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Creating Deepfakes using Dlib Framework

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ABSTRACT

With the recent developments in technologies such as Artificial Intelligence (AI) and Machine learning (ML), have opened a wide array of capabilities for systems that were limited before. One of these advancements is in the field of photo and video manipulation. The main trending aspect is deepfake [1]. The word deepfake itself is combination of two words "Deep Learning" and "Fake". Deepfake leverages the power of advanced techniques such as machine learning algorithms, generative adversarial networks (GANs) to create digital media that is more realistic and has more chances to fool people compared to old media editors. Keeping all this in mind this project aims to let us understand how a deepfake is created. Knowing how a deepfake [2] is created will let us understand its core mechanisms and allow us to identify them better later on. In this project we will create a deepfake image where characteristics of one image (source) will be transferred to second image (destination) using various AI and Blending techniques such a Poisson Blending and Bilinear Interpolation. All these techniques work together to create a seamless juxtaposition between the images.

Keywords – Artificial Intelligence, Deepfake, Bilinear Interpolation, Poisson Blending

1. INTRODUCTION

As explained in the abstract deepfake is form of photo and video manipulation. They are usually used in movies and such to bring various effects to life that cannot be replicated in real life. Example a lot of movies use deepfake technology to bring various fictional and deceased characters to life.

This modifying of photos and videos has existed since the 18th Century. But with the recent increase in development of video and photo manipulation techniques it has become more prominent and easily accessible to each and every one. With these new technologies deepfake can be created more easily, in fact some programs can create a deepfake with just a few clicks. Even though photo and video manipulation techniques were first created with good intentions they are slowly being used for a different agenda.

In the recent years deepfakes have been used for more ulterior motives [3]. Deepfakes have been used to put people under peril. Deepfakes are slowly becoming a major threat to the society; it diminishes the fine line between what is real and what is phony. Deepfake has the ability to create situations where they can mislead people very easily. In recent times deepfakes have been used to falsify data, mislead people and put people into compromising positions that they didn't want to be in.

1.1 Motivation

With recent growth in the deepfake technology it becomes absolutely essential to find out whether an image or video is doctored or not. In order to combat deepfakes we have to first understand how the technology works. Deepfake usually use complex AI networks, masking and interpolation techniques that work together to bring about a cohesive result. So this project is small effort in order to create a working deepfake tool that can successfully create a face swap between two individual images. This project uses three main techniques that being; Poisson Blending [4], Bilinear Interpolation [5] and Dlib for face detection.

2. LITERATURE REVIEW

[2]In this article the author summarizes about how deepfake are evolving, and how they are slowly becoming easier to make. The author expresses that deepfakes are becoming so easier to make that slowly even people with no technical expertise can make a pretty convincing deepfake. The article also talks about how even though deepfakes are now still in the initial age, slowly with more improvement they can become detrimental to the society. The author enforces that in order to combat this issue there needs to a certain amount of governance on the advancement of such technologies.

3. REQUIREMENTS

All the components of this project are of software in nature.

- Dlib (Face Recognition)
- Anaconda
- Jupyter Notebook
- OpenCV Python Libraries –
- Numphy – For mathematical calculations.
- SciPy – For image processing and interpolation.

4. PROPOSED SYSTEM

The aim of the project is to create deepfake software, in order to successfully swap the features of one face to another. This is the proposed system in order to get a functional result.

4.1 Overview of Architecture

Entirety of the coding is done in python. The program has two modules and one main program. The main program that is "main.py" is called in order to execute the program. The main program then calls the two sub modules to execute their work. The first sub module is entirely responsible for detecting whether the photo has a face or not. It also uses Dlib to map 64 points onto both photos in the case that a face is found. The second module is responsible for the face swap procedure and all of the post-swap polishing. Up scaling is done before everything else.

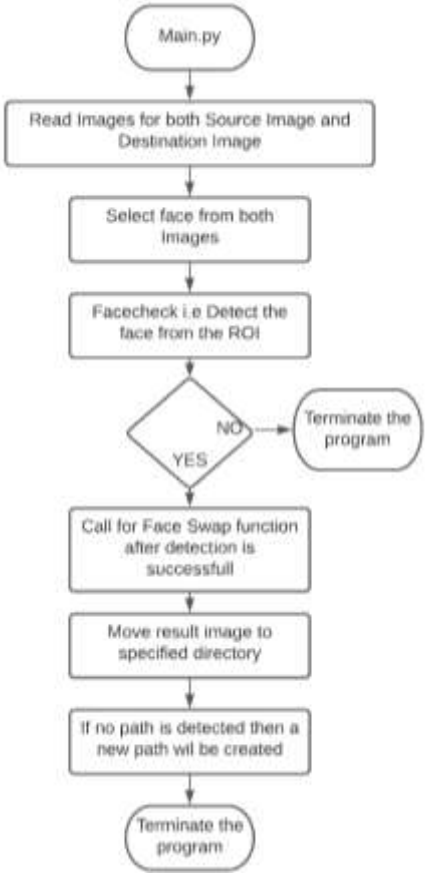

Fig1.1 Main.py workflow

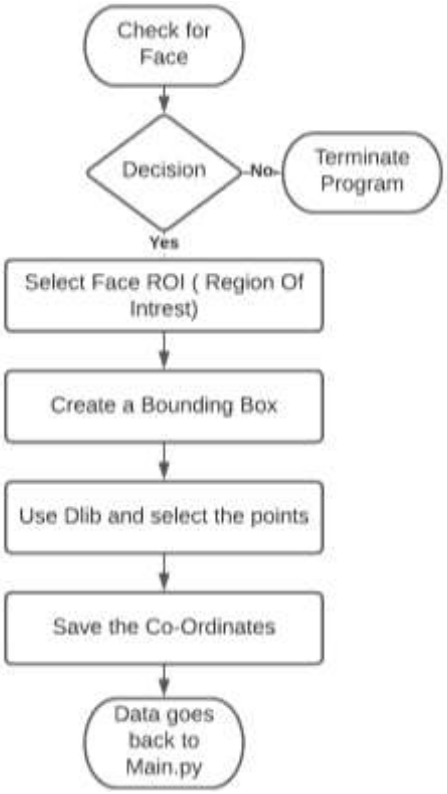

Fig 1.2 FaceDetection.py workflow

The second module of the program is responsible for the face detection and is named "face_detection.py". The subroutine works in this manner. First the subroutine finds face, if no face is detected then it terminates the process. If a face is found then it, selects the face and creates a bounding box around it. Then with the help of the Dlib model it marks the face with 64 different points. These points are then stored for later usage while swapping. These co-ordinates will allow the program to face swap properly. This process is done for both the source and destination picture. If any conditions for the face check have to be added it has to be added here.

The third and final subroutine is the most important one. This program is responsible for the swapping of the two faces. First the program takes the co-ordinates that were calculated during the face detection phase and then calculates the height and width of the faces. This step is very important because in order to make the photo realistic it has to scale properly. The source photo should match the destination photo's scale. Then a 3d warp mesh is created on the photo. Basically, the photo is divided into multiple triangles with the various points. Then a mask is created between the source and destination photo in order to create a blended effect and make it look more natural than just copy pasting one photo on another. Then a color correction is done. The image is then rasterized in order to convert into from multiple triangles to a pixels format of picture. Then the mask is resized to the required size. Then Poisson Blending is used to ensure that the pictures are of the same contrast to ensure a more seamless look.

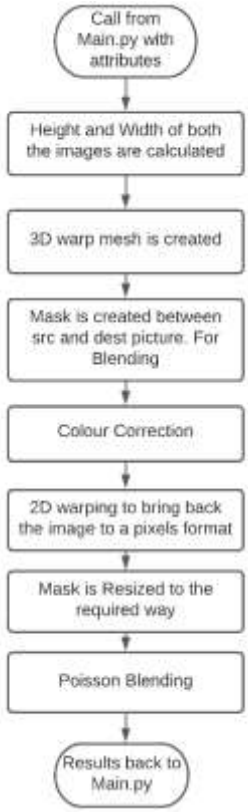

Fig 1.3 FaceSwap.py workflow

4.2 Techniques Used

- **Poisson Blending** – [4]This is a type of a blending technique which is mainly used for color correction in image processing. Basically, the technique allows an image processor to adjust the contrast and brightness of the inserted image with the contrast and brightness of the destination image. This makes the picture look more realistic and tries to replicate the inserted image to look like it belongs in the same dynamic range.

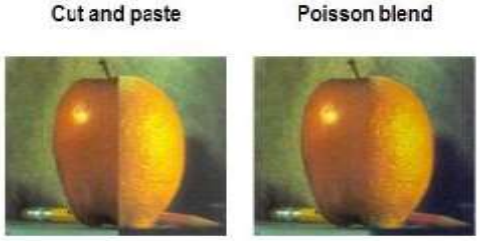

Fig 1.4 Difference between both methods

- **Bilinear Interpolation –** [5]During the up-scaling process we use a technique known as the Bilinear Interpolation. It's a technique which is used in image processing to scale the images to make it bigger or smaller. It uses an averaging technique to calculate the pixel colors. When an image is increased in size the pixels colors have to be adjusted, if not the image will not resemble the original image. This is done by calculating the average of the 4 adjacent pixels and then the color is adjusted depending on the average of the other pixels.

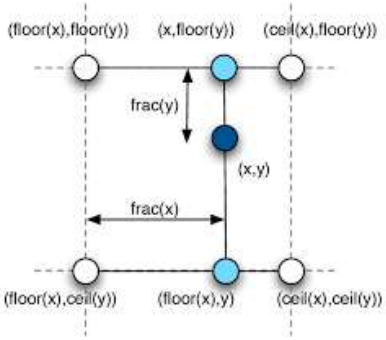

Fig 1.5 Bilinear Interpolation Diagram

5. RESULTS


Source image used


Destination Image


Image after face swap process

The face swap will be of a much better quality if the characteristics of both faces are as identical as possible. Even various other elements such as skin tones, lighting and emotions displayed etcetera have a drastic effect on the quality of the final product. The more these conditions are similar between the images the more the image is refined and realistic.

6. CONCLUSION

This project gives us a basic understanding of what the process of creating a deepfake is. We create a certain variety of deepfake that is known as a face swap to understand the internal workings off one. The created prototype can successfully swap the feature of one photo to another while trying to balance the lighting and meshing to create a realistic photo as much as possible.

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