Masked-Face recognition

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Introduction

- These days after covid-19 has spread out, wearing masks is mandatory to enter any organizations and institutions. Indeed, taking attendance using fingerprints or regular schedules is risky and many companies are looking for safe attendance and departure registration. Therefore, we will try to build models that recognize people while they keep their masks on.

Problem Description

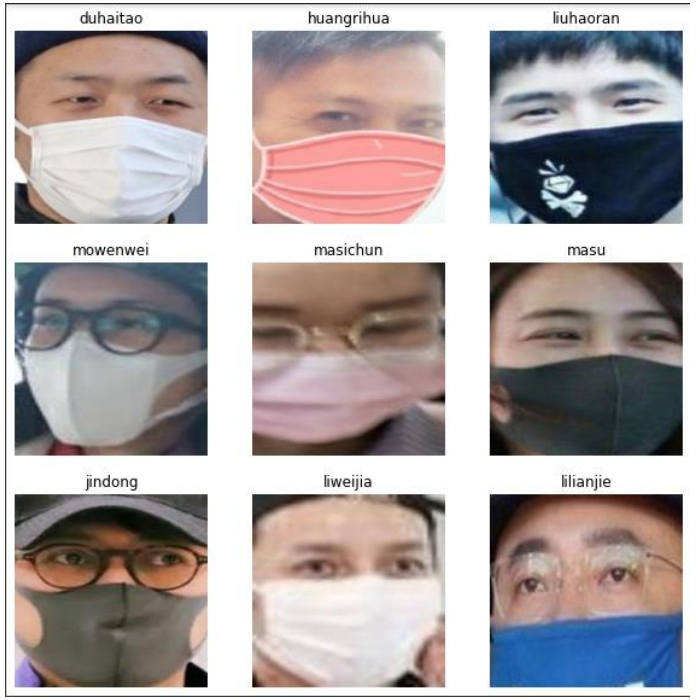
- Face recognition is the general task of identifying and verifying people from photographs of their face.
- Face Verification. A one-to-one mapping of a given face against a known identity (e.g. is this the person?).
- Face Identification. A one-to-many mapping for a given face against a database of known faces (e.g. who is this person?).

Data set

69 persons
Masked_Unmasked_Mixed

Train

Test



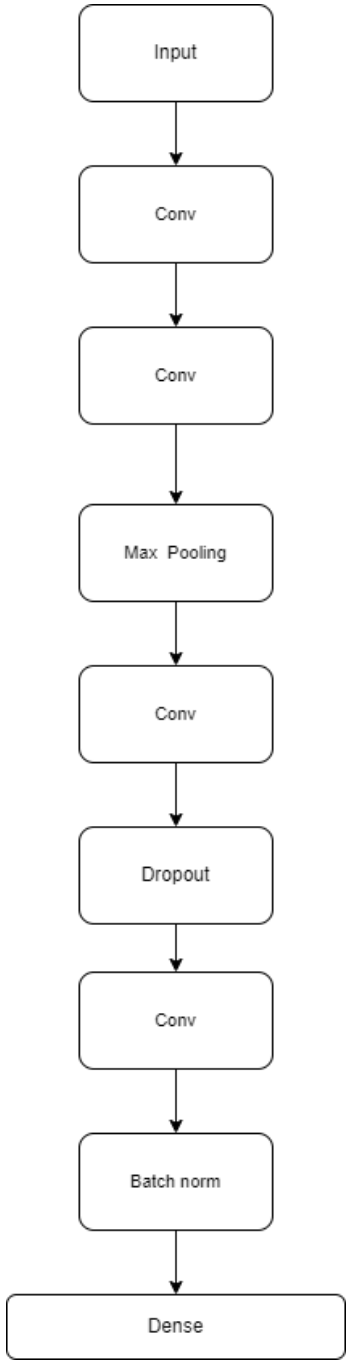
Detailed Description

- We searched for multiple solutions and we found that we must use CNN since we are dealing images.
- First we used a simple classic CNN with a classification layer. Unfortunately, the accuracy was low. so we tried to use some learned models like VGG16 and we got a bit better results.
- After that we tried to play on another scale. We used the CNN model just for extracting the features from images then we fed it to another model like RNN and the accuracy was improved.
- Finally, after more searching we found an amazing model called FaceNet which is a CNN model that needs previous training. It just applies triplet-loss to do embedding, then we classify using SVM.

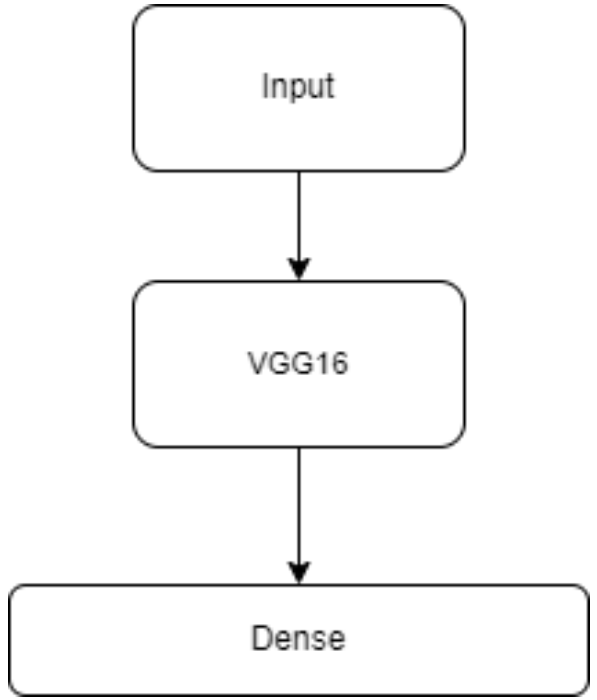
Detailed Description

- Classic CNN
- Transfer Learning
- CNN-RNN
- FaceNet-SVM

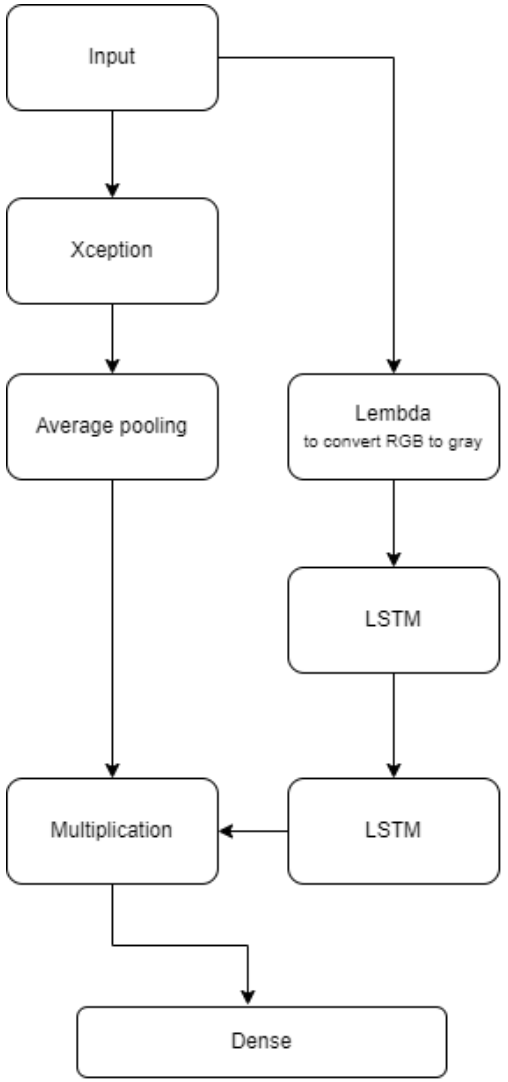
Classic CNN


Input
Conv
Conv
Max Pooling
Conv
Dropout
Conv
Batch norm
Dense

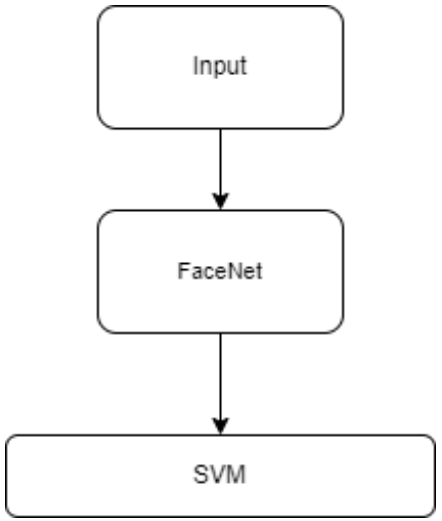
Transfer Learning (VGG16)



CNN-RNN


Input
Xception
Average pooling
Lembda
to convert RGB to gray
LSTM
Multiplication
LSTM
Dense

Facenet-SVM



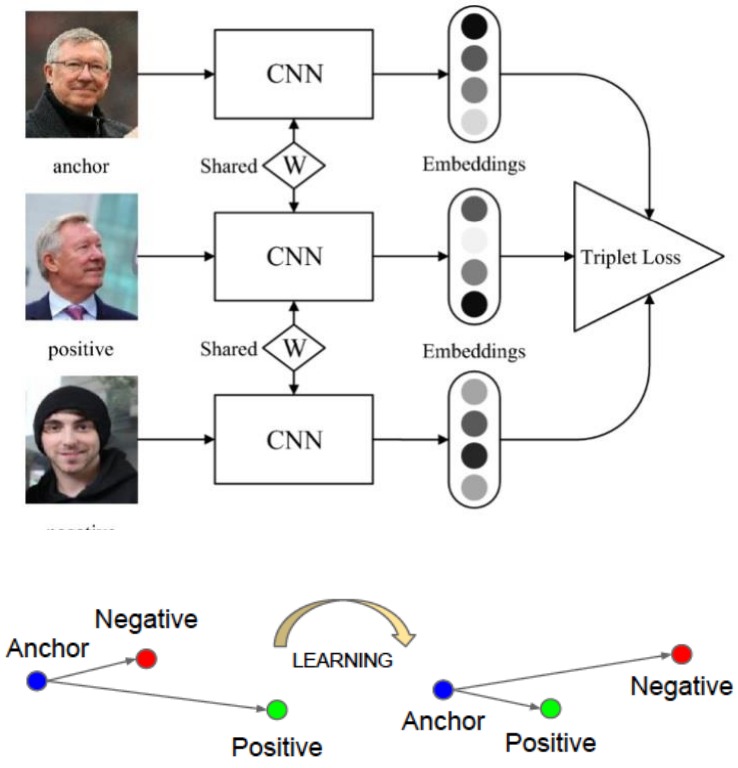


Fig 2: Triplet Loss

Experimental Results

1- Classic CNN

```
Test Loss: 6.064 | Test Acc: 2.08%
```

2- Transfer Learning (VGG16)

```
Test Loss: 9.674 | Test Acc: 13.54%
```

3- CNN-RNN

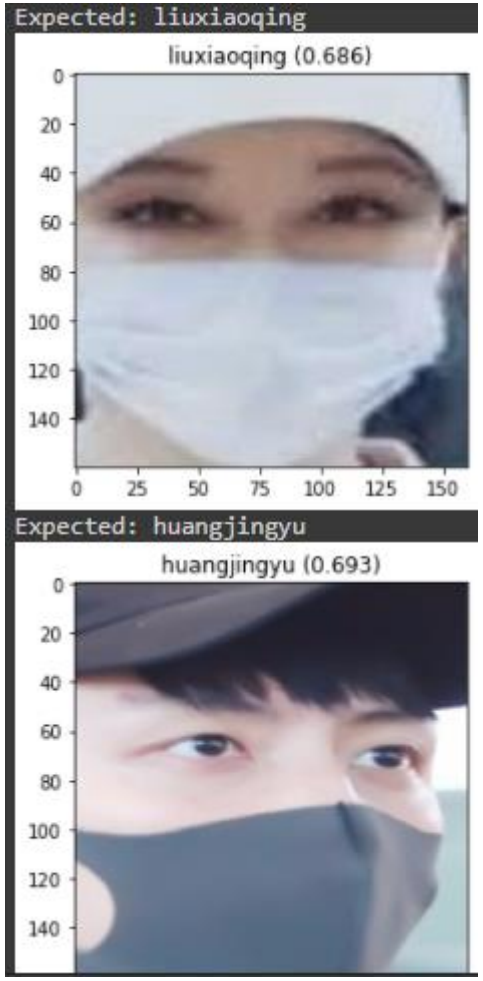
```
Training done, doing final evaluation...
11/11 [==============================] - 7s 362ms/step - loss: 3.2342 - accuracy: 0.2857 - top_k_categorical_accuracy: 0.5536
['loss', 'accuracy', 'top_k_categorical_accuracy'] [3.2341911792755127, 0.2857142984867096, 0.5535714030265808]
accuracy: 28.57%
```

4- Facenet-SVM

```
Accuracy: train=85.806, test=50.595
```

Experimental Results

Correct



Incorrect

Possible error sources

- Different color of the mask
- Closed eyes
- Image with face from side
- Wearing glasses

Conclusion

- As we show, the results of using different models will differ in the accuracy obtained from the test set. The lowest accuracy that was presented in our work is obtained from vanilla CNN (classic CNN) with a test accuracy around 2.08%, and the best accuracy that we got was around 50.595% that was obtained by implementing faceNet.

References

- Masked_Unmasked_Mixed dataset: Masked_Unmasked_Mixed | Kaggle
- FaceNet Model: https://www.kaggle.com/nikhil1011/facenet
- How to Develop a Face Recognition System Using FaceNet in Keras (machinelearningmastery.com)