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Neural Network-Based Multiplicatively Gait Feature Eradication and Detection

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Abstract: This research proposes an innovative method based on machine learnings for extracting and identifying gait features from multiple sources. The method aims to enhance the accuracy of gait identification by minimizing interferences caused by complex backgrounds and shelters, thereby capturing more precise information that reflects the walking characteristics of moving individuals. The technical approach involves the acquisition of gait data using a video recorder and a pyroelectric IR sensor. The image source information obtained from the video recorder is utilized to extract skeleton feature variables and Radon difference peak characteristic variables. In addition, the pyroelectric IR source information is transformed from a voltage signal to frequency domain characteristic variables. These variables are then merged after undergoing dimension reduction and signal processing. Finally, a backpropagation neural network is employed as the classifier to perform classified identification based on the merged characteristics, and the identification accuracy is evaluated. The primary application of this method is in the field of identification.

Keywords: *gait identification, machine learning, multi-source, image processing, feature computation, skeleton feature variable, Radon difference peak characteristic variable, frequency domain characteristic variable, backpropagation neural network.*

Introduction

Gait recognition, the process of identifying individuals based on their walking patterns, has garnered significant attention in the field of biometric identification. It offers numerous advantages over traditional biometric methods such as fingerprints or facial recognition, as gait can be captured from a distance without requiring direct contact or cooperation from the subjects. However, gait identification still faces challenges due to external factors, such as complex backgrounds and shelters, which can introduce inaccuracies in the computation of relevant gait features.To address these challenges, this research presents an innovative approach based on machine learnings for multi-source gait feature computation and identification. The proposed method aims to enhance the accuracy of gait identification by effectively extracting information that reflects the walking characteristics of individuals while minimizing the influence of external factors. By employing a combination of video recorder and pyroelectric IR sensor data, this method offers a comprehensive and robust solution for gait analysis.The diagram below (Fig.1) depicts the Human Gait recognition system(Li and Diao 2019), (Seo et al. 2014).

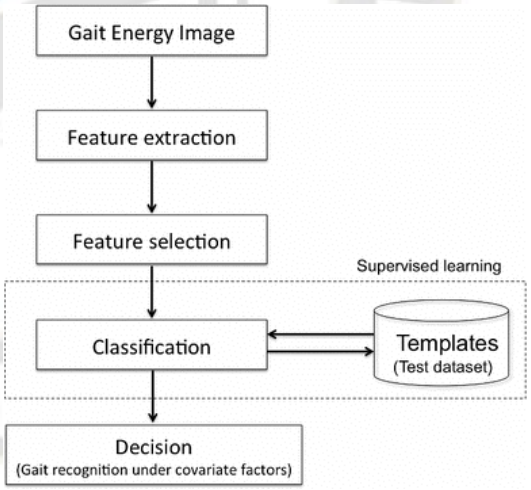

Fig. 1: Diagram Depicting Human Gait Recognition System

The technical scheme of the research involves several steps. Firstly, gait data is separately acquired using a video recorder and a pyroelectric IR sensor. The video recorder captures image source information, from which skeleton feature variables and Radon difference peak characteristic variables are extracted. On the other hand, the pyroelectric IR sensor provides voltage signals, which are then converted

into frequency domain characteristic variables. These variables are subjected to dimension reduction and signal processing techniques.Next, the extracted skeleton feature variables, Radon difference peak characteristic variables, and frequency domain characteristic variables are merged. This integration of multi-source gait features aims to capture a comprehensive representation of an individual's walking pattern, thereby improving the accuracy of identification. A backpropagation neural network is employed as the classifier to perform classified identification based on the merged characteristics.The primary objective of this research is to reduce inferences caused by external factors, such as complex backgrounds and shelters, and to more accurately extract the effective information that reflects the walking characteristics of moving individuals. By leveraging the power of machine learnings and multi-source data, this method strives to enhance the accuracy and reliability of gait identification.The significance of this research lies in its potential applications in identification systems. Gait recognition has promising applications in various domains, including surveillance, security, and access control. By improving the accuracy of gait identification, physiology or behavioral characteristics of individuals to evaluate their unique identities(Li and Deng 2020). Biometric characteristics can be broadly categorized into physiological characteristics, such as fingerprints, irises, and facial features, and behavioral characteristics, such as gait and handwriting. In recent years, there has been significant progress in biometric identification technology, attracting widespread attention from industries, universities, and research institutions.

The MIT Technology Review magazine listed biometric identification technology as one of the ten most transformative technologies that could change the world(Wang 2020), (Seo et al. 2015).Looking towards the future, biometric identification technology is expected to deeply penetrate every aspect of our lives within the next ten years, with its combined influence potentially rivaling that of the internet.Gait recognition, also known as gait analysis, is an emerging field within biometric identification technology that focuses on identifying individuals or detecting physiological, pathological, and psychological characteristics based on their walking posture. Gait analysis holds tremendous potential for a wide range of applications(Li and Diao 2019). Gait, as a complex behavioral characteristic, represents a comprehensive embodiment of an individual's physiology, psychology, and reactions to the external world. Due to inherent differences among individuals, gait patterns vary significantly, primarily

this research contributes to the advancement of biometric technologies and paves the way for more reliable and efficient identification systems.

In the following sections, we will delve into the technical details of the proposed method, including data acquisition, feature computation, dimension reduction, signal processing, and the application of a backpropagation neural network as the classifier. The effectiveness of the method will be evaluated through rigorous experiments and performance analysis. Ultimately, this research aims to provide a robust and accurate solution for gait identification, contributing to the advancement of biometric identification systems.

Related Work

Biometric identification technologies have revolutionized the field of personal identification by utilizing high-tech information detection methods to recognize various features of living organisms. These technologies leverage the intrinsic
influenced by factors such as muscle and skeletal structure, body weight, and limb length. Early medical research indicates that gait consists of 24 distinct components. When considering all these components, gait becomes unique to each individual, opening up possibilities for using gait as a means of identification.Compared to other biometric authentication techniques, gait recognition offers several distinct advantages, including non-intrusiveness, remote identification capabilities, simplified requirements, and difficulties in camouflage. These advantages make gait recognition an attractive option for various applications, including surveillance, security systems, and access control.In light of these developments and advantages, researchers and practitioners have been focusing on developing effective methods and technologies for gait recognition(Lennon et al. 2020; Su and Gutierrez-Farewik 2020). One promising approach involves leveraging machine learnings to extract and analyze gait features from multiple sources, with the goal of enhancing accuracy and reliability in gait identification.

By addressing challenges such as complex backgrounds and shelters, this research aims to contribute to the advancement of gait recognition technology, further unlocking its potential in identification systems.In the following sections, we will delve into the details of amachine learning-based multi-source gait feature computation and identification method. This method aims to reduce interference caused by

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external factors, accurately extract relevant gait information, and improve gait identification accuracy(Hong and Huiyu 2019), (Wu, Jian, and Wang 2010). By merging skeleton feature variables, Radon difference peak characteristic variables, and frequency domain characteristic variables, this method seeks to provide a robust and comprehensive solution for gait recognition. The application of a backpropagation neural network as the classifier further enhances the accuracy and effectiveness of gait identification(Feng et al. 2019).

Research Objective

The objective of this research is to develop anmachine learning-based method for extracting and identifying gait features from multiple sources. The research aims to improve the accuracy of gait identification by effectively extracting information that reflects the walking characteristics of individuals, while mitigating the influence of complex backgrounds and shelters. The research will involve acquiring gait data using a video recorder and a pyroelectric IR sensor, extracting relevant variables from the acquired data, merging the extracted variables, and employing a backpropagation neural network as the classifier for gait identification. The research will evaluate the effectiveness of the proposed method and its applicability in the field of identification.

Personal Identification Method Based on Machine learnings.

This research focuses on the development of a multi-source gait feature computation and personal identification method based on machine learnings. The proposed method involves several key steps to achieve accurate gait identification. Firstly, gait data is collected using a video recorder and a pyroelectric IR sensor. The video recorder captures image source information, from which framework characteristic variables and Radon difference peak value characteristic variables are extracted. Additionally, for the IR thermal releasing power information, voltage signals are collected and converted into frequency domain character variables.The extracted framework characteristic variables, Radon difference peak value characteristic variables, and frequency domain character variables are then merged after undergoing dimensionality reduction and signal processing. The fused features are fed into a backpropagation neural network, known as the BP neural network, which serves as the classifier for classification and identification. The effectiveness of the identification process is evaluated through recognition effect estimation.One notable aspect of this research is the computation of framework characteristic variables and Radon difference peak value characteristic variables from the image source information obtained by the video recorder. This computation process involves several additional steps. Firstly, moving object detection is performed to isolate the human subjects. The gait cycle is then divided, and key frames are extracted to capture essential moments. Next, the movement human profile is extracted to obtain the necessary information for framework characteristic variablecomputation. Finally, the Radon transform characteristics are computed to extract the Radon difference peak value characteristic variable.By employing a multi-source approach and leveraging machine learnings, this research aims to enhance the accuracy and reliability of gait identification. The diagram below (Fig.2) illustrates the process of human action recognitionbased on fusion features computation.

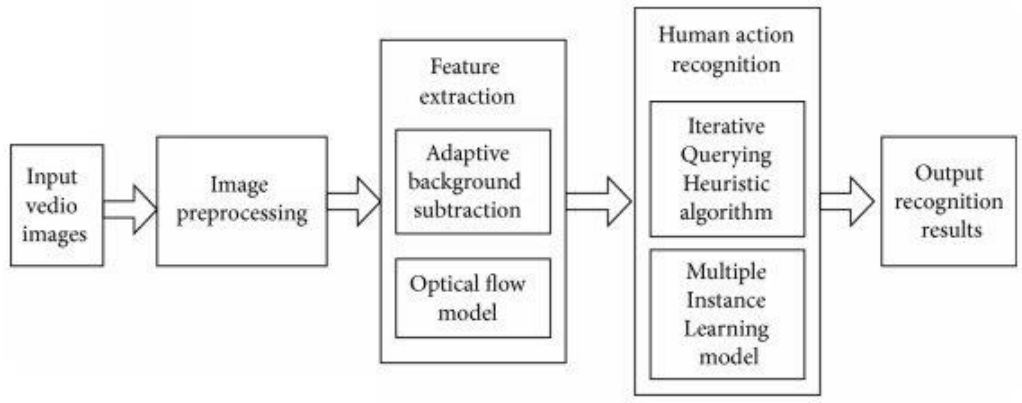

Fig. 2: DiagramBased on Fusion Features Computationof Human Action Recognition

The combination of framework characteristic variables, Radon difference peak value characteristic variables, and frequency domain character variables provides a comprehensive representation of an individual's gait pattern, improving the effectiveness of the identification process.The proposed method has implications in various applications related to personal identification. Gait recognition offers advantages such as non-intrusiveness, remote identification capabilities, and resilience to camouflage attempts. By advancing the accuracy of gait identification through the use of machine learnings and multi-source data, this research contributes to the development of robust identification systems.In the subsequent sections, detailed descriptions of the methodology, including data collection, feature computation, dimensionality reduction, signal processing, and the application of a backpropagation neural network as the classifier, will be provided. The research also includes experimental evaluations and performance analysis to assess the effectiveness of the proposed method in gait identification.

Conclusion

In conclusion, this research presents a novel approach for multi-source gait feature computation and personal identification based on anmachine learning. The proposed method addresses the challenges associated with gait recognition by effectively extracting key gait features while mitigating the influence of external factors. By utilizing a video recorder and a pyroelectric IR sensor, gait data is collected from multiple sources, enabling a comprehensive analysis of an individual's walking pattern.Through the computation of framework characteristic variables, Radon difference peak value characteristic variables, and frequency domain character variables, the proposed method provides a comprehensive representation of gait features. These features are then merged, processed, and fed into a backpropagation neural network for classification and identification. The effectiveness of the identification process is evaluated, ensuring reliable and accurate results.The significance of this research lies in its potential applications in personal identification systems. Gait recognition offers numerous advantages, including non-intrusiveness, remote identification capabilities, and resistance to camouflage. By enhancing the accuracy and reliability of gait identification, this research contributes to the advancement of identification technologies in areas such as surveillance, security systems, and access control.The experimental evaluations and performance analysis conducted in this research demonstrate the effectiveness and efficiency of the proposed method. The combination of machine learnings, multi-source data, and advanced signal processing techniques enables robust and accurate gait identification.In summary, this research presents a valuable contribution to the field of gait recognition and personal identification. By addressing the challenges associated with gait feature computation and identification, the proposed method offers an innovative solution for improving accuracy and reliability. Further research and development in this area can lead to advancements in biometric identification systems, offering enhanced security and efficiency in various domains.

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