Image Morphing Using Pixel Transformation and Information Hiding by Morphing

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Abstract- **In this paper colour transition method is based on colour difference in the pixel of the source and target images. In pixel transformation the pixel value of source image smoothly converted into pixel value of corresponding destination image. Information security is a very important issue in a ubiquitous computing environment. Cryptography may not be secure because it tells the attacker clearly that some secret messages are contained in the data. Usually, the encrypted messages look very unnatural. Some malicious person or group may just concentrate on the unnatural parts, and use all computing recourses to decrypt the messages. Thus, to make the information more secure, some other technology is required.**

Keywords- **Image morphing, Feature Specification, Warp Generation, Cross Dissolve, Pixel Transformation.**

I. INTRODUCTION

Image morphing has been the subject of much attention in recent years. It mainly involves feature specification, geometric transformation and colour blending. Image morphing is an effect that shows a transition from one image to another image smoothly. It has been widely used in various fields of work, such as animation, movie production, games, and mobile applications. Image morphing is used in various fields of works such as computer animations, games and movies. In the beginning, image morphing was well-known from the advertisement by Exxon Company in 1989. Afterwards, face morphing was also used for Michael Jackson‘s music video Black or Whitein 1991. Image morphing is not only well-known but also usable for application in various kinds of work. For example, software developer can apply image morphing in their games, animations and movies. However, the developed program is still not usable by general users; thus, this is the reason to improve the morphing program to become more user-friendly. Image morphing is a method for transforming a source image to a destination image smoothly by interpolating some in-between images; hence, the interpolated images contain similar features to both the source image and the destination image.

Two images can be easily morphed by cross dissolving the images. This gives an effect of fading out the source image and fading in destination image, so not effective actually. In addition during face image morphing the double exposure effect in the eyes and mouth areas is seen and morph does not look natural.

In information hiding, the secret message is embedded in some unrelated cover message. The cover message in which the secret message is embedded is called stegodata in steganography [4]. To ensure the security, it is crucial to keep the stegodata as close as the cover message, or the existence of the secret message can be detected easily. For example, if we want to hide some secret massage in the Mona Lisa, the stegodata should be similar to the original picture, or it will be meaningless to use steganography.

II. RELATED WORKS

Before the image warping [1, 8] was introduced image morphing was achieved through the cross-dissolve of images, where one image is faded out and other image is faded in but this is not so effective in signifying the actual metamorphosis [1]. The results are poor, owing to the double-exposure and ghosting effect apparent in misaligned regions i.e. in face images generally it is most prominent in the eyes and the mouth regions. This was due to misaligned mouth and eyes regions in face. Over the past few years many image morphing techniques have been proposed. Effectiveness of the image morphing lies in the feature point selections and wrap generation.

Morphing human faces with automatic control point's selection and colour transition discuses use of combination of a face detection neural network, edge detection and smoothing filters. A triangulation method is used as the warp algorithm [5] while a method based on the one dimensional Gaussian function is applied in colour transition control or blending of wrapped images.

A. Cross Dissolve:

Cross dissolving is a linear colour interpolation to fade from one image to another is one of very initial method of morphing. A cross dissolve is usually applied to the whole image and in effect the texture of the source image is transformed to the texture of the destination image by blending the colour of the pixels[1, 8]. The result is poor because of the double exposure effect that is apparent in regions where the features of the source image do not align with those in the destination image.

B. Mesh Warping:

There are two major ways of performing image warping, namely mesh warping approach [8] and field morphing method [3]. For the first method, a mesh with predefined resolution is placed over the image and the user moves a subset of the mesh points to some desired positions. A warp is then computed based on all the mesh points. The advantage of this method is its fast computation speed. However, as the warping is calculated on a predefined resolution and each mesh point exerts the same amount of influence on the warp, the expressiveness and flexibility of the method are poor. For the field morphing method, instead of imposing a mesh on the image, several feature points or lines and their movements are identified by the user. The warping is then determined by creating a "force field" on the image pixels. Although this method allows the user to express and control the exact warping of the feature points and lines, it is relatively slow as each image point in the image is affected by all the warping force fields generated by the features.

C. Transition Control:

Setting up the rate at which warping and colour blending takes place during a morph sequence is called the transition control. When the transition rate is different from part to part for in-between images in a morph sequence, interesting results can be expected. Such non-uniform transition functions can improve the visual effect of the morph.

III. PROPOSED METHOD

A. Image Morphing: Color transition by merging colour difference in the pixels. In this method balanced sequence of the intermediate images is generated and the number of morphs is controlled by user. If the number of intermediate frames is more, the generated morphs are smoother and vice versa. No threshold is required here. This method can be compared with existing cross dissolve method of colour transition discussed in section II, when the number of intermediate images is in the range of 3 to 15. Weights required to control the rate of blending are computed using difference in the colour of two corresponding pixels from source and target images and the number of intermediate frames required.

Author	Technique Used	Advantage	Disadvantage
T. Beire and S. Nelly [3]	Featured based	Feature Morphing gives high level of control to programmer on output results and produce good animator effect.	Feature Morphing has disadvantage of ghost lines and speed.
G. Wolberg [8]	Mesh warping	Mesh Warping breaks images into small region and maps pixel to pixel from source to destination image. So no ghost lines appear in image.	It does not produce transition on image with more perfection and take more time at least two minutes in morphing process.

Table1. Comparison of existing morphing technique

Algorithm:

1. Start
2. Read source image A and destination image B.
3. Read number of frames F.

4. Resize both images to size M×N pixels.
5. Compute colour difference D, pixel wise using steps 6 to11
6. $If\ A(i,j,k) < B(i,j,k)$
$$D = B(i,j,k) - A(i,j,k)$$
7. Compute step size S as
$$S(i,j,k) = D / F$$
8. If $A(i,j,k) > B(i,j,k)$
$$D = A(i,j,k) - B(i,j,k)$$
9. Compute step size S as
$$S(i,j,k) = -(D / F)$$
10. $If\ A(i,j,k) = B(i,j,k)$
$$D = 0$$
11. Compute step size S as
$$S(i,j,k) = 0$$
12. For 1 to F repeat step 13 and 14
13. Compute intermediate image as
$$C(i,j,k) = A(i,j,k) + S(i,j,k)$$
14. Display intermediate image C.
15. Stop.

In this method computation of weight and deciding of step size is simple and it performs in faster manner. The quality of morphs image is good and hence when represents one after other it looks like seamless transition of source image to destination image.

B. Hiding Information: Originally, image morphing is the process to change one image (the source image) to another (the target image) smoothly [1,2]. It is interesting to notice that any intermediate image produced in the morphing process looks like a natural image, and some of them can actually be used as the stegodata. In this paper, we call an intermediate image the morphed image. Clearly, both the source image and the target image can be hidden in the morphed image. Since the morphed image is similar to the source image and the target image, it may not be secure if we try to hide two images together. Thus, we just consider to use one image (e.g. the source image) as the secret image, and use another (e.g. the target image) as the cover image. To ensure the security, the cover image is used as oneof the stego keys, and is kept secretly [4].So far, we have studied the problem to hide face images, and applied the morphing based technique for protecting the privacy contained in a face database. However, there are two fatal problems in the morphing based technique. First, the morphed image may not look natural due to inaccurate definition of the feature lines or feature points. Second, the secret image can be estimated to some extent from the stegodata.

Steganography based on morphing:

This section describes the image morphing based information hiding technology briefly. The flow diagram of this technique is shown in Fig. 1. First of all, to hide a secret image through morphing, we should define some features (points or lines) in the secret image and the cover image. We also need to define the morphing rate. With these stego keys, we can combine the secret image and the cover image through morphing, and get the morphed image. The morphed image will be used as the stegodata, and be transmitted to the authorized person through public channel. Upon receiving the morphed image, the authorized person can reconstruct the secret image through de-morphing using the same stego keys, which are sent to the authorized person in advance through some secret channel.

The basic idea of the morphing based information hiding technique is to protect the secret message (e.g. a face image) by storing the morphed image, which is one of the intermediate images produced in the morphing process. In fact, the morphedimage can be produced directly if the morphing rate is given. The point is, if the morphed image looks natural, it will be difficult to know the existence of the secret message.

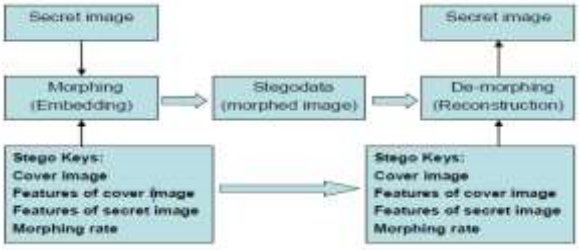

Fig. 1: Morphing based Information Hiding

IV. RESULTS

Image morphing using pixel transition here it performs on MATLAB R2012b using a computer Intel(R) Core(TM) i5-2430M CPU @ 2.40 GHz 4GB RAM.

The algorithm is tested on image of human, animal and flower. In between source and destination image there are seven intermediate images are considered.

Fig. 2: Morph sequence obtains by pixel transformation method.

In Fig. 2(a) and (i) are the source and target images respectively and (b), (c), (d), (e), (f), (g), (h) are the intermediate morph sequence.

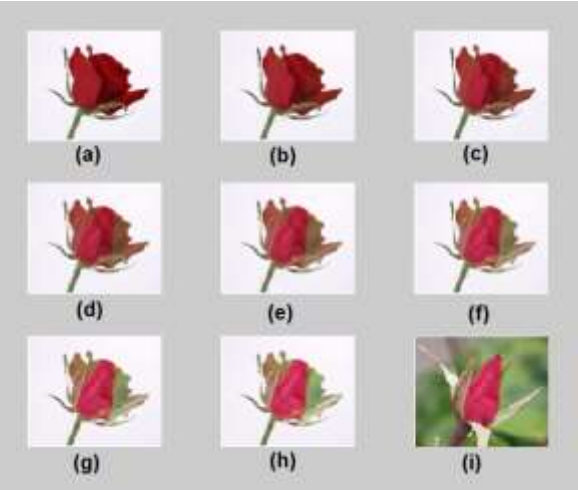

Fig. 3: Morph sequence obtains by pixel transformation method in between two flowers.

In Fig. 3 (a) and (i) are the source and target images respectively and (b), (c), (d), (e), (f), (g), (h) are the intermediate morph sequence.

V. APPLICATION

Image morphing has traditionally been associated with visual effects for entertainment. Visually compelling fluid transformations are created by synthesizing intermediate images between supplied image pairs. The basis for these results is attributed to the geometric alignment that is maintained throughout the image sequence. This same result applies to other domains where image interpolation can benefit from supplied geometric correspondence. Although intermediate slices can be computed with conventional linear, cubic, or higher degree interpolation functions, this traditional approach does not consider the underlying structure of the imaged organs. Superior results are made possible by establishing geometric correspondence of features among successive pairs of scans.

VI. CONCLUSION

In this paper the approach to image morphing and information hiding have been proposed, have some important advantages: It is relatively fast and generates good quality middle image compared to the existing cross dissolve method of colour transition. The advantage of this method over existing cross dissolves method is that computing step size is easy and number of intermediate images to be generated can be controlled by user, where as in existing cross dissolve method step size computation requires proper adjustments of the weights according to number of frames required. In cross dissolve first frame is always source image and last frame is always target image. Whereas second proposed method always generates two extra frames and this contributes to seamless transformation.

When the colour transition method is used for face images of humans and animals, morphs generated does not look good due to the double exposure effect in significant regions in the face, like eyes and mouth regions. This is because even if both images are of same size the faces in both images need not be of same size and hence the eyes and mouth regions are misaligned which gives double exposure effect in morphs. Further work will be on 2D face image morphing for wrapping the source image with respect to the target image to align the significant features in face then to morph them.

In this paper, we have pointed out the problems in the existing morphing based information hiding technique, and proposed several methods for solving the above problems. To increase the security further, we also proposed to separate the features of the cover images, which are important stego keys in the proposed technique, from the secret message. We believe that these methods can make the morphing based information hiding technique much more practically useful.

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