Authentication and Detection using GAIT

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Abstract - Gait analysis is unique and is important in characterizing human's walk. One approach to analyze the gait is through the video analysis of the recorded gait. Gait video analysis requires technique that will enable the gait feature to be extracted to recognize the human gait. A technique may suit a group of homogenous subjects but may not be suitable on others. This study attempts to identify the suitable technique for gait analysis on children and adult; for both normal and with impairment. The study was conducted by reviewing articles on gait related video analysis. Several techniques were identified. The findings give a suggestion and justification for a best technique for gait video analysis feature extraction for both children and adult that are normal and impaired. gather information on video feature extraction techniques from several reviewed articles. It will analyze and suggest the suitable techniques for gait analysis on children and adult; for both normal and with impairment.

***Key Words*:** gait analysis, homogenous subjects, feature extraction

1. INTRODUCTION

1.1 Fundamental

Gait is a daily movement, and many elements influenced the gait for example age, weight and possible gait disorder. For e.g., Similar to fingerprint, each individual's gait is unique. Gait recognition is a new biometric approach; objective is to recognize human by their walking style. Defining the gait is a very challenging task. Mentioned that for human to walk is an easy process but it comprises a significant information such as health, age, gender and emotion. Human's gait analysis involves with challenging issues because of the self-occlusion and highly flexible structure of the human body. Most of the gait characteristic that extract from video could be repeated or unessential to the recognition task without enrolling some kind of feature extraction strategy. In this paper we try to understand the feature extraction technique based on paper reviewed. The comparison of the feature extraction techniques is based on comments and suggestions in the reviewed article. We will suggest the best technique for gait video feature extraction based on the gathered information.

1.2 Objectives

1. Develop a program capable of performing recognition of individuals derived from a silhouette or a video sequence of a person walking.

2. Automatic extraction of relevant gait feature points from a silhouette or a video sequence in order to automate the classification process.

3. To analyze, evaluate and compare different machine learning techniques which can be employed for gait classification.

4. To suggest techniques which are best suited for gait classification.

1.3 Scope

To develop a program capable of performing recognition of individuals derived from s video sequence of a person walking. The program should be able to store the derived gait signature for comparison at a later stage. Automatic extraction of relevant gait feature points should be available from a video sequence in order to automate the classification process. Other main scope of our project is this that the application is user friendly. It must provide high security purpose. Anyone can use this application.

2. LITERATURE SURVEY

2.1 Automated Detection of Human Gait events from Conventional Videography (2018)

Chandra Prakash [1] Rajesh Kumar [2] Namita Mittal [3] Real-time detection of gait events plays a vital role in movement dependent control applications such as rehabilitation for lower limb amputations. It also helps in determination of spatiotemporal and kinematic parameters. Gyroscopes, inertial sensors, magnetometers and foot sensors are popular in the detection of gait events. They need to be mounted carefully, or foot should be placed specifically on foot pressure during detection. This study presents a framework for automated detection of gait events from conventional videography using passive markers at Robotics and Machine Analytic Laboratory (RAMAN Lab). The proposed Passive maker-based Gait event detection (PMGED) algorithm automatically detects heel strike (HS) and toe-off (TO); the timing of stance and swing phase; the number of the gait cycle. Ten healthy subjects are considered to evaluate the robustness and reliability of proposed algorithm. The method is comparable when evaluated against human expert detection.

2.2 Gait Based Human Identification in Surveillance Videos (June 2018)

Man Qi [1] Human identification using gait has received an increasing attention from the research community due to a rapid deployment of CCTV cameras. This paper presents a review on human identification based on gait features i.e. the walking patterns of people. It describes the steps involved in this process with a focus on gait feature extraction approaches which include model-based approaches, model-free state space approaches and model-free spatiotemporal approach.

2.3 Human Gait Recognition System (November 2018)

Bilal Jawed [1] Othman O. Khalifa [2] Biometric identification like fingerprints, retina, palm and voice recognition needs subject's permission and physical attention, but Human Gait recognition works on the gait of walking subjects to identify people without them knowing or without their permission. The purpose of this report is to summarize the research and related work done in the past on human gait recognition system and to solve algorithms which helps in identify walking subject from distance without any permission and interference of the walking subject. This can be achieved by making a database in which we record a video of the subject from a camera and then converting the video into frames of still images and later applying feature extraction techniques to get the silhouettes and training the silhouettes with principal component analysis. The input images are then matched with the one that already exist in the database used to identify walking subject.

2.4 Human Identification using Gait Recognition (2017)

Gowtham Bhargavas M [1] Harshavardhan K [2] Identification of a person based on gait has created a sphere of curiosity in computer vision domain due to its high recognition capability even at a far distance. Vision based stance recognition has the ability to support Human Computer Interaction (HCI) efficiently. Gait recognition technology can be used in many civilian and high security applications like car parks, banks, military bases, railway stations and airports. The main aim of the project is to develop automatic biometric system to identify a person based on his Gait. This can be implemented by identifying subject from video frame, necessary feature extraction using skeleton information obtained from Microsoft Kinect sensor and classification against the database.

3. OVERVIEW

3.1 Existing Methodology and Systems:

Existing methods for gait recognition can be divided in two main categories: model-free and model-based. Two model-free baseline approaches have been proposed for gait recognition based on the silhouette images:

Phillips et al. measured the correlation between the probe silhouette image sequences and those in a data-set, while Collins et al. applied template matching between selected key frames. Other low level image features are extracted, for identification of the spatial and temporal variances of human gait: the width of the outer contour of the silhouette, gait mask responses, moments of the optical flows, generalized symmetry operator, etc.

Lee et al. fit seven ellipses in the human body area, and used their locations, orientations, and aspect ratios as features to represent the gait. All features used in these approaches are calculated either on the pixel level (background subtraction) or within small regions (edge map and optical flow calculation), hence are susceptible to noise and background cluttering. More recently, silhouette refinement has been proposed to improve the recognition rate.

However, the features extracted using the above methods include shape information, which should be avoided for gait recognition.

On the other hand, with gait features closely related to the walking mechanics, model-based approaches have the potential for robust feature extraction. Human-like structures are proposed in gait feature extraction: A 2D-stick model was obtained through line fitting to the skeleton of the silhouette images by Niyogi and Adelson, while Cunado et al. modelled the thighs as interlinked pendular to extract their angular movements. These recognition features are extracted over large regions, which are less sensitive to the image noise. More significantly, these features do not contain shape information.

The above methods achieved satisfactory recognition rate over small gait data set, demonstrating the potential of identifying persons using movement features only.

3.2 Proposed Methodology and System:

Gait classification system is designed with the goal to achieve locomotion through the movement of human limbs. Human gaits are the various ways in which a human can move, either naturally or as a result of specialized training. The motive of our project, silhouette-based or video-based is to show the recent advances in image acquisition and analysis facilitating cost-effective, portable, video-based gait assessment.

The image below shows the proposed architecture of the system. In the proposed system, various parameters are extracted using motion captive system. These parameters are used as an input to the proposed gait classification method, comparison with the database is done and the collected information is used for gait analysis.

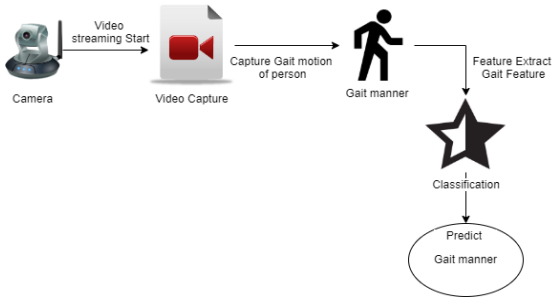


Fig1. Proposed System Architectural diagram

In the proposed system, water-fall model methodology is used in the following way:

1. Requirement gathering and analysis: In this step of water fall model, various requirements and need for our project such as software and hardware requirements, database, and interfaces are identified.

2. System Design: In this system design phase, a user-friendly or easily understandable system for the end-users is designed. some UML diagrams and data flow diagrams (DFD) are designed to understand the system flow and system module and sequence of execution.

3. Implementation: In implementation phase of the project, implement various module required for successfully getting expected outcome at the different module levels. With inputs from system design, the system is first developed in small programs called units, which are integrated in the next phase. Each unit is developed and tested for its functionality which is referred to as Unit Testing.

4. Testing: The different test cases are performed to test whether the project module is giving expected outcome in assumed time. All the units developed in the implementation phase are integrated into a system after testing of each unit. Post integration the entire system is tested for any faults and failures.

5. Deployment of System: Once the functional and non-functional testing is done, the product is deployed in the customer environment or released into the market.

6. Maintenance: There are some issues which come up in the client environment. To fix those issues patches are released. Also, to enhance the product some better versions are released. Maintenance is done to deliver these changes in the customer environment. All these phases are cascaded to each other in which progress is seen as flowing steadily downwards like a waterfall through the phases. The next phase is started only after the defined set of goals are achieved for previous phase and it is signed off, so the name “water-fall” model. In this model phases do not overlap.

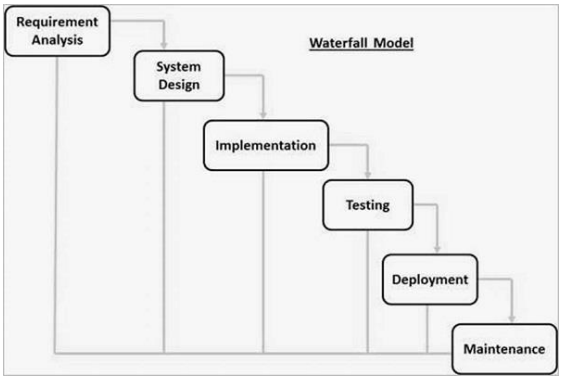
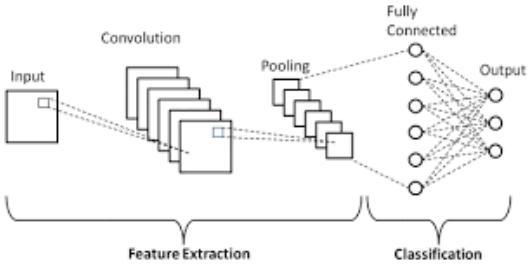


Fig 2. Water-fall model methodology

3.3 Algorithms:

The proposed system is based on CNN (Convolutional Neural Network) Algorithm. In deep learning, a Convolutional Neural Network is a class of deep neural networks, most commonly applied to analyzing visual imagery. Convolutional Neural Network is one of the main categories to do image recognition, image classification, object detection widely used. CNN image classification takes the input image, process it and classify it. computer sees an input image as array of pixels depends on the image resolution(h*w*h). CNN have applications in image and video recognition, recommender systems, image classification, medical image analysis, natural language processing, brain-computer interfaces, and financial time series. CNNs take a different approach towards regularization: they take advantage of the hierarchical pattern in data and assemble more complex patterns using smaller and simpler patterns. Therefore, on the scale of connectedness and complexity, CNNs are on the lower extreme. Convolutional networks were inspired by biological processes, in that the connectivity pattern between neurons resembles the organization of the animal visual cortex. Individual cortical neurons respond to stimuli only in a restricted region of the visual field known as the receptive field. The receptive fields of different neurons partially overlap such that they cover the entire visual field. CNNs use relatively little pre-processing compared to other image classification algorithms. This means that the network learns the filters that in traditional algorithms were hand-engineered. This independence from prior knowledge and human effort in feature design is a major advantage. Following image is a simple representation of what a Convolutional Neural Network (CNN) algorithm does or how does it work:



4. HARDWARE & SOFTWARE DETAILS

The hardware and software required by the system to be developed is given below:

Intel core processor with speed up to 2.80 GHz and hard-disk /drive (HDD) with 40GB is required. The main memory required is 8GB and above so that the whole program can reside on the same memory at once. This will avoid the requirement to swap the memory contents of the system.

Hard disk drive is required to store the program permanently on the storage so that the loss of power will not affect the availability of the program. Processor is required to process the data quickly on the system. The standard input and output

devices are required to take the input from the user and display the output to the user. Other than this the hardware device required by the system will be a Computer or laptop. A Computer/Laptop is required to enable the user to interact with the system while on the go.

The software requirements of the system are described below. The operating systems used will be windows 10 OS. Windows 10 or above version of the operating system will be required by the system to set up a server. The server hence will be working on windows platform. Anaconda Integrated Development Environment (IDE) and Spyder programming language will be required to execute the system.

5. SUMMARY

Thus, in this paper we have implemented a system for gait authentication and detection that provides security and extract gait features of a human being from video or image, processes it using CNN algorithm, classifies and detects the gait manner.

6. CONCLUSION

Based on these six techniques all are able to deal with spatiotemporal data. Spatiotemporal parameters can be made with simple methods or tools. According to most of the survey in has concluded where the nonlinear techniques are efficient compared with the linear technique because most of the real-world data are in nonlinear form. In video gait analysis, it is difficult to get a person who can walk in same stride length, step width, and speed especially for a children and people who has impaired brain. So, in this case we need to choose an optimal technique which can deal with nonlinear data structure. This project has 4 techniques under nonlinear structure which are KPCA, ICA, LBP and LDP. Between these 4 techniques only ICA, LBP and LDP are extracting local features. Stated that by using local features extraction approach, we can obtain more robust in human activity features. Added that the local feature is more powerful under noise situation and it is controllable because it doesn't need any camera calibration and complex multi-camera system.

As a conclusion, based on the project reviewed that has been carried out, we will suggest LDP is the best technique for gait analysis feature extraction.

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