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A Survey on Segment Based Evaluation of Co-factor Used in Human Gait Recognition

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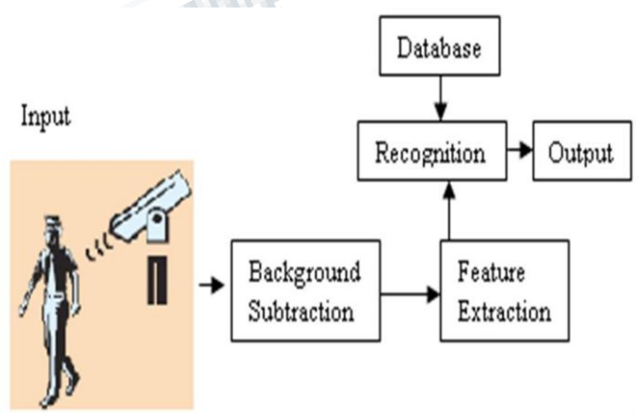
Abstract;- **Gait recognition is an effective biometric feature to identify persons from a distance by the way people walk or run. While gait has several attractive properties as a biometric, the greatest disadvantage in gait recognition is to identify an individual with cofactors and in different emotional and environmental conditions. Different views and angles of the camera also constitutes in degradation of the gait identification. Thus different measures and methods have been proposed for enhancing the gait identification in these cases. This paper is study of gait recognition during these conditions and discussing ways for lowering the degradations. This paper presents a literature review of cofactor affected gait recognition and propose a method to identify cofactor affected probes in certain view angles. Recent researches in gait identification techniques are presented in this paper**

I. INTRODUCTION

Many biometric resources, such as fingerprint, palm print, face recognition, iris, have been systematically studied and employed in many systems. In spite of their widespread applications, these resources has certain disadvantages such as performance degradation due to low resolution images, pictures taken at a distance and needfulness of a person to come close to the system for identification. For these reasons, innovative biometric recognition techniques for human identification at a distance emerged and gained immense attention among the researchers in recent years.

Gait Recognition can be based on the human shape analysis, movement analysis or any other richer recognition cue. Gait is a natural contender for recognition of a person at distance, given its unique identification techniques and capabilities. Gait recognition includes visual cue extraction as well as classification. But the major role play here is the representation of the gait features in an efficient manner. Two common categories of gait recognition are appearance-based and model-based approaches. Model-based approaches include evaluation of gait dynamics, such as stride length, cadence, and joint angles. These approaches could not claim high performance partly due to the self-occlusion caused by legs and arms crossing. Appearance-based analysis uses gait features measured from silhouettes by feature extraction methods, such as gait energy image (GEI), Fourier transforms etc. Gait features from silhouettes can be separated into static appearance features and dynamic gait features, which reflect the shape of human body and the way how people move during walking, respectively. The appearance of a person gets changed when it is affected with a cofactor and decreases the efficiency of the technique. There are several approaches to identify the cofactors.

Cofactor affected GEI detection and removal process were exemplified in and got remarkable recognition rate. The whole GEI is first segmented into three parts considering the area of cofactor appearance in it. Cofactor information are detected and eliminated. Finally, the three segments are recombined for final classification.



II. LITERATURE REVIEW OF GAIT IDENTIFICATION TECHNIQUES

All basic gait identification technique currently being used by the researchers and industry will be discussed and evaluated in this section.

A. Silhouette Transformation Based on Walking Speed for Gait Identification

The paper presents a method of gait identification using silhouette- based frequency domain features. When a person changes his/her walking speed, dynamic features such as stride and joint angle are changed while static features such as thigh and shin length are not changed. Based on this fact, first, static and dynamic features are identified and separated from gait silhouettes by fitting a human model. Secondly, a factorization based speed transformation model for the dynamic features is created using a training set for various persons on various speeds. Methodologies adopted in the paper are GSV (Gait silhouette Volume) for silhouette extraction normalization by the height registration. The method transforms the dynamic features from a reference speed to another arbitrary speed. Even though person with multiple walking speed can be determined the method Evaluates the speed ratio only by a single factor dynamic features. Should include full body model fitting, Gait style classification etc.

B. Gait Recognition across Various Walking Speeds Using Higher Order Shape Configuration Based on a Differential Composition Model

The model proposes a higher order shape configuration for gait shape description which conserves discriminant information in the gait signatures and able to tolerate the varying walking speed. In this paper, Procrustes shape analysis (PSA) is adopted for gait recognition because it has been proved as a special shape description that can tolerate the change of orientation of an object. The method adapts proper noise elimination and holes remedy methods. This method eliminates the degradations caused by CSC (centroid shape configuration) such as unstable shape centroid by HSC & PSA techniques.DCM improves performance of cross speed gait recognition. But Gait shape of an individual can be easily altered by many factors such as change of walking speed and inconsistency in walking patterns.

C. Human ID Gait Challenge Problem, Datasets, Performance and Analysis

The paper presents the means for measuring progress and specifying the properties of automatic gait recognition by the help of a baseline algorithm, set of 12 experiments and very large dataset. The baseline algorithm estimates silhouettes by background subtraction and performs recognition by temporal correlation of silhouettes. The 12 experiments are of great difficulty, which is measured by the baseline algorithm, and examine the effects of covariates on performance. The data set consists of 1,870 sequences from 122 subjects spanning covariates. Baseline algorithm is the reasonable solution for reporting the performance and the scientific basis for advancing and understanding automatic gait recognition. It involves the segmentation process which involves some segmentation errors due to no much threshold change and moving objects in background.

D. Individual Recognition Using Gait Energy Image

GEI based human recognition is the concept in the paper. As a solution for the problem of lack of training templates, they propose an approach for human recognition by combining statistical gait features from real and synthetic templates. And then directly compute the real templates from training silhouette sequences, synthetic templates are generated from training sequences by simulating silhouette distortion. Statistical approach used for learning effective features from real and synthetic templates. This method outperforms the baseline algorithm and good computational efficiency for real world applications. Even though the proposed synthetic feature classifier is insensitive to silhouette distortions, performance is not satisfactory in case of large silhouette distortions.

E. Human Carrying Status in Visual Surveillance

This paper proposes effective methods to solve the carrying status problem in visual surveillance systems. The paper introduces a set of Gabor based human gait appearance model incorporated with GTDA (General Tensor Discriminant Analysis). The very high dimensionality of the feature space makes training phase difficult. Thus they are using GTDA incorporated with object structure information and it also reduces ill-posed problems. The method is highly useful for face recognition, texture classification and image retrieval and not up to the level for gait recognition.

F. General Tensor Discriminant Analysis and Gabor Features for Gait Recognition

Traditional representation methods are not suited to conventional classification methods such as the linear discriminant analysis (LDA) because of the undersample problem. Thus they came up with three different Gabor function based image representations such as GaborD, GaborS and GaborSD also for LDA, two-dimensional LDA (2DLDA). GaborD is the sum of Gabor filter responses over directions, GaborS is the sum of Gabor filter responses over scales, whereas GaborSD is the sum of Gabor filter responses over scales and directionsThe method significantly reduces the effects of under sampling on classification and preserve discriminative information. With the introduction of 2DLDA the complexity of the method increased and also performance degraded in silhouette quality.

G. Segment Based Co-factor Detection and Elimination for Effective Gait Recognition

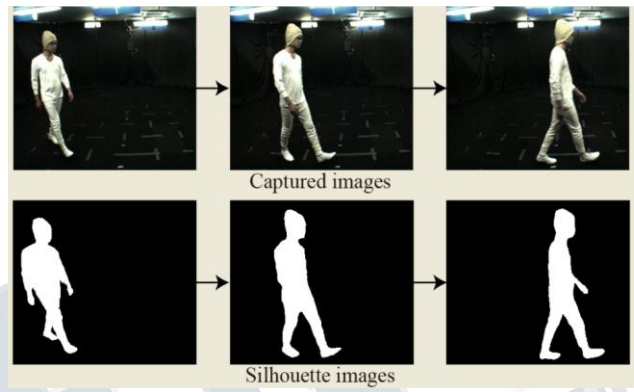
The paper presents a method for detecting cofactor affected segments of GEI and an approach for dynamic reconstruction of cofactored GEI for more accurate recognition. The GEI image is split into three or four segments and the cofactor affected segment is analyzed. Thus the segment is avoided from the feature extraction and the rest is processed. The greatest advantage in this method is elimination of cofactored information from affected body segments rather than replacing them with earlier images. Even though this method performs good in cofactor affected segment identification, identification of gait image with cofactor information is performed only in a single angle of 90 degree.

H. Integrated Face and Gait Recognition from Multiple Views

A normalisation of input sequence approach is performed which provides greater recognition accuracy than is obtained using the not normalized input sequences. Tracking a person and recognition should ideally incorporate information from multiple views, and work well even when people are far away. Two main problems that make this challenging are varying appearance due to changing pose, and the relatively low resolution of images taken at a distance. First problem is solved with a view-normalization approach and second with a multi-modal recognition strategy. Image based visual hull (IBVH) is computed from a set of monocular views and used to render virtual views for recognition. VH allows rendering a synthetic view of the object from desired viewpoints at a moderate computational cost and provides information about the objects 3D location and shape. The features used in gait recognition algorithm are clearly view dependent and it is generally impractical to collect data for each person across all possible views.

I. Person identification from spatio-temporal 3D gait

This model presents a spatio-temporal 3D gait database and a view independent person recognition method from gait which creates a database with virtual images synthesized and view transformation model methodology. A spatio-temporal 3D gait database is built using multiple cameras that consists of sequential 3D models of multiple walking people. Then from these 3D models, synthesizes virtual images from multiple arbitrary viewpoints and affine moment invariants are derived from virtual images as gait features. In the recognition phase, images of a probe that walks in an arbitrary direction are taken from one camera, and then calculate gait features. Finally the person is recognized and one's walking direction is estimated. This method can deal with the change of azimuth angle but cannot deal with the change in elevation angle. People can be identified with correct classification using small dimension number of features. There can be dégradation in précise 3D model reconstruction.



J. Silhouette based Gait Recognition Using Procrustes Shape Analysis and Elliptic Fourier Descriptors

This model combines spatio-temporal motion characteristics, statistical and physical parameters (STM-SPP) by analyzing shape of the subject's silhouette contours using Procrustes shape analysis (PSA) and elliptic Fourier descriptors (EFDs). EFD is introduced here to achieve efficiency against cofactor attached or carrying conditions whereas physical parameters of human body to resolve similar dissimilarity scores between probe and gallery sequences obtained by PSA. The method is suitable for real world applications. The method is also robust to subjects carrying small items and limited across-day gait variations, but not significant change of styles. Efficient against missing or distorted frames to some extent mainly due to segmentation imperfections and insensitive to color and texture of the subjects clothing. The method is not much significant to change of styles for e.g. pants Vs skirts or long coats, massive leg injury, variations of camera viewpoints etc.

III. CONCLUSION

This paper mainly focuses on the study of human gait recognition techniques under various conditions. It is found that even if the accuracy with which we are able to measure certain gait parameters improves, we still do not know if the knowledge of these parameters provides adequate discrimination power to enable large scale deployment of gait recognition technologies. Therefore, it is not possible to consider a single method for all type of images nor all methods can perform well for a particular type of image. Hence, it is good to use hybrid solution consists of multiple methods for human gait recognition technique.

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