# IMAGE MORPHING USING BEIER-NEELY METHOD

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May 2, 2023

## Abstract

Image Morphing is the combination of generalized image warping with a cross-dissolve between image elements. Implementing image morphing with Beier-Neely method, which is a feature based metamorphosis. A morph operation blends between two images, source image and destination image. We define Feature landmarks of both the source and destination image. In result, the algorithm will generate 16 morphed frames which will be converted to an animated sequence.

## 1 Introduction

Image Morphing is an image processing technique in which it transforms one image into completely another image through a smooth transition. The source image is the first image where the metamorphosis starts and proceeds till it completely turns into the target image. This "Morph" phrase is originated from "image metamorphosis". The basic idea is to provide a warp that distorts the first image into the second. As the transformation progresses, the first picture becomes progressively distorted and fades out, meanwhile the second image begins completely deformed towards the first and fades in. As a result, the initial frames in the series are quite similar to the first source image. The sequence's middle frame is the average of the first source image distorted halfway to the second and the second source image warped halfway back to the first. Fig[1].

This algorithm will generate 16 frames, in that 2 frames are source and target image, whereas the rest 14 frames are intermediate "morphed" frames. These morphed frames are the combination of the image warping with cross-dissolving. Image warping coordinates the transformations to swap spacial configuration between two images, in which it maps each pixel from one certain position to another position. For each intermediate morphed image I, $\alpha$ value is defined. It is the weight of that particular intermediate image's face shape and color. For every I, $\alpha$ value varies. When $\alpha$ value is 1.0 it relates to the source image without any distortion and if the *alpha* value is 0 then, it displays destination image. The values that lies between $1.0 > \alpha > 0$ are the intermediate morphed images. Fig[2].

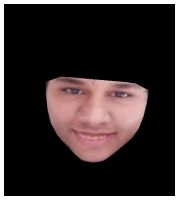

*Figure 1: one of the intermediate morphed frame.*


*Figure 2: 16 Frames with different $\alpha$ values.*

These middle key morphed images are very important to give better results because if they look good then the entire animated sequence video looks good.

## 2 Motivation

In late 19's, there were first movies that used Morphing for special effects like "Willow, 1988", and "I Indiana Jones and the Last Crusade, 1989" Fig[3], first music video used morphing by one of the famous pop singer Michael Jackson in his album "Black or White", 1991, and first Disney animation with speeding productions were "Mickey Mouse", "I SpongeBob SquarePants", "I Gopher Broke".

*Figure 3: 16 Frames with different $\alpha$ values.*

## 3 Implementation

As we know, morphing means transforming one digital image to another digital image. It seems like cross-dissolving is enough then why it is so important to combine cross-dissolving with image warping. If we do cross-dissolving alone, it gives artificial, non-physical, and mainly with double image effect. The interpolation between pixels are not matched properly therefore, it looks messier. Fig[4].

*Figure 4: Cross-dissolving*

That is why we combined image warping for better results such that it will align objects features in both images properly. There are three different morphing techniques- "Wolberg, Mesh-Based Image Morphing, 1990" which relates image features with meshes and interpolates between mesh nodes to generate multiple frames in the transformation, "Wolberg, Thin-Plate Spline Interpolation Method, 1998." which apply surface interpolation over scattered data that finds a "minimally blended" smooth surface passing through all given points, and "Beier and Neely, Feature-Based Image Morphing, 1992. which relates image features with directed feature segments and interpolate between these segments to generate multiple frames.

The algorithm implementation steps of beier-neely method are:-

1. Read in two images file Source and Destination image.
2. Specify the correspondence between source image and destination image interactively using a set of feature points. This feature points can be extracted using DLIB package.
3. Read the face landmark points file. It contains pair of feature points of both images.
4. Compute destination feature points by bilinear interpolating between the source image and destination image by wrap function. There face landmarks define the destination shape.
5. Wrap source image to its destination shape, computing a new image and Wrap target image to its destination shape, computing a new image and Cross-dissolve between those new images by dissolve fraction $\alpha$.
6. Save each morphed image into a file.
7. Finally generate a video visual from the sequence of all the morphed images. Fig[5].

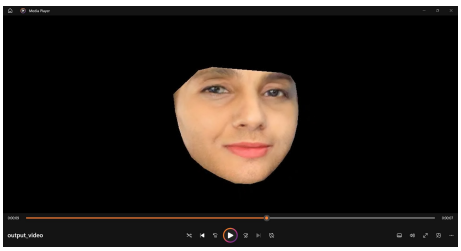

*Figure 5: Animated video*

## 4 Architecture Diagram

The below architecture diagram is the flow of the project idea.

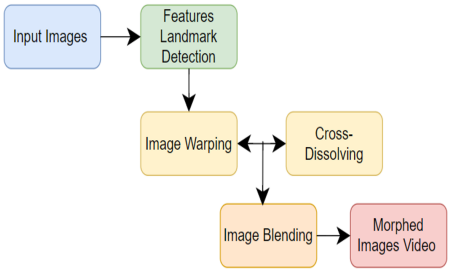


*Figure 6: Architecture Diagram*

## 5 Results

Based on the above implementation steps, algorithm will generate 16 morphed frames. Let's compare the results of source and destination image with one of the intermediate morphed image. Fig[7].

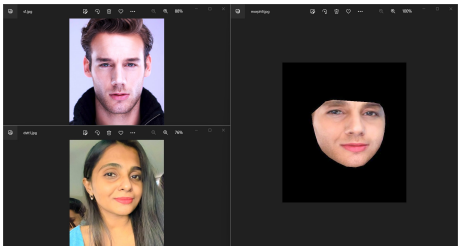

*Figure 7: $9^{th}$ intermediate morphed frame.*

The $9^{th}$ morphed image is neither the source image nor destination image. It is the combination of the both. If we clearly observe, few features from the first image like eyebrows, upper lip, chin(beard), and eyes are mapped and few features from the second image such as nose, lower lip, eyebrows and cheeks are mapped onto the morphed image. Basically during the metamorphosis process the middle images are halfway blended with first image and the last image. i.e source and destination image.

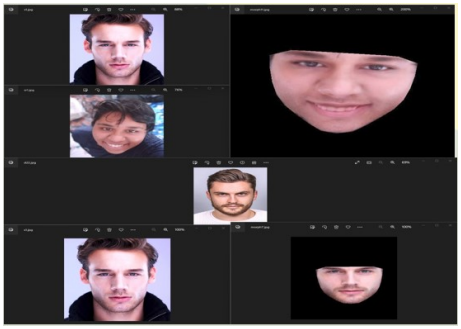

*Figure 8: intermediate morphed frames.*

## 6 User Interface

A user can upload two images that is source and destination image as input through the user interface. Fig [10].

Developed frontend by using python framework. Once the user uploads the two images and click on the morph button, it will display a video of the animated sequence of the morphed images as the result. Fig[9].

In backend, the algorithm will generate 16 morphed frames and these frames are saved in a randomly generated new folder. These new folders are created randomly whenever the user


*Figure 9: User Interface before giving inputs.*


*Figure 10: User Interface after giving inputs.*

clicks the morph button which is on the user interface. Fig[11]

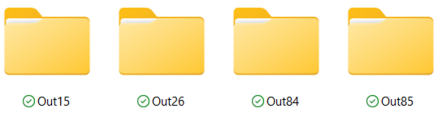


*Figure 11: Randomly generated folders to store the respective morphed frames.*

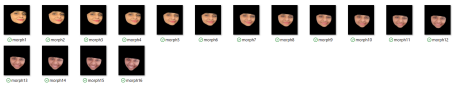

*Figure 12: 16 frames in the new folder.*

## Conclusions

Implemented Image Morphing using Beier-Neely method which is a feature based metamorphosis. Performs image warping with cross-dissolving by defining the correspondence of feature landmarks in both the input images and based on that maps bilinear interpolation between pixels and generate morphed images. In result, all the frames are converted to an animated video which will be displayed on the frontend user interface.

## References

[1] https://dl.acm.org/doi/pdf/10.1145/142920.134003

[2] https://www.ece.uvic.ca/ frodo/publications/fengzhumengprojectslides.pdf

[3] http://www.cs.cmu.edu/afs/andrew/scs/cs/15-463/99/pub/www/notes/warp.pdf