

# Face swapping and harmonization using neural nets

Akshay Kumar (akshayk@stanfoed.edu)

CS 231N: Convolutional Neural Networks for Visual Recognition

## Introduction

Advent of online social media networks like facebook, pinterest, etc. has ignited the question of privacy concerns on online social networking sites. In this project, we will try to face recognition model by swapping the face of a target image with a different face.

## Overall framework



- Three step process
- Face Verification for evaluation

## Related Work

### • Face detection

- Viola – Jones algorithm
- Recent CNN based routines - sliding window, R-CNNs, RoI

- Solved by state of art face recognition models
- Facenet or Deepface. Accuracy > 97%.

### • Face swapping

- Face alignment – detection, fitting, scaling, rotating
- ? Highly texture dependent

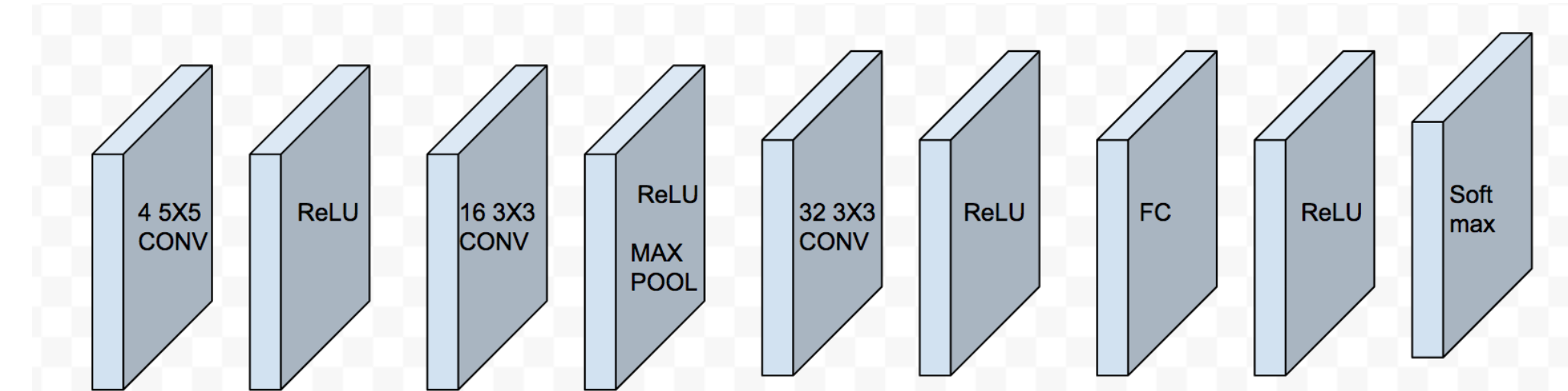
### • Face blending

- Active shape models : can easily retrace original image
- Deep dream neural net approach
- Poisson blending



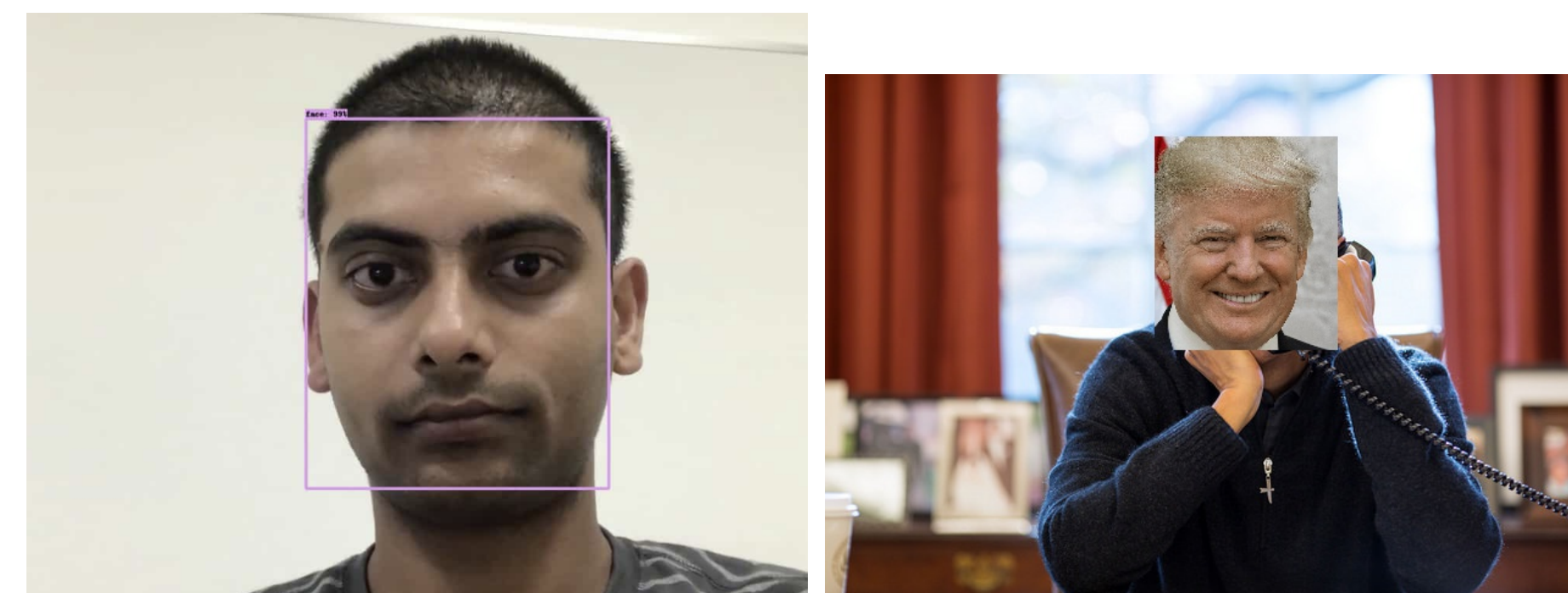
### • Face Verification

## Face Detection



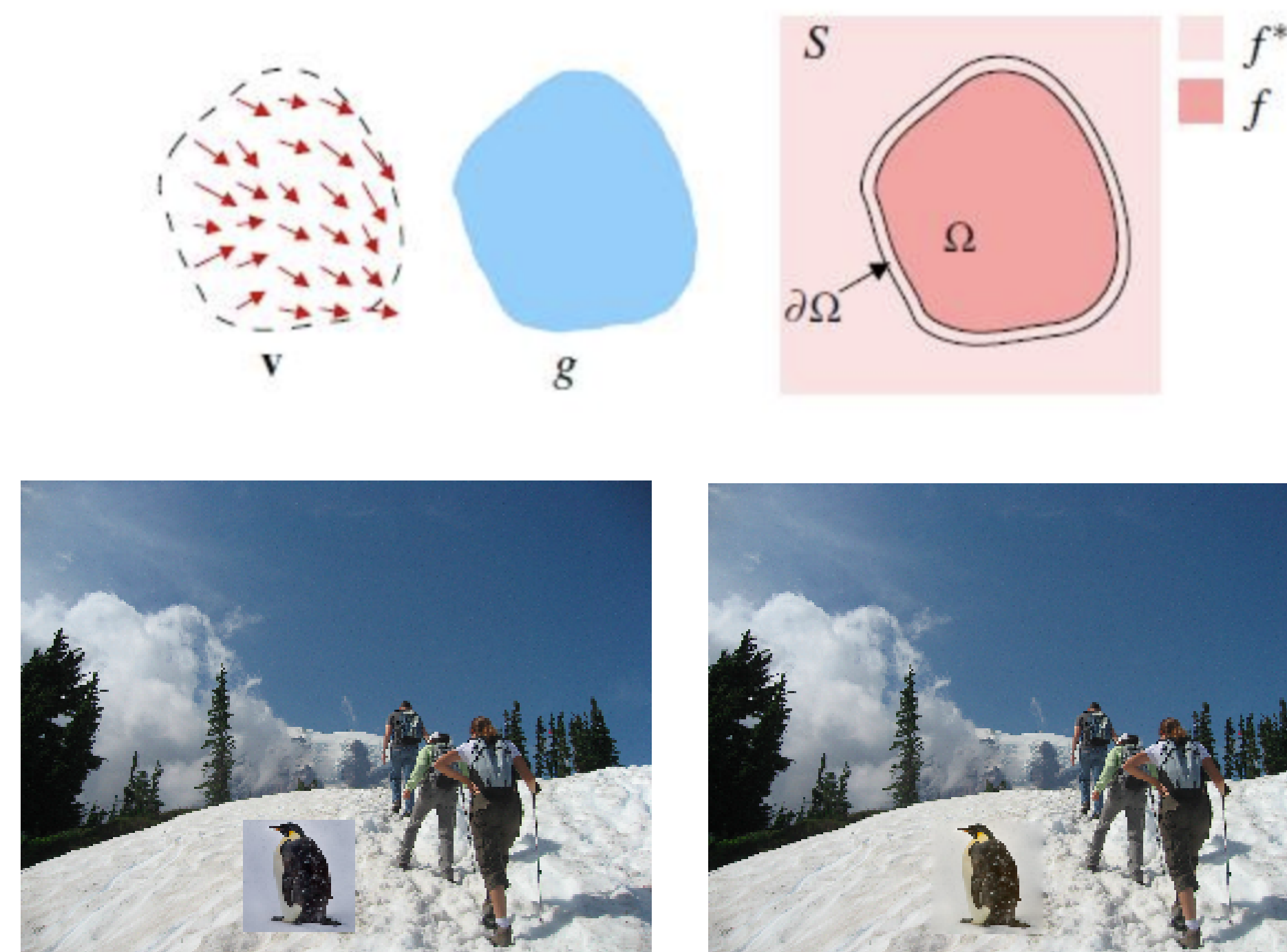
- Softmax loss used.
- Resize image to  $300 \times 300$ .
- Sliding window of size  $40 \times 40, 50 \times 50, \dots, 100 \times 100$ .
- Stride of 20.
- Scores (confidence) of each bounding box being a face.
- Pick the one with highest confidence.

## Face Detection and Face Swapping



## Face Blending

**Poisson Blending:** Reduce "abruptness": Minimize change in gradient when moving from source image to destination image



## Face Verification

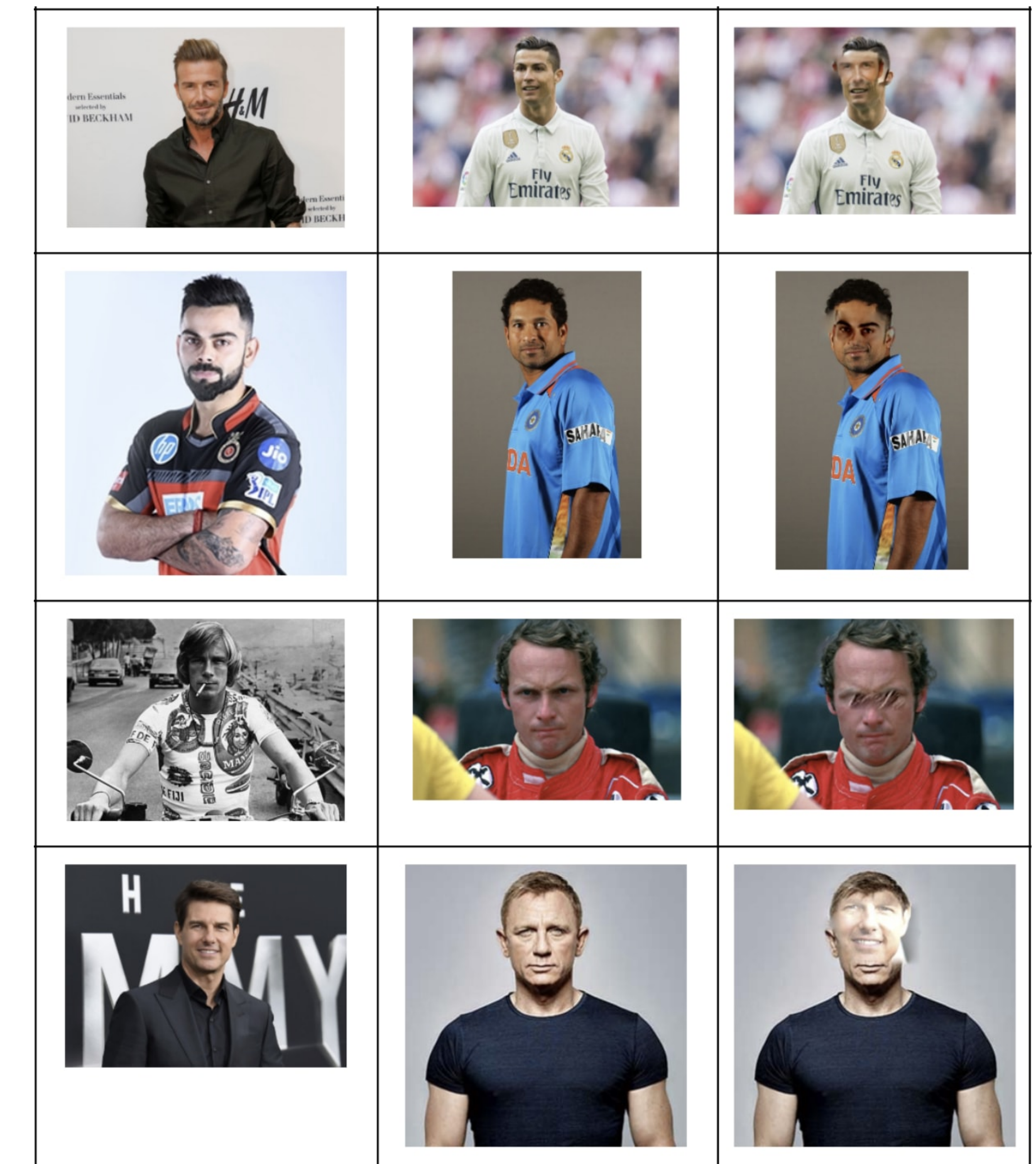
**Facenet embedding:** 128 bit vector output for an input image. Compare L2 norm and threshold.

$$d(u, v) = \sqrt{\sum_i (u_i - v_i)^2}$$

## Dataset

- LFW (Labelled Faces in the Wild) : 13k images of faces from the web.
- Data augmentation : Flip the images horizontally.
- Training:Validation:Testing split = 60:20:20.

## Results



	Output image similar to destination image	Output image not similar to destination image
Output image similar to source image	6	9
Output image not similar to source image	2	8

## Conclusion

- Novel technique of face swapping
- Texture of face changes b/w two faces. Fooling not so easy.
- Susceptible to texture difference in the two faces.
- Can't take into account orientation aspects.
- Future work : GAN kind of approach. Try to fool a face recognition system.

## Acknowledgements

CS231N course staff and my previous team members (who dropped the course)