Abstract

Age-progression is the process of modifying the facial image of a person in order to make him appear several years older. The process of generating synthesized facial images has several applications in searching for missing children, age progressed face recognition, entertainment, movies etc. Police investigators who search for children that have been missing for several years have to predict the children's current looks from images taken at an earlier age. Earlier, this work was done by forensic artists, based on their experience and artistic skill. The time and cost involved in generating manually age-progressed face images restrict the use of this technology in real-life applications. The process of computer-assisted age progression involves the modification of the shape and texture of a person's face in order to reflect age-related trends coupled with person-specific transformations such as aging pattern adopted by close relatives of the subject. Facial aging effects induce notable variations in one's appearance across ages. During formative years, facial aging effects are typically observed in the form of pronounced variations in facial shape and during adulthood, they are observed in the form of subtle variations in facial shape and texture. Typically, individuals of the same gender and ethnic background exhibit similar facial aging traits across ages.

Identification of facial feature points (or landmark points) is the first step in facial aging process as well as many facial image applications like video surveillance, face detection and recognition, age grouping, expression classification, face modelling, face anthropometric, emotion expression, and robotics. The most significant feature points are eyebrows corners, eyes corners, mouth corners, nostrils, nose tip, chin and face edges. Eyes are the most crucial facial feature for face analysis because of its inter-ocular distance, which is constant among people and unaffected by moustache or beard.

This work aims to develop a technique for predicting older face images from a given child's face image. This technique requires two input images, one is the source image of a child and the other one is older target image, which one may be a close relative of the child. The two images are morphed to get older predicted images of the child.

In order to perform morphing landmark points are to be marked on the source as well as the target image. We have proposed a semiautomatic method for localizing landmark points on a face image. The manual work involved is the marking of

the positions of left eye, right eye and mouth midpoint on the input face image. Then a total of 68 landmark points are automatically marked by the method. For automatic marking of these facial feature points we utilise a pre-prepared template of landmark points. A set of such templates are prepared for different age groups such as 1-5, 6-10, . . . , 66-70. Such a template is prepared by manually marking all the 68 landmark points on an artificial face image created by averaging many face images of that group. Landmark points on a given image are marked by fitting a template appropriate for the age. In order to do this the template face should be enlarged or shrunk horizontally and vertically so that the eye positions and mouth midpoint of the template and given image match. The templates need to store only the normalized coordinates of the landmark points.

Before morphing the source and target shapes indicated by the landmark points are to be warped to an intermediate shape. To do this triangulation of the landmark points are done for both the shapes. Then corresponding individual triangles are warped. We proposed a triangle wise mapping method for image warping. To get the pixels values of target triangle from the pixel values of the source triangle, both the triangles are recursively sub divided until no more sub division can be performed in at least one of the triangles. Termination condition is computed based on in-radius of the triangle. After termination, pixel values indicated by in-centres of the two triangles will be mapped from source to target. Different situations that may arise after termination are handled appropriately. A Triangle is subdivided by joining the three middle points of the three sides of the triangle.

Using the proposed method the source image is warped to the shape of intermediate image getting the first temporary image. Similarly the target image is warped to the shape of intermediate image getting the second temporary image. The two temporary images are then morphed to get the required output image. Morphing parameters can be controlled to produce a progression of output images.

Acceptable synthesized face images are obtained by performing practical experiments on the proposed method.

The main advantage of the proposed approach is that no model is needed for the aging process. It is based on examples.

Keywords — Synthesize image, age progression, future image prediction, face image modeling, missing children.