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Theta Estimation of a Head Pose using Depth Parameters of a 3D Morphed Image from a 2D Query Image

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ABSTRACT: Face detection and face recognition have been the primary focus when computer vision and face related research is considered. Estimating the head posture of a person is a common ability of any identity invariant systems designed to meet the applications of certain evaluated and generic methodologies. In this scenario where the images are constrained to detect localized eye positions and head pose, a hybrid scheme is proposed to estimate the head pose angle of a face in a 2d face image. The reference image is a morphed 3d projected image projected all together onto a 2d space. The hybrid scheme also minimizes the depth errors of any two prominent features the query image and the corresponding points of interest on the referenced 3d face model. Depth morphing process is done to alleviate the sensitivities that arise from the pose variations. Optimization procedures that are incorporated put into use their objective functions along with the regularization term and linear coefficients to improve the computational efficiency of the scalar depth parameter that is used in order derive a more accurate 3d structure. Depth parameters captured are measured to be optimal by observing the feature disparities when a 2d face query image and 3d face reference structure which is effectively projected on to the 2d space. The process of training the system to obtain a 3d structure depends upon the multiple images of the same query face image that is in 2d, and the system produces a 3d face model very similar to the input provided to the system. Several databases for query images are considered such as USF Human-ID database for depth optimization and Pointing '04 database for head pose estimation. The experimental results on average for shaking and nodding angles are as low as 7.93^{o} and 4.65^{o} respectively for any 2d face image.

I. INTRODUCTION

Human computer interaction triggers many aspects of face detection and confronting problems of recognition of face and its features which can also find applications in eye gaze tracking.

A GEM meaning generic elastic model is used to calibrate the differences between the rotations of the fitting structure of a 2d query image on to the 3d reference model of the same genus and origin parameters. The generic elastic model gives the user promising results when compared to other approaches for facial expression detection and head pose estimation by using an elastically contorted 3d depth map of an input query image to approximate the shape of the image. This approach is highly successful in obtaining a synthesized & a generalized 3d shape of the input image for validation at approximate pose angles of the same synthesized query 2d image.

It is a systematic gradient descent search breakthrough involving an implicative multiplying depth factor to reduce the disparity between the reference model and the potential derivative of distinctive poses of the query 2d image

Number of independent AAM's (Active Appearance Model) can be combined to retrieve improved frequency rates in convergence and more desirable computational costs is a visual paradox with very few parameters considered. The inverse compositional algorithm used here is essentially is transformed to combine the results of similar 2d elements with the normalized image. The transformation procedure is local to the digital image since the global transformation is varies when the non-rigid shape of the image is concerned.

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II. LITERATURE REVIEW

a. Optimal Estimation of Regularized Discriminant Analysis: A novel method which is termed as SRDA that automatically detects a parameter that can be optimized for regularization and estimated to enhance the distribution of feature vectors and categorization of sub-space learning methods indicated to effectively and efficiently with some space and cubic-time complexity constrains. The choices seem to be dedicating a lot external factors and influencing the result set. The proposed method describes the adoption of general cross validation to emulate the differences between the Eigen decomposition and the dense matrix regulation. This perspective gives us a retrospective vision of testing samples which is a linear coefficient a minimized and sub-optimal parameter denoted by $Y^{*.}$

b. A novel method for analysis of a morph-able 3d model to efficiently fit the 2d face model recognized: Image processing of 3d reconstructed facial model often constitutes the analysis data set for modelling estimation. Spatial anatomical knowledge presents us with biological features which determine the effect of PCA (Principal Component Analysis) mechanism. This elucidates the estimation of Eigen value scalar components and the time taken to achieve the desired value for parameter value approximation. The perspective if the camera is defined to function over predefined reflective surface models for a minimized evaluation cost specified morph-able image.

c.A Estimation of age, gender and race of unconstrained 2d representations of facial images: A lot of potential applications consider the need for facial images that are acquired under unconstrained and challenging scenarios. Normalization of the features in the image as input is demographically rectified by photometric correctors of the frontal pose and the connected but surrounding area of the face delimited by unconstrained attributes. This involves the acquisition of benchmarking methods to describe the visual attributes of facial subject under consideration. Support vector machines are utilized to propose the normalization, aggregation methods to substitute a subject with character or attribute from a small subset of binary classified and accurate transformation according to 2d in-plane rotations.

III. EXISTING SYSTEM

Head profundity is highly associated with the attention of a human operator to a specific object in the surroundings. Estimating head pose of a human subject has been an active research topic in computer vision because of its importance in many applications such as strategic biometric simulations, video surveillance systems, and ambient intelligence systems. The proposed system introduced a head pose estimation method from a single 2D face image using a 3D face model morphed from a reference 3D face model. A reference model refers to a 3D face of a person of the same ethnicity and gender as the query subject. The proposed method uses a small number of prominent facial features such as eye corners, nose tip, and lip corners extracted from the query face image. For evaluation purposes, the feature points were selected manually on a 2D face image and mapped onto a reference 3D face model. The morphing process involves introducing a scalar constant to rectify the errors by multiplying a depth parameter to the derived expanse of a reference 3D face model at each extracted feature point. The use of depth parameters simplifies the morphing process to allow local deformation at each facial feature point for accurate 3D model building.

The disadvantages of the existing system are as follows:

- The existing system, though recognizes the input images with face recognition and detection, this is a major setback since it does not consider various angles of the facial image.
- The system does not show any signs of improved accuracy or increase in terms of recognition and detection rates.
- The effectiveness of facial recognition is said to increase of the image quality considered from a video camera is much better than scanning the image to morph the same content for 3d reconstructions.

IV. PROPOSED SYSTEM

The proposed system introduced for estimate the various head pose angles such as i.e., nodding, shaking, tilting, haw, pitch and roll. To estimate head pose from an input image, the detection of specific facial features is important. Because the intention of this direction of work is to enhance the utilization of both the depth concerns in the eyes and the nose regions to estimate the amount of tilt along the z-axis. The application of methods such as Haar-like feature and AdaBoost to detect such features in the model rather than using pixel intensities and location invariance component directly. Haar-like feature originated from the Haar basis function which takes into account the adjacent rectangular

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shaped density and color differentiated sub section in a specific scene of the localized instance and then sums up the pixel intensity values and theta ranges along with hue magnitudes to obtain the difference between these sums of pixel values in sub region and the intensity values in the entire spectrum of image. Haar-like feature originated from the Haar basis function which takes into account the adjacent rectangular shaped density and color differentiated sub section in a specific scene of the localized instance and then sums up the pixel intensity values and theta ranges along with hue magnitudes to obtain the difference between these sums of pixel values in sub region and the intensity values in the entire spectrum of image.

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Advantages of proposed system

- The system proves to highly accurate in its detection rate of the facial expression patterns and helps the user in establishing a virtual connection between the 3d model and 2d instantiation at faster processing rate.
- Head pose angle estimation is related to facial feature extraction and its detection rates are highly improved when the 2d face model on the matrix vector is substituted by the scalar values of constants from the depth descriptors.

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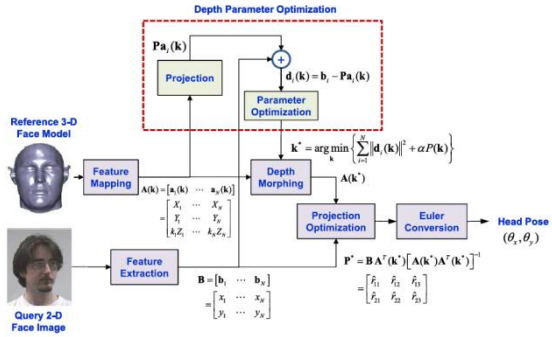
V. SYSTEM ARCHITECTURE



Manner has three major components. They are:

- Depth Parameter Optimizer
- Projection Enhancer/Optimizer
- Euler Converter for angle values

The input to the system is the face image that is a 2d constrained query replica that will be used to obtain the features through various modeling techniques. Face Recognition relies on extensive discriminated information on facial images and subjective patterns to be recognized.

This undermines the capability of computer vision to employ feature extraction techniques such as histograms Euclidean distances between descriptors of eyes, nose and lips to extract compact and distinctive feature vectors and other algorithmic techniques to construct a matrix defined as B[x]. The same set of vectors extracted as 7 point linear values are studied based on the 3d reference model projected on to the 2 dimensional spaces to get a feature map vector which is derived to get a matrix projection termed A[k]. The projection matrix represented by $Pa_i[k]$ is statistically given to obtain the depth map and intensity information to improve the performance of face recognition. The depth features are extracted from Gabor wavelets to refine the search on the depth parameters. This normally leads to optimization and parameterization of vectors closer to the intensity points. Thus the difference between the values of projection matrix and represented by $Pa_i[k]$ and b_i which is a set of feature vectors initially extracted in the 2d space gives us $d_i[k]$ which is the relative depth index to be morphed.

This will indeed fetch us k^* that is a argument minimum of the same planar feature and the output is 3d matrix of vectors finally represented by $A(k^*)$ which in turn should be optimized to resolve the differences between the degeneracy concepts of local v/s global minima. Hence the projection optimized value denoted by P^* is finally given

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a chance to remit the disparity levels to minimum of the 2d projected matrix B and transposed matrix of A^T along with the values of k^* which will be a 2d matrix vector.

The last procedure that reveals us of the Euler conversion strategy to obtain the Θ_x and Θ_y values of the head pose of the 3d reference model onto the 2d space. The corresponding feature vectors are normalized to give us a persepctive into the 2XN matrix vector representation. The $\tan^{-1}$ values of the row added least square minimized values are distinguished for the final angle calculation of the Euler paradigm.

VI. CONCLUSION

This project envisions the act of representing the 3d model of the single 2d facial model which is again morphed to obtain the disparity measure in features.

Head posture angles are determined for corresponding measure of the 3d face model plotted against the 2d model of same genus and gender, either of Asian or Caucasian. During the training process the referenced model becomes more specific to the object instance to retrofit the 2d orientation for minimization of errors corresponding to depth morphed parameters. The proposed process for morphing is computationally and numerically efficient and effective to harness the capabilities of a subject multiplied by the scalar value of depth vector symmetrically oriented for frontal 2d face models. The average nodding and shaking verticals for a 2d face model are 9.25 and 5.68 respectively. But the proposed methods with 3d interference give us results without the margin of errors to be 7.93 and 4.65 degrees.

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