Face Verification
Final Project – CSCE 4604

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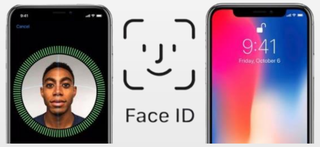
Problem Statement

- **The Face verification** is the process of **extracting facial features** from an image and then **comparing** them to the facial features of another image to **verify** the identity of the person in the image.
  Real-life example: **face ID feature** of cell phones.

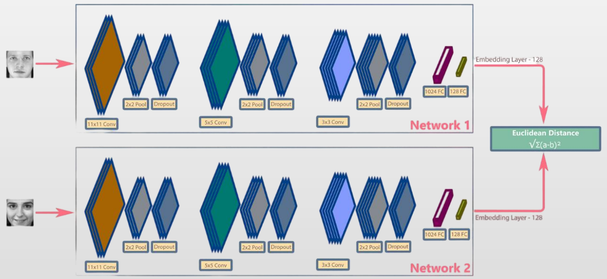


Dataset Description

- Name: **Extracted Faces, face-recognition-dataset**, derived from the **LFW Dataset**.
- Size: 190 MB
- Description: Each picture is **centered** on a **single face** and encoded in **RGB** and of size **128x128x3**. **1680 celebrity** directories, with **2-50 images** per directory.
- Faces extracted from the original image using **Haar-Cascade Classifier (cv2)**.

Original chosen model

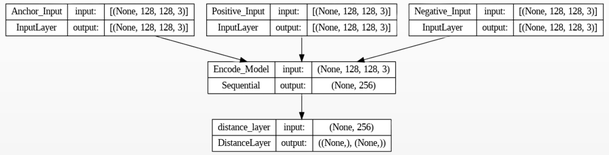
- **Siamese Network:** It **does not classify** the images into categories, rather, it finds out the **distance** between any two given images. If the images have the **same label**, then the network should **learn the parameters**, in such a way that it should produce a **smaller distance** between the two images, and if they belong to **different** labels, then the **distance** should be **larger.**



- **Encoder**: is responsible for **converting** the images into their **feature vectors**.
- A pre-trained model, **Xception** is used.
- It is connected to **Dense layers** and the last layer uses **L2 Normalization**.

How it works

- The **Siamese Network** takes 3 input images (**anchor, positive, negative**) and uses the **encoder** to get the **feature vectors**.
- Those features are passed to a **distance layer** which computes the **distance between (anchor, positive) and (anchor, negative) pairs.**

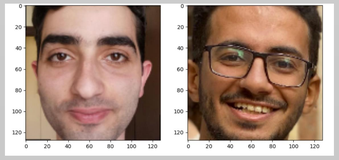


- After training (using the **triplet loss function**), **Encoder** is **extracted** and given two pictures to get their **feature vectors** and calculate the **distance** between them.
- Given a **threshold**, it's determined **whether** the images are the **same** person or a **different** person.

Updates to the model

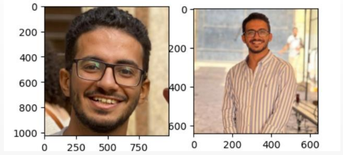
- Data is split into correct and fixed sets and triplets.
- Adjusted the number of frozen layers in the Xception model to 35 layers.
- Data augmentation was used to compensate for the small dataset and as a way of regularization.
- Shuffled the training data.
- Added function to do face extraction and alignment.
- Added more evaluation metrics besides accuracy.
- Live face verification.
- Hyperparameter tuning:
  - Tanh instead of Relu
  - Max pooling instead of Average
  - Batch sizes 64, 128, 256
  - Augmentation percentages of 30%, 50%, 60%, 100%

Input / output example



```
Distance: [1.7238022]
prediction is Different
```

Input Output



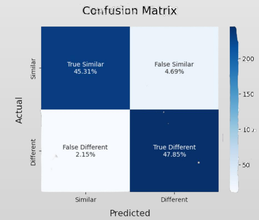
```
Distance: [0.44238418]
prediction is Same Person
```

Input Output

Initial Results Vs Final Results

- **Initial Accuracy: 84.375%**

- **Final Accuracy: 93.164%**
- **Recall: 95.7%**
- **Precision: 91.1%**
- **F1 score: 93.3%**
- **AUC: 93.16%**
- **Categorical Cross-entropy: 2.46**



Conclusion

- Learned to work with limited resources (colab + small dataset) by using the pre-trained model and data augmentation.
- One-Shot Learning.
- Model is biased.
- Results are still far from SOTA or product.

Acknowledgements

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