

Detection of Gender in Crime Investigation

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Abstract— The study and reconstruction of crime scenes has always intrigued common man. Determination of the identity of individuals relevant to a crime scene plays an integral role in forensic investigation and the associated medico-legal practices. This paper proposed a computer based system that could effectively predict the gender of an individual using SVM basic kernel functions.

Key words: Support Vector Machine, Kernel, Facial Features, Gender Identification, Crime Scene

I. INTRODUCTION

Forensic anthropology particularly deals with the building of an antemortem profile of an individual from skeletal as also other remains left by the body of an individual in a crime scene. Gender information is also used for enhancing the performance of current face recognition methods especially facial expression recognition systems. It is also used in various other applications like restricting the access to certain areas based on gender. Support Vector Machine (SVM) is used as new learning method for binary classification. The basic idea is to find a hyperplane to separate the samples of data perfectly into its two classes.

Gender is among the strongest predictors of crime, particularly violent crime. Arrest, self-report, and victimization data consistently show that men and boys commit significantly more crime, both serious and not, than women and girls. This pattern persists despite data indicating that crimes committed by females may be rising. Evidence also suggests that males are generally more aggressive than females, even before the preschool years.

The results of the Biosocial Study confirmed past research which had demonstrated gender differences in the prevalence of crime. Males engaged in more crime and violence than females, and they were more likely to repeat their crimes. However, the Biosocial Study also corresponded with some research and theory which had indicated gender differences in the prediction of crime. With some exceptions, biological factors were found to be more predictive of crime among females, whereas environmental factors were found to be more predictive of crime among males.' Also, more factors overall were correlated with crime among females than males.

Gender differences in the prediction of crime may substantially affect differences in prevalence. Gender becomes particularly important when assessing the "criminal careers"⁸⁰ of individual offenders, because predictive influences may vary depending on an individual's age and physiological development. An analysis of a criminal career focuses on two key elements: (1) participation—the difference between those who do or do not commit a crime, and (2) frequency—the number of crimes an active offender commits.⁸¹ Certain factors, such as the offender's age at the initiation of a criminal career, the escalation and desistance of the offender's criminal behavior, and the policy approaches for restraining criminal careers, are influential in determining the onset and continuation of criminal careers.

'Gender-based violence' and 'violence against women' are terms that are often used interchangeably as most gender-based violence is inflicted by men on women and girls. However, it is important to retain the 'gender-based' aspect of the concept as this highlights the fact that violence against women is an expression of power inequalities between women and men. A multidisciplinary approach to crime is crucial for understanding both why crime occurs and the conditions for any possible gender differences. In crime investigation this chapter suggests that classification of gender plays an important role for understanding behavioral pattern of crime.

Over the period of time, automated classification of gender has gained enormous significance and has become an active area of research. Many researchers have put a lot of effort and have produced quality research in this area. Still, there is an immense potential in this field because of its utility in many areas like monitoring, surveillance, commercial profiling and human-computer interaction. Security applications have utmost importance in this area. Gender classification can be used as part of a face recognition process.

Gender classification can be stated as inferring female or male from a collection of facial images. It is actually binary classification, there exist different methods for gender classification, such as gait, iris, hand shape and hair, yet the prominent methods to achieve the goal is based on facial features. Gender identity is defined as a personal conception of oneself as male or female (or rarely, both or neither). This concept is intimately related to the concept of gender role, which is defined as the outward manifestations of personality that reflect the gender identity. Gender identity, in nearly all instances, is self-identified, as a result of a combination of inherent and extrinsic or environmental factors, gender role, on the other hand, is manifested within society by observable factors such as behavior and appearance. The basic idea in this work was to develop a computer based system that could effectively predict the gender of an individual.

II. REVIEW WORKS

In recent times, more and more civilian and commercial applications are either using or actively considering using fingerprint-based identification because of the availability of inexpensive and compact solid state scanners as well as its superior and proven matching performance over other biometric technologies. Skin on human fingertips contains ridges and valleys which together forms distinctive patterns. These patterns are fully developed under pregnancy and are permanent throughout whole lifetime. Prints of those patterns are called fingerprints. Injuries like cuts, burns and bruises can temporarily damage quality of fingerprints but when fully healed, patterns will be restored.

Fingerprinting remains the best to establish personal identification and tracking criminals. Few researchers addressed the use of fingerprint for gender

identification which will be more helpful in short listing the suspects. Gender recognition is an interesting problem that can be used to boost the performance of several important applications such as face recognition and video surveillance. Gender classification can be utilized as an indexing technique to reduce the search space for automatic and manual recognition techniques. Further, other areas such as human computer interaction also have many interesting applications ranging from automatically identifying gender of individuals to image search over the internet.

Gender classification problem is an active research area which has attracted a great deal of attention recently. It is a challenging pattern recognition problem. Generally gender classification involves a process of determining the gender of a subject from face images. The face images analysis plays an important role in computer vision. Face images analysis has been successfully used in many applications ranging from biometric to robotic-human interaction. Current face detection applications operate with high accuracy as compared to gender classifications systems, because gender classification systems do not offer same level of performance and accuracy. Face is a very important biometric feature of human. Automatic recognizing and analyzing of face is one of challenging tasks in object recognition. Successful performing this task allows many applications in human computer interaction. Gender plays a significant role in our interactions in society and with computers [6]. Actually Gender classification is a binary classification problem in which one has to predict an image belongs to a man or woman. It is an easy job for a person but a challenging one for computers [7].

III. PROPOSED METHOD

In this paper, novel methodologies has been proposed to achieve the goal of gender classification. Input image set are pre- processed to perform noise removal, histogram equalization, size normalization and then face detection is performed. Secondly, Feature Extraction from facial image is performed. Finally to evaluate the performance of the proposed algorithm, experiments have been performed on various image set that contain equal proportion of male and female by using suitable binary SVM classifier which will classify the data set into two categories i.e male or female. The basic idea behind this paper is to appraise the performance of SVM basic kernel functions which has been employed to detect and classify the human gender into two class problem i.e. (1) male class and (2) female class. These functions read the feature(s) of human facial image(s) as input. The proposed algorithm is then executed on the elementary features of a human facial image i.e. eyes, nose, lips and their all possible combinations. Finally based on the accuracy percentage of the computed result the admissible outcome of the Kernel Functions have been realized. The following algorithm illustrates the basic process for the method.

IV. ALGORITHM

- Step 1: Read Image Set of Male and Female
- Step 2: Convert each input image to grey scale.
- Step 3: Using ROI principle perform feature extraction from individual image.

- Step 3.1: for each image perform the following steps
- Step 3.1.1: Extract the 'lip' from individual image
- Step 3.1.2: Reshape the extracted image from 2 D to 1 D.
- Step 3.1.3: Associate with each image a class label. Assign +1 to female image and -1 to male image.
- Step 3.1.4: Form a Feature Vector consisting of the extracted images and the class label.
- end
- Step 4: Shuffle the Feature Vector matrix.
- Step 5: Cross- Validate the matrix and generate the train data set and the test data set.
- Step 6: Perform training on the train data set of the SVM classifier.
- Step 7: Perform testing on the test data set along with the train vector.
- Step 8: Obtain the resultant classified data.

Cross Validation of the Shuffled Matrix is one of the key steps in Gender Recognition Algorithm. It resolves the issues like over fitting of images. Besides if the original data set is appropriately cross validated, it can be effortlessly divided into the train set and the test set. The size of the train set and the test set however depends on the degree of the cross validation technique. Like the 'hold out technique divides the original set into two equal sized sets, while the other techniques like '10 fold' cross validation and '5 fold' cross validation dissociates the primitive data into 10 segments and 5 segments respectively. Each time one segment is tested to predict the class labels of the undetermined set after acquiring the result of the training of the remaining (n-1) segments.

Studies have consistently shown higher rates of offending for males than for females, and especially higher rates of violence. Gender differences in the development of social cognition may help to explain gender differences in crime and violence. How an individual ultimately responds to a stressful life event or risk factor depends on how that event is perceived, which, in turn, depends on an individual's cognitive processes. Social information-processing skills allow individuals to encode information, interpret and consider risks and benefits of a particular action, and determine an appropriate response based on their repertoire of behavioral scripts. It is not necessarily suggested that deficiencies in cognitive capabilities cause crime, but rather that certain ways of processing social information and certain social cognitive memory structures help to protect the individual from personal, social, environmental, or situational pressures towards criminal behavior.

V. CONCLUSIONS

Gender Classification is a binary Classification problem. There exist several algorithms which have been already implemented to generate a solution to the stated problem. This study addresses the issue of gender classification and age detection of the identified gender using Support Vector Machine Classifier. Although the stated methodologies have been implemented on facial image data set and results are obtained with a level of accuracy, yet there are areas which

are yet to be cultivated and where further enhancement can be achieved.

Social cognition appears to be an important variable in relation to crime and violence. Offenders frequently show deficits in social problem-solving skills, perspective taking, empathetic understanding, and interpersonal communication. In addition, hyperactivity, impulsivity, and attention deficits are related to deficits in cognitive abilities. It is unclear whether a neurological deficit causes or results from a cognitive deficit. Harsh or inconsistent parenting, as well as delinquent peer associations, can limit the development of prosocial cognitive skills.

Rather than viewing deficits in cognitive ability as causes of crime and violence, competent social cognitive processing skills should be thought of as mediators between risk factors and delinquent behavior. Cognitive processes mediate behavior by providing mechanisms for the individual to interpret, consider, and respond to an event on the basis of current cues, past scripts, and schemas.

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