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Country: Mexico

Project Report

A face recognition application was designed and implemented using a compact Convolutional Neural Network (CNN) architecture, specifically MobileNet V3 Small, to ensure functionality on an embedded device. The system identifies the 'closest' match based on a chosen distance metric, in this case, Euclidean distance. The identification is facilitated by a trained CNN, using a K-Nearest Neighbors (KNN) classifier. My given country was for selecting the images was **Mexico**. The project has been **successfully tested** on a **Raspberry PI**.

The application returns the n (7 gave the best results) closest neighbors and chooses the label with the highest occurrence.

In order to have good results the initial images first have to go through a pre-processing stage that crops the faces from the images. For this porpoise a Haar Cascade Classifier from the open-cv library is used. The results are stored for later use as this process can take some time. The images are then split into reference images and test images.

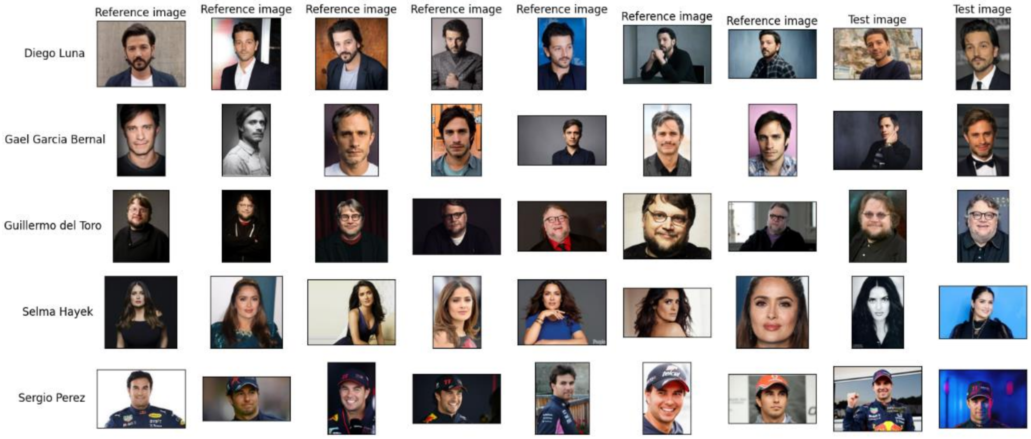

Figure 1: Initial Images

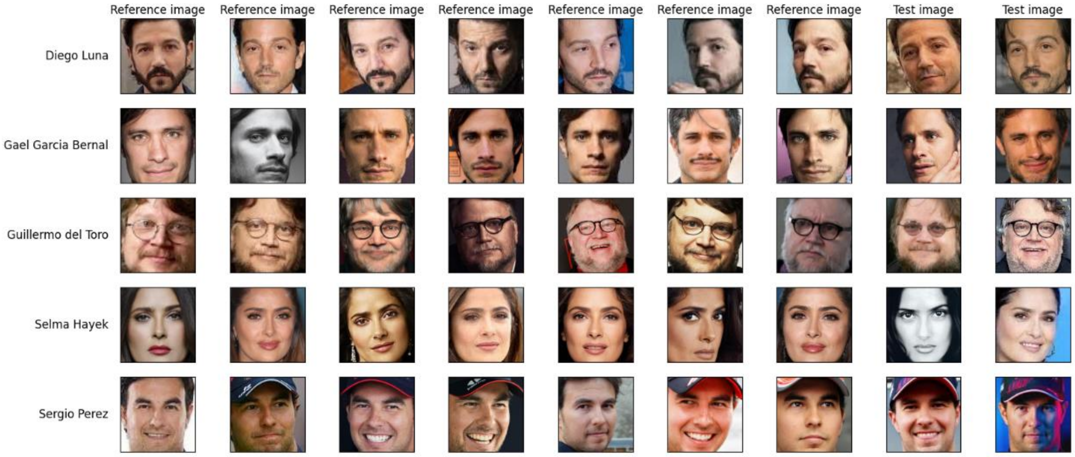

Figure 2: Face cropped images

The pre-processed images are then fed through the MobileNet-V3-Small model to extract a feature vector for each of the images. The reference data and the test data are then transformed into a format that can be used by a KNN Classifier (in this case the KNeighborsClassifier from sklearn library). The reference data is used to fit the KNN Classifier. Euclidian distance is used. The n nearest neighbors are selected and shown. The label for the current picture is chosen by whichever test label has the highest occurrence from the selected neighbors.

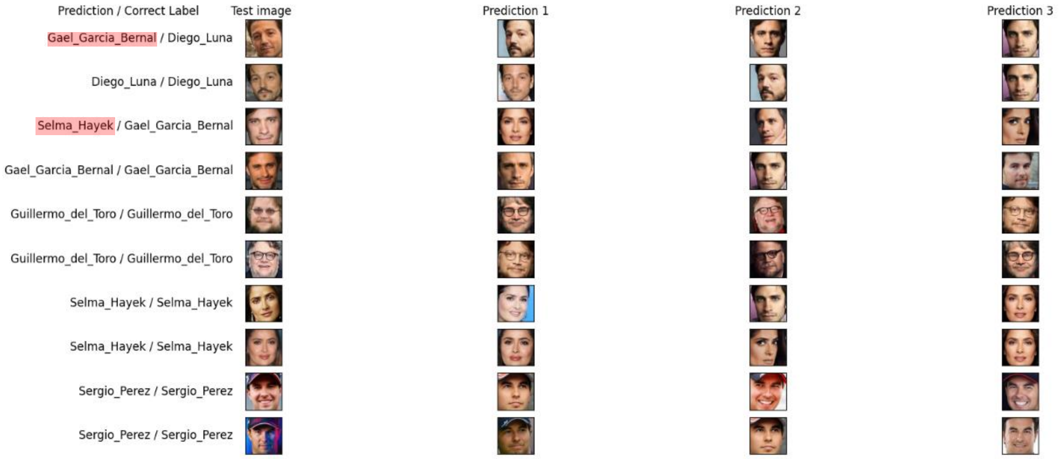
Prediction / Correct Label
Test image
Prediction 1
Prediction 2
Prediction 3
Gael_Garcia_Bernal / Diego_Luna
Diego_Luna / Diego_Luna
Selma_Hayek / Gael_Garcia_Bernal
Gael_Garcia_Bernal / Gael_Garcia_Bernal
Guillermo_del_Toro / Guillermo_del_Toro
Guillermo_del_Toro / Guillermo_del_Toro
Selma_Hayek / Selma_Hayek
Selma_Hayek / Selma_Hayek
Sergio_Perez / Sergio_Perez
Sergio_Perez / Sergio_Perez

Figure 3: Results for 3 neighbors. Accuracy is 80%

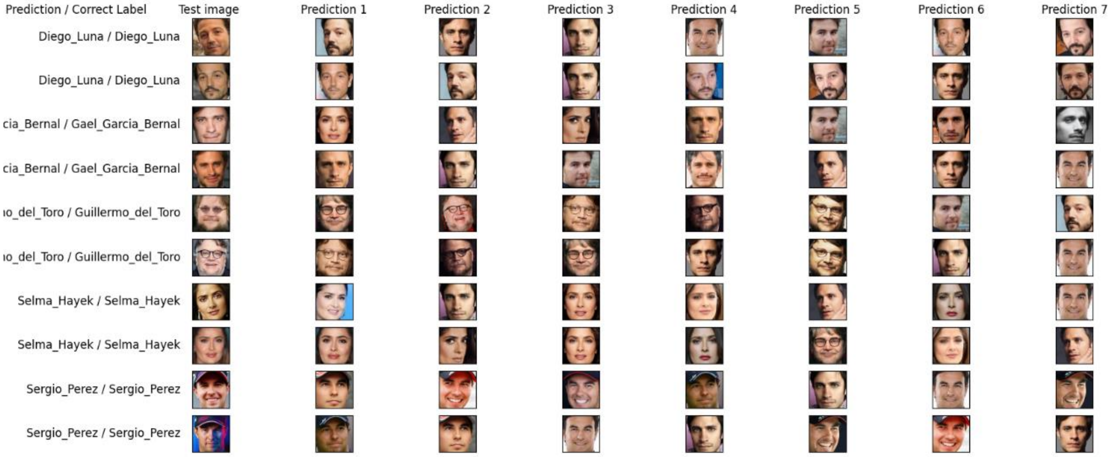
Prediction / Correct Label
Test image
Prediction 1
Prediction 2
Prediction 3
Prediction 4
Prediction 5
Prediction 6
Prediction 7
Diego_Luna / Diego_Luna
Diego_Luna / Diego_Luna
cia_Bernal / Gael_Garcia_Bernal
cia_Bernal / Gael_Garcia_Bernal
ıo_del_Toro / Guillermo_del_Toro
ıo_del_Toro / Guillermo_del_Toro
Selma_Hayek / Selma_Hayek
Selma_Hayek / Selma_Hayek
Sergio_Perez / Sergio_Perez
Sergio_Perez / Sergio_Perez

Figure 4: Results for 7 neighbors. Accuracy is 100%

This project successfully implemented a face recognition application using MobileNet V3 Small and KNN. The system identifies matches based on Euclidean distance, with optimal results at 7 neighbors. A pre-processing stage using a Haar Cascade Classifier for face cropping improved results. The system achieved 80% for 3 neighbors and 100% accuracy for 7 neighbors. The project has been successfully tested on a Raspberry Pi, demonstrating its effectiveness on embedded devices.

The project's success opens avenues for further exploration and refinement. Future work could investigate the impact of different distance metrics, classifiers, or CNN architectures on performance. This could lead to even more efficient and accurate face recognition systems, particularly for embedded devices.