Face recognition techniques and its application

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ABSTRACT

In the past two decades, Shape detection has been proven as the most interesting research field. We present a novel approach to measuring the similarities between shapes and exploit it for object recognition. The measurement of similarity preceded by solving correspondences between points on two shapes as well as by using the correspondences to estimate an aligning transform. In this paper, we are going to describe some important aspects of face detection, which are very much useful in many applications like face recognition, facial expression recognition, face tracking, facial feature extraction, gender classification, identification system, document control and access control, clustering, biometric science, human computer interaction (HCI) system, digital cosmetics and many more. Before that, I would like to focus on some well-known face detection techniques and then some feature detection methods because until and unless we extract the important features (eyes, nose, mouth) from a face we won’t be able to uniquely identify the person properly. The dissimilarity between the two shapes is computed as some of matching error between corresponding points. We treat recognition in a nearest neighbor classification framework as the problem of finding the stored prototype shape that is maximally similar to that in the image.

Keyword: Face detection, Segmentation, Facial Features, Shape

1. Introduction

Comparing with other biometrics, the most superiority of face biometric is its non-intrusive nature. Therefore, face is one of the most suitable biometrics for surveillance applications. Superiority is always followed by disadvantage. In typical surveillance scenarios, people are usually walking free, and they are impossible to always keep their faces frontal or looking to the cameras. This leads to a problem in face recognition, unconstrained face recognition. Most face images captured by surveillance systems are non-ideal, because they are often affected by many factors: pose, illumination, expression, occlusion, distance, weather and so on. This paper will mainly focus on the pose problem while considering the other factors together. Face detection is a procedure by which we can able to extract face region from a human body. Now, the concept can be implemented in various ways but mainly we use four steps for this implementation. In the first step, we localize the face region that means we are anticipating those parts of an image where a face may present. In the second step we normalize the detected region, so that the alignments of various facial features are in the proper location. In the third step we extract various facial features like eyes, nose, mouth, etc [1]. And in the forth step, we actually verify whether the anticipated parts are actually carrying out a face or not. We are doing this using some rules, template or image databases. The concept of extraction can be implemented by various techniques. There are a huge number of papers regarding the literature survey of face detection [2]. Most of the earlier work was on the frontal upright face, but recent work is mainly focus on non-frontal face with variation in their alignment. Also instead of still image, they are considering video stream images.

2. Face Detection Technique

A large number of representation techniques are available for face detection, including Knowledge-based, Feature invariant based, Template matching method, Appearance-based methods, Part-based methods.

2.1. Feature Invariant Approaches

These algorithms aim to find structural features that exist even when the pose, viewpoint, or lighting conditions vary, and then use these to locate faces. To distinguish from the knowledge-based methods, the feature invariant approaches start at feature extraction process and face candidates finding, and later verify each candidate by spatial relations among these features, while the knowledge-based methods usually exploit information of the whole image and are sensitive to complicated backgrounds and other factors. Readers could find more works in [3][4][5]. Face detection based on color information, random labeled graph matching fall in this category.

2.2. Knowledge-based methods

These rule-based methods encode human knowledge [6] of what constitutes a typical face. Usually, the rules capture the relationships between facial features. These methods are designed mainly for face localization, which aims to determine the image position of a single face.
2.3. Template matching methods
In this category, several standard patterns of a face are stored to describe the face as a whole or the facial feature separately. The correlations between an input image and the stored pattern are computed for detection. These methods have been used for both face localization and detection. Deformable template matching [7] falls in this category, where the template of faces is deformable according to some defined rules and constraints.

2.4. Appearance-based methods
In contrast to template matching, the models (or templates) are learned from a set of training images, which should capture the representative variability of facial appearance. These learned models are then used for detection. More significant techniques are included in [1][8]. Examples of such type of methods are view-based face detection, Haar features and the Adaboost algorithm.

2.5. Part-based methods
With the development of the graphical model framework and the point of interest detection such as the difference of Gaussian detector [9] (used in the SIFT detector) and the Hessian affine detector, the part-based method recently attracts more attention. Some well-known approaches like face detection based on the generative model framework, component-based face detection based on the SVM classifier falls into this category.

3. Face recognition
Face detection is the first step towards many applications; one of them is face recognition. To recognize a face, we first detect the face and then we compare it with a set of known individuals present in a database to verify the identity of the person. The concept of face recognition can be further extended to various biometric approaches including fingerprint, iris/retina and voice recognition. Face recognition techniques can be classified as two main approaches: Geometric approach or Feature-based approach where we analyze various features by means of their relationships [10] and holistic approach [11] such as Eigenfaces, neural networks [12]. In Feature-based approaches [13] we first preprocess the input image to remove the noise, and then we extract distinctive facial features such as the eyes, mouth, nose, etc., and then compute the geometric relationships among those facial points, thus reducing the input facial image to a vector of geometric features. Standard statistical pattern recognition techniques are then employed to match faces using these measurements. Most of the previous works was based on this technique. Unlike Feature based method, holistic based approaches use the global information rather that local feature information of the face. Here we represent the entire image with some small key values, which are directly derived from the pixel information of face images. This small key information is sufficient to uniquely differentiate individual faces. Here we describe two holistic approaches to face recognition called statistical and AI approaches.

4. Facial Expression Recognition
Human facial expression recognition by a machine can be described as an interpretation of human facial characteristics via mathematical algorithms [14]-[15]. Gestures of the body are read by an input sensing device such as a web-cam. It reads the movements of the human body and communicates with computer that uses these gestures as an input. These gestures are then interpreted using algorithm either based on statistical analysis or artificial intelligence techniques. The primary goal of gesture recognition research is to create a system which can identify specific human gestures and use them to convey information. By observing face, one can decide whether a man is serious, happy, thinking, sad, feeling pain and so on. Recognizing the expression of a man can help in many of the areas like in the field of medical science where a doctor can be alerted when a patient is in severe pain. It helps in taking prompt action at that time.

5. Conclusion
In this paper, we have covered a detail discussion on the various stages of any face recognizing technique. Also, some popular well-known face detection techniques are described very briefly. Recently, face detection techniques have been employed in different area of applications such as face recognition, facial feature extraction, detection of facial expression, which are also the subjects to be focused of this paper. Hence, before developing any kind of method of your
choice, if you go through this paper, you will definitely get an overview about various ways and applications used in face detection process. Also you can justify the face expression so you can give the various opinions on this faces.

References

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