

Gait Pattern Analysis Through Various Techniques and Methods - A Review

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ABSTRACT

The gait cycle, which involves propelling the centre of gravity in the direction of motion, is the interval of time or series of action during locomotion from the moment one foot touches the ground to the moment that same foot contact the ground again. Examination of person's waking style or standing and walking pattern called gait analysis. The result of this analysis can be used to determine the causes skeletal muscular Examination or neurological issues, as well as it is applicable in criminal investigation to find out the unique gait pattern of an individual by using the different parameters and technique

Keywords : Gait pattern, Analysis, Tools and techniques.

I. INTRODUCTION

Every individual having its unique gait pattern. find out this uniqueness and individual characteristics some tools and technique are used. Once technique are evaluate dynamic posture and coordination during movement is through gait analysis. This analysis serves as a tool to assess, document and implement any necessary adjustment to promote a fluid gait. Some of the examples which is applicable in gait recognition or analysis that is force plate measurement dynamic electromyography and motion analysis. Real time method for gender detection based on gait and depth cameras. the primary contribution is a new quick feature extraction method that makes used of 3d point cloud that is derived from each frame of gait cycle. (lgual 2013) .This study show the new approach to use the digital image processing method

to find out the neurological disease detection. An expert neurologist can use visual information gleaned from a person posture and movements during a human gait cycle assess mental health .in this type of work a prototype are record a subject's gait on video with a reasonably easy setup and process selected gait frames in a computer has been developed (lee 2008) There is evidence that pain phenotype influence clinical score Is patience with osteoarthritis of the knee, but little is known about the connection between pain phenotype and gait analysis. The objective was to look into the connection between gait limitations and pain phenotype. (nagura 2022) For a variety of monitoring and surveillance applications, gait recognition is crucial. When other biometrics are not clearly visible in the surveillance tape, gait information is frequently used as supporting documentation Expanding upon the latest

developments in (a. l. laura lgal) subspace-based methodologies, we examine the gait recognition issue on the Grassmann manifold. We demonstrate that a large gain in performance may be achieved by embedding the manifold into replicating kernel Hilbert space and using the graph embedding mechanics on such a manifold. This paper presents a unified approach to the gait identification problem that can be applied to both supervised and unsupervised setups. To further leverage the local structure of the data in an adaptable manner, sparse representation is further integrated into the learning mechanism. (tee connie 2014) A human gait classification method based on radar Doppler signatures represented in the time-frequency domain is effectively implemented using an image classification technique that was recently introduced for visual pattern recognition. There are three processing phases in the suggested procedure. The third stage carries out classification, whereas the previous two stages are intended to extract Doppler properties that can efficiently classify human motion based on the characteristics of arm swings. We take into consideration three different types of arm motion: no-arm swings, one-arm limited swings, and free-arm swings. The final pair of arm movements may represent someone carrying something or someone under stress. In order to extract specific Doppler properties, the study explains the various procedures and shows how they contribute to the desired final categorization. recently introduced image classification technique for visual pattern recognition is effectively used to implement a human gait classification method based on radar Doppler signatures represented in the time-frequency domain. The recommended procedure consists of three stages of processing. Classification is done in the third stage, while the first two are meant to extract Doppler properties that can effectively classify human motion based on the features of arm swings. We examine three distinct forms of arm motion: free-arm swings, one-arm limited swings, and no-arm swings. The last

set of arm motions could be someone carrying something or someone who is stressed. The study explains the various procedures and illustrates their contribution to the desired final result in order to extract specific Doppler properties. (tivive 2010) This paper proposes a boosted linear discriminant analysis (LDA) solution on features extracted by the multilinear principal component analysis (MPCA) to enhance gait recognition performance. Three-dimensional gait objects are projected in the MPCA space first to obtain low-dimensional tensorial features. Then, lower-dimensional vectorial features are obtained through discriminative feature selection. (haiping lu 2009) .This study presents a novel gait recognition method based on walking individuals' image self-similarity. We argue that a projection of gait dynamics is encoded in the similarity plot. Moreover, it is robust against segmentation noise, correspondence-free, and performs well with low-resolution video. Several data sets of various sizes and levels of difficulty are used to test the method. (abdelkader 2004) . Body height has a major impact on gait performance, including stride length and stability margin. Here, we examine a quadruped's performance. The similar mechanism changes as the ground-moving robot moves. There are various phases within a gait cycle, such as the step forward and switching stages. For every gait period, there is a corresponding equivalent mechanism. You can think of the motion of these various equivalent mechanisms as the robot's locomotion. (Kun Xu 2019) A rodent pain model has been used to analyse gait in a few prior reports. Objective assessments of behaviour related to pain could be made by applying the Catwalk method; however, this approach has not been studied with the nucleus pulposus (NP) applied model, which was created as a model of lumbar disc herniation. In order to assess the pain-related behaviour brought on by NP application, we set out to measure mechanical withdrawal thresholds and examine gait patterns using the Catwalk method. (Takuya Kameda 2017) In this paper, a method based

on a series of 3D point clouds representing a subject's walking motion is proposed for estimating an index that indicates human gait normality. From each cloud, a cylinder-based histogram is extracted to highlight gait-related features and minimize the number of data dimensions. Ultimately, these histograms of typical gait patterns are used to build a deep neural network model that provides gait normality indices to support gait assessment tasks. Two other datasets that were converted from mocap data and a dataset with nine distinct gait types executed by nine subjects are used to illustrate the capabilities of our approach. The experimental findings are also contrasted with those of related techniques that handle various input data formats, such as skeleton, depth map, and silhouette. (nguyen 2019)

II. METHODS AND MATERIAL

A different tools and techniques are used to determine the individuality and uniqueness in walking pattern Through gait analysis, dynamic posture and coordination during movement are evaluated. This analysis can be used as a tool to evaluate, record, and put into practice any modifications that are required to support a fluid gait. It is also applicable clinical gait assessment. A person's ability to walk after a stroke depends on the severity of the stroke and is usually determined by two factors: the person's walking distance and tolerance level. 3D Techniques for Gender Recognition Based on Gait. It is introduce a feature extraction technique that draws some inspiration frSom the research conducted by Li et al. [12]. Since their objective is to deal with, they chose this algorithm as a baseline due to its trade-off between simplicity and robustness. (lgual 2013)



Fig-1 (lgual 2013)

This study presents a novel method for detecting neurological diseases using digital image processing. Visual data obtained from a person's posture and movements during a human gait cycle it can be used by a skilled neurologist to evaluate mental health. In this kind of work, a prototype that records as subject's gait on video with a comparatively simple setup and uses a computer to process chosen gait frames has beend.

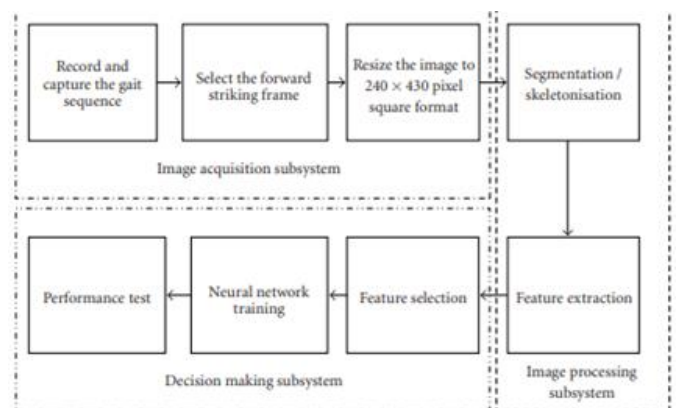


Fig: 2 (lee 2008)

patience with knee osteoarthritis, although the relationship between pain phenotype and gait analysis is not well understood. Investigating the relationship between gait characteristics and pain phenotype was the goal. Participants in the current study included 34 patients (10 males and 24 females) with end-stage

medial compartmental knee OA of at least grade 3 severities on the Kellgren–Lawrence scale.

Based on the recommendations of two surgeons, all of the patients were scheduled for knee replacement surgery at our university hospital (KH and YN). Between April 2015 and April 2017, surgeries were performed. None of the participants had a history of hip osteoarthritis, lumbar canal stenosis, or significant trunk injuries. The following were the inclusion criteria: read the questionnaire on your own and walk without the aid of a cane. The current rheumatoid arthritis. (nagura 2022)

For a long time, the intriguing mathematical characteristics of the Grassmann manifold have been recognized. Its uses in machine learning and computer vision, however, are very new. On the Grassmann manifold, Turaga et al. showed how to use computer vision applications like activity recognition, video-based face recognition, and picture set-based object recognition. In the facial shape's Grassmann manifold structure is also used for face verification and age estimate. The Grassmann manifold's geometrical structure was used in [11] as a visual tracking method. (tee connie 2014) Doppler spectrograms for PAM, FAM, and NAM, the three arm motions. The horizontal axis shows the time, and the vertical axis shows the Doppler frequency. The returned signal's amplitude is colour coded, with blue being the lowest intensity and red the maximum. Each plot's spine depicts the subject's torso motion, or speed, while the positive and negative Dopplers show the subject traveling in the direction of the radar, respectively. The arms, legs, and feet are represented by the plots' recurring peaks. For example, quick arm motions are displayed as high peaks in Figure 1(b), while foot and leg motions are displayed as smaller peaks. (tivive 2010)

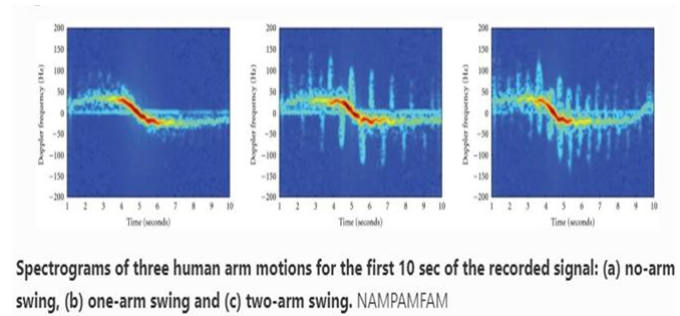


Fig:3 (tivive 2010)

In order to improve gait recognition performance, this paper suggests using features extracted from the multilinear principal component analysis (MPCA) to apply a boosted linear discriminant analysis (LDA) solution. Firstly, low-dimensional tensorial features are obtained by projecting three-dimensional gait objects in the MPCA space. Next, discriminative feature selection is used to obtain vectorial features that are lower-dimensional. Then, using a novel feature weighting and sampling procedure, multiple regularized and weakened LDA learners collaborate to create a strong learner by feeding these feature vectors into an LDA-style booster. For classification, the LDA learner uses a straightforward nearest-neighbour classifier that uses a weighted angle distance measure. The suggested method has successfully enhanced gait recognition performance and outperformed multiple cutting-edge gait recognition techniques, according to the experimental results on the NIST/USF "Gait Challenge" data-sets. Gait is useful for biometric and passive surveillance applications because it is one of the few biometrics that can be measured remotely. The fundamental challenge of finding gait features that can be reliably and accurately extracted from low-resolution video while also having sufficient discrimination power remains unsolved, though, as gait recognition research is still in its early stages. This work introduces a novel gait recognition technique based on the image self-similarity of walking individuals. We contend that the similarity plot encodes a projection of gait dynamics. It is also robust against correspondence-free segmentation noise and works well with low-

resolution data sets with different sizes and complexity levels. In execution. A quadruped robot's legs typically have three or four links in them. There are three rotation joints in a leg with three links, and four rotation joints in a leg with four links. Here, they talk about the quadruped robot, which, as seen in Figure , has three links in its legs: the hip link, the thigh link, and the calf link. The thigh link is joined to the hip link and the calf link by means of parallel axes in the hip and knee joints, respectively. In the meantime, the waist joint, whose axis is perpendicular to the axes of the hip and knee joints and parallel to the body's longitudinal axis, joins the hip link to the body. When walking steadily, the robot does not slip.



Fig: 4 (Kun Xu 2019)

Using the CatWalkTM XT (Noldus Information Technology, Wageningen, The Netherlands), a gait analysis utilizing the CatWalk method was carried out in order to assess the specific functional changes in gait (Hamers et al. 2001). A charge-coupled device (CCD) camera beneath the floor monitored the floor as animals moved through the vitreous corridor. The corridor's fluorescent lighting allowed the camera to take pictures of footprints. The paw's force was reflected in the intensity of the light. Following the recording of the real-time footprint images on a computer, the CatWalk XT software package (Noldus Information Technology, Wageningen, The Netherlands) was used to calculate the parameters

mentioned in In order to minimize pain, animals were trained to run on a CatWalk runway for a few uninterrupted laps one day before surgery. (Takuya Kameda 2017) Estimating the gait normality index is one of the issues that healthcare systems study the most frequently. In order to gather additional information for gait analysis, numerous researchers used sophisticated marker-based and multi-camera systems. Their requirement for expensive, specialized devices with high computational costs is one of their disadvantages. Consequently, a single camera was used in some recent studies to address gait analysis issues. The subject's silhouette or depth map is the input for those methods, depending on the sensors that are being used. Many gait signatures, including the motion history image (MHI) [9], gait energy image (GEI) gait energy image (GEI 17], have been proposed using the previously mentioned data. Every signature is a condensed version of a series of successive two-dimensional silhouettes. (nguyen 2019)

III.CONCLUSION

The outcome of using this analytical technique and method can be applied in a criminal investigations to ascertain an individual unique gait pattern by utilizing various parameters and techniques .it can also be used to be ascertain the causes of skeletal muscular examination or neurological issues .

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