Overview Of Face Recognition System Challenges

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Abstract: In this paper the likely challenges occur in finding the suspects face match with the database are discussed. Developing a computational model of face recognition is quit difficult, because faces are complex, multidimensional and meaningful visual stimuli. Different algorithms are developed to solve these challenges. The magic of matching suspects with the database faces does not works some times even though many face recognition algorithms are developed with high success rates. Face recognition software fails some time despite the fact that the suspects image were present in public and private record database. To get a match of suspect our database should have different appearances/ poses of a person.

1. Introduction:

Face Recognition has received significant attention, especially during the last few years. Recently it gain special importance because of its strong need in few application areas. There are at least two reasons for this trend: The first is the wide range of commercial and law enforcement application. Second is the availability of feasible technologies after 30 years of research. Face recognition have substantial potential in two areas:

- It can help the users to caught criminals and suspected terrorists.
- In minimizing cyber-crimes where it can be used in controlling access to areas where security risks are especially high.

Today's environment there is a great deal of interest in using face recognition for verification of identities. Recently face recognition software did not identified the bombers. The technology come up empty even though images exist in official database. The bombers also have driver's license which is provided after complete verification and adding their face as identity in face database. The bombers also had legally immigrated that means they gone through the face verification carried out in airport for security. The responsible officers told that the face recognition system might be failed in this particular case because the bomber had used sunglasses. This means face recognition technique still need to prove its metal. Face recognition has become one of the most challenging tasks in the pattern recognition.

2. Over view of Face Recognition System:

The facial recognition process normally has four interrelated phases or steps:

(1) Face detection.
(2) Normalization.
(3) Feature extraction.
(4) Face recognition.

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The first step in the facial recognition process is the capturing of a face image. This would normally be done using a still or video camera.

2.1: Face detection: detecting a face in a image has to decide which pixels in the image is part of the face and which are not. Traditionally, methods that focus on facial landmarks (such as eyes, nose etc), that detect face-like colors in circular regions, or that use standard feature templates, were used to detect faces.

2.2: Normalization: Once the face has been detected (separated from its background), the face needs to be normalized. This means that the image must be standardized in terms of size, pose, illumination, etc. relative to the images in the gallery or reference database. To normalization a probe image, the key facial landmarks must be located accurately. Using these landmarks, the normalization algorithm can reorient the image for slight variations. Recognition can only succeed if the probe image and the gallery images are the same in terms of pose orientation, rotation, scale, size, etc.

2.3: Feature Extraction: Once the face image has been normalized, the feature extraction and recognition of the face can take place. In feature extraction, a mathematical representation called a biometric template or biometric reference is generated, which is stored in the database and will form the basis of any recognition task.

2.4: Face Recognition: In last phase the biometric template of the suspect face is compared with the biometric template of each face present in the database. We recognize the face when we get a match between these two biometric templates.

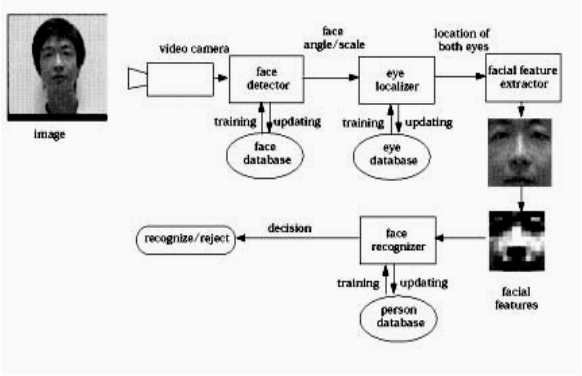

Fig: face recognition system phases

As faces does not works some times even though many face recognition algorithms are developed with high success rates. Face recognition software fails some time despite the fact that the suspects image were present in public and private record database. To get a match of suspect our database should have different appearances/ poses of a person.

Fig: face database having different appearance of a person

3. Challenges of a face recognition system.

3.1 The Image Quality

The primary requirement of face recognition system is suspects good quality face image and a good quality image is one which is collected under expected conditions. For extracting the image features the image quality is important. Without the accurate computations of facial features the robustness of the approaches will also be lost. Thus even the best recognition algorithm deteriorate as the quality of the image declines.

3.2 Illumination Problem

Same face appears differently due to change in lighting. Illumination can change the appearance of an object drastically. We must overcome irregular lighting. Following image processing can be used to provide a degree of lighting invariance.

- Normalizing
- Histogram equalization
- Order-statistic filtering

Fig: face image in different illuminations

3.3 Illumination problem approaches

The illumination problem can be faced employing different approaches

3.3.1: Heuristic approach: an approach based on symmetry of human faces is given by sirovich. This algorithm shows a nearly perfect accuracy recognition frontal face image under different lighting conditions.

3.3.2: Statistical approach: in statistical approach, each image is represented in terms of the features. So, it's viewed as a point (vector) in a d-dimensional space. Therefore, the goal is to choose and apply the right statistical tool for extraction and analysis of the underlying manifold.

3.3.3: Light-modeling approach: some recognition methods try to model a lighting template in order to build illumination invariant algorithms.

3.3.4: Model-based approach: the most recent model-based approaches try to build 3D model. The idea is to make intrinsic shape and texture full independent from extrinsic parameters like light variations. The 3D heads can be used to build a model, which is used to fit the input images. Light directions and cast shadows can be estimated automatically.

3.3.5: Multi-spectral imaging: Multi-Spectral Images (MSI) are those that capture image data at specific wavelengths. The wavelengths can be separated by filters or other instruments sensitive to particular wavelets. MSI enables the separation of spectral information of illumination from other spectral information.

3.4 Pose Variation

Usually, the training data used by face recognition systems are frontal view face images of individuals. Frontal view images contain more specific information of a face than profile or other pose angle images. The problem appears when the system has to recognize a rotated face using this frontal view training data. User need together multiple views of an individual in a face database.

Fig: database of a person with different pose

The pose problem has been divided in to three categories

- Simple case with small rotation angle.
- Most commonly addressed case, when there is a set of training image pairs, frontal and rotated images.
- Most difficult case, when training image pairs are not.

Following are the most relevant approaches to pose problem

3.4.1: Multi-image approach: these methods requires multiple images for training. The idea behind this approach is to make template of all possible pose variations. So, when an input image is classified, it is aligned to the images

corresponding to a single pose. This process is repeated for each stored pose, until the correct one is detected.

3.4.2: Single-model based approach: this approach uses several data of a subject on training, but only one image at recognition.

3.4.3: Geometric approach: there are approaches that try to build a sub-layer of pose-invariant information of face. The input image are transformed depending on geometric measures on those models. The most common method is to build a graph which can link features to nodes and define the transformation needed to mimic face rotation.

4: likely requirements of a successful face match

To get a successful match of the probe image to that of database image, the probe image should have at least few of the followings:

- Is one in which the face takes up to 70% - 80% of photograph.
- Is in sharp focus and clear.
- Shows skin tones naturally.
- Has appropriate brightness and contrast.
- Is color neutral.
- Shows eyes open and clearly visible.
- Has a plain light-colored background.
- Shows subject without head cover.
- Where eye glasses do not obscure the eyes and are not tinted.
- Has a minimum of 90 pixels between the eye centers.
- Is no more than few years old.

5: conclusion

Face recognition is very challenging area of research. The reason is that, even today with so much different techniques and algorithms for different requirements, face recognition system fails.

6: References

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