Vision-Based Gait Analysis for human identification with covariate conditions

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by

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CHAPTER 6

Concluding remarks and future direction

6.1 Conclusion

In conclusion, this thesis addresses the challenges of human gait recognition by proposing gait analysis methods that combine model-free and model-based approaches. The investigation of covariate issues, both known and unknown, is thoroughly analyzed through experimental analysis. The results highlight the sensitivity of model-free approaches to unknown covariate issues, while known covariates can be effectively handled with high test accuracies.

The thesis further explores the fusion of dynamic and static features for subject classification, achieving significant improvements over early studies. A Convolutional Neural Network (CNN) model is also proposed, surpassing the performance of existing gait recognition algorithms using the same dataset.

Moreover, this work introduces a novel dataset that differs from existing benchmark datasets in terms of data acquisition settings, background settings, and covariate conditions such as carrying and clothing. The challenges of object detection from walking sequences in real-world scenarios are addressed using adaptive background segmentation algorithms and deep convolutional neural network models, demonstrating the effectiveness and accuracy of the proposed techniques.

Finally, a pose-based human gait analysis approach is studied to tackle covariate factors such as clothing, carrying, and viewing conditions. The Blazepose human pose estimation algorithm is employed to extract body keypoints, which are used to evaluate distances and angles for classification. Feature vectors incorporating dynamic keypoints, knee angle, and maximum foot distance.

Overall, this thesis makes significant contributions to the field of human gait recognition by addressing covariate challenges and proposing novel approaches for gait analysis for human identification. The techniques and the findings presented here pave the way for improved gait recognition systems in practical, real-world conditions, with potential applications in security, surveillance, and biometrics.

6.2 Future direction

This research work presents a solid foundation for further advancements in human gait recognition and analysis. Building upon the findings and techniques presented, there are several promising directions for future research in this field. The proposed Convolutional Neural Network (CNN) model in this work showed improved accuracy compared to existing algorithm, further exploration of advanced deep learning model

Exploration of advanced deep learning models: While the proposed Convolutional Neural Network (CNN) model showed improved accuracy compared to existing algorithms, further exploration of more advanced deep learning architectures could potentially yield even better results. Models such as recurrent neural networks (RNNs), attention mechanisms, or graph neural networks (GNNs) could be investigated to capture temporal dependencies, focus on important gait features, or leverage skeletal structures for enhanced performance.

The proposed dataset in this research already introduced important aspects such as natural settings, varying background conditions, and covariate factors like carrying and clothing. However, expanding the dataset to include a larger and more diverse population, capturing additional covariate variations, and ensuring a balanced representation of subjects could further improve the generalization and robustness of gait recognition models.

Gait analysis can benefit from the integration of multiple modalities, such as video, depth, and inertial sensor data. Combining information from different sources could provide richer representations and mitigate the impact of covariates. Research efforts could be directed towards developing fusion techniques that effectively leverage multi-modal data for more accurate and reliable gait recognition.

In practical applications, real-time gait recognition systems are crucial. Future research can focus on optimizing the proposed methods for efficient real-time processing, exploring hardware acceleration techniques, and addressing the computational challenges associated with deploying gait recognition algorithms on resource-constrained platforms or embedded systems.

While the presented work addresses various covariate issues, gait recognition in unconstrained scenarios remains a challenge. Future research could focus on handling complex real-world situations, such as crowded environments, outdoor settings, or scenarios with occlusions, where multiple individuals with different walking styles are present. Robust techniques for object detection, segmentation, and tracking in unconstrained gait recognition scenarios would be valuable contributions.

The performance, robustness, and application of gait recognition systems can be enhanced through the proposed methods in this research work. Future research in these areas will enable successful implementation in various fields, including security, surveillance, healthcare, and human-computer interaction.