Facial Recognition

But with masks

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Motivation and Objective

- Masks have become a common clothing item during the pandemic

- Facial recognition technology struggles with this new norm

- We wanted to create a model that, given two photos of the same person wearing a mask, would be able to recognize that it's the same person.

Approach

- Build a model using Siamese networks (One shot learning) and Transfer Learning that can perform facial recognition on unmasked faces

- In order to train the model with masked faces, we create an image data set using image editing techniques.

- Build a model that can perform facial recognition on masked faces as well

- Dataset: "Labeled Faces in the Wild" http://vis-www.cs.umass.edu/lfw/

One shot learning

"encoding" of $f(x^{(1)})$ ← $f(x^{(1)})$

128

$f(x^{(2)})$
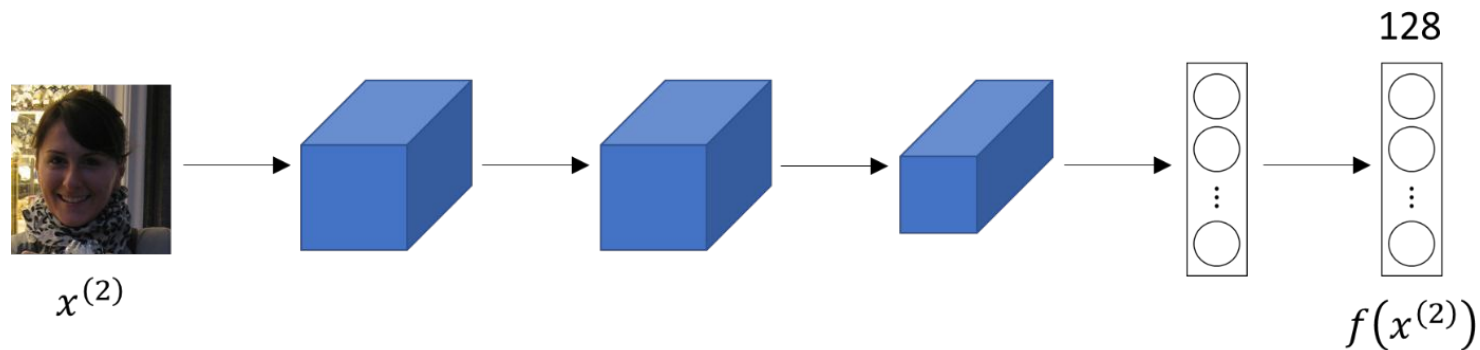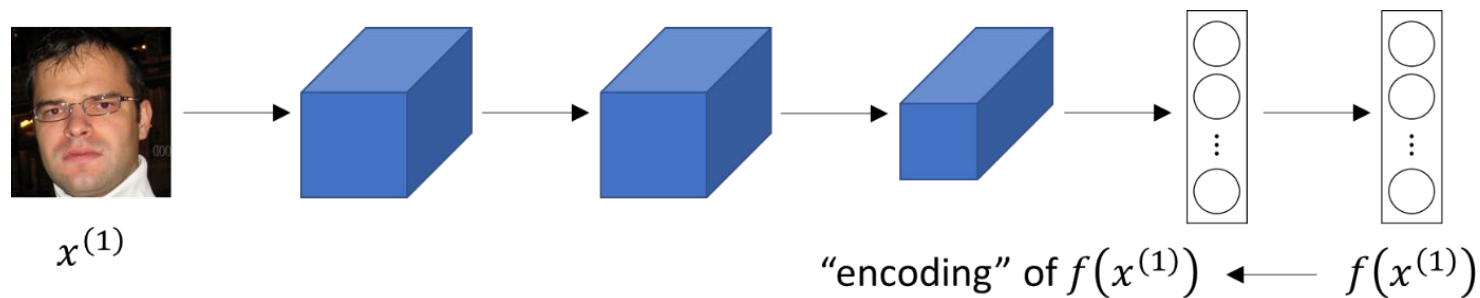
Training on Unmasked Faces

- InceptionResnet backbone, pre-trained on VGGFace2 dataset.
- Pass embeddings to a fully-connected layer with Sigmoid activation function
- Loss function: Binary Cross Entropy
- Optimizer: ADAM
- Hyperparameters
  - 20 epochs
  - learning rate = 0.001
  - weight decay = 0.0075

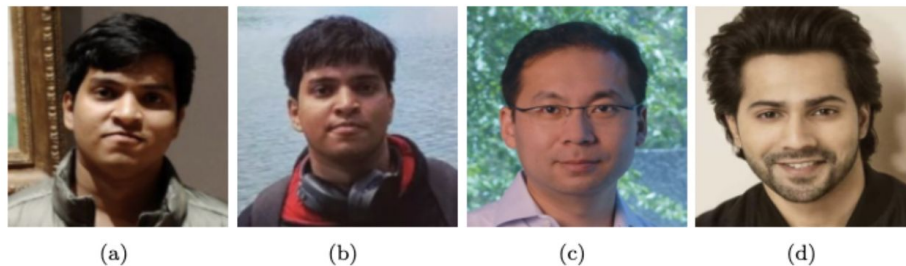# Unmasked Face Recognition Results - 91% Accuracy

Figure 8: Example Photos of Unmasked Faces, (a) and (b) are of the same person, (c) and (d) are different from (a) and (b)

```
1 verify('Vaibhav/Vaibhav_0001.jpeg', 'Vaibhav/Vaibhav_0002.jpeg')
```
1

```
1 verify('Vaibhav/Vaibhav_0001.jpeg', 'Jianbo/Jianbo_0001.jpeg')
```
0

```
1 verify('Vaibhav/Vaibhav_0001.jpeg', 'Varun/Varun_0001.jpeg')
```
0

Data Collection for Masked Images

- We modified our existing LFW dataset to create a duplicate dataset but with all masked faces

- Identified six landmark points on the face and measured head tilt angle to superimpose mask on the face appropriately

Masked dataset results

Figure 4: Images of Adam Sandler before applying masks vs after applying masks

Training on Masked Faces

- InceptionResnet backbone, pre-trained on VGGFace2 dataset.
- Pass embeddings to a fully-connected layer with Sigmoid activation function
- Loss function: Binary Cross Entropy
- Optimizer: ADAM
- Hyperparameters
  - 20 epochs
  - learning rate = 0.001
  - weight decay = 0.01

Masked Face Recognition Results - 82% Accuracy

Figure 10: Example Photos of Masked Faces, (a) and (b) are of the same person, while (c) is different

```
1 verify('Rasya/Rasya_0001.JPG', 'Rasya/Rasya_0002.JPG')
```

1

```
1 verify('Rasya/Rasya_0001.JPG', 'Cassie/Cassie_0001.JPG')
```

0

Demo

Conclusion and takeaways

- Successfully able to build a model to do face recognition with and without masks

- The dataset we used was a very good one

- Challenges
    - complex models
    - painstaking and time consuming to train

Future Scope and Improvements

- More data would certainly increase the accuracy of our model

- Build a better model by unfreezing the last few layers of the network

- Explore dataset creation options using GANs

Thank you!