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Morphing Effect and Its Techniques

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Abstract: Morphing means to transform shape of objects from one form to another, which is shortened form of metamorphosis. The metamorphosis generates a sequence of in between images in which an image gradually changes into another image over time. The approach of morphing makes the animator high-level control of the visual effects. Morphing algorithms continue to advance and programs can automatically morph images that correspond closely enough with relatively little instruction from the user. This paper involves morphing techniques which can be classified into two categories i.e. mesh based and feature based methods in terms of their ways for specifying features. Comparison with the existing methods is made along with the advantages and disadvantages. Along with these techniques this paper involves the cross dissolving technique which is a common transition between the cuts.

Keywords: 2D-3D Techniques, Cross Dissolving, Featured based morphing, Mesh warping, Single line transformation, Specification of transformation

I. INTRODUCTION

Morphing, or metamorphosis, aims to generate a smooth shape sequence which transforms a source object shape into a target object shape. This technique has become increasingly important in computer graphics for animation and entertainment, and is commonly employed by the special effects industry. Many morphing techniques have been developed for the 2D case. Morphing is a technique in which we smoothly change one object into another. To accomplish this change is to have the set of vertices that define one object change their locations (& other attributes) to those of the other objects [1].
The idea is to produce a visible metamorphosis effect as intermediate images are being displayed. Image morphing was popular in TV, movies and advertisements in the 1980s and 1990s. Morphing can be seen as a modified version of piecewise warping, in which the user specifies control points in both the initial and final images. An important aspect of morphing is that the warp is computed incrementally, one small step at a time, in combination with a dissolve effect from the initial image to the final one. An alternative method for image morphing, fields based morphing, originally proposed by Beier and Neely [bn92], does not use meshes. The Morphing can be seen as a modified version of piecewise warping, in which the user specifies control points in both the initial and final images. These control points are then used to generate two meshes. An important aspect of morphing is that the warp is computed incrementally, one small step at a time, in combination with a dissolve effect from the initial image to the final one [8].

Image metamorphosis denotes interpolation between images of different objects from correspondences alone i.e. without any additional information such as geometry. Well known is the line based morphing method proposed by Beier and Neely [1992]. The system was used to create the classical morphing sequence in Michael Jackson's Video clip Black & white [3-4]. Basically, morphing is achieved by coupling image warping with color interpolation. The idea is to specify a wrap that distorts the first image into another. The inverse of this will distort the second image into the first. As the metamorphosis moves on, the first image gradually distorted and gets faded, while the second image starts out totally distorted towards the first and is faded in. The early images in the sequence are much like the first source image. The centre image of sequence is the average of both the first image distorted halfway toward the second one and second image back toward the first image. The images in the backward direction are in the sequence similar to the second source image. The middle image is key, if it looks good then probably the entire animated sequence will look good [5].

Morphing has been used as a computer graphics technique. Tom Brigham used a form of morphing in experimental art at NYIT in early 1980's. Industrial light and Magic used this morphing method in cinematic special effects in Willow and Indiana Jones & Last Crusade. These examples are given in Wolberg's excellent treatise on the subject.

The explosive growth of image morphing is due to the compelling and pleasing effects possible through warping and color blending. Morphing tools is directly tied to solutions to the feature specification, wrap generation and transition control. They together influence the ease and effectiveness in generating high quality metamorphosis sequences. A trade off exists between the complexity of feature speciation and wrap generation becomes more formidable [6].

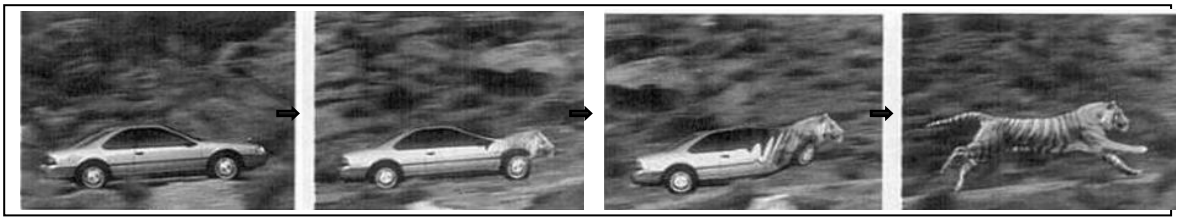

Fig. 1 Image Morphing between the two images

Organization of the paper:
The rest of the paper is organized as follows. In Section II Computer Graphic Techniques with the cross dissolving transition is described, section III describes the Mesh warping Method, Section IV includes featured based image warping, and in section V covers the advantages and disadvantages of the two methods.

II. COMPUTER GRAPHIC TECHNIQUES

By the use of technology in other ways we can build a metamorphosis tool. One approach involves the representation of a pair of three dimensional objects and can be used as a collection of polygons. The vertices of the one object are then displaced with corresponding vertices of the second object over time to coincide in position, with color and other attributes similarly interpolated. The problem with this technique is the difficulty in establishing a desirable vertex correspondence.
For example: The technique was used for the interpolation of a regular grid of 3D scanned data in "Star Trek IV"-the Voyage Home [5].
By two dimensional computer graphics image processing technique it is easier to manipulate scanned photographs of the scene, than to attempt to model and render. The simplest method for changing one image into another is simply to cross dissolve between the two images. The pixels color of image is interject over time from the first image value to the corresponding second image value. But the main disadvantage of cross dissolving is the ghosting effects.

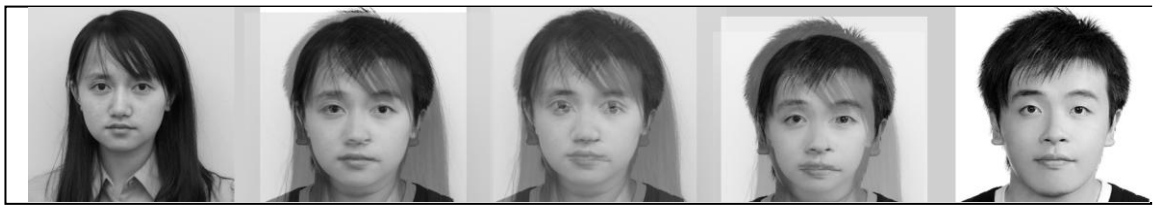

Fig. 2 Cross dissolve effect between two images

The mesh specification uses a representation by parts. The coordinate system is represented by some mesh, and the change of coordinates is computed from its values on the mesh representation [4]. The mesh is a two dimensional grid superimposed over the image. The intersections are points that can be moved around to describe the desired deformation and the connections between the points are spline. [7]

The use of meshes of spline curves [Smithe, 1990] or surfaces suggests a naturally smooth transformation, and was used in image morphing applications for the first time for the special effects in the 1988 movie Willow [4].
The other specification technique is the featured based technique in which the source and destination elements are used to establish a correspondence between distinguished features of the graphical objects. This specification relies on the property of features preservation. The advantage of feature specification is that the user only needs to specify the transformation at relevant features [4].

III. MESH WARPING

The algorithm involves two steps that accept a source image and two 2D arrays of coordinates S and D. The S coordinate represent the control pixels in the source image and the 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, set a rectangular topology to the mesh. The only limitation 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 separately. An intermediate array of points I, whose having x coordinates

same as those in D and whose y coordinates are the same as those in S is developed. 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 means re-sampling again but this time it will be done column wise. After this Horizontal splines are 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 image D the destination image. The collection of vertical splines fitted through S and I in the first step and with the horizontal splines fitted through I and D in the second step, as shown below in the figure 3.

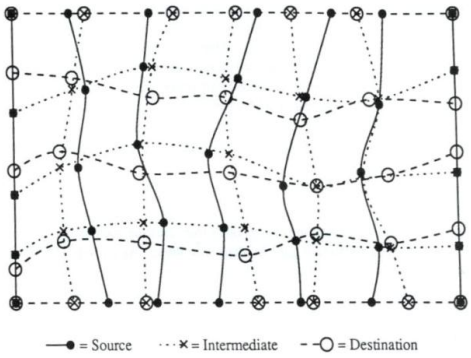

Fig. 3 Vertical spline

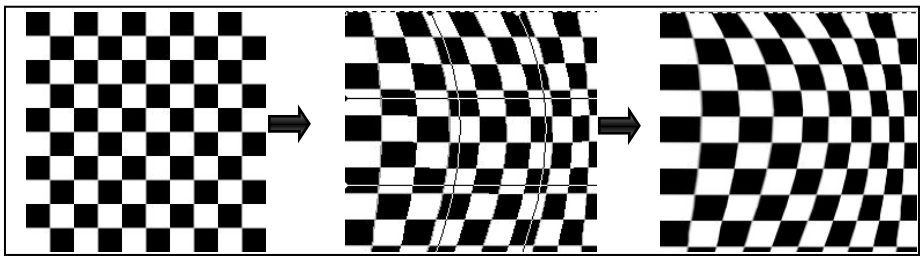

Fig. 4 Mesh warp of image

IV. FEATURED BASED IMAGE WARPING

An alternative method for image morphing, fields based morphing, originally proposed by Beier and Neely [bn92], does not use meshes. It depends on pairs of reference lines drawn on both images and reckon perpendicular distance between each pixel and each control line. It then uses distance and relative position to determine the correct position where a pixel should be placed in the final image [8].

In this method, the features lines in two images that are being morphed are interactively selected. The algorithm uses lines to related features in the source image to features in the final image. It uses reverse mapping for warping the image.

A pair of lines defines a mapping from one image to the other. The algorithm transforms each pixel coordinate by a rotation, translation or a scale, in this way transforming the image completely. However, there are multiple features in the images to be morphed and consequently multiple feature line pairs are specified [3].

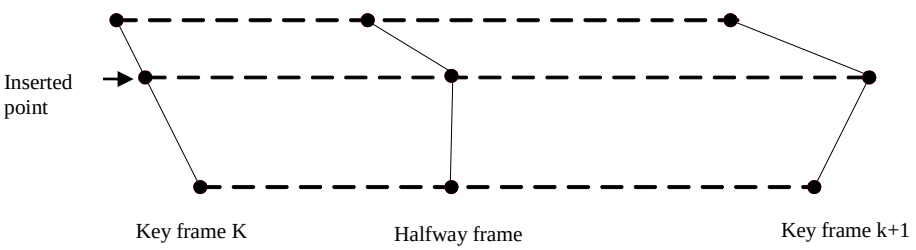

Fig.5: Transforming a line segment

The displacement of a point in the source image is weighted sum of the mappings occurs due to each line pair, with the weights related to distance and line length. The weight assigned to the lines should be strongest when the pixel is exactly on the line and is weaker when the pixel is far away.

Zero-dimensional Features

An important case of feature based warping is the point based specification. In this case, each feature is described by a point which belongs to the geometric data set of the graphical object. Point based morphing specification is largely used in commercial image morphing. In some particular cases, it is possible to reconstruct the warping exactly, from a point based specification. This is the case of the affine and projective warping.

One-dimensional Features

This is an example where the features are specified by curves defined on the shape of the graphical object. Therefore, the specification uses 1-dimensional features. An implementation of an image morphing system where the features are described by oriented line segments was done at Pacific Data Images (Beier & Neely, 1992). This oriented segment based feature system has been extended recently to specify morphing of objects in 3-dimensional space.

Another interesting use of one-dimensional features has been proposed by George Wolberg (Wolberg's, 1989). He addresses the problem of warping an arbitrary shaped subset of an image which is specified just by two corresponding outlines. A thinning operation is used to determine the mapping for the interior region of the outlines.Curve based features has also been used to describe features of images. In (Lee *et al.* 1995) snakes are used to fit a curve the boundary features of images. In figure3 X' is the location to sample the source image for the pixel at X in the destination image. The location is at a distance v from the line P'Q' and at a proportion u along that line.

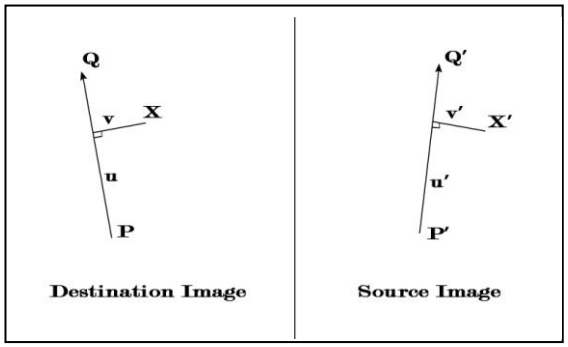

Fig.6 Mapping from one image to the other

V. ADVANTAGES AND DISADVANTAGES

Advantages of mesh warping:-

1. It is less intuitive.

Disadvantages of mesh warping:-

It has local control only and sometimes unexpected interpolations are generated and pixel may be far away from the lines.

Advantages of featured based morphing:-

1. It is more expressive.
2. It makes the animator simply has to describe how lines in a source image are mapped into lines in a destination image.
3.

Disadvantages of featured based morphing:-

The speed and control are the disadvantages of the featured based morphing because all line segments need to be referenced for every pixel.

VI. CONCLUSIONS

The paper includes the morphing along with the techniques and provides the animator with sufficient information to help them. The implementation of cross dissolve is also explained along with the mesh warping method. Image morphing can enhance many multimedia projects or computer based training and can be used to create convincing slow motion effects and has also appeared as a transition between one scene and another in television, though if the images contents are unrelated. It is also used in the field of medical science to recover features not visible in images by establishing correspondence of features among successive pair of scanned images.

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