Efficiency improvement for RFG based face recognition

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Abstract— **The face recognition branch of biometrics is one of the most studied and researched. Even after its extensive research the recognition process still remains a challenging task. With the increase of online connection and transactions like social network, live video surveillance requirement for unconstrained practical face recognition has also increased where the analysis of the face is the most important. This paper presents the performance or efficiency improvement of face recognition in context of graph theory. In the initial stage we extract the face from a background by using the hybrid combination of Viola Jones technique and skin pixel color detection. From the face, we extract the few features like position of face and nose etc. Using these facial features Face Grid template (FGT) will be constructed for the basic classification and then accordingly the Reference Face Graph (RFG) is generated. Recognition of the given face is archived by comparing it to the faces in the constructed RFG. This proposed efficient grid RFG based recognition algorithm is robust to change in the pose and it is also alignment free. Due to the richness in the reference set construction, the proposed method can also handle illumination and expression variation. This FGT is computation efficient, has high rate of classification and using this, a person can be identified with the minimal efforts and in real time.**

***Index Terms*— Viola Jones, Skin pixel color, facial feature, Face Grid Template, Reference Face Graph.**

I. INTRODUCTION

There are many means by which we can recognize a human being. Face and Voice are the most distinct things by which we recognize our fellow human beings. Faces have different sizes, shapes, colors, etc. We recognize them without any failure. But this task for a computer system is a very hard one. Basically face recognition in a given still or video image of a scene, identifies or verifies the person in the scene using the stored database. Face recognition system identifies faces of different human beings having different shapes, sizes, colors and postures. Images can vary in pose, illumination, edges, facial expressions and perspective. It is one of the most popular areas of research in Computer Science. It is also the most successful application of image analysis. Because of the nature of problem many different field researchers are interested in it, like Neuroscientists, Psychologists, etc. Recognition is to be done on a real time basis, so faster execution should be done with less Power and Memory.

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II. EXISTING SYSTEM

In the existing system there are two phases first is the construction of RFG while second is generating RFD. For the recognition, it checks the whole database for the final result, which increases the number of computations. Even though the system gives very good results, it lacks efficiency. It also lacks in reference set selection, feature transformation or selection. In this case our proposed system comes into consideration.

III. PROPOSED SYSTEM

In our system we are proposing to increase the efficiency and accuracy of the system for any pose in any kind of environment and to reduce the computation time as its main factor in the real time system. Also recognition of a face is done with more accuracy and in lesser time. Face recognition with reference faces as less as possible also make the complex existing systems simpler. In this system we group the similar faces together at the computation.

IV. PROCESS

In the process of face recognition there are two stages: Database creation and face recognition.

1. Database creation -
   a) Initially while adding the face in the database, facial features will be extracted by using combination of viola jones face detection algorithm and skin color pixel detection.
   b) After the detection of the facial feature like the position of the mouth, eyes and nose the Face Grid Template (FGT) for the face will be constructed which will be known as the Base FGT (BFGT).
   c) For every different face a unique BFGT will be constructed.
   d) If two or more faces are having the same dimensions, then those faces will be grouped under the same FGT.
   e) If more than one reference faces are under the same group i.e. FGT then, Reference Face Graph (RFG) for that particular group will be constructed.
   f) As the reference faces of one group will be

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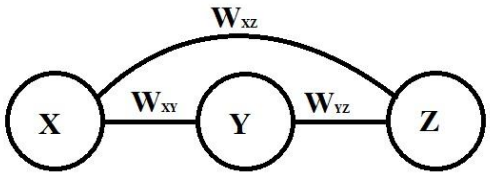
completely dissimilar to the reference faces of the other group, the relation between the reference face of different groups is not considered.

g) If all the FGTs of the faces in the database are different then RFG will not be constructed.

2. Face recognition
   a) In face recognition phase, the face is captured and same as in the first phase the facial features will be extracted and FGT will be constructed which will be known as Sample FGT (SFGT).
   b) Some modifications, if required, will be made in this SFGT. Modification like if the face is not in the correct straight poison w.r.t horizontal and vertical axis then the realignment will be made to the SFGT.
   c) This SFGT will be matched with the BFGT that are stored in the database.
   d) If a match is found then the RFG for these similar faces will be made for finding the similarity between the faces.

V. EQUATIONS

For finding the similarity between the references faces following formula are used



In the figure X, Y & Z are the reference faces

$$sim(A, R_i) = \sum_p w_p \max_q \psi(A^p, R_i^q)$$

$$W_{i,j} = sim(R_i, R_j)$$

For finding the dissimilarity between the ref. faces $C_D^{'w}(i)$ is used

$$C_D^w(i) = \sum_j^N W_{ij}$$

$$C_D^{'w}(i) = 1 - \frac{C_D^w(i)}{N-1}$$

Closeness is deduced by $C_C^{'w}(i)$

$$C_C^{'w}(i) = \frac{C_C^w(i)}{N-1}$$

$$C_C^w(i) = \left[\sum_j^N d^w(i, j)\right]^{-1}$$

$$d^w(i, j) = \left(\frac{1}{W_{ih_u}} + \cdots + \frac{1}{W_{h_v i}}\right)$$

Where h_u and h_v are the intermediate nodes or ref. faces between the nodes i, j.

In the second phase of the existing system following formulae are used.

For generating face descriptor there are two steps. First is a basis descriptor F_A is generated.

$$F_A = [sim(A, R_1), \ldots, sim(A, R_N)]$$

Second step is generation of reference face descriptor G_A

$$G_A = \left[F_A \times C_D^{'w}, F_A \times C_C^{'w}\right]$$

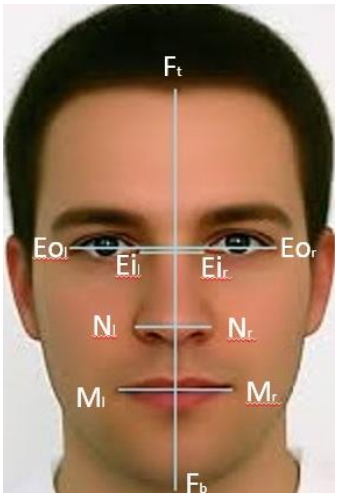


Fig: FGT

For the correction in identifying the misalignment of the face following formula is used.

$$\theta_V = \sin^{-1}\left(\frac{\delta}{h}\right)$$

Where,

θ_V = vertical rotation of the face

δ = difference in the position of y coordinates of Eo

h = is the distance Eo right and Eo left

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