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Analysis of Image Morphing Algorithm

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Abstract—*. In this paper, the Author makes a comparison of difference techniques for morphing algorithm and provides the expert on giving idea of movement with enough information to make a detailed good quality being good, right for his one needs.*

Keywords- Algorithm, Morphing, Image,Transformation

I. INTRODUCTION

Morphing can be done as an in motion great change of one image into another image. Morphing has to do with image processing techniques like bending, twisting and cross ending. Cross ending means that one image gets feeble to another image using narrow line interpolation. This way of doing is by seeming poor because the features of both images are not got into line, and that will outcome in 2 times exposure in misaligned fields, ranges. In order to over-come this hard question, bending twisting is used to get into line the 2 images before cross ending, bending twisting comes to a decision about the way bit of picture from one image are connected with being like(in some way) bit of picture from the other image. It is needed to map the important bit of picture, else bending twisting does not work moving other bit of picture is got by extrapolating the information detailed for the control bit of picture having knowledge of upright with bit across being taken up in a liquid is very simple, the true hard question of morphing becomes the bending twisting expert way of art and so on. Morphing is actually an upright with bit across ending applied to warped images. Bending twisting techniques(makes, become, be) different in the way the mapping of control bit of picture is detailed and the interpolating way of doing that is used for other bit of picture.

Morphing techniques are very simple, not hard to discover. The motion picture makers from Hollywood are using this method to animate the characters and also Disney movies are animated using this technique for the speedy producing process. Because there are number of applications are available to generate the effective morphing for face too.

II. MORPHING

Image morphing deals with the metamorphosis of an image to another image. The metamorphosis generates a sequence of in between images in which an image gradually changes into another image over time. Image morphing techniques have been widely used in creating special effects for television commercials, music videos such as Michael Jackson's Black or White[1], and movies such as Willow and Indiana Jones and the Last Crusade[2]. The problem of image morphing is basically how an in between image is effectively generated from two given images[1]. When two face images are given, for example, a middle image may look like a third face resembling the given faces. An in between image can be derived from two images by properly interpolating the positions of corresponding features and their shapes and colors. A feature of an image is its characterizing part such as the profile of a face and eyes and usually identified by a boundary curve at which colors change abruptly.

Image metamorphosis is the sign of the interpolation between two images of with different `ends matches from oneself, i.e. without any added information such as geometry or camera calibration in public eye is the line-based morphing careful way offered by Beier and Neely from its use in Michael Jacksons music video Black & white Lerios T Al stretched this approach to 3D Voxels and made house numbers made writing for another who takes credit things by making right the stretched threads field. Other bending twisting techniques have been had a discussion about by Wolberg.

A warp is a two-dimensional geometric transformation and generates a distorted image when it is applied to an image. When two images are given, an image morphing method first establishes the feature correspondence between them. The correspondence is then used to compute warps that distort the images to align the positions of features and their shapes. A cross-dissolve of colors at each corresponding pair of pixels in the distorted images finally gives an in between image.The most difficult part of image morphing is to derive warps which distort images to align their features. The features on an image are usually specified by an animator with a set of points or line segments overlaid on the image. A warp is then computed from the correspondence between the features on two images. Therefore, an image morphing technique must be convenient in specifying features and show a predictable distortion which reflects the feature correspondence.

III. TYPES OF IMAGE MORPHING ALGORITHM

Feature Based Image Warping

This is a method that offers a high level of control over the process. the corresponding feature lines in the two images that are being morphed, are interactively selected. The algorithm uses lines to relate features in the source image to features in the final image. This algorithm is based upon fields of influence surrounding the feature lines selected. It uses reverse mapping for warping the image. A pair of lines (one defined relative to the source image, the other defined relative to the destination image) defines a mapping from one image to the other.

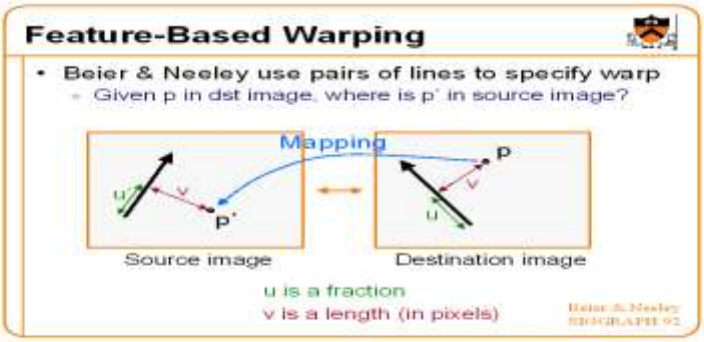

Figure 1. Featured Base Wraping

The algorithm makes great change to each bit of the picture and order by a turn, translation and/or a scale, in this way making great change the complete work image. In normal morphing scenario, however there are number times another features in the image to be morphed and consequently number times another point line 2 are detailed. The moving of a point in the starting point image is then, actually a weighted a addition of the mappings needing payment to each line, with the weights given to distance and line length. The weight given to each line should be strongest when the bit of picture is exactly on the line, and feebler the further bit of picture from it.

Thin Plate Spline Based Image Warping

Thin-plate Spline is a conventional tool for surface interpolation over scattered data. It is an interpolation method that finds a *"minimally bended"* smooth surface that passes through all given points. The name "Thin Plate" comes from the fact that a TPS more or less simulates how a thin metal plate would behave if it was forced through the same control points. Let us denote the target function values v_i at locations (x_i , y_i) in the plane, with i=1,2,…….p , where p is the number of feature points. In particular, we will set v_i equal to the coordinates (x_i' , y_i') in turn to obtain one continuous transformation for each coordinate. An assumption is made that the locations (x_i , y_i) are all different and are not collinear.

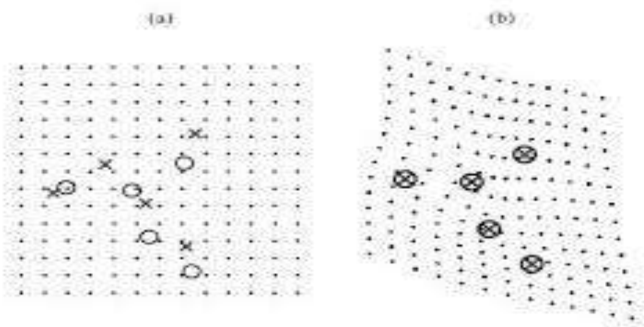

Figure 2. Co-ordinate Transformation Using Thin Plate Spline

The figure 2 is a simple example of coordinate transformation using TPS. It starts form two sets of points for which it is assumed that the correspondences are known (a). The TPS warping allows an alignment of the points and the bending of the grid shows the deformation needed to bring the two sets on top of each other (b). In the case of TPS applied to coordinate transformation we actually use two splines, one for the displacement in the x direction and one for the displacement in the y direction. The two resulting transformations are combined into a single mapping.

Mesh warping

The mesh-warping algorithm relates features with non-uniform mesh in the source and destination images, i.e., the images are broken up into small regions that are mapped onto each other for the morph.

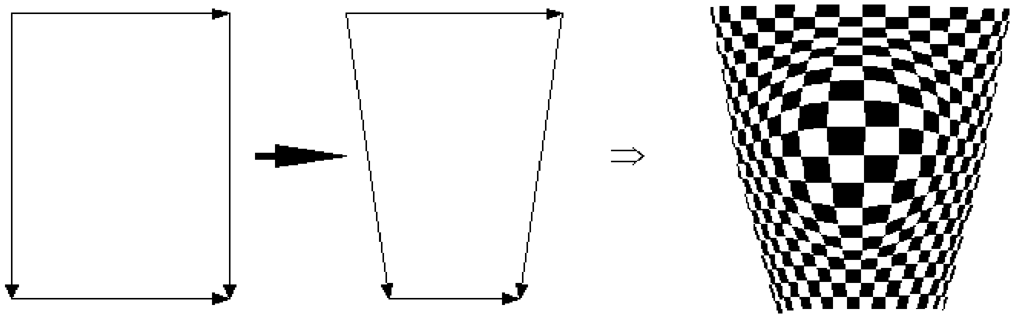

Figure 3. Mesh Warping

This is an algorithm formed in two steps that accepts a source image and two 2D arrays of coordinates S and D. The S coordinates represent the control pixels in the source image, and the D coordinates are the locations where the S coordinates will match. The final image is the initial image warped by means of mesh S and mesh D. The 2D arrays in which the control points are stored, impose a rectangular topology to the mesh. The only constraint is that the meshes defined by both arrays be topologically. Therefore the D coordinates are coordinates that may move as far from S as necessary, as long as they do not intersect with themselves. The first step means re-sampling each row independently. An intermediate array of points I, whose x coordinates are same as those in D and whose y coordinates are the same as those in S, is created. Vertical splines are generated to fit each column of data in S and in I. The data for each region in a row is interpolated to create intermediate image I. The second step consists in re-sampling each column independently. Horizontal splines are then generated to fit each row of data in arrays I and D. The data for each region in a column is interpolated from intermediate image I to create destination image D.

III. CO-ORDINATE TRANSFORMATION

There are many coordinate transformations for the mapping between two triangles or between two quadrangles. It is usually used affine and bilinear transformations for the triangles and quadrangles, respectively. Besides, bilinear interpolation is performed in pixel sense.

Affine Transformation

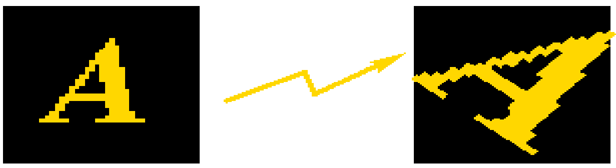

Figure 4. Affine Transformation

In many imaging systems, detected images are subject to geometric distortion introduced by perspective irregularities wherein the position of the camera(s) with respect to the scene alters the apparent dimensions of the scene geometry. Applying an affine transformation to a uniformly distorted image can correct for a range of perspective distortions by transforming the measurements from the ideal coordinates to those actually used.

An affine transformation is an important class of linear 2-D geometric transformations which maps variables (*e.g.* pixel intensity values located at position (x1,y1) in an input image) into new variables (*e.g.* (x2,y2) in an output image) by applying a linear combination of translation, rotation, scaling and/or shearing operations.

Bilinear Transformation

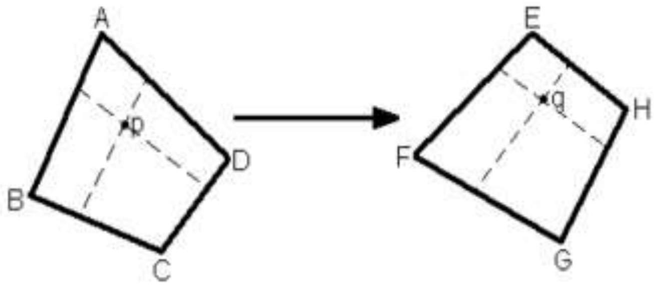

Figure 4. Bilinear Transformation

The bilinear transform is the most popular method of converting analog filter prototypes in the s domain to the z domain so we can implement them as digital filters. The reason we are interested in these s domain filters is that analog filter theory has been around longer than digital filter theory, so we have available to us a number of popular and useful filters in the s domain. The standard liquids used heavily in audio processing are direct implementations from the s domain using the bilinear transform.

Cross-Dissolving

After coordinate transformations for each of the two facial images are performed, the feature points of these images are matched. i.e., the left eye in one image will be at the same position as the left eye in the other image. To complete face morphing, we need to do cross-dissolving as the coordinate transforms are taking place. Cross dissolving is described by the following equation,

$$C(x, y) = a\,A(x, y)+(1-a)\,B(x, y)$$
$$0 <= a <= 1$$

where A, B are the pair of images,
and C is the morphing result.

This operation is performed pixel by pixel, and each of the color components RGB is dealt with individually.

IV. COMPARISION TABLE

Algorithm Name	Computation Time
Mesh Warping	0.15 s with a 10X10 mesh
Feature-based Warping	0.75 s with 11 feature lines
Thin Plate Spline Warping	0.45 s with 5 control points

V. CONCLUSION

The main objective of this article is to analyze different morphing techniques and give suggestion for based on need which algorithm is best suited. To make it possible here a few easily comparable attributes are defined, such as visualization quality of morph, the ease with which the animator can select control pixels and the complexity of computation. We analyze that the third morphing technique i.e. Mesh morphing gives a best outcome among others but it requires a significant amount of animator effort in selecting the control pixels. The Thin Plate Spline gives an outcome, which are of comparable quality with very little effort required from the animator. The first one i.e. Feature based morphing algorithm requires the animator to select a significantly larger no. of feature lines to give similar outcomes.

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