Middle-East Journal of Scientific Research 21 (7): 1153-1156, 2014
ISSN 1990-9233

DOI: 10.5829/idosi.mejsr.2014.21.07.21582

Human Identification in Video Streaming Based on Some Facial Classification Parameters

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Abstract: Human identification is the trending feature in most software packages it is highly used by security organizations. Most of these software packages are developed only to identify human by searching him/her in database. Authors of the following research paper propose the software package that identifies human in video streaming based on some classification parameters. Mainly, in this research, three classification parameters: gender, age and race, are used. Classification of gender, age and race groups is based on facial features of human.

Key words: Human identification · Classification parameter · Facial feature · Video streaming

INTRODUCTION

One of the main goals of computer vision is the identification of humans. Human can be identified based on several parameters like gait, face, fingerprint and iris. In this research paper, authors used face recognition, because the aim of the research project is to develop a system, which will identify human based on some classification parameters. People can be classified into age, gender and race groups based on their facial features. Some examples of this classification are shown in Fig. 1. Besides this, other modalities can be used for classification; especially, human body can be used for gender classification. The main focus of this research paper is face-based age estimation, gender and race classification. Today, in this modern time there is a problem with the control of children. People need software that will control access to the Internet sites with content oriented for audience over 18 years old, which will prevent children from the access. Moreover, people need software in vending machines that will not lend the children items like cigarettes, alcohol, etc. It is the social problem of all people in the world and the software with age estimation, gender and race classification feature can solve it.

Besides that, this kind of software can also be used for obtaining statistical data. For example, extracted demographic information of the customers could provide

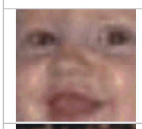
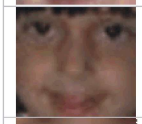
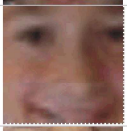
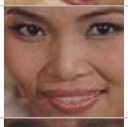
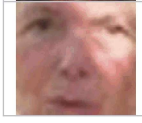
Image	Est. age	Est. gender	Est. race
	0-2	M	White/ Caucasian race
	3-7	M	White/ Caucasian race
	8-12	F	White/Caucasian race
	13-19	F	Mongolian
	20-36	F	Mongolian
	37-65	M	Black/ Negro race
	66+	F	White/ Caucasian race

Fig. 1: Example of age, gender, race classification

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statistical data for marketing departments of any company, especially for companies specialized on sales for collecting data about their customers.

Nowadays, most security agencies need software with functionality to search person in video streaming according to given classification parameters like age, gender and race. This kind of software can be used in access control points of airports, financial institutions and banks. For example, it can be used for verification of every person in blacklist database and for detecting person, who fits the search criteria.

Related Work: Many algorithms for face recognition have been proposed until today. For detailed information see [1]. Nevertheless, all of them are sensitive to large variations in lightning and facial expressions. Considering these lacks, authors of [2] developed a face recognition algorithm, which is insensitive for those type of variations. This algorithm is based on two methods, Fisherfaces and Eigenfaces. The Fisherfaces method is a derivative of Fisher's Linear Discriminant [3], which maximizes the ratio of between-class scatter to that of within-class scatter. The Eigenfaces method is also based on linearly projecting the image space to a low dimensional feature space [4] and [5].

Classification: The first step of this work is to classify any person into gender and age groups by using face recognition algorithms; for doing this, Fisherfaces method was chosen. The Eigenfaces method is based on the Principal Component Analysis, which is an unsupervised statistical model and not suitable for this task. The Fisherfaces instead yields a class-specific linear projection, so it is much better suited for the age and gender classification task [6]. According to experiment in [7] done by P. Wagner, we can see that the Fisherfaces method achieves a 98% recognition rate in a subject-independent cross-validation. A subject independent cross-validation means that images of the person under test are never used for learning the model.

Fisherfaces method is already implemented in OpenCV framework. OpenCV is an open source computer vision and machine learning software library. For the age and gender classification we need to train classifiers, which can be loaded into Fisherfaces recognizer in OpenCV library. To train age and gender classifiers we need a set of images of different people faces.

Face Database: Before starting to train classifier, authors had a choice to create own dataset or to start with one of the available face databases. We have chosen the available dataset, because it will save time. There are many available face databases like AT&T Facedatabase [8], Yale Facedatabase A [9], Extended Yale Facedatabase B [10], etc. We have chosen The Images of Groups Dataset created by A. Galagher and T. Chen, because this dataset was oriented for age and gender classification task, which is clearly described in [11]. They built a collection of people images from Flickr images. They divided photos into 3 groups: Family photos (Fig. 2), Group photos (Fig. 3) and Wedding photos (Fig. 4). Each person's face in photos was labeled by gender and age category. They used seven age categories: 0-2, 3-7, 8-12, 13-19, 20-36, 37-65 and 66+, roughly corresponding to different life stages. For gender labeling, they used 1 and 2 for female and male. In all, 5,080 images containing 28,231 faces are labeled with age and gender; it is the largest dataset so far. This dataset contains a great deal of variety. There are many types of images, in which people are sitting, laying, or standing on elevated surfaces. People often have dark glasses, face occlusions, or unusual facial expressions. They distribute their dataset for non-commercial research purposes use only.

Using these images, age and gender classifiers were trained. All images from dataset were collected to one folder. As there are only group photos, all faces were cropped into separate images with the size of 70x70 pixels. Seven age categories as in original dataset were used, but for labeling male and female – binary format consisting 0 and 1 was used. For training classifiers, one specific application was developed using OpenCV framework. This application takes a while to train one classifier on a custom PC. For the experiment, 1500 cropped images to train age and gender classifier were taken. At the end, we get one xml file for each classifier.

System Overview: Software is developed using OpenCV and QT frameworks. QT is a cross-platform application and UI framework. OpenCV is used for logic construction, whereas QT is used for developing UI. Software is implemented as a desktop application (Fig. 2).

Desktop application has the sequence of five operations (Fig. 3). Video stream input comes from file or locally connected camera. Application has the usable search engine. It can search people from video by three parameters: age category, gender and human race. There are seven age categories: 0-2, 3-7, 8-12, 13-19, 20-36, 37-65 and 66+; two gender categories: male and female; three main human races: Mongolian race, White/ Caucasian race and Black/Negro race. By default, application searches for people who first matches, i.e. if there are many people in video, then it will show only one human,

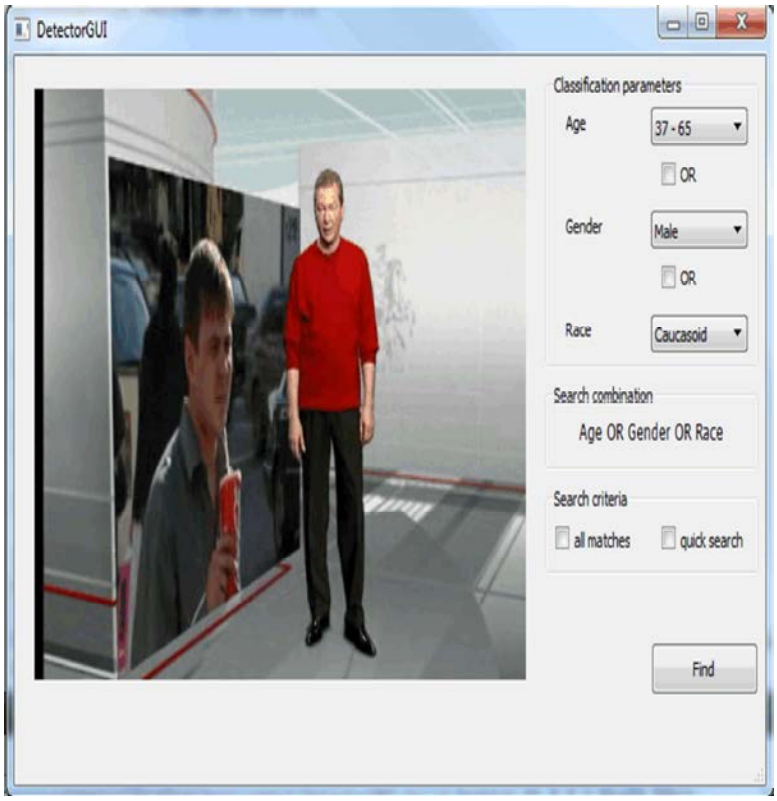

Fig. 2: Main window of desktop application

Fig. 3: Sequence of operations

Fig. 4: Search result window of desktop application

who was found first. It can be configured to search all people in video. Search will not be finished until human is found. It can be configured to search people only in current moment of video. Search is performed by Age OR Gender OR Race combination, i.e. search will be ended if any of these search parameters matches with a person in video, which means that human was found. User can configure the search by himself, which means any combination can be configured. As the result of search, application shows new window with screenshot of video with rectangle around the detected face (Fig. 4) in case of fining a human, otherwise, there will be window with no results.

CONCLUSION

The main attention is paid to desktop application, which can search people in video streaming, according to specified search parameters. This application is the main part of one big security system software. All work done as a demonstration of new features, which suitable for all security systems software. In general, application works well, but has low recognition rate, because only 1500 face images were used for training classifiers. In next coming releases, this problem will be resolved and new features will be added.

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