Face Transformation

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Abstract : Image metamorphosis or morphing for short is commonly referred to as the animated transformation of one digital image to the other. Image morphing finds numerous applications in many fields including computer vision, animation, art and medical image processing. Morphing involves the image processing techniques of cross-fading and warping to morph one image into a completely different image. Morphing software allows a step by step transformation from one image into another. We divide the task into two categories, morphing algorithms and automatic feature detection algorithms. The most difficult one is warping of one image into another image. It is the starching and pulling of the images, that makes morphing effects so realistic. Morphing is an image processing technique used for the metamorphosis from one image to another. The idea is to get a sequence of intermediate images which when put together with the original images would represent the change from one image to the other. The simplest method of transforming one image into another is to cross-dissolve between them. In cross-desolation, the color of each pixel is interpolated over time from the first image value to the corresponding second image value. This is not so effective in suggesting the actual metamorphosis. For morphs between faces, the metamorphosis does not look good if the two faces do not have the same shape approximately

IndexTerms – Morphing **,** warping**,** interpolated**.**

I. INTRODUCTION

The actual morphing of the images can be accomplished either by using morph points or morph lines. Morph points are the markers that you set up on the start image and the end image. The morphing program then uses these markers to calculate how the initial image should bend/warp to match the shape of the final image. The second method is lines instead of individual points. Both methods produce very realistic morphing image. Image warping can be defined as a method for deforming a digital image to different shapes. Practically, this can be simulated using an image drawn on an elastic surface. By moving the corners of the elastic material to new positions, the image will deform accordingly. Image morphing combines image warping with a method that controls the color transition in the intermediate images produced. To morph one image to another, new positions and color transition rates for the pixels in each of the images in the sequence must be calculated. The image morphing involves three processes:

(1) Feature specification,
(2) Warp generation and
(3) Transition control [1]

II. RELATED WORKS

Over the years, many methods have been proposed to perform image morphing. Of these, the following are worth mentioning. Triangulation based methods achieve interpolation through a triangulation of control points by first dissecting the defining space into a number of triangles with the given control points being the corners of the triangle. Each of the resulting triangles is then interpolated independently [2]. Obviously, given any number of control points, many triangulations are possible. To avoid thin, poorly shaped triangles and therefore find the optimal triangulation, Delaunay triangulation [3] is commonly used. Field morphing handles correspondence by means of line pairs. A line of corresponding lines in the source and target images defines a coordinate mapping between two images, [4]. The Shepard approach of scattered data uses a weighted average of the data values at the data points, with weights dependent on the distance of the points from the given control point, [5]. Other methods include the radial basis functions, nearest neighbor interpolation, inverse distance weighted method etc. A recent comprehensive study of these methods is available in [6].

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III. MORPHING

PROPOSED DESIGN

The complete details about the proposed morphing approach are outlined here. This is completely aligned in three sections. They are:

- Control Points Extraction
- Warping
- Color Transition

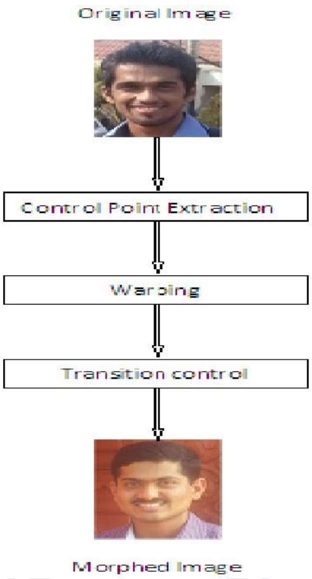

Fig 1: Flow chart of Image morphing

A. Control points Extraction

The choice and number of control points determine how accurately two images can be warped. The use of many control points will usually result in a very good warp. However a high number of control points will reduce the speed of the system since the number of triangles increase, which in turn increases the computation time. Given an image, this work focuses on the warping of the human face. Therefore, the control points selected are all within the face region as shown in Fig.

Fig 2: Control points Extraction

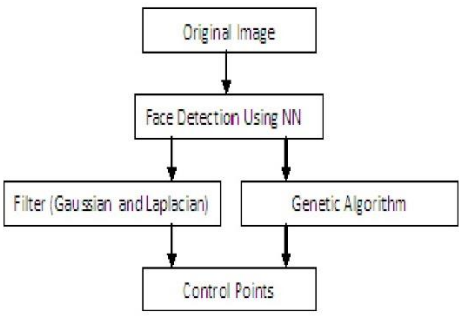

Fig 3: Flow diagram of control point selection

B. Warping

Control points extraction is performed for both the source and target images. Once these points are found, the images are ready for warping. The source and target images are of the same size, but the faces in them can be of different sizes. The warping method used in this work is triangles based interpolation. The images are divided into several triangles using the control points already found.

To evaluate the values of these points all that needs to be known is the size of the image. For two corresponding triangles, one from the source image and the other from the target image, the warping transformation from one to the other can be performed. Let points P1, P2, P3 on the source image be located at x1= (u1, v1), x2= (u2, v2) and x3= (u3, v3). Also let points Q1, Q2, Q3 on the target image be located at y1= (x1, y1), y2= (x2, y2) and y3= (x3, y3). The points on the source image can be mapped to those on the target image using equations,

$$x = a11\ u + a21\ v + a31 \qquad (1)$$
$$y = a12\ u + a22\ v + a32 \qquad (2)$$

The coefficients a 11, a 12, a 21, a 22, a 31 and a 32 can be calculated. Then warping can then be done using target to source mapping.

C. Transition control

A morph contains a sequence of intermediate images from the source image to the target image. Color transition is the method that determines the rate of color blending across the sequence. The choice of this rate determines the quality of the morphs. Interesting morphs can be created depending on whether the color-blending rate changes locally or globally. The rate of color blending is usually based on weights. Such weights are selected to smoothly complete the transition between the images on the sequence. In this paper, the weights are calculated using a one-dimension Gaussian function. This method is implemented as follows:

Given two corresponding target and source pixels. First, calculate the difference in color between them and then set the Gaussian function 1 for the target pixel and to 0 for the source image. The weight for each morph in the sequence is then calculated based on the color difference calculated before, the value of the Gaussian function at that point and the number of warps in the sequence.

Algorithm

Image morphing is made by warping and color blending. Based on triangle coordinate system, we can apply geometric transformations to some images to retain geometric alignment between their features, and blend their colors. Followings are the detailed algorithm instructions.

Step1: Mark the feature points on the source image and corresponding feature points on the target image respectively as,
S = S(i) and D = D(i) Where, i = 1, 2,....., n and n be the number of feature points.

Step2: Form triangle net on face image with the feature points as the vertices of triangle.

Step3: Consider k number of intermediate frames which has shifted point sets V = V(i) Where, i = 1,2,.....,n and
Vx(i) = Dx(i)−Sx(i)/k;Vy(i) = Dy(i)−Sy(i)/k Where, i = 1,2,.....,n

Step4: For each point in the source image, compute its triangle coordinates from triangle net.

Step5: Consider the feature point sets of jth frame
Cj = Cj(i) Where, i = 1,2,.....,n and j = 1,2,.....,k
1)Cjx(i) = Sx(i) + j ∗Vx(i),Cjy(i) = Sy(i) + j ∗Vy(i) Where, i = 1,2,.....,n
2) For each point in the source image, compute its cartesian coordinates according to its triangle coordinates computed in step 4, and triangle net represented by Cj.
3) Color blending and interpolation.
4) j = j+1 where, j < k.

The color for each image in the morph sequence is then calculated using;

$$\psi j = \psi i - \omega i * \Delta\psi ij \qquad (3)$$

Where: ψj is the color for the new warped pixel, ψi is the weight and ψij is the color difference between the target and source pixels.

This procedure is repeated for every pixel in the image and for every image in the morph sequence. The source image changes from the original image, to the new image produced by the first warp and so on.

IV. RESULTS AND DISCUSSION

BY MESH MORPHING

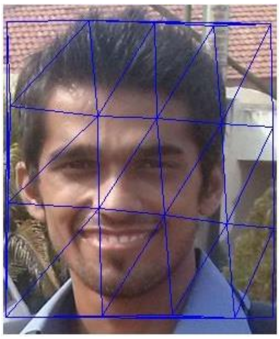
Fig. 4 Mesh on source image

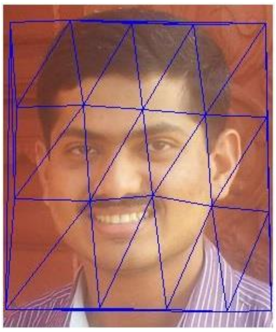
Fig. 5 Mesh on target image


Fig. 6 Morphed image

Fig. 7 Mesh Morphing Frames

TRIANGULATION MORPHING

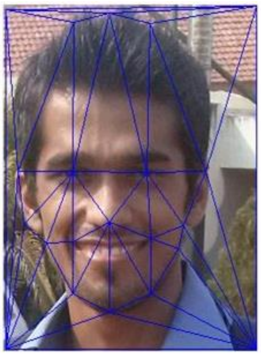
Fig. 8 Triangle net on source image

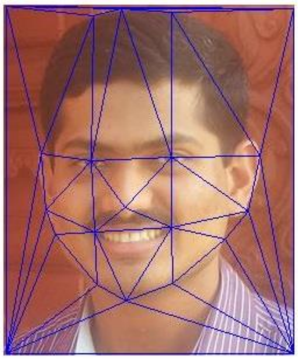
Fig. 9 Triangle net on target image


Fig. 10 Morphed image

Fig. 11 Trianleg Morphing Frames

Parameters	Origional image close to Morphed image	Morphed image by Mesh morphing	Morphed image by Triangulation morphing
Time	-	9.3445	8.4085
MSE	-	3.155221751360000e+02	39.829042133333395
PSNR	-	46.281009473439990	64.257609977552220
MEAN	1.272475111111111e+02	1.249909488000000e+02	1.263561346666665e+02
Std.Deviation	52.642724742151630	45.856199263603760	50.095215380887000

Fig. 12 Comparison of results obtained in mesh morphing and triangle morphing

In two methods previous method as well as proposed method. The previous method called mesh warping and the proposed method called triangle warping, compare to the mesh warping the triangle warping has more accurate

V. CONCLUSION

The PSNR value for triangular warping is higher than that of Mesh warping. The proposed method called triangle warping, compare to the mesh warping triangle warping has more accurate PSNR. The results show that the triangulation morphing method produces smooth morphs than mesh morphing. We get better morphed result in case of triangulation morphing than mesh morphing and also the required processing time is less.

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