IOSR Journal of Electronics and Communication Engineering (IOSR-JECE)
e-ISSN: 2278-2834,p- ISSN: 2278-8735.Volume 12, Issue 4, Ver. V (Jul.-Aug. 2017), PP 11-16
www.iosrjournals.org

Human Age, Gender and Weight Determination Using Face Images

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Abstract: *Today life is rapidly changing. New innovations, new things daily happing in today's life. Technology is going beyond our expectation. Also for this changing technology security issue is very important. This paper is about method for real time human Face detection and determining their age, gender and weight. Automatic age estimation, it remains a challenging problem. This is because the face aging process is determined not only by intrinsic factors, e.g. genetic factors, but also by ex-trinsic factors, e.g. lifestyle, expression, and environment. There are many methods have been proposed in the literature for the age estimation and gender classification. However, all of them have still disadvantage such as not complete reflection about face structure, face texture. We propose a hierarchical approach for automatic age estimation. Two main components for building an effective age estimator are facial feature extraction and estimator learning. Using feature extraction and comparing with our input data in which we have different age group face images with specified weight. Here we using raspberry pi for better efficiency. In this project work on the identification of younger image and older image are focused on the methods using image processing. First we extract certain features from the input Face images, later using different method like thresholding, segmentation, edge detection and thus we get related databases. Comparing several trained databases, we get a specific range for younger images and older images also get information of their gender and weight. Hence this project is very useful for detection of human age, weight and gender form face images only.*

Keywords: *Raspberry pi, Face detection, Age estimation, Gender and Weight determination*

Date of Submission:28-07-2017 Date of acceptance: 25-08-2017

I. Introduction

Most face detection algorithms are designed in the software domain and have a high recognition rate, but they often require several seconds to detect faces in a single image, a processing speed that is insufficient for real-time applications. A simple and easy hardware implementation of face detection system using Raspberry Pi, which itself is a minicomputer of a credit card size and is of a very low price. Automatic age estimation, which involves evaluating a person's exact age or age-group and weight estimation, is a crucial topic in human face image understanding. A effective gender classification process can improve the performance of many different applications, including person recognition and smart human-computer interfaces. Here use of Raspberry Pi board as a platform for this process. Camera Pi is an excellent add-on for Raspberry Pi, to take pictures and record quality videos, with the possibility to apply a considerable range of configurations and effects.

For real time and from specific image face detection, i.e. Object detection is done and the proposed system is tested across various standard face databases, with and without noise and blurring effects. Efficiency of the system is examined by calculating the Face detection rate for each of the database. The results disclose that the proposed system can be used for face recognition even from low quality image and shows excellent performance efficiency. Automatic age estimation, which involves evaluating a person's exact age or age-group, is a crucial topic in human face image understanding. The task of estimating exact human age adopts a dense representation of the age labels (e.g., from 0 to 80), and the task of age-group estimation divides the labels only into rough groups (e.g., elder, adult, and teenage/children). In this paper, we focus on the setting of the former task that can be applicable to more general situations. Nevertheless, the proposed method can be used for age-group estimation as well. Two main components for building an effective age estimator are facial feature extraction and estimator learning. Recognizing human gender is important since people respond differently according to gender. In addition, A effective gender classification process can improve the performance of many different applications, including person recognition and smart human-computer interfaces. In this article, we presents the problem of automatic gender identification by exploiting the physiological and aspects of the face at the same time, we explore the possibility of using head motion, mouth motion and facial appearance in a gender

identification scenario. Hence, propose a multimodal recognition approach that integrates the temporal and spatial information of the face through a probabilistic framework. The advantages of this system is real time face detection and tracking is possible, The raspberry Pi processor is of low cost, Execution speed is very fast, More than one face can also be detected using this system at a time. The efficiency of the system was analyzed in terms of face detection rate. The analysis revealed that the present system shows excellent performance efficiency and can be used for face detection even from poor quality images.

II. Literature Review

Methodology for face recognition based on information theory approach of coding and decoding the face image is discussed in [Sarala A. Dabhade & Mrunal S. Bewoor, 2012] [1]. Proposed methodology is connection of two stages – Face detection using Haar Based Cascade classifier and recognition using Principle Component analysis. Various face detection and recognition methods have been evaluated [Faizan Ahmad et al., 2013] [2] and also solution for image detection and recognition is proposed as an initial step for video surveillance. Implementation of face recognition using principal component analysis using 4 distance classifiers is proposed in [Hussein Rady, 2011] [3]. A system that uses different distance measures for each image will perform better than a system that only uses one. The experiment show that PCA gave better results with Euclidian distance classifier and the squared Euclidian distance classifier than the City Block distance classifier, which gives better results than the squared Chebyshev distance classifier. A structural face construction and detection system is presented in [Sankarakumar et al., 2013] [4]. The proposed system consists the different lightning, rotated facial image, skin color etc.

Lanitis et al. [5] proposed the first approach applying AAM to age estimation, which extracts craniofacial growth and skin aging during childhood and adulthood. Different classifiers (including shortest-distance classifier, quadratic function and neural networks) are compared when AAM is employed as the feature representation. The approach also differentiated between 1) age-specific estimation, which is based on the assumption that the aging process is identical for everyone; and 2) appearance-specific estimation, which follows the assumption that people who look similar tend to have similar aging processes. Subsequently, a personalized age estimation used in the specialty of aging processes is then introduced to cluster similar faces before classification. In addition, Geng et al. [6] modeled the aging process with AAM based on a sequence of age-ascending face images for the same individual. Hence, different aging models can be learnt for different persons. More specifically, Geng et al. [7] introduced a personalized age estimation method that describes the long-term aging subspace of a person, called Aging pattern Subspace (AGES). AGES estimates his/her age by projecting the query face into the aging subspace that best reconstruct the face image. Sun et al. [8] applied principal component analysis (PCA) to represent each image as a feature vector in a low dimensional space; genetic algorithms (GA) were then employed to select a subset of features form the low dimensional representation that mostly encodes the gender information. Four different classifiers were compared in this study: the Bayesian decision making, a neural network (NN), support vector machines (SVM) and a classifier based on linear discriminate analysis (LDA). Nakano et al. [9] focused on the edge information and exploited a neural network (NN) classifier for gender recognition. In particular, they computed the density histograms of the edge images, which were successively treated as input features for the NN. Kim et al. [10] base their gender recognition system on a Gaussian Process Classifier (GPC). Facial images are first normalized to a standard dimensions and background and hair information was removed. Parameters for the GPC are learned using Expectation Maximization (EM) - Expectation Propagation (EP) algorithm. Finally GPC is used for classification. Four different classifiers were compared in this study: the Bayesian decision making, a neural network (NN), support vector machines (SVM) and a classifier based on linear discriminant analysis (LDA). The SVM achieved the best performance in the comparative experiments. Gutta et al. [12] considered a hybrid classifier for gender determination of human faces that consisted of an ensemble of radial basis functions (RBFs) and decision trees (DTs). Moghaddam et al. [13] also proposed to classify gender from facial images (of21x21 pixels) using support vector machines (SVMs). They tested the SVMs by implementing different kernels and they obtained the best experimental results with the Gaussian kernel, followed by the cubic polynomial kernel.

III. Proposed Work

A general block diagram of the system is as shown below:

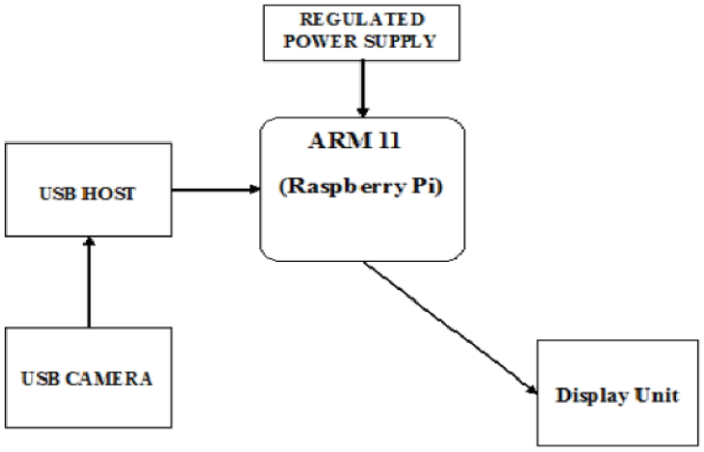

Fig.1 Basic Block Diagram

Figure 1 shows the block diagram of proposed system; initially image is captured real time using the USB camera. Open CV is used at face detection stage. Open CV (Open Source Computer Vision) is a library of programming functions mainly aimed at real-time computer vision. In simple language it is library used for Image Processing. It is mainly used to do all the operation related to Images.

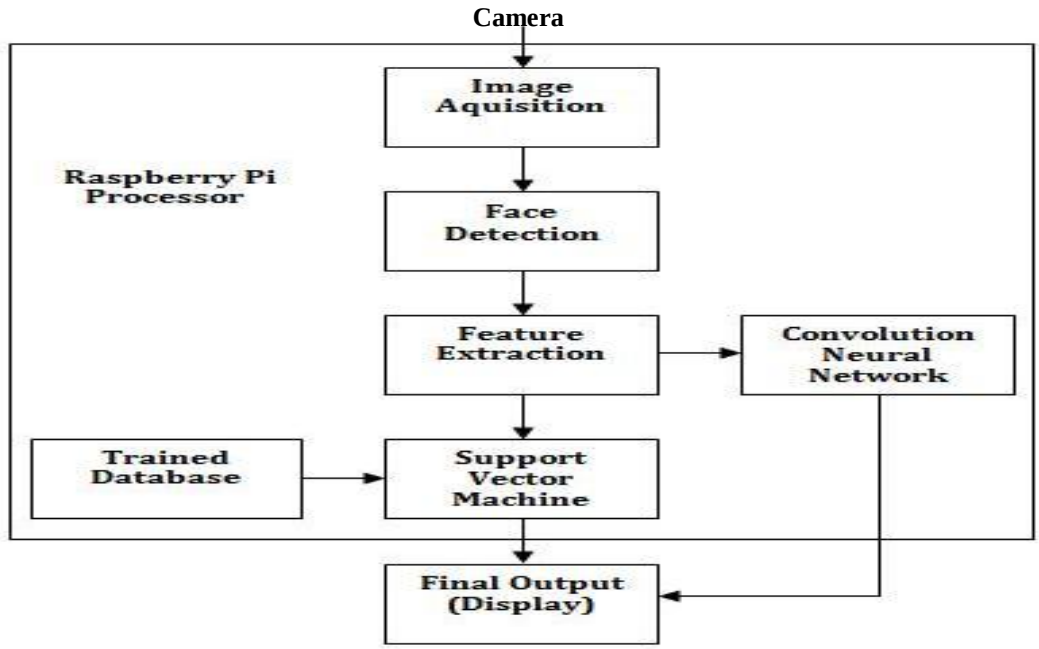

Fig.2 Block Diagram of Proposed System

As Shown in Figure 2, Firstly image is captured real time by means of the USB camera. OpenCV is used at face detection stage. OpenCV (Open Source Computer Vision) is a library of programming functions mainly designed at real-time computer vision. In simple language it is library used for Image Processing. It is mostly used to do all the operation related to Images. Now face detection and extraction algorithm will work i.e. viola Jones algorithm which uses Haar feature based cascade classifiers algorithm for face detection. As long as a face is detected, a red bounding box is drawn on the face in the image. Local binary pattern method which is most successful for face recognition is used for feature extraction for age estimation. After that extracted features is given to convolution neural network (CNN) which is pre-trained model will find out whether the features extraction of an image in testing set is matching to the feature extracted from the training set and gives the

estimated age. Histogram of oriented gradients (HOG) algorithm is used for gender and weight estimation. HOG algorithm is used for feature extraction for gender and weight estimation. Now SVM (support vector machine) will find out whether the feature extraction of an image in testing set is matching to the feature extracted from the training set. Finally output will be displayed on screen. Proposed system uses different techniques for face recognition, age estimation, weight estimation and gender estimation namely

1. Viola Jones Algorithm:

The basic principal of algorithm is to detect the faces from the given input image. Before this there were so many images processing approach but all of them were time consuming due to making the entire image to the fix size and then run the image in the detector. Opposite of this is the viola Jones algorithm were the detector is rescale and whatever the size of image would be.

2. Histogram of oriented gradients (HOG) Algorithm:

The histogram of oriented gradients (HOG) is a feature descriptor used in computer vision and image processing for the purpose of object detection. The technique counts occurrences of gradient orientation in localized portions of an image. This method is similar to that of edge orientation histograms, scale-invariant feature transform descriptors, and shape contexts, but differs in that it is computed on a dense grid of uniformly spaced cells and uses overlapping local contrast normalization for improved accuracy. It use for gender estimation procedure.

3. Support vector machines:

In machine learning, support vector machines (SVMs) are supervised learning models with associated learning algorithms that analyze data used for classification and regression analysis. In support vector machine is used to analyze the complex data and gives the result. SVM is very useful in finding patterns which are very useful and not complex.

4. Convolution Neural Network:

In machine learning, a convolution neural network (CNN) is a type of feed-forward artificial neural network in which the connectivity pattern between its neurons is inspired by the organization of the animal visual cortex. Individual cortical neurons respond to stimuli in a restricted region of space known as the receptive field. The receptive fields of different neurons partially overlap such that they tile the visual field. The response of an individual neuron to stimuli within its receptive field can be approximated mathematically by a convolution operation. Convolutional networks were inspired by biological processes and are variations of multilayer perceptions designed to use minimal amounts of preprocessing. They have wide applications in image and video recognition, recommender systems and natural language processing.

IV. Result And Discussion

In this system the parameters under observation are face image of the human. Different age group of people is having different face images. As humans are classified into two types our system also gets result for male and female two different categories. In the result section we are getting three different face images having different age group. Now by extracting their face parameters we get output.

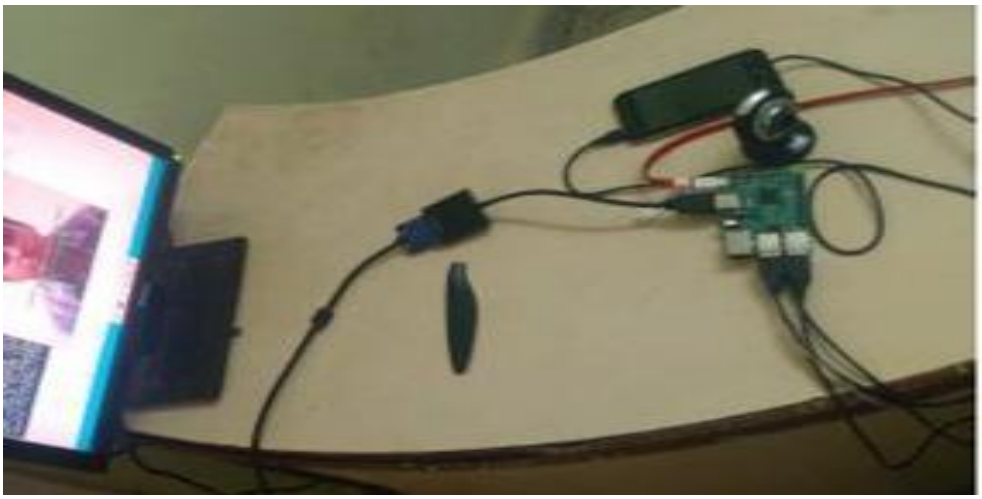

Fig.3 Project Preview

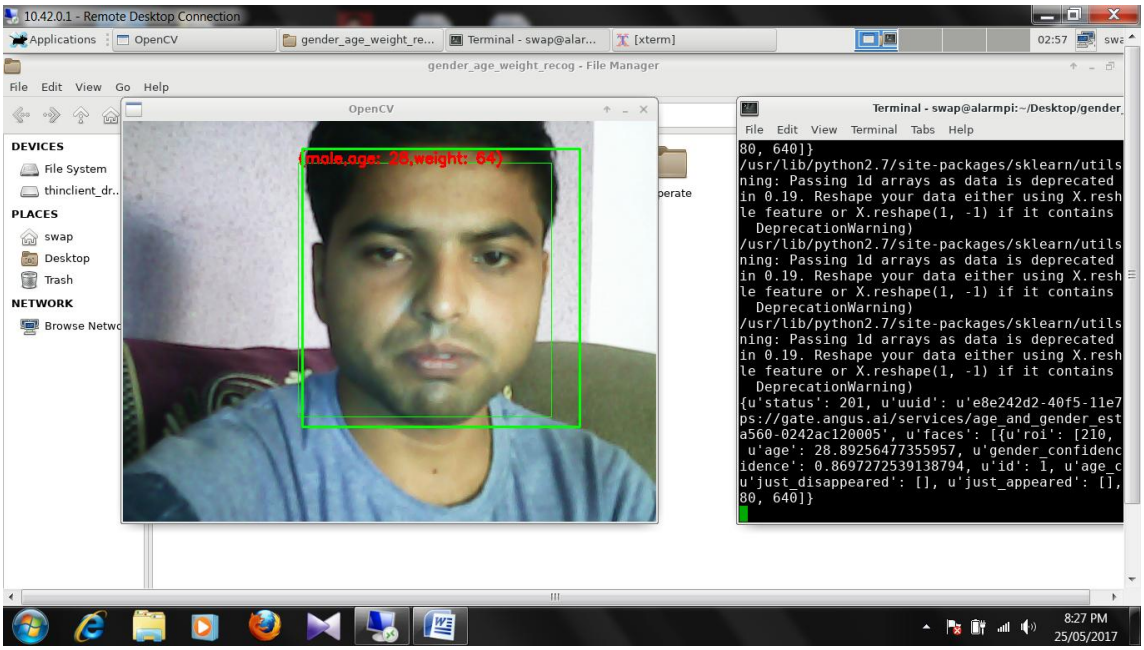

Fig.4 Output

From figure 4 we get the gender, age and weight output of face image. The result describe as gender of this human is male, age 28 and weight 64. We can get the result this from face image. Result obtained from this system is more efficient than previous one. Because in this system we are using raspberry pi as operating system. Some changes in values are attributed to measurement conditions brightness, darkness face image distance from camera takes major role during this. The aim of this work was to design and develop the system for the automatic human age, gender and weight detection from face images by using raspberry pi as processor.

V. Conclusion

A face detection, tracking and age, gender and weight estimation system using Raspberry Pi 3 model B processor was developed. The system was programmed using Python programming language. Both Real time face detection and face detection from specific images, i.e. object recognition, was carried out. The efficiency of the system was analyzed in terms of face detection rate. The analysis revealed that the present system shows excellent performance efficiency and can be used for face detection even from poor quality images. Currently in our system we are just accessing the system from local PC system. So in future we can implement a system with video database storage for reference even which we can use single RAM for different system like servers in companies. Currently, we focus on age estimation from faces of nearly neutral facial expressions, and evaluate our methods on the datasets without serious facial expression variations. However, expression changes could affect the age estimation results. Estimating both the age rank and facial expression intensity rank is a possible way to solve this problem.

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IOSR Journal of Electronics and Communication Engineering (IOSR-JECE) is UGC approved Journal with Sl. No. 5016, Journal no. 49082.

Mr. Shrikant R. Dhu. "Human Age, Gender and Weight Determination Using Face Images ." IOSR Journal of Electronics and Communication Engineering (IOSR-JECE), vol. 12, no. 4, 2017, pp. 11–16.