Adversarial Effects On GANimation: Anatomically-Aware Facial Animation From A Single Image

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1. Introduction

Being able to Automatically animate the facial expression from a single image would open the door to many new exciting applications in different areas. As Generative and Adversarial Networks have become more prevalent, this task has experienced significant advances, to change the attributes of the face, such as age, hair color or gender. Facial expressions, however, are the result of the combined and coordinated action of facial muscles that cannot be categorized in a discrete and low number of classes(happy, sad, angry). 30 Action Units(AU) were found to be anatomically related to the contraction of specific facial muscles. For example, the facial expression for fear is generally produced with activation units: Inner Brow Raiser (AU1), Outer Brow Raiser (AU2), Brow Lowered (AU4), Upper Lid Raiser (AU5), Lip Stretcher (AU20) and Jaw Drop (AU26). Depending on the magnitude of each AU, the expression will transmit the emotion of fear to a greater or lesser extentHere we are testing and evaluating the performance of GANimation after applying adversarial effects like Gaussian noise and pixelation on the input image. We designed a denoising network using deep Convolutional Neural Network.

2. Motivation

As advanced face generation and manipulation methods have become available, new types of false data generation methods are being created. One such method is GANimation. We were impressed with the GANimation model and wanted to test its performance once adversarial effects were applied to the input.

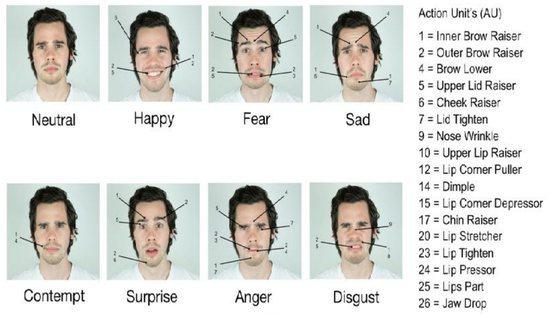
3.Research Challenges

- Huge dataset
- High Computing power required to train the model.
- Collecting action units for the image dataset

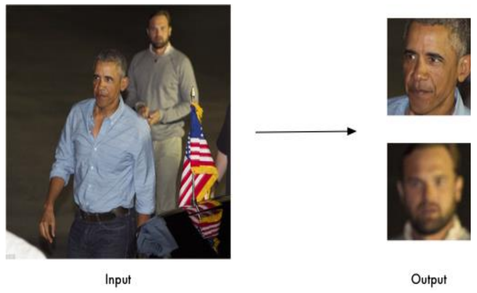
4. Data Preprocessing

SELECTION OF 200K CELEB-A DATASET

EXTRACT AU FEATURES USING OPENFACE



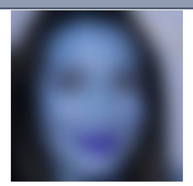
DETECT AND CROP FACE USING FACE-RECOGNITION



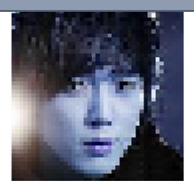
We used these preprocessed images to train our GANimation model

ADVERSARIAL EFFECTS ON IMAGES

GAUSSIAN NOISE

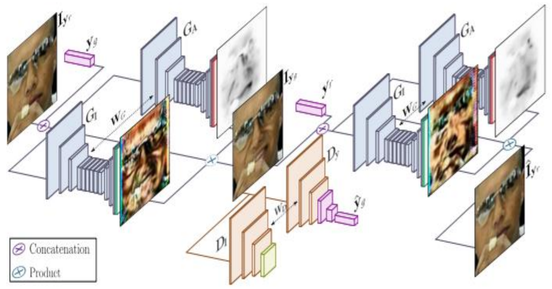


PIXELATION



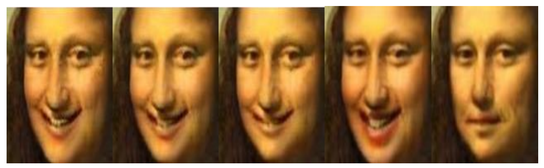
The GANimation model is tested with the adversarial effected images

5. Implementation



Design Architecture

- An input image $I_{yr} \in R\ H \times W \times 3$ is captured under an arbitrary facial expression.
- This architecture consists of two main modules. On the one hand , generator $G(I_{yr} | yg)$ is trained to realistically transform the facial expression in image I_{yr} to the desired yg. On the other hand ,discriminator $D(I_{yg})$ to evaluate the quality of the generated image as well as its expression.



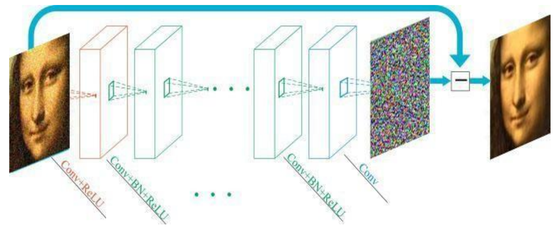
Test result before adding noise

Test result after adding noise

- Set of Action Units are passed along with Input image to animate the image with different expressions
- We see that the model does not perform as expected when a perturbed image is given as input to image

6. Solution

Deep Neural Networks for Image Denoising



- Using Deep CNN for image Denoising, we modified the architecture.
- Here multiple layers with Conv + ReLU, Conv + Normalization + ReLU are used to create a residual image for denoising the image

7. Future Work

SMOOTHER VIDEO GENERATION

BUILD A MODEL PERFORMING BOTH ANIMATION AND DENOISING

ADD AN ACTION UNITS SELECTOR OPTION FOR TRAINING

8. References

[1] Du, S., Tao, Y., Martinez, A.M.: Compound facial expressions of emotion. Proceedings of the National Academy of Sciences p. 201322355 (2014)
[2] Pumarola, Albert, et al. "Ganimation: Anatomically-aware facial animation from a single image." Proceedings of the European Conference on Computer Vision (ECCV). 2018.
[3] Celeb A dataset from kaggle - https://www.kaggle.com/jessicali9530/celeba-dataset
[4]GANimation model training- https://github.com/albertpumarola/GANimation

9. Acknowledgements

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