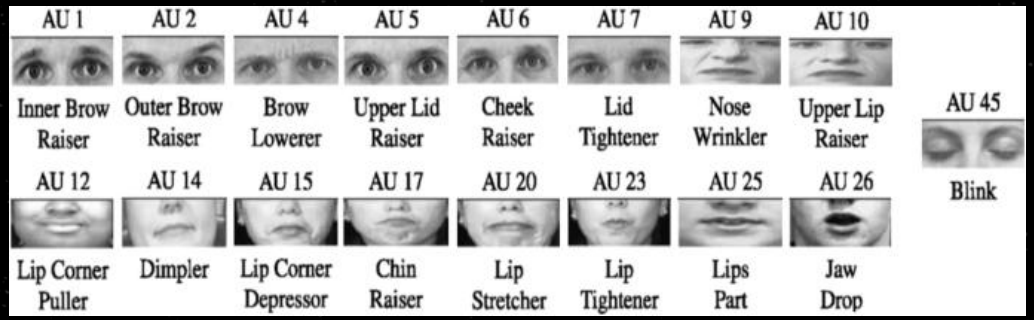
How can we detect whether a facial expression is genuine?

...By observing involuntary facial microexpressions.

ACTION UNITS

Action Units are **movements of facial muscles**, as defined in the **Facial Action Coding System (FACS), e**ach AU corresponds to a specific muscle contraction.

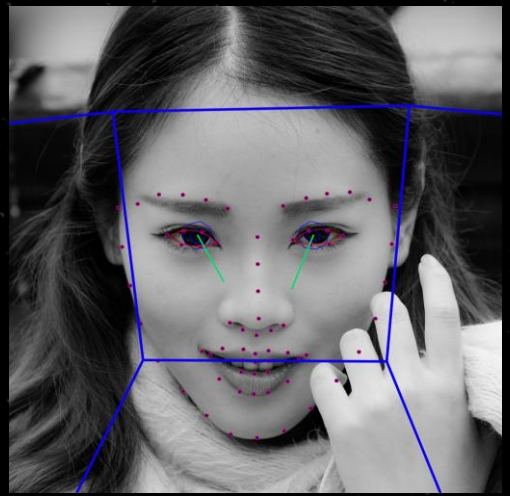
Some AUs (like AU6 in a genuine smile) are **hard to fake**, making them useful for detecting true emotions.



OPEN FACE

OpenFace is an open-source facial behavior analysis toolkit. Although it offers multiple functionalities, we used it solely to extract Action Units (AUs) from images.

It detects both the presence and intensity of each AU, however, we retained only the intensity values for our analysis.



BUILD THE DATASET

No suitable public dataset was available, so we created a custom one

STEP 01

Identify a dataset with posed facial expressions

STEP 02

Identify a dataset with genuine facial expressions

STEP 03

Use OpenFace to extract facial Action Units

STEP 04

Combine the extracted data and assign the corresponding labes

THE MODEL (MLP)

2 HIDDEN LAYER

Followed by: Batch Normalization, Leaky ReLU, Dropout

1 OUTPUT LAYER

The output is a logit for binary classification

BCE WITH LOGITS LOSS

Sigmoid activation + binary cross-entropy loss

ADAM OPTIMIZER

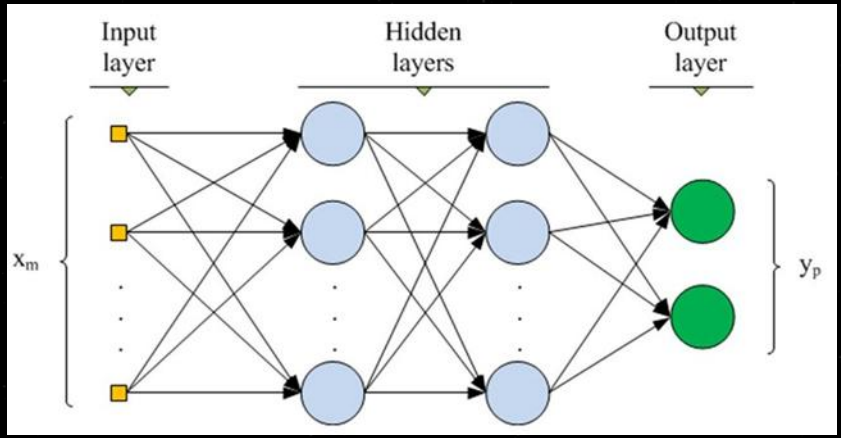
With 0.0005 learning rate, plus a L2 penalty

STEP LR

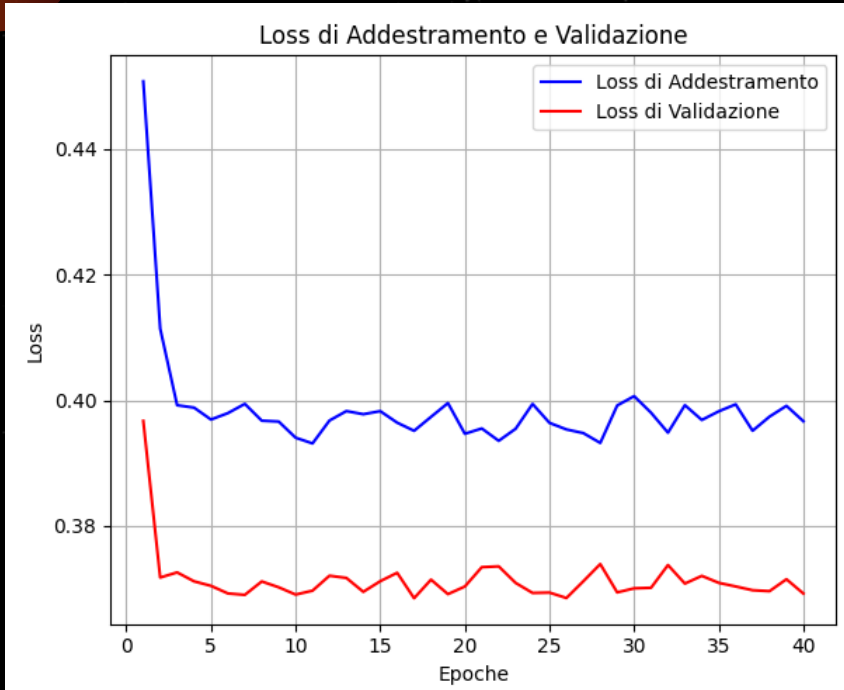
Gradually decrease the learning rate over time to improve convergence

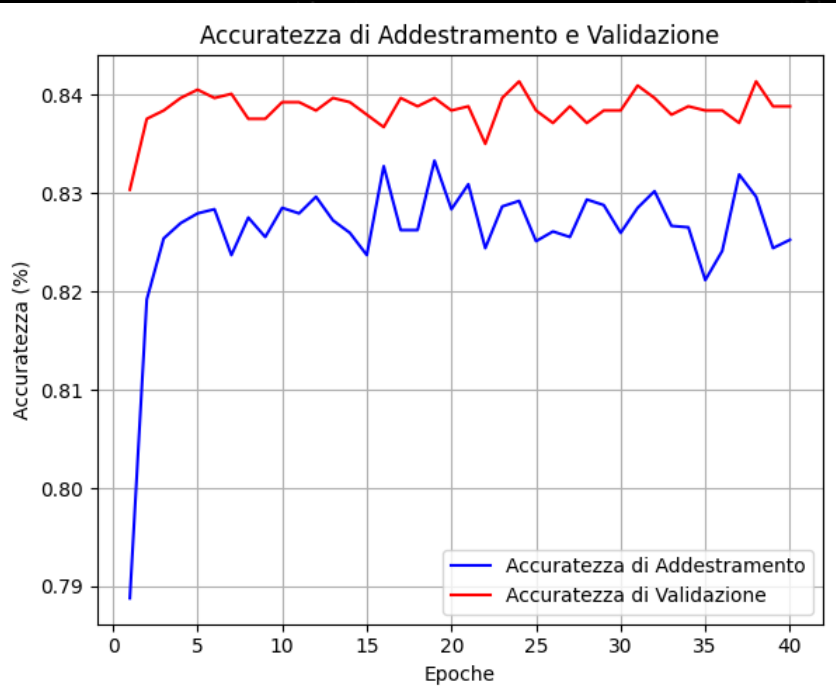
CROSS VALIDATION

Used 4-fold validation to improve validation robustness



ACCURACY AND LOSS PLOTS



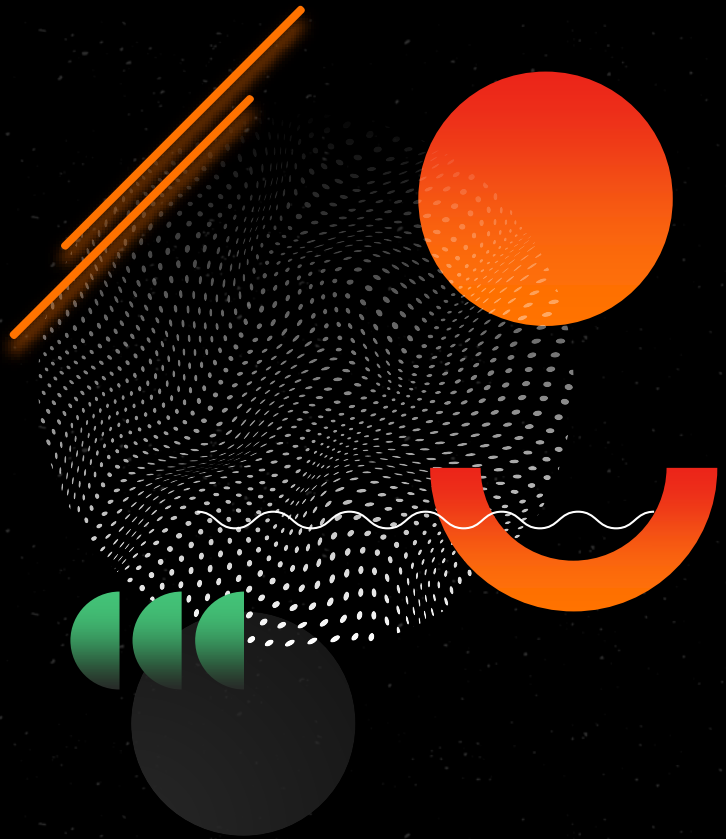


MODEL BIAS

Although the model achieved high accuracy, its performance is not consistently reliable due to discrepancies between the two datasets used.

Despite both being 224 x 224 grayscale images noticeable differences images style are evident between them

- Left image from posed
- Right image from genuine



RESULTS 04

Despite some challenges along the way, we developed two different models—a CNN and an MLP—each tailored to its specific task.

When tested in real scenarios, we found that while the models aren't perfect and do make occasional mistakes, they perform well in most cases.

Overall, we are proud of the work we have accomplished

FINAL WORKFLOW

RUN THE MAIN.PY

This will load the models and activate the webcam for real-time inference

01

02

EMOTION RECOGNITION

When a face is detected, the CNN model recognizes the emotion in real time

GENUINENESS DETECTION

To obtain the genuineness press «A», AUs will then be extracted and fed to the model

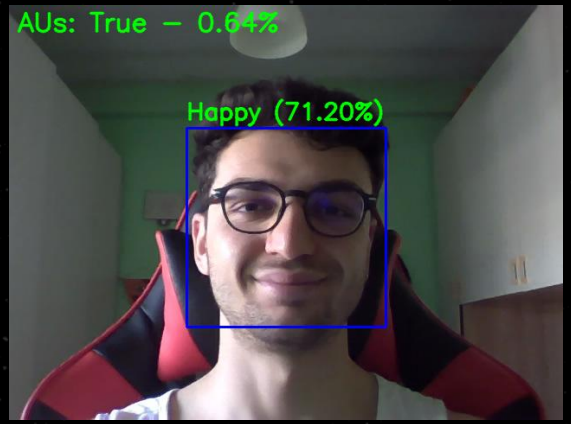
03

04

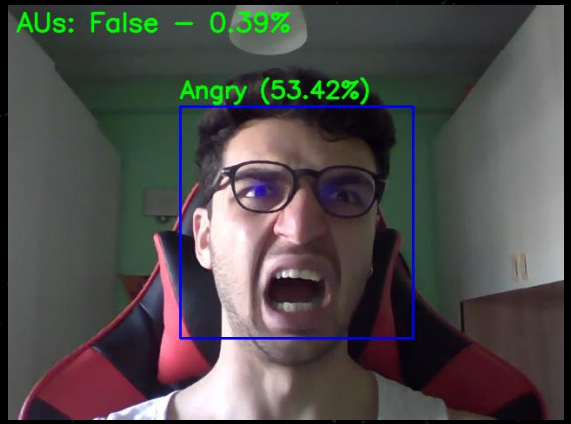
FINAL RESULT

A freeze frame will show the emotion label and a true / false value indicating genuineness

SHOW THE RESULTS



Why do you smile?



Take it easy bro..

Do you have any question for us?

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Thanks so much for listening!

Hope you enjoyed the presentation, and good luck when it's your turn!