



A Survey on Face Recognition Using Face Mosaicing

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ABSTRACT: Mosaicing is the combination of information constituted by many images through the application of a registration and blending procedure. It describe about a face mosaicing scheme that produces a combine face image during enrolment based on the information given by frontal and semi profile face images of an individual. Face mosaicing remove the need to store several face templates representing multiple poses of a user's face image. In the propose method, the side profile images are arranged with the front view of the image using a hierarchical registration algorithm that utilizes neighbourhood properties to determine the transformation relating the two images. Side profiles and the frontal image is then blend with multiresolution splining and generating a combine face image of the user.

KEYWORDS: Face Mosaicing, Face recognition, Multiresolution Splining.

I. INTRODUCTION

Mosaicing is one of the techniques of image processing which is useful for tiling digital images. Mosaicing is blending together of several arbitrarily shaped images to form one large radio-metrically balanced image so that the boundaries between the original images are not seen. Mosaicing also obviates the need to store multiple templates of a user during enrollment, thereby optimizing storage demands and processing time. Various steps are involved in image mosaicing such as image registration, image warping and image blending. Image registration is the most important step in image mosaicing. It is the process of superimposing two or more images of the same scene taken by different sensors, from different viewpoints, at different time instants. It is the process of aligning of two images geometrically – the reference and target images. Registration method can be classified into following type: algorithm that directly uses image pixels using correlation method; algorithm that use analysis in frequency domain; feature based algorithm that use low level image features such as edges and corners; algorithm that uses high level image features such as defined objects, or image patches or relation between image features. In image warping approach, the two images that are going to create mosaic are warped by using the geometric transformation. It is the mapping function which maps or places the pixel intensity value from current location to new location.. In Image stitching approach, there are two types of blending processes: optimal seam finding and transition smoothing.

Likewise the face mosaicing is the process of blending together the front and the side profile images to form a new arbitrary face image. The primary goal of the face mosaicing is for enhancing the matching performance of a face recognition system. In addition, it is used increasingly in verification, identification, security, access control-surveillance-border, public safety and commercial applications.

The role of a face mosaicing in face recognition technology is very important as matching a frontal facial image with the mosaiced facial image will give more accurate result as compared to matching different angel/positional facial image. So for increasing the accuracy of face recognition, the accuracy of face mosaicing needs to be increase. But despite of being a research topic for more than 20-years with several classifiers developed, the threats like change in illumination, pose and facial expression have not been solved yet. (i.e. designing pose-invariant algorithms is particularly very challenging). Several methods have been suggested to address the issue of pose variations including the use of active appearance model, morphoable model, multiple templates and multiclassifier fusion. 3D face mosaicing can serve to solve the important problem that is face recognition with pose and illumination variations. Acquisition of data is the key to 3D human face modeling. To acquire 3D human face data is an ill-posed problem. Based on the characteristics of the human visual system, facial structure and facial features which serves as the prior knowledge to constrain the efficient solution set can be used to solve the ill-posed problem. In order to cope up with these limitations information from a 3D



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face mosaiced image can be used for face recognition as 3D face mosaicing can serve to solve the important problem that is face recognition with pose and illumination variations.

Face mosaicing also has three steps: Image registration, image warping and image blending. Here in face mosaicing image registration is the process of geometrical transformation using facial features detection algorithm and photometrical registration using probabilistic color correction approach. Once the mosaiced image is obtained the boundaries between the mosaiced images needs to be removed using multi-resolution. The accuracy of the face recognition can be improved as the source image can be compared with a 3D mosaiced facial image and also the computation time can be reduced as it can now compare with only single mosaiced image instead of having more faces for each individual.

Existing 3D face mosaicing systems still encounter difficulties in achieving accuracy for face recognition due to illumination and facial feature extractions. Using improved facial feature extraction technique along with accurately localizing the feature points around the lips and eyes can improve the feature extraction to some extent which in turn can improve face recognition process. And the current 3D mosaicing techniques works only for grey scale images so to work with the colored images introduce/apply the color correction approach for each of the feature detected. Hence we proposed to improve accuracy of 3D face mosaicing using Color Correction Based on Probabilistic Approach [1].

II. RELATED WORK

The mosaiced image produced from a continuous sequence of images of the same scene is a synthetic composition. This is by understanding the geometric relation between the input images, that how the other is image is geometrically arranged with respect to the reference image. The geometric relations are the coordinate system that binds the different image coordinate systems. After the suitable transformation has been applied, images are warped and the overlapping areas of warped images are combining into a common surface which gives the single identical image which is a tantamount version of a single large image of the identical scene. The resultant image is the motivation for image mosaicing. Different steps are involved in image mosaicing such as image registration, image warping and image blending. Image registration is the most important step in image mosaicing. More than two images of the identical scene taken by unlike sensors, from unlike position, at unlike time instants are the process of superimposing. The procedure of arranging in a line of two images geometrically - the reference and target images. Data can be several images of the identical scene or from different sensors taken at unlike times or from different position.

Image registration plays an vital part among those image specific areas where the output information is received from the consolidated sources like in image mosaicing, image binding, image restoration and change identification. Registration is necessary for differentiation or integration of the received data from dissimilar measurements. Registration process can be classified into following types: algorithm that rely on image pixel value directly, algorithm that performs frequency domain analysis, algorithm using low level image features such as edges and corners, e.g., feature based methods, algorithm using level features such as recognized objects, or connection between features, e.g., graphical methods. Homography is the mapping between two spaces which is frequently used to represent the relation between two images of the identical scene. It is bidirectional that is, can be performed in both directions, reverse and forward. Image warping is the procedure where the digital manipulation of an image can be done such that any shapes illustrated have been somewhat sarcastic. It can be used for removing deformity in the image and also for creative purposes for e.g. morphing. At this position, the two images are enveloped by using the geometric transformation to create mosaic image. It is the mapping function which plots or places the pixel intensity value from current location to new location. Image combining is the process of removal of intensity seam at the edges of joint of two images in order to get the seamless mosaiced image. It is process of acquiring a mosaiced image with smooth transition. It changes those pixels values which are present in the neighbourhood of the edges that gives a smooth transition so as to acquire a merge image by removing the intensity seams.

A. APPLICATIONS:

Mosaicing of images is a process of joining two or more images in order to create a single wide area image. Some of the application areas are as follows:

- The mosaic of large air scope and satellite remote sensing image,
- Meteorological and environmental monitoring,



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- Sea-bottom survey and geological survey,
- Combination of medicine and scientific micro-fragment image,
- The 3D rebuilding of objects,
- The building of virtual scene and virtual walkthrough,
- Video compression,
- Video search browse, and video edit, etc,

III. THE MAIN STEP OF MOSAICING

Image stitching is the process of combining different images to form one single image. The image stitching can be divided into following three main steps: image calibration, image registration, and image blending [2], as shown in fig.1.1 Image calibration produces an evaluation of the intrinsic and external camera parameters. In Image registration, multiple images are differentiating to find the translations that can be used for the correct position of images. After registration, these images are combined together to form a single image. In the following subsections, these main steps are discussed briefly.

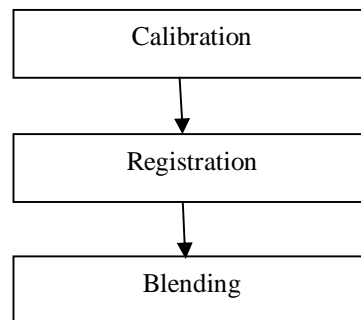


Fig 1.1 Main steps of Image Stitching

Calibration: Image calibration aims to reduce differences between an ideal lens model and the camera-lens combination that was used. [2].

Image Registration: Image registration is defined as the process of arranging two or more images which are captured from different point of perspectives.

Image Blending: Image blending is applied across the stitch image so that the stitching would be seamless [2].

IV. IMAGE STITCHING APPROACHES

Image stitching is the process of combining two or more different images to form one single image. On a broader scale there are two main approaches for image stitching.

- A. Direct techniques
- B. Feature-based techniques

The direct techniques work by directly minimizing pixel to pixel dissimilarities. And, the feature-based techniques work by extracting an infrequent set of features and then matching these to each other [2].



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IV. IMAGE STITCHING MODEL

In this section, a complete image stitching model is discussed. As shown in fig. 1.2, the image stitching model consists of following stages: In the following subsections, the main stages of image stitching are described in detail.

Face mosaicing is very important as matching a frontal facial image with the mosaiced facial image will give more accurate result as compared to matching different angel/positional facial image. The 2D mosaiced face cannot provide an accurate result varying light, illumination and poses. 3D mosaicing can be used to study and improve the effects of light, illumination and pose. We are proposing method to generate an accurate 3D face mosaicing using color correction approach. This model can then be used to study different impacts of illumination and poses. Since our goal is to reconstruct a photo realistic 3D human mosaiced face one of the most important criteria is to make a realistic version of a virtual gave with optimized vertices. First we extract some points, also called feature points, from two orthogonal photos taken from the front and side views. Then we modify a generic model by using radial basis function neural networks (RBFNN) to make an individualized 3D face. To increase the photorealism of the face, we apply texture generating using photos.

The proposed method will use ASM i.e. Active Shape Model and Fisher discriminant Analysis along with probabilistic color correction approach for generating the 3D mosaiced face. ASM is used for selecting feature points from the face. ASM implicitly defines facial feature properties by using statistics, which automatically derives feature models by the use of a set of training samples. ASM performs poorly if the model is not initialized properly. It can be seen that generally it is difficult for a single technique to achieve high performance in both robustness and accuracy. So to achieve a better model initialization for ASM we use a rough estimation of major feature components (eyes, nose and mouth) base on probabilistic color correction approach to get color information. To accurately localize the feature points around the lips and eyes we classify each pixel into RGB color space. This classification is achieved by using the fisher discriminant analysis technique.

Then we modify the generic model by using RBFNN which gives the 3D displacements between the original point positions and the new adapted positions for every vertex. The construction of a RBFNN, in its most basic form, involves three layers with entirely different roles.

The input layer is made up of source nodes that connect the network to its environment. The second layer, the hidden layer in the network, applies a nonlinear transformation from the input space to the hidden space; in most applications the hidden space is of high dimensionality. The output layer is linear, supplying the response of the network to the activation pattern applied to the input layer.

Depending on how the centers of the RBF of the network are specified, there are different learning strategies that we can follow in the design of an RBFNN. Here we identify the approach, self-organized selection of centers, whose formulation is based on interpolation theory. For the self-organized process we need a clustering algorithm that partitions the given set of data points into subgroups, each of which should be as homogeneous as possible. K-means clustering algorithm places the centers of the RBF in only those regions of the input space where significant data are present.

Texture generation change the roughness of shape determined by finite feature points but also increase the quality of individual face with more realistic complexion. To avoid visible seam effects, we apply multi-resolution technique. This Multiresolution technique is effective in removing the boundaries between the three photos. The Laplacian pyramid (LP) is derived from the Gaussian pyramid (GP), which is a multi-scale representation obtained through a recursive reduction (low-pass filtering and decimation). Guided by the feature lines used for photo merging in above section, we decide to which plane a point on a 3D face is to be projected. The points projected on one of three planes are then transferred to either the front or the side 2D-feature point space. Finally, we transform them to the space of texture to obtain the final texture coordinates and the final mapping of points on a texture is generated.

The front and the side profile image will be passed as an input to the application these images needs to be normalized by making the head size of the front and side view the same. On which the active shape model (ASM) and fisher discriminant analysis technique is applied to accurately localize the feature points around the lips and eyes. The feature points will be detected for both the front and the side profile images in which the face definition parameters (nose, chin, tongue, eyes, eyelids, eyebrow, lips and some of face and hair) and custom parameters (the absence points like outlines of hair) are detected and compared separately. Once the feature points are detected for front and side profile images carry a probabilistic color correction approach on each features of front and side profile respectively. Ones the normalized feature detected facial images then carry a Radical basis function network (RBFNN) and clustering algorithm method

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which gives the 3D displacements between the original point positions and the new adapted positions for every vertex in the original generic face model. K-means clustering algorithm places the centers of the RBF in only those regions of the input space where significant data are present. After all the successful steps proposed above the texture generation is carried which will change the roughness of shape determined by finite feature points but also increase the quality of individual face with more realistic complexion. To avoid visible seam effects apply multi-resolution technique which will effectively remove the boundaries between the three photos to make it more realistic and smooth.

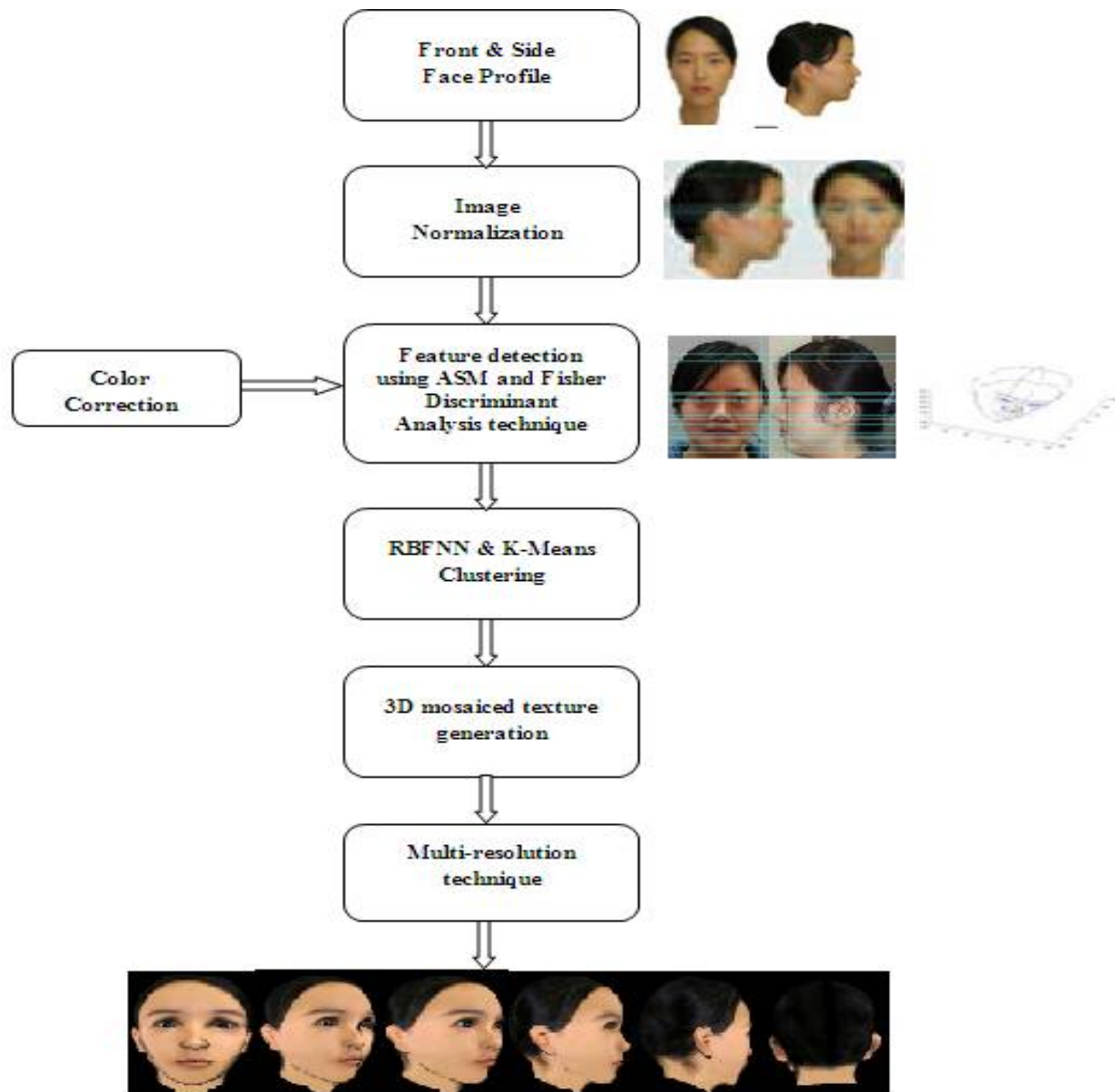


Fig 1.2 Flowchart for the proposed 3D Face mosaicing algorithm with color correction approach

V. CONCLUSION

As research shows that matching a frontal facial image with the mosaiced facial image will give more accurate result. The proposed system contributes technique to improve the accuracy of face recognition by generating a 3D



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mosaiced facial image with the use of ASM and fisher discriminant analysis technique along with the probabilistic color correction approach to make the mosaiced images more realistic. And also by using multi-resolution technique the boundaries between the mosaiced images can be removed to make the 3D mosaiced face image more smooth and realistic.

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