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HUMAN GAIT RECOGNITION BY OPENCV

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Abstract- Biometrics have increasing applications in security systems which demands that it is non-contactable, non-invasive and hidden from the subject. In this project we propose model based human recognition using gait with the help of real time OpenCV library. The approach is to first extract the gate features from the image sequences for constructing a locomotion human model. The model based approach is chosen so that the effect of exterior factors like clothing, shoes, briefcase and environmental context is minimized. Further we propose to apply and evaluate application of advance machine learning algorithms from the OpenCV computer vision library for Gait recognition which should give near real time recognition system.

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Introduction

Biometrics refers to technologies that measure and analyze human body characteristics, such as DNA, fingerprints, eye retinas and irises, voice patterns, facial patterns and hand measurements, for authentication purposes. Verification is becoming increasingly common in corporate and public security systems, consumer electronics and point of sale (POS) applications. Biometrics refers to the various intrinsic or physical signatures people produce that can be used to uniquely identify them. Some popular established biometrics system uses fingerprints to hand geometry and some more advanced based on face recognition and iris. Fingerprint and hand geometry need contact and face recognition and iris have limitations of controlled environment and distance. Human Gait characterizes the walking style of an individual which is periodic in nature and called as Gait cycle.

Human gait recognition and analysis is a promising technology with possible applications in numerous sectors of our society apart from security surveillance applications, clinical rehabilitation of patients, automatic robotic rehabilitation of patients, e.g., for treadmill Training, design of walking biped robots and many applications in medical research.

Material & Methods

In this section we will investigate the current state of the art in gait recognition, providing an overview of the methods which are currently being investigated and will provide background information on all of the techniques which have been used throughout this project. Gait recognition techniques can be broken down into two main sections, model based and model free. These different approaches are described in more detail below.

The advantages of a model free approach are that the methods derived are not linked to one object, it is a holistic approach, therefore a method detecting human gait could be used for animal gait and vice versa with little modification. A number of model free approaches to gait recognition have been investigated. Some of them are detailed below:

Dr V. Huang [3] performed gait recognition using PCA and Canonical Analysis. He used the silhouette of the subject during motion to derive the gait parameters, this motion was then compressed using PCA. He then applied Canonical analysis to derive the signature from which the subject can be recognized. A recognition rate on a small database had a success rate of 100% suggesting

that this technique is reliable and has the potential to be improved and extended.

Model based approaches to feature extraction, use prior knowledge of the object, which isbeing searched for in the image scene. Models used are typically stick representations either surrounded by ribbons or blobs, as shown in figure 1b. When modelling the human body, there are various kinematical and physical constraints we can place on the model which are realistic i.e. maximum variation in angle of knee joint.

Fig. 1A- Human silhouette Image

The advantages of a model based approach are that evidence gathering techniques can be used across the whole image sequence before making a choice on the model fitting. Models can handle occlusion and noise better and offer the ability to derive gait signatures directlyfrom model parameters i.e. variation in the inclination of the thigh. They also help to reduce the dimensionality needed to represent the data.

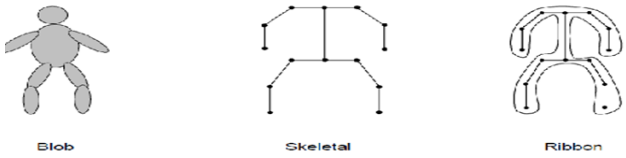

Fig. 1b- A model based approach

The aim of a model based approach is to model the motion of a human, and then fit this model to the motion of a human being tracked see Cunado [7]. Previous projects involving gait recognition using model based approaches are detailed below:

Dr. D. Cunado [5] modelled the leg as a pendulum. The method of identification was defined by calculating the difference between SHM and the motion of the subjects' thighs. The gait signature was successfully extracted and could withstand differing amounts of noise and occlusion. This method achieved recognition rates of 100% on a database of ten subjects.

Problem formulation: Need and significance of proposed research work-

The ability to be able to identify an individual efficiently and accurately is an important task. Controlled environments such as banks, military installations and even airports need to be able to quickly detect threats and provide differing levels of access to different user groups. Recent events and security threats have brought biometrics a lot of attention as a method of identification. Gait as a biometric has many advantages as stated above which make it an attractive proposition as a method of identification. Gaits main advantage, unobtrusive identification at a distance, makes it a very attractive biometric. The ability to identify a possible threat from a distance, gives the user a time frame in which to react before the suspect becomes a possible threat. Another motivation is that video footage of suspects are readily available, as surveillance cameras are relatively low cost and installed in most buildings or locations requiring a security presence, the video just needs to be checked against that of the suspect. As well as the inherent advantages of gait, the increase in processor power, along with the fall in price of high speed memory and data storage devices have all contributed to the increased availability and applicability of computer vision and video processing techniques.

Objectives

The main objective of this project is to:

1. Develop a method capable of performing recognition of individuals derived from a video sequence of a person walking which is near real time.
2. Automatic extraction of relevant gait feature points should be available from a video sequence in order to automate the classification process.
3. The Project can be broken down in three main section.

Segmentation- this module will take the video sequence as aninput, then perform processing in order to determine which pixels are part of the foreground and which are part of the background.

Model Fitting – the binary image produced from the segmentation process will be used as input for the model fitting process. This module will fit a model of the human form onto the segmented area. OpenCV provides Frame Differencing a very simplest background subtraction method to subtract one frame from another (possibly several frames later) and then label any difference that is "big enough" the foreground. Also Averaging Background Method Which basically learns the average and standard deviation (or similarly, but computationally faster, the average difference) of each pixel as its model of the background. Many of memory requirement.

Recognition- the recognition engine will take data from either a newly captured subject via the feature extraction module, or a previously stored signature, and perform recognition based on a database of test subjects.

Feature Extraction- once the model has been fitted to the image, features, which can be used to create a gait signature, will be derived from the model parameters i.e. variation in thigh angle over n frames**.**

Discussion

Gait recognition is a multistage process. In order to be able to perform analysis on the gait of the individuals caught on video the subject needs to be extracted from the video sequence. It is important that gait capturing is performed in environments where the background is as uniform as possible. Moreover, since gait recognition Semantic nets aim to be as general as possible, so that they can be applicable in many different situations. An important point to note is that semantic nets only store the relational structure of an object, they don't store any size or location information about

the individual components, as this would severely limit their usefulness to extract objects from different scenes.
Once the gait feature has been extracted from the person, it will be projected into a feature space and it will then have to be classified. This means we have to determine which group in the feature space (i.e. which person) the unknown feature point should belong to. A classifier defines boundaries in a feature space which are used to separate different sample classes from each other in the data.
We will use a suitable machine learning segment of the OpenCV project which provides following algorithms.

K-nearest neighbors
The simplest possible discriminative classifi er. Training data are simply stored with labels. Thereafter, a test data point is classifi ed according to the majority vote of its K nearest other data points (in a Euclidean sense of nearness). This is probably the simplest thing you can do. It is often effective but it is slow and requires lots of memory.

Boosting
A discriminative group of classifiers. The overall classification decision is made from the combined weighted classification decisions of the group of classifiers. In training, we learn the group of classifiers one at a time. Each classifi er in the group is a "weak" classifier (only just above chance performance). These weak classifiers are typically composed of single-variable decision trees called "stumps". In training, the decision stump learns its classification decisions from the data and also learns a weight for its "vote" from its accuracy on the data. Between training each classifier one by one, the data points are re-weighted so that more attention is paid to data points where errors were made.

Haar classifier
An object detection application based on a clever use of boosting. The OpenCV distribution comes with a trained frontal face detector that works remarkably well. You may train the algorithm on other objects with the software provided. It works well for rigid objects and characteristic views.

Result
The expected project outcome is summarized as below-
1. The image pre-processing like video sequence capture, background subtraction, segmentation etc. will be implemented using OpenCV.
2. The real time human gait recognition will be possible once it is implemented using the real time OpenCV.
3. The portable nature of OpenCV will allow implementing the human gait recognition on portable platforms like Android.

Conclusion
In this paper, we have presented two approaches to represent and recognize people by their gait. The width of the outer contour of the binarized silhouette as well as the silhouette itself were used as features to represent gait. In one approach, a low-dimensional observation sequence is derived from the silhouettes during a gait cycle and an HMM is trained for each person. Gait identification is performed by OpenCV with machine learning that a given observation sequence was generated by a particular HMM model. In the second approach, the distance between an image feature and exemplar was used to estimate the observation probability. The performance of the methods was illustrated using different gait databases.

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