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2D-3D Enhanced Image Conversion Using NLS Method

Rohit Singla, Ms. Nandini, Deepak Dixit, Hemant Sharma

M. Tech Student, Dept. of Computer Science& Engineering, Shri Ram College of Engineering and Management, Palwal, affiliated to M.D.U Rohtak (Haryana), India.

Asst. Professor, Dept. of Computer Science& Engineering, Shri Ram College of Engineering and Management, Palwal, affiliated to M.D.U Rohtak (Haryana), India.

M. Tech Student, Dept. of Computer Science& Engineering, Shri Ram College of Engineering and Management, Palwal, affiliated to M.D.U Rohtak (Haryana), India.

M. Tech Student, Dept. of Computer Science& Engineering, Shri Ram College of Engineering and Management, Palwal, affiliated to M.D.U Rohtak (Haryana), India.

ABSTRACT: Image processing has completely different forms to perform the popularity, identification and enhancement of pictures. One in all the such associated growing field is that the transformation of the image from one kind to different. This transformation will be done from one image format to different or one structural facet to different. one in all such transformation sort is to generate the 3D image by mistreatment the series of 2nd pictures. As we know, in world objects are obtainable in 3D kind. If the objects area unit conferred in same approach in pictures, the recognition or the identification rate are high. however just in case of existing dataset available in 2D kind, there's the necessity of some machine-controlled system, which will get the 3D image from 2D image set. This image set is that the real time set of pictures that covers the various structural views of 2D face. The bestowed thesis work is on the brink of supported identical conception. The work is about to use the prevailing 2D real time image dataset and kind a 3D image from it. The presented work is targeted on facial dataset wherever a series of 2nd pictures in hand. The work relies on the structural analysis of the prevailing image and to derive the structural feature like depth of those feature points. To perform the facial feature analysis, the improved least sq. methodology is employed during this work. supported this analysis, the structural information is collected and also the correlation analysis is performed on these feature points to obtain the article similarities and also the feature analysis. Finally, the similar and distinctive options area unit separated and determine the meaningful options mistreatment that the face reconstruction is performed. The work is enforced in mat-lab atmosphere. The results obtained from the system shows the effective generation of 3D facial image from 2D image set.

KEYWORDS: 2D-3D Image Conversion, Image Processing, Non Linear Least Square Method, .Matlab.

I. INTRODUCTION

Face detection: Face detection is outlined as straightforward technique of extracting the faces from the image i.e. when we input the image to face detection method it straightforward detects the faces gift on the image. The face detection method are often divided into 3 classes that's face detection, face location and face chase. These stages square measure thought of after we solely specialize in the face detection method [20].
Now lets United States discuss face detection method well however truly it works. From the figure below showing method, offer United States shell description concerning the method of detection i.e. when we input the image within

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the system it's within the variety of image of the video. that the image we get as input is of high resolution, which can increase the quality of the detection process. therefore we tend to down sample the image at low resolution so the quality reduces. Now we do the detection of the faces from the image [20].

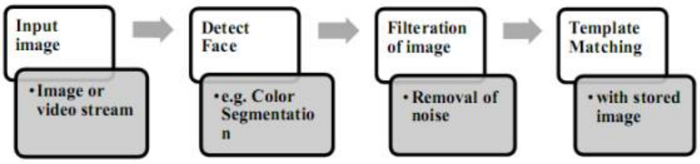
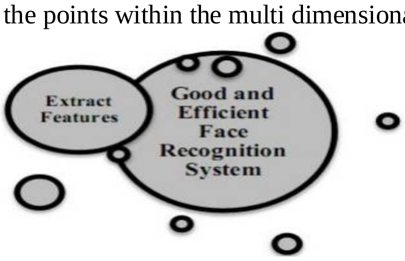


Fig 1: Face Detection process.

For this we even have take into account the instance of color segmentation that is explicit as follows, in this mainly 2 techniques area unit being employed that's color segmentation (using RGB, HIS, YCbCr) to detect the coloring and to induce binary image, second morphological technique (filtering erosion filter, dilation filter, gap filter closing filter etc.) to get rid of noise from the segmented image. currently the guide matching is completed over the obtained image with the average image. Then the face recognition method will be applied used any technique. It may be victimization computing, neural network or the other per your convenience.

Feature Extraction: feature extraction is that the next step to the feature detection. Feature extraction suggests that extracting options from the image. it's the core sub method of the face recognition method. It helps in extracting relevant info from the image, which can facilitate us. in face recognition. In alternative words we will say that, options that area unit chosen play a really necessary role, so as to style the great and economical face recognition system [30]. Well, we've to perform depth estimation, therefore some special options area unit to be extracted from the input image. These special options will be chin, nose, lips, eyes and form of the face. There area unit several feature extraction ways distinct Fourier Transformation, distinct circular function Transformation, Eigenvectors-PCA, distinct moving ridge Transformation, Gabor filter and lots of more [30] currently let's have a short discussion regarding the feature extraction method. This process helps us. to extract all sets of the options forming the actual patterns, which can help us. in face recognition. Patterns area unit the points within the multi dimensional area figure below depicts the same.



3D Image Processing: 3D face models are wide applied in face image process, such as in face recognition, face trailing and face animation, etc., attributable to their superior performance over second models with reference to variation in create and illumination. 3 Dimensional face models has attracted plenty of recent attention attributable to its wide selection of applications in biometrics (fingerprint and iris). Currently, 2 thought approaches area unit sometimes adopted to create a 3D facial model. a technique is to use special instrumentality, sort of a 3D scanner, to capture the 3D shapes of human heads. However, the high price and restricted pertinences of 3D sensing devices area unit, at present, distinct obstacles to exploit ample and helpful information. As an alternate, 3D face models of people is reconstructed victimization the techniques based on second pictures, like video sequences [23] or multi-view images [1] .Reconstructing a 3D model of a personality's face from a monocular video sequence is associate in nursing important tool that may be utilized in police work and in numerous transmission applications. However, the inferiority of the input video information typically greatly degrades the reconstruction performance. There area unit 2 problems thought-about for constructing a 3D face model from multi-view pictures or images that are: the planning of Associate in Nursing economical reconstruction model and also the utilization of the offered previous data. Generally speaking, Associate in Nursing economical 3D reconstruction algorithmic rule will greatly enhance the capabilities of existing second or 3D face recognition systems. [1] A 3D form is expressed in many ways that, e.g., depth, surface traditional,

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surface gradient, or surface slant. The depth price is thought-about either because the relative distance from the camera to the surface points, or the relative surface height higher than the x-y plane. Many algorithms for 3D reconstruction are developed up to now, like shape-from-shading (SFS), the 3D morph-able model, structure from motion etc.

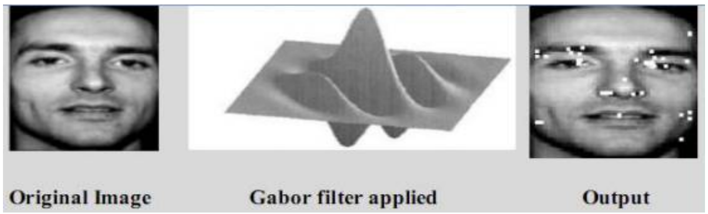
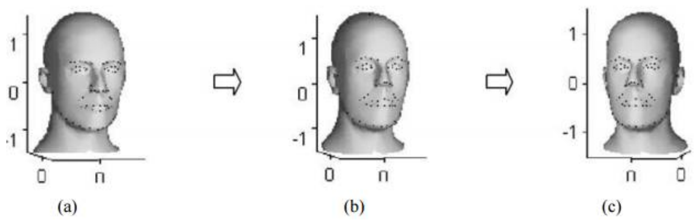


Fig 2: Gabor Filter

Shape from Shading: F Shape recovery is a classic problem in computer vision. The goal is to derive a 3D scene description from one or more 2D images. The recovered shape can be expressed in several ways: depth Z(x, y), surface normal (n_x,n_y ,n_z), surface gradient (p, q), and surface slant, and tilt . The depth can be considered either as the relative distance from camera to surface points, or the relative surface height above the x-y plane. The surface normal is the orientation of a vector perpendicular to the tangent plane on the object surface.

The surface gradient (p, q) = (dz/dy) * (dz,dx) is the rate of change of depth in the x and y directions, shading, stereo, motion, texture, etc. Shape from-shading (SFS) deals with the recovery of shape from a gradual variation of shading in the image [16] [1]. To solve the SFS problem, it is important to study how the images are formed. A simple model of image formation is the Lambertian model, in which the gray level at a pixel in the image depends on the light source direction and the surface normal. In SFS, given a gray level image, the aim is to recover the light source and the surface shape at each pixel in the image. However, real images do not always follow the Lambertian model [1].

D Morph-able Model: There are different modalities that one can use for obtaining data from an individual's face. Some are 3-D in nature such as a laser scanner, a stereoscopic camera system, or an active light stripper. The acquisition of this range data requires special purpose high-cost hardware, or requires a costly software method for establishing point correspondences necessary for triangulation. A cheaper modality would be the use of regular CCD cameras or camcorders, where in that case either an intensity-based or a feature-based approach is used to establish corresponding points in the different images, from which the depth information (3-D coordinates) are obtained. In general, the point correspondence and automatic face structure extraction are challenging problems. This is due to the fact that automatic extraction and matching of a set of significant feature points on different image views on the face which are needed to recover the individual's 3-D face model, is a very hard machine task [17][1]. Features on the face image such as the chin, the eyebrow, the eyelid, the mouth are numerous, which makes the establishment of correspondences on the different images very difficult, and usually picked up manually. The method introduced for it is the distance map to bypass this problem. The distance map uses a distance function from a point (the perspective projection of a point on the 3-D face onto the image) to an object set (image features), rather than to one point. As such it does not require correspondences for these features [17] [1].



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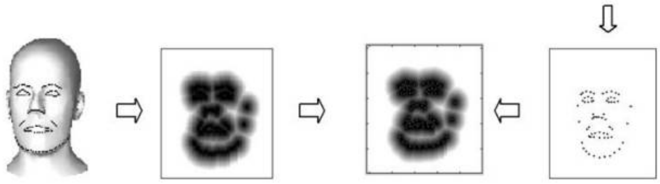

Fig.3: Face structure estimation process (a) Feature points on generic face model (b) morphed face model (c) certain pose (d) image and features (e) distance map (f) 2D features (g) lookup tables.

Structure From Motion: It is a popular approach to recover the 3D shape of an object when multiple frames of an image sequence are available. Given a set of observations of 2D feature points, SFM can estimate the 3D structure of the feature points. For example, this technique can be applied to video recordings of a talking person. The CANDIDE model is used for initialization only in iterative process because the 3D face structure is unknown in the first iteration. The definitions of the three axes are shown in Fig 1.5 [18] [19].

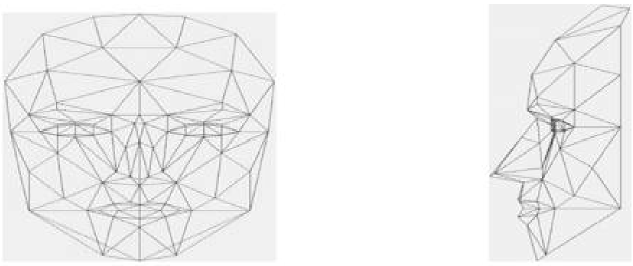

Fig 4: The CANDIDE model in frontal and profile view

Based on the position of the important feature points, the CANDIDE model is first adapted to the frontal-view face image as shown in Fig.5

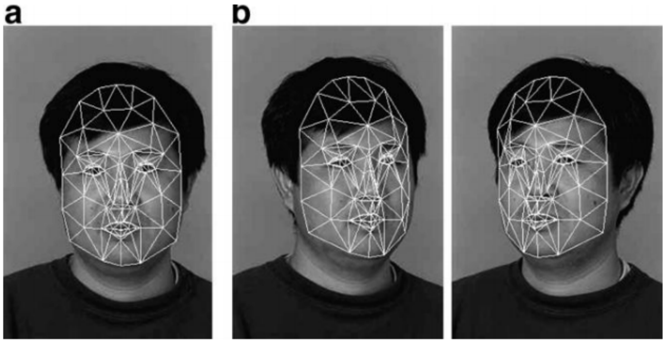

Fig 4.: (a) Face images with an adapted face model, and (b) face images under different poses adapted by the rotated face mode

Then, the CANDIDE model is rotated to the same poses as the non-frontal-view face images, and the depths of the feature points of the model are adjusted so that the feature points obtained by projecting the 3D model onto the 2D space can fit the corresponding feature points of the images accurately [18][19][1]. One difference between the above three techniques is that the information utilized is different. On the other hand, from the viewpoint of the number of data points, SFS and the 3D morph-able model are used to recover the whole surface of an object, i.e. a dense 3D 8 representation, while SFM is generally adopted to estimate the depth values of some feature points, i.e. a sparse 3D representation. Therefore, SFM has a far smaller storage requirement than SFS and the 3D morph-able model, which is

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very helpful for real-time applications. However, when they are applied to face recognition, SFS and the 3D morphable model generally have a better recognition performance than SFM because the information about more feature points is utilized. Recently, some hybrid algorithms have been proposed to alleviate the drawbacks of any one algorithm. Among various SFM methods, the partial transformation approach is one important branch. Specifically, in [18] a similarity-transform based method is proposed to derive the 3D structure of a human face from a group of face images under different poses. The proposed algorithm does not require any prior knowledge of camera calibration, and has no limitation on the possible poses or the scale of the face images. In addition, the method in [18] has been verified that it can be extended to face recognition to alleviate the effect of pose variations. Unfortunately, the genetic algorithm (GA) used to estimate the depth usually encounters a heavy computational burden. Moreover, how to design a reasonable chromosome, how to make a feasible gene operation scheme, and how to adjust the parameters remain difficult problems. To reduce the computation of the method in [1], the nonlinear least-squares (NLS) model-based methods are proposed to estimate the depth values of facial feature points, i.e., a sparse 3D face representation. In the NLS model, not only the pose parameters, but also the depth values of the facial feature points, are considered as the variables to be optimized. In addition, the symmetry information of face is utilized further in the proposed methods in order to alleviate the sensitivity to the training samples used. Note that one frontal view face image and one non-frontal-view face image are sufficient to reconstruct a 3D face model using our proposed algorithms. And for cases when multiple non-frontal-view face images are available, a model-integration approach is proposed to improve the depth estimation accuracy [1].

II. LITERATURE REVIEW

Literature review includes various new approaches as under:
In [2], Prasanna S R et al. presented a new face-recognition algorithm by combining Gabor features within the scope of diffusion-distance calculation. This strategy starts from the Gabor filtering that consists of three scales and six orientations. It is followed by the calculation of diffusion distance based on a Bayesian model. This proposed algorithm has been compared against several state-of-the-art techniques. The experimental results show that the proposed face-recognition scheme has the best performance in accuracy. In this paper, Gabor features are generated to represent the local characteristics. These features are driven by the nature of human perception, being of a good capability to differentiate the face images used. To enhance the performance of face recognition, a Bayesian model was used to determine the similarity degree between two histograms. The rationale of using this Bayesian decision model is to ensure the maximization of likely estimation across different histograms.
The available experimental results have justified the successful usage of the Gabor features and the Bayesian model.

In [3], Tudor BARBU proposed a novel supervised facial recognition system in this paper. The main contribution of this article is the proposed 2D Gabor filter-based feature extraction that produces robust three-dimensional face feature vectors. Another contribution of this paper is the supervised classifier used for facial feature vector classification. It uses minimum average distances and the squared Euclidean metric. The proposed threshold based verification technique, containing an automatic threshold detection procedure, represents an important novelty element of this paper, too. A high recognition rate has been achieved by this technique, as it results from the performed experiments. The obtained results prove the effectiveness of this method. This technique provides a higher recognition rate than many other facial recognition approaches.

In [4], Mohamed ABID et al. provided proper information regarding how Gabor filter can be used in our research. This was a kind of base for letting me choose that the feature extraction can be done using Gabor filter. In this paper they just mark the facial feature points using 10 Gabor filter and then create a template by measuring their face feature distance among themselves. Then they simple match the calculated distance with already stored images in the database. The outcome of the result was good. To conclude, we can say that the recognition of individuals remain a complex problem, in spite of current active research. There are many conditions real, difficult to model and, which limit the performances of the current systems in terms of reliability and real time.

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In [5], Subhashini Ramalingam et al. proposed a novel approach having the following is different face gestures like Surprise, Smile, Sad, Disgust, Angry and Fear. Use of Gabor filters with the proposed way of getting feature extraction using energy, mean and standard deviation, uses less computation power with a pretty decent result compare to the complex way of using mathematical approaches. This system can be enhanced by using proper face model inclusion in the system. In short, this system used the Gabor filter for feature extraction. In this the different face expressions are being extracted and recognized.

In [7], Marc ESCHER et al. defined a face model i.e used which is modified to fit to the real face. Primarily two aspects are considered: (1) modeling involving the construction of a 30 texture mapped face model fitting to the real face: (2) the animation of the new constructed face. Automatic texture fitting is employed to produce the virtual face with texture mapping from the real face image.

III. RESERACH AND ELABORATION

In this scheme, we propose algorithmic approach is Formulation Of NLS Model using sparse matrix, however he presented work is about the construction of the 3D face image by using a series of 2D face images and by performing the structural analysis over it. To perform this construction we need a set of 2D images with different poses. The presented work is divided in two stages.
In first stage, the structural information will be extracted from the face image. These structural points are called the facial feature points and the second level, the depth estimation of these feature points will be done. To estimate the depth of feature points a non linear least square method will be adapted in this approach. The depth estimation includes the arranging the feature points according to obtained depth points as well as to eliminate the hidden points and to generate the structural boundaries over these points. Once the effective depth estimation will be performed, the structural symmetry will be points over these points and the model integration will be done. The work also includes the estimation of the accuracy over these points under the depth estimation as well as to generate the facial symmetry over these generated facial points. The work also includes the estimation of these points under the frontal view of the face and to obtain the structural boundaries respectively. The actual methodology steps that will be adapted in this presented work are defined in the form of process flow shown in figure 6 as underline proposed model.

In this present work, the 3D face reconstruction approach is presented using a set of 2D images. The presented work is a hybrid model in which the Least Square Analysis approach is used along with Structural Point Generation and lamination approach to perform the 3D Structural Point Reconstruction. The presented systems itself have a number of properties along with standard architecture. The architecture includes the basic three
components called Input Image Set, Structural Point Extraction, Generation of 3D Points. When the input image or the dataset images are collected or extracted they can be slightly different respective of defined properties. In such case before implementing the 3D Face Arrange it respective to depth from front view Remove the duplicate and non required hidden feature points Generate the Symmetry points on these filtered facial points Arrange it respective to depth from front view Model the face based on these symmetric features Generation after some preprocessing operations are performed to improve these Properties so that better extraction of facial features will be done. The Accuracy of the system is based on this pre-processing stage.
Where the preprocessing stage defined is used to improve the effectiveness of the system in terms of efficiency and the accuracy. The post processing is used to estimate the reliability of the system. As discussed earlier, the reliability depends on two major factors. One is the structural point extraction and other to generate the 3D structure. Figure 7 is showing the actual model used by the presented work to perform the 3D Face Construction of the 2D image set. Generation of 3D Face Image using a 2D dataset is more challenging than in a fixed view, e.g. frontal view, owing to the significant non-linear variation caused by rotation in depth, self-occlusion and self-shadowing.

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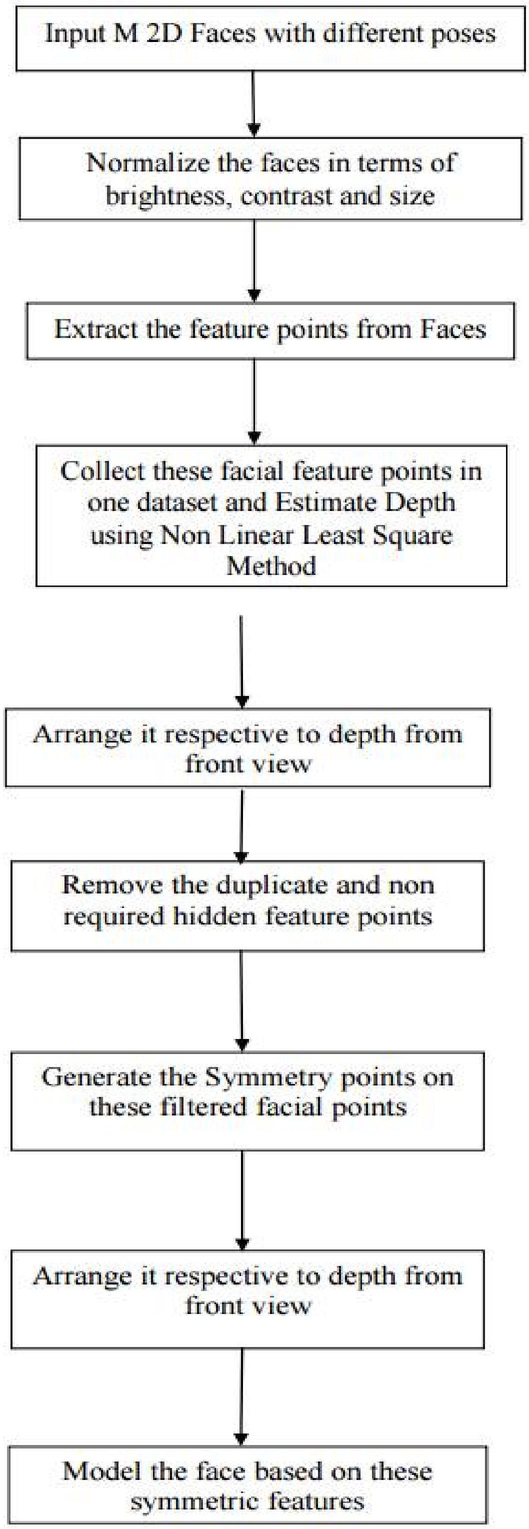

Figure 6: Proposed Algorithm

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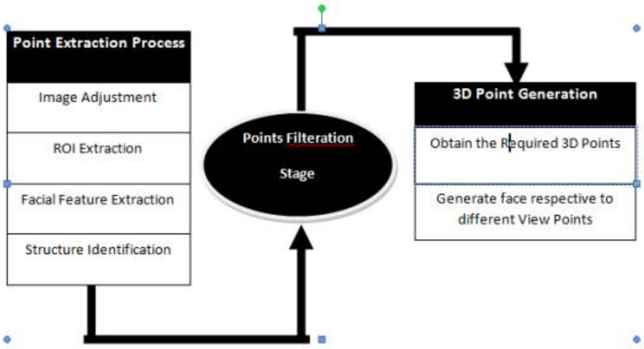

Figure 7 : Model of proposed work

The view sphere is separated into several small segments. On each segment, a face detector is constructed. In this work we have used a classification approach to categorize the input image in the form of relational images. We have maintained all the co related images as a single class. Once the dataset is maintained the network is to perform the matching process. Formulation depiction for feature extraction is below:

$$\varphi j(\vec{x}) = \frac{k_j^2}{\sigma^2} \exp\left(-\frac{k_j^2 x^2}{2\sigma^2}\right)\left[\exp(i\vec{k}_j\vec{x}) - \exp\left(\frac{-\sigma^2}{2}\right)\right]$$

1) Start searching from bottom left to detect the right corner end point.
2) Start searching from bottom right to detect the left corner end point.
3) Start searching from top left to detect the right corner end point
4) Start searching from top right to detect the left corner end point. After detecting the corner end point of each Object, Euclidean distance of each end point is measured and stored in a data base and corner end point is marked by a middle symbol. After finding the gray level co-occurrence matrices of each Object the following equation can be used to get a texture feature of Objects:-

1) Input Image
I(x,y)=front view image
2) Detect face region by applying viola-Jones algorithm
Face_Img = viola_jones(I)
3) Convert face region into Gray scale
Gray_face=Grayscale(Face_Img)
4) Crop different Object from gray scale image
Left_eye_face =crop(Gray_face)
Right_eye_face=crop(Gray_face)
Nose_face = crop(Gray_face)
Mouth_face =crop(Gray_face)
5) Compute the gray level co-occurrence Matrices (PEP) of each Object
PLeye_PEP=PEP(Left_eye_face)
PReye_PEP=PEP(Right_eye_face)
PNose_PEP=PEP(Nose_face)

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PMouth_PEP=PEP(Mouth_face)
6) By using the Gray level co-occurrence matrix (PEP) of each Object, equation from 3-10 is evaluated for calculating the different texture parameter.
7) Store each texture parameter in a database

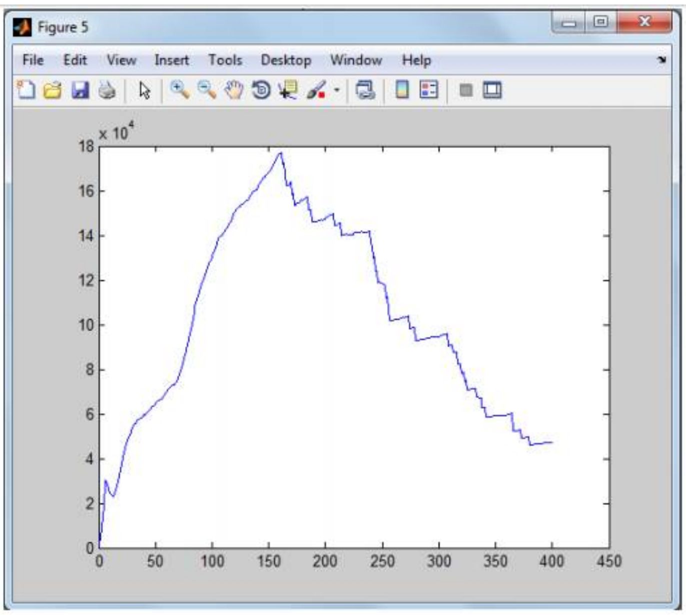

Figure 8 : Result : pixel vs frequency graph for figure 4.

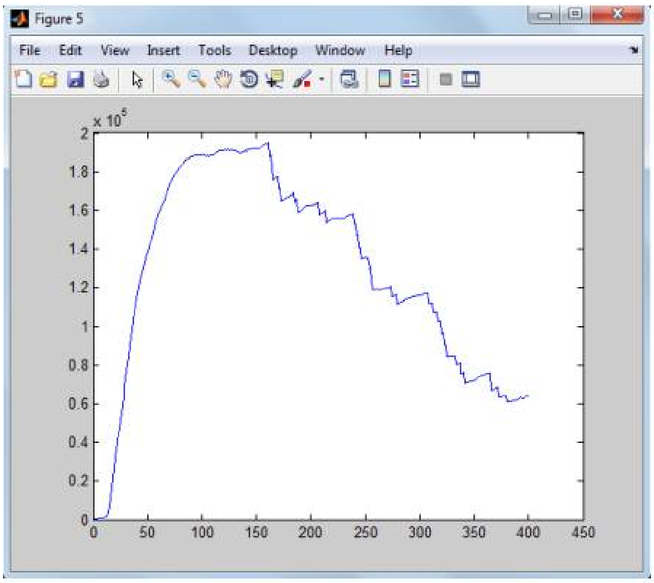

Figure 9 : Result : pixel vs frequency graph for figure 4.

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IV. CONCLUSION

The presented work is about to generation of the 3D face image from a series of 2D facial images. In this present work, an improved Least square method is presented to generate the 3D facial image by using the 2D real time image set. The presented work is based on the structural feature extraction and the analysis. At the earlier stage, the least square method is used to identify the facial features. After the extraction of features, the correlation analysis and the feature point analysis is performed to identify the effective facial features, feature similarity and the distinctive features. Based on this analysis, the effective feature selection is performed and the organization of these features results the construction of 3D face image. The work is tested on real time dataset and the obtained results shows the effective generation of 3D face from 2D face images.

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