

Image Based Biometry Assignment #3

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1 Introduction

We look at face recognition on the 5 Celebrity Faces Dataset and the Labeled Faces in the Wild dataset. The model used for prediction a convolutional neural network (CNN).

2 Data acquisition

In our previous homework we selected the WIDER FACE dataset and extracted the images and annotations. This dataset isn't made for face recognition. We therefore select new datasets to train and test our face recognition model. We select two datasets meant for facial recognition, the 5 Celebrity Faces Dataset [2] and a portion of the Labeled Faces in the Wild [1]. The 5 Celebrity Faces Dataset contains photos of 5 celebrities with 14-20 photos of each. Labeled Faces in the Wild contains 173MB of annotated images, due to computing constraints we select a 400 person sample within this dataset.

3 Preprocessing

The images are converted into RGB, if not already then converted into an array representation. We detect faces with the MTCNN model. Faces are

Dataset	Train	Test
5 Celebrity Faces	100.000	100.000
Labeled Faces in the Wild	73.851	90.000

Table 1: Accuracy of the model between training and testing sets.

split into training and validation datasets. For each face we then get embeddings. For each face we standardize the pixel values across all channels. We use standard deviation for this. We then transform the face into one sample and make prediction.

4 The model

We created the model from the pre-trained CNN model Facenet [3]. The model is a facial recognition system that was proposed by Google in 2015 [4]. For each face we get embeddings using the Facenet model. Embeddings are then saved into a file for classification purposes. We train the model on 93 images of famous persons and test on 25. We also train on 1044 images of people from the Labeled Faces in the Wild dataset and test on 10 from the same dataset [5].

5 Evaluation

We evaluate the performance of the model on both Labeled Faces in the Wild dataset and the 5 Celebrity Faces Dataset. On the 5 Celebrity Faces Dataset we observe 100% train and test accuracy. This is due to a powerful model and a very small dataset. On the Labeled Faces in the Wild dataset we observe accuracy of 73.85% on the training set and 90% on the testing set. This is due to a very small testing set. The accuracy of the training set is worse since there are a lot of people in the dataset for which there are very few photos. We display our results in table 1. We evaluate the precision and recall scores of the Labeled Faces in the Wild dataset. This is shown in table 2

Dataset	Train	Test
Precision	97.477	83.333
Recall	38.762	83.333

Table 2: Precision and recall scores of the Labeled Faces in the Wild dataset.

References

- [1] Gary B. Huang, Manu Ramesh, Tamara Berg, and Erik Learned-Miller. Labeled Faces in the Wild: A Database for Studying Face Recognition in Unconstrained Environments. University of Massachusetts, Amherst, Technical Report 07-49, October, 2007.
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- [3] J. Brownlee, “How To Develop A Face Recognition System Using FaceNet In Keras,” Machine Learning Mastery, 06-Jun-2019. [Online]. Available: <https://machinelearningmastery.com/how-to-develop-a-face-recognition-system-using-facenet-in-keras-and-an-svm-classifier/>. [Accessed: 06-Jan-2022].
- [4] C. Vargas, Q. Zhang, and E. Izquierdo, “One Shot Logo Recognition Based on Siamese Neural Networks,” 2020, doi: 10.1145/3372278.3390734.
- [5] N. Renotte, “Build A Python Facial Recognition App With Tensorflow And Kivy,” YouTube, 25-Oct-2021. [Online]. Available: <https://www.youtube.com/watch?v=LKispFFQ5GU>. [Accessed: 06-Jan-2022].