Human Face Detection and Tracking for Age Rank, Weight and Gender Estimation based on Face Images utilizing Raspberry Pi Processor

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Abstract - *This paper describes the method for real time human face detection and tracking for age rank, weight and gender estimation. Face detection is involved with finding whether or no longer there are any faces in a given image and, if present, track the face and returns the face region with content of each face. Here describes a easy and convenient hardware implementation of face detection procedure utilizing Raspberry Pi, which itself is a minicomputer of a credit card size. This paper presents a cost-sensitive ordinal hyperplanes ranking algorithm for human age evaluation based on face images. 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 weight is specified according to that we also specify weight. In this article we present a novel multimodal gender estimation, which effectively integrates the head as well as mouth motion information with facial appearance by taking advantage of a unified probabilistic framework. Facial appearance as well as head and mouth motion possess a potentially relevant discriminatory power, and that the integration of different sources of biometric data from video sequences is the key approach to develop more precise and reliable realization systems.*

Key Words: Age rank, human face detection, Ordinal hyperplanes ranking, Raspberry pi, Tracking, Unified probabilistic framework, Weight

1. 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 examine 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.

2. 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 discriminant 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.

3. PROPOSED WORK

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

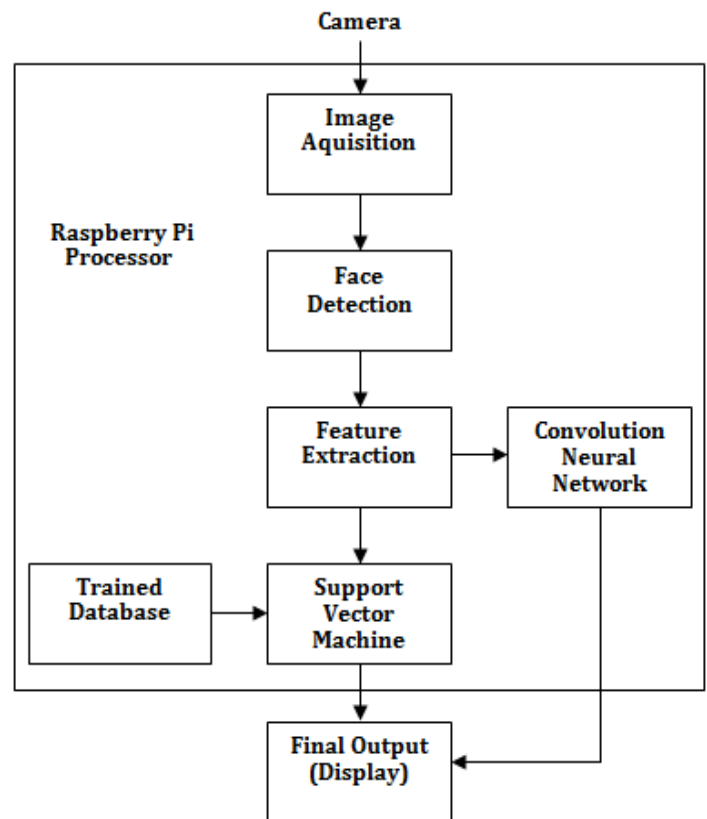
Fig. 1. Block Diagram of Proposed System

Working :

Intially image is captured real time using the USB camera. OpenCV is used at face detection stage. OpenCV (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.

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. Local binary patterns (LBP) :

LBP is one of the binary patterns which is used for feature extraction. In this the face image is firstly divided into small regions from which LBP features are extracted gives the output in histogram. LBP is used because there are micro patterns which are invariant of monotonic grey scale transformation. Combining all this gives the face image. LBP is widely used in many application due to its high tolerance against object recognition texture analysis and high discriminative power.

4. 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.

5. 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 perceptrons designed to use minimal amounts of preprocessing. They have wide applications in image and video recognition, recommender systems and natural language processing.

4. CONCLUSION

This paper proposed a system for face detection, tracking, age, weight and gender estimation technique. Also, some popular well-known face detection technique is described. Face detection techniques have been employed in different applications such as face recognition, facial feature extraction. On the basis of this age, weight and gender estimation will be done using the algorithms mentioned above.

Face detection and tracking is being challenging for many researchers with real time Image sensor. With the advancement the real time face detection in remote monitoring is help for building much efficient application. Moreover such technology can be useful in tracking the lost object under dynamic environment. Further enhancement of this work can be extended with stereo depth analysis of face detection using two image sensor interfaced with High speed Processor. The future scope of this is to improve the database of public where the large public database is available.

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