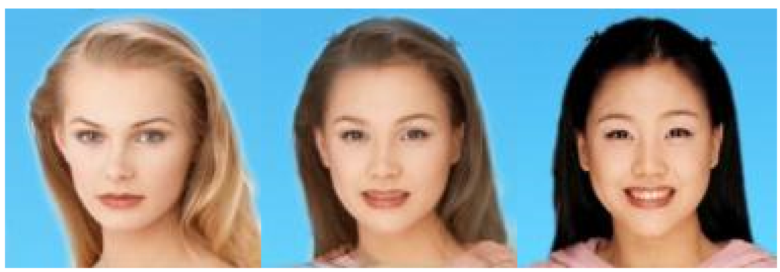
DIGITAL IMAGE PROCESSING

ROLE IN

IMAGE MORPHING



WANT TO CHANGE YOUR IMAGE??

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ABSTRACT

As there is a great saying "Face is the Index of Mind", we look at the image of the person for analysation or for clear understanding. Image Processing is one of those methods which are used for Entertainment, in Medical fields, Aerospace Industries, Graphics etc. Here comes the topic Image Morphing for the conversion of Source image into Destination image. The main objective of this paper is to gradually transform source image into destination image known as morphing process. Image Morphing is a powerful tool for visual effects. Image Morphing techniques are used in film and television depicting the fluid transformation of one digital image into another.

Feature Specification, Warp Generation and Transition Control problems are solved by using morphing algorithms. These features are used to generate the in-between images between Source and Destination.The different steps involved in Feature Specification, Warp Generation and Transition Control are explained through Data Flow Diagrams. We then implement the source code for the generation of in-between images. The Limitations of source code and the steps to be taken to solve those limitations are also discussed here. Finally we conclude with the three solutions to Feature Specification, Warp Generation and Transition Control of Image Morphing.

CONTENTS

Introduction to Digital Image Processing:

An image is digitized to convert it to a form, which can be stored in a computer's memory or on some form of storage media such as a hard disk or CD-ROM. This digitization procedure can be done by a scanner, or by a video camera connected to a frame grabber board in a computer. Once the image has been digitized, it can be operated upon by various image-processing operations.

Image processing operations can be roughly divided into three major categories, **Image Compression**, **Image Enhancement and Restoration**, and **Measurement Extraction**. Image compression involves reducing the amount of memory needed to store a digital image.

Image defects which could be caused by the digitization process or by faults in the imaging set-up (for example, bad lighting) can be corrected using Image Enhancement techniques. Once the image is in good condition, the Measurement Extraction operations can be used to obtain useful information from the image.

Image Morphing is also one of the interesting operations of Image Processing. Image Morphing can be defined as follows:

IMAGE MORPHING:

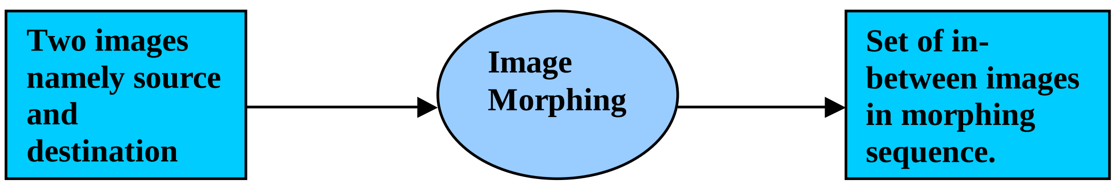
Image morphing is a useful visualization technique. It is often used for educational or entertaining purposes. Image morphing techniques have been widely used in creating special effects for television commercials, music videos.

Image morphing is an image processing technique used to compute a transformation, that is, a metamorphosis, from one image to another. The process is called "morph" for short. The idea is to create a sequence of intermediate images, which when put together with the original images, represents the transition from one image to the other.

Image metamorphosis between two images begins with an animator establishing their correspondence with pairs of feature primitives, e.g.; meshnodes, line-segments, curves or points. Each primitive specifies an image feature, or landmark. The feature correspondence is then used to compute mapping functions that define the spatial relationship between all points in both images.

Since mapping functions are central to warping, we shall refer to them as warp functions. They will be used to interpolate the positions of the features across the morph sequence. Once both images have been warped into alignment for intermediate feature positions, ordinary color interpolation (i.e. cross-dissolve) is performed to generate an in-between image.

We concentrate here to generate the in-between images in the morph sequence. By getting in-between images between the source image and the destination image we can animate them to produce morphing effect of source image to destination image. ***The Data Flow Diagram for Image Morphing is given below.***



The generation of in-between images mainly depends on the solutions to the following problems. In this frame work all these three components are shared by all morphing algorithms.

1. Feature Specification

2. Warp Generation

3. Transition Control

Feature Specification:

Feature Specification for the images can be done with the help of polylines, curves or points which ever is the convenient and easiest. Once a feature specification primitive f0 is placed on image I0,a primitive f1 is also deposited on the other image I1.To guarantee that f0 and f1 have the same number of control points, we let f1 be a copy of f0.

To derive the set of feature point pairs from the specified features, a set of points are sampled on polylines or curves. This makes all no point features have the same number of sampled points or curves. This makes all no point features have the same number of sampled points on each segment. Feature point pairs between two images are then derived from the sampled points on corresponding feature points.

Mouse is used to draw features on both source and destination images. To clearly observe the matching features on both the images, find the edges in the images. That means edge detection operation is performed on the images. For this purpose method Sobel operator edge detection is performed on the image.

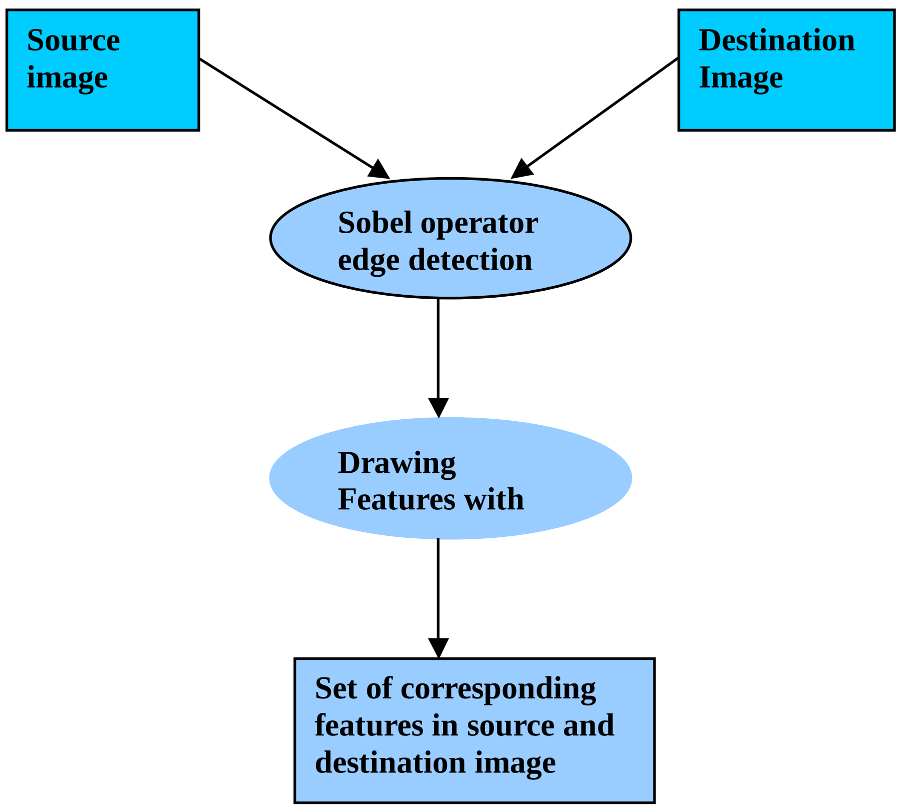
In Sobel Operator Edge Detection mask matrices are used to achieve the gradient values for each method mask matrices are used to achieve the gradient values for each point in the image. To get correct alignment of the gradient value, gradient values are computed in all the eight directions like North, North East etc in clockwise direction. The maximum of obtained gradients obtained in all directions is taken as gradient value of that point. The gradient value of the particular point in the image depends upon the surrounding eight points in the image. The matrices used to compute the gradient values in all eight directions are given below with directions taken in clockwise direction.

1 2 1	0 1 2	-1 0 1	-2 -1 0
0 0 0	-1 0 1	-2 0 2	-1 0 1
-1 -2 -1	-2 -1 0	-1 0 1	0 1 2
N	**NE**	**E**	**ES**
-1 -2 -1	0 -1 -2	1 0 -1	2 1 0
0 0 0	-1 0 1	-2 0 2	1 0 -1
1 2 1	2 1 0	1 0 -1	0 -1 -2
S	**SW**	**W**	**WN**

This edge detection is performed by the function ***edge_convert().***Once the edge conversion of the images have completed features are specified using mouse. Feature specification is done with the function ***feature_spec().***Corresponding features on the images are drawn with mouse. When feature is specified on the source image the corresponding feature must be specified on the destination image. While drawing the program will scan the points on the image.

When corresponding features are specified on both the images same number of points on both features are selected. This is achieved with function ***select_points().***In this way feature correspondence between the image is obtained as two sets of points **P** of the source image and **Q** of the destination image. Both **P** and **Q** will contain same number of points. The different steps involved are:

Steps involved in Feature Specification:



Warp Generation:

This set of features of the source and destination image is given as input to second phase of the morphing process called Warp generation process. Warp function generation is done by the function ***warp_function().***

Feature correspondence among images I0 and I1 is established by two set of points P and Q.The points may either be explicitly given constraints or, more commonly, they are samples from user-specified feature primitives. In either case, they provide correspondence information at a set of sparse and irregular positions.

The warp generation process is responsible for smoothly propagating this information to all points in the image plane to determine warp functions W0 and W1.In this work, we shall be interested in deriving smooth and one-one functions. The smoothness of a warp makes it possible to obtain a distorted image with no discontinuities or abrupt deformations. The one-one property guarantees that the distorted image does not fold back upon itself.Hence,the warp generation problem requires us to find a smooth one-one 2D mapping from positional constraints.FFD manipulation is also manipulated in this warp generation.

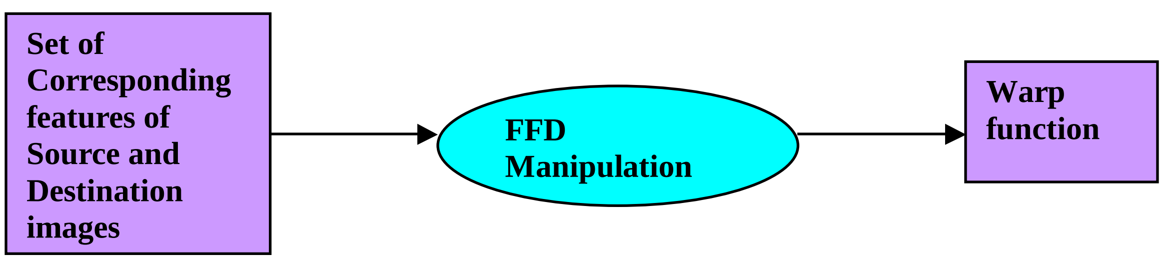
Free-Form Deformation:

This technique is used to generate the warp function as follows:

A 2D FFD is to deform a rectangular plate in the xy-plane by manipulating a rectangular lattice overlaid on it. The bivariate cubic B-Spline tensor product is taken as the deformation function of FFD because a B-Spline has local control. This property makes it possible to locally manipulate a lattice when a point on the plate is moved to the specified position. Therefore, the new lattice producing this improvement can be efficiently computed even for a large number of control points.

FFD process finds the set of lattice point displacements that are added to the initial lattice positions to obtain the new positions of the lattice points. This new lattice gives deformed plate. This ***compute_dphi()*** finds set of lattice displacements. The different steps involved in Warp Generation are as follows:

Warp Generation Steps:



Transition Control:

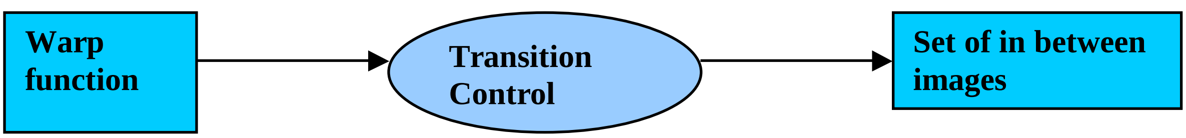
Another interesting problem in image morphing is transition control. If transition rates are allowed to vary locally across in-between images, more interesting animations are possible. Transition rates on an in-between images are derived from transition curves by constructing a smooth surface. The surface represents the propagation of transition rates defined by the user at sparse position across the image. The in-between point position and color is obtained by the following formulae.

$\textbf{Color}_{\text{in-between}} = \textbf{(1-time)*color}_{\text{source}} + \textbf{color}_{\text{destination}}$

$\textbf{Point}_{\text{in-between}} = \textbf{(1-time)*point}_{\text{source}} + \textbf{point}_{\text{destination}}$

A trade off exists between the complexity of feature specification and Warp generation. As feature specification becomes more convenient, warp generation becomes more formidable. The different steps involved in Transition control are shown in the following figure.

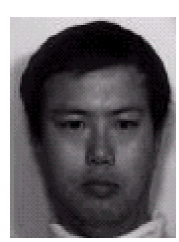
Steps involved in Transition Control:



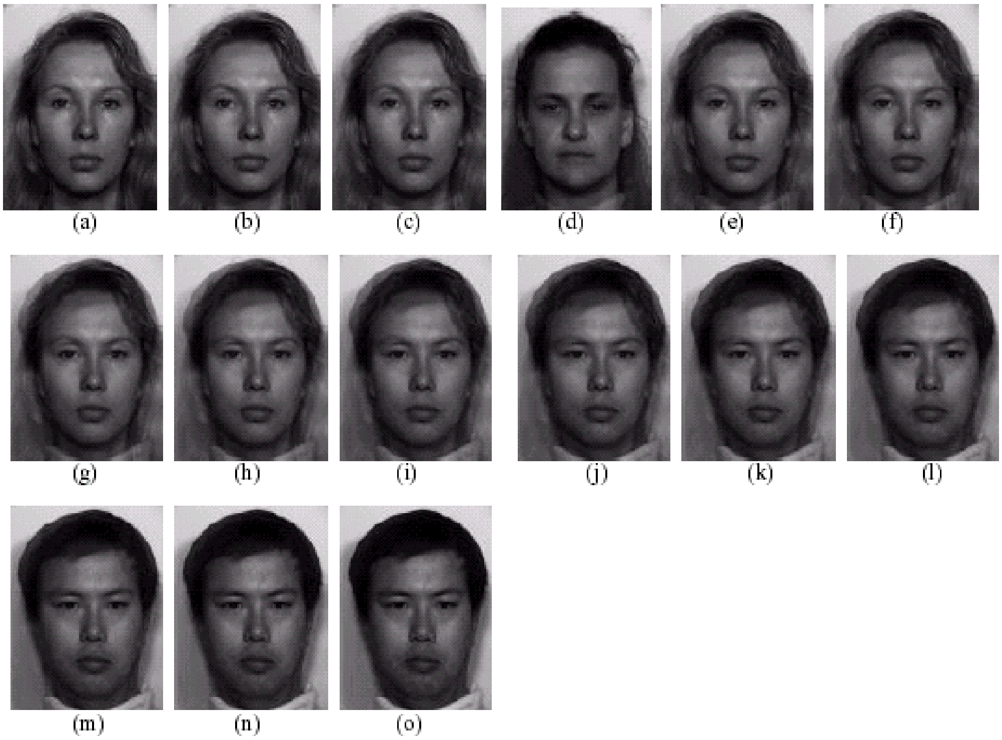
The Source Code for the generation of in between images is given separately as .cpp file & when we execute the Source code, we get the following result.

When the above Source Code is executed, we get the following result. When we select the in between images to be generated as 13, we get the following transformations.


Source Image


Destination Image

In-between Images:



LIMITATIONS:

1. The input image should be .bmp format images. This program does not work for other image formats.
2. In boundary morphing only boundaries of the images are morphed.
3. Feature Specification is tedious process. The two biggest disadvantages of the feature-based technique are speed and control. Because it is global, all line segments need to be referenced for every pixel, which can cause speed problems. In some line combinations and special transformation processes unexpected and unwanted interpolations are generated, that cause additional fixing effort.

Steps to Overcome the Limitations:

1. The image formats may be extended by knowing their image data coding.
2. Boundary morphing can be extended by incorporating color blending using four-corner map method.
3. To reduce tediousness in specification snakes (active contour models) can be used.

Conclusion:-

The solutions to the following problems in the Image Morphing are solved.

1. Feature Specification
2. Warp Generation and
3. Surface generation for Transition Control.

The warp and surface generation techniques in this paper may be applied in other areas of computer graphics. The FFD can be readily extended to 3-D and used to directly Manipulate the shape of deformable objects. If the above limitations are overcome then we will have the better image processing technology.