An Automated Technique for Criminal Face Identification Using Biometric Approach

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Abstract

Face recognition has become a popular area of research in computer vision, it is typically used in network security systems and access control systems but it is also useful in other multimedia information processing areas. One of its application is criminal face identification. Criminal record generally contains personal information about particular person along with the photograph. To identify any criminal we need some identification regarding particular person or persons, which are given by eyewitnesses. Based on the details given by the eyewitnesses, the further investigation would be carried out. In most cases the quality and resolution of the recorded image segments is poor and hard to identify a face. In this paper, we have classified image processing operations into three categories; low, medium and high level to process and analyze a given face. This paper presents better results than conventional methods in use relating to the face recognition process that are used in criminal identification.

Keywords: Face Identification, image processing, Biometrics, Face clippings.

1. INTRODUCTION

Face Identification is a technique that is mainly used to identify criminals based on the clues given by the eyewitnesses. Based on the clues we develop an image by using the image that we have in our database and then we compare it with the images already we have. To identify any criminals we must have a record that generally contains name, age, location, previous crime, gender, photo, etc. The primary task at hand is, given still or video images require the identification of the one or more segmented and extracted from the scene, where upon it can be identified and matched. The word image is defined as an exact or analogous representation of a being or a thing. The image or monochrome image such as black and white paragraph is represented as two-dimensional light intensity function f(x,y) where x and y denotes spatial co-ordinates. A digital image is an image of f (x, y) that has been digitized both in spatial co-ordinate and brightness. The elements of such a digital array are called image elements, picture elements or pixels.

Biometric technologies [3] have been evolved as an enchanting solution to perform secure identification and personal verification. The need for highly secure identification and personal verification technologies is becoming apparent as the level of security breaches and transaction fraud increases. The increasing use of biometric technologies in high security applications and beyond has created the requirement for highly dependable face recognition systems. The Face recognition system is used to verify an identity of a person by matching a given face against a database of known faces. It has become alternative to traditional identification and authentication methods such as the use of keys, ID cards and passwords. Face recognition involves computer recognition of personal identity based on geometric or statistical features that are derived from the face images [8]. Even though human can detect and identify faces in a scene easily, building an automated system is challenging. Face recognition technology can be applied to a wide variety of application areas including access control for PCs, airport surveillance, private surveillance, criminal

identification and for security in ATM transactions. In addition, face recognition system is moving towards the next-generation smart environment where computers are designed to interact more like humans. In recent years, considerable progress has been made in the area of face recognition with the development of many other useful techniques. The advances in computing technology have facilitated the development of real-time vision modules that interact with humans in recent years. Examples abound, particularly in biometrics and human computer interaction as the information contained in faces needs to be analyzed for systems to react accordingly [7]. For biometric systems that use faces as non-intrusive input modules, it is imperative to locate faces in a scene before any recognition algorithm can be applied. An intelligent vision based user interface should be able to tell the focus of the user (i.e., where the user is looking at) in order to respond accordingly [1]. To detect facial features accurately for applications such as digital cosmetics, faces need to be located and registered first to facilitate further processing.

It is evident that face detection plays an important and critical role for the success of any face processing systems. The face detection problem is challenging as it needs to account for all the possible appearance variation caused by change in illumination, facial features, occlusions, etc. In addition, it has to detect faces that appear at different scale, pose, with in plane rotations. Often the size of the image is very large, the processing time has to be very small and usually real-time constraints have to be met. Therefore, during the last decades there has been an increasing interest in the development and the use of parallel algorithms in image processing. Face detection is attached with finding whether or not there are any faces in a given image (usually in gray scale) and, if present, return the image location and content of each face. This is the first step of any fully automatic system that analyzes the information contained in faces (e.g., identity, gender, expression, age, race and pose).This work focuses on how to make parallel computations by partitioning the image into manageable and meaningful parts for efficient calculations and results.

2. CLASSIFICATIONOF IMAGE OPERATIONS

Image processing is referred to processing of a 2D picture by a computer. An image may be considered to contain sub-images sometimes referred to as regions-of-interest, ROIs, or simply regions. This concept reflects the fact that images frequently contain collections of objects each of which can be the basis for a region. In a sophisticated image processing system it should be possible to apply specific image processing operations to selected regions. Thus one part of an image (region) might be processed to suppress motion blur while another part might be processed to improve color rendition. Image processing operations can be classified as low-level, intermediate-level and high-level [2]. Based on this classification, it is possible to define a skeleton library for image operations in order to carry out image recognition operations.

- Low-level image operations.
- Intermediate-level image operations.
- High-level image operations.

Skeletons for image operations:

It is possible to use the data-parallelism paradigm with the master-slave approach for low-level, intermediate-level and high-level image processing operations [5]. A master processor is selected for splitting and distributing the data to the slaves. The master can also process a part of the image (data). Each slave processes its received part of the image (data) and then, the master gathers and assembles the image (data) back.

Before going to processing an image, it is converted into a digital form. Digitization includes sampling of image and quantization of sampled values. After converting the image into bit information, processing is performed. These processing techniques are image preprocessing, Image enhancement, Image reconstruction, and Image compression.

Image Preprocessing: Preprocessing functions involve those operations that are normally required prior to the main data analysis and extraction of information, and are generally grouped as radiometric or geometric corrections.

Image Enhancement: It refers to accentuation, or sharpening, of image features such as boundaries, or contrast to make a graphic display more useful for display & analysis. This process does not increase the inherent information content in data. It includes gray level & contrast manipulation, noise reduction, edge crispening and sharpening, filtering, interpolation and magnification, pseudo coloring, and so on.

Image Restoration: It is concerned with filtering the observed image to minimize the effect of degradations. Effectiveness of image restoration depends on the extent and accuracy of the knowledge of degradation process as well as on filter design. Image restoration differs from image enhancement in that the latter is concerned with more extraction or accentuation of image features.

Image Compression: It is concerned with minimizing the number of bits required to represent an image. Application of compression are in broadcast TV, remote sensing via satellite, military communication via aircraft, radar, teleconferencing, facsimile transmission, for educational & business documents , medical images that arise in computer tomography, magnetic resonance imaging and digital radiology, motion , pictures ,satellite images, weather maps, geological surveys and so on.

Image Classification and Analysis: These operations are used to digitally identify and classify pixels in the data. Classification is usually performed on multi-channel data sets and this process assigns each pixel in an image to a particular class or theme based on statistical characteristics of the pixel brightness values. There are a variety of approaches taken to perform digital classification. The two generic approaches which are used most often are supervised and unsupervised classification.

3. FACE IDENTIFICATION TECHNIQUE

Face identification is a term that includes several sub problems. The technique for face identification comprises of three steps: face detection, feature extraction and face recognition.

Face Detection:

Face detection is defined as the process of detecting faces from images and scenes. So, the system positively identifies a certain image region as a face. This procedure has many applications like face tracking, pose estimation or compression.

Feature Extraction:

Feature extraction- involves obtaining relevant facial features from the data. These features could be certain face regions, variations, angles or measures, which can be human relevant (e.g. eyes

spacing) or not. This phase has other applications like facial feature tracking or emotion recognition.

Face Recognition

It is a one-to-many matching process that compares a query face image against all the template images in a face database to determine the identity of the query face. The identification of the test image is done by locating the image in the database that has the highest similarity with the test image. The identification process is a “closed” test, which means the sensor takes an observation of an individual that is known to be in the database. The basic underlying recognition involves either eigen features or eigen faces. The German word "eigen" refers to recursive mathematics used to analyze unique facial characteristics. When a facial feature identification system utilizes an eigen face approach, the system interprets each facial image as a two-dimensional set of light and dark areas in a particular pattern. It is these light and dark areas that are considered the eigen faces. The light and dark area patterns are then converted and represented as an algorithm, which is then temporarily stored as a combination of eigen faces. Finally, the current combination of eigen faces are is scanned by a facial identification system and is used to compare against saved eigen faces in a database. However, an eigen feature system approach strives to determine the distances between such facial features as the nose, eyes, bone structure, mouth and eyebrows. The distinction in this method is that the facial identification system captures one's face and then extracts certain eigen features in a database. As a final note, facial feature systems can also be categorized as continuous or triggered. Continuous systems are always active and are constantly scanning facial images. Triggered systems must be activated in some way in order for the system to scan one's face. In order to identify the criminal, face identification is very important as when a particular person has done the crime he can be easily identified using this particular technique.

As we know we have a database regarding the existing criminals in our records, it would become an easy task in collecting the information regarding the person who has a criminal record and is a suspect in this particular case. Now by seeing the situation we would have an eye-witness in which he could trace the suspected image and make it sure that the paint made by him is similar to the face which has been seen at the particular crime. Now, in order to compare the face with the existing database, firstly, we need to split the face in to six equal parts as hair, head, eyes, nose, mouth and chin. By splitting the data it would become an easier task for face identification. In most of the cases it would be recognized while considered the split of images. A particular image is split into six equal parts as hair, forehead, eyes, nose, mouth, chin as shown below in figure1.

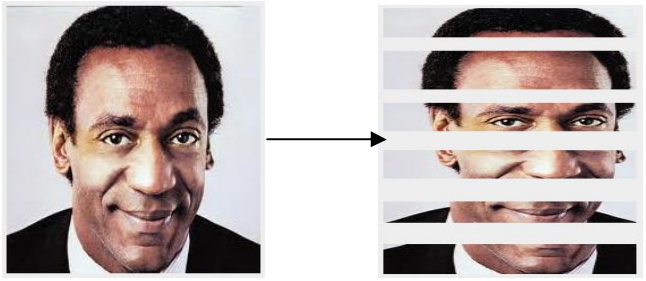

Fig 1: clipping a face into various parts.

Now the face has been divided into parts which is an easy way to match the criminal with the database. Using these individual parts, we can now construct some new faces according to the predictions of the eye-witness. For the construction of a new image, we can combine any of the facial clippings with any other clipping to construct a new face. Now based on these newly constructed faces, we can compare these new faces with the previously saved images in the database and start matching the complete image with the images which are having some similarities so that we could get the best match from the available database. Finally a particular person outcome is shown on the screen which can be considered as the most suitable suspect. By this we can identify the existing criminal information regarding which it could become easy in identifying criminals. Thus, it is been a good task in identifying the criminal with the underlying algorithm proposed in this paper. Generally the image considered from the eye witness is a manually painted one. By using this particular painted picture we need to identify the exact picture of the criminal. If the particular image person is not available in the database, then the investigation team can start the actual campaigning in finding out the criminal by considering the case details. If the face details are matched with the database then by just giving the input of the data as a face image it would display the complete bio-data of the criminal by using this proposed method [4]. This would help the investigating team in gaining some or the other details which would help in tracing out the criminal.

4. EXISTING SYSTEM

Criminal record generally contains personal information about particular person along with photograph. To identify any criminal we need some identification regarding person, which are given by eyewitnesses [6]. Based on the details given by eyewitnesses, the criminal who did the crime will be identified manually.

Problems in existing system:

a. In most cases the quality and resolution of the recorded image segments are poor and hard to identify a face.

b. If a eyewitnesses observe a criminal only from single direction, it may not be possible to recognize him.

c. The photograph, which is a hard copy, cannot be able to divide or split into different modules. So it is very difficult to find, unless we get full-fledged details.

d. Some times the eyewitness may not be able to draw, the face of criminal [2].

e. Sometimes, if we maintain the criminal details manually and physically. After a time span, the photographs and other details may tend to tear out.

5. THE PROPOSED SYSTEM AND IMPLEMENTATION

Feature extraction domain has plenty of collection of generalized face features from several images of the same subject. Then, each face image is processed, features are extracted and the collection of features are analyzed and combined into a single generalized features collection, which is written to the database. The face is our primary focus of attention in social inter course playing a major role in conveying identification and emotion. Although the ability to infer intelligence or character from facial appearance is a guess but still the human ability to recognize faces is remarkable. This analogy would give us enough scope to envisage a new algorithm. There are mainly three important ways in construction of the face i.e., by using the eyewitness function, adding details and clipping image. This offers us a face as finally identification parameter to know who has committed the crime.

The Image Partitioning Algorithm:

Step 1: Split the image into six equal parts as hair, forehead, eyes, nose, mouth, and chin.

Step 2: Now the face has been divided into individual parts, which is an easy way to create new faces and match the criminal with the database.

Step 3: Use these individual parts to create new faces as per opinion of the eye-witness.

Step 4: Compare all the face partitions with the database available. It would generate a list of matched responses from the database i.e. may be more that one.

Step 5: Initiate a process of comparison to match the complete image with the images which are having some similarities so that we could get the most suitable suspect from the available database among all the suspects.

Step 6: Thus with recursive match computations done to all the parts of the image against database images, we would arrive at a particular image which showcases maximum matche. Thus, emerges an image that is a perfect match of the suspected criminal.

Advantages of the proposed system:

- Fast and accurate face location for reliable detection of multiple faces in the video streams and still images.
- Simultaneous multiple face processing identification in a single frame.
- It can handle large face databases.

6. CONCLUSION AND FUTURE WORK

The approach presented in this work uses image partition algorithm in which input image is scanned at almost every pixel location and scale, to boost the performance of the detector along with the enhanced accuracy. In this, we have classified image processing operations into three categories, low, medium and high level. Based on the face recognition process under proposed system this work has suggested better approach for identification used in criminal identification.

In this work we have taken a pre-captured image and performed processing techniques on it. In future we intend to take a real image and perform "real time image processing" on it.

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