

Development of a Camera-based Gait Analysis System

using Human Pose Estimation Algorithms

Student



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Introduction: Human gait, the deceptively simple yet intricately nuanced act of walking, has long intrigued researchers. Beyond its commonplace occurrence, gait holds a treasure trove of individual information, akin to a distinct signature. This has led to gait analysis becoming a valuable asset in assessing physical conditions, aiding diagnoses, and verifying identities.

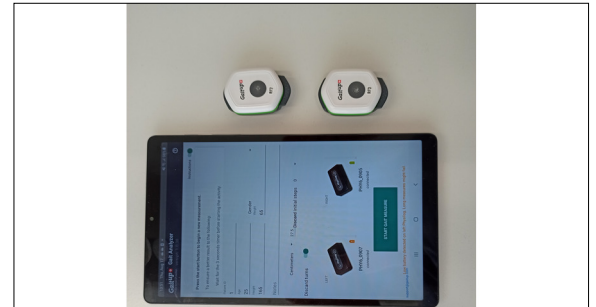
Although automatic gait analysis is feasible through methods like the GaitUp system from Physiolog, which is currently in use by the department of physiotherapy at OST, their integration into daily operations is challenging. The advent of technological advancements, especially in human pose estimation, unveils fresh possibilities for visual gait analysis.

Approach: The process began with the extension of the Interdisciplinary Center for Artificial Intelligence (ICAI)'s pose estimation network to identify crucial keypoints for gait analysis. This expanded model was employed alongside Google's Mediapipe's BlazePose network to detect keypoints, which represent a participant's joints, in video frames. Following this, experiments were conducted to evaluate the accuracy of these models. The extracted keypoints were then input into an algorithm designed to identify key frames, including liftoff and strike frames. These frames are used as a foundation for feature calculation, facilitated by a series of signal processing techniques.

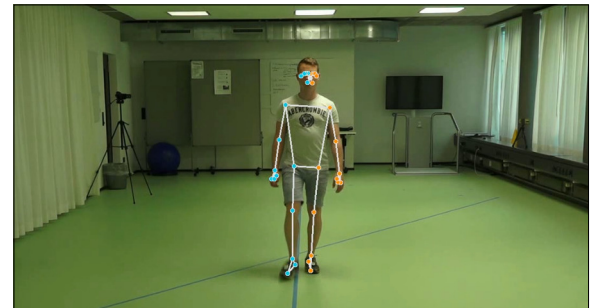
Conclusion: The fusion of human pose estimation and signal processing has yielded valuable insights into visual gait analysis. This approach, employing various models, has led to accurate joint location predictions. Yet, challenges like keypoint mislocation highlight the need for meticulous camera placement and

unobstructed views for precise predictions. Nonetheless, the subsequent signal processing algorithms provide a promising foundation for feature calculation, with potential for further expansion in the future.

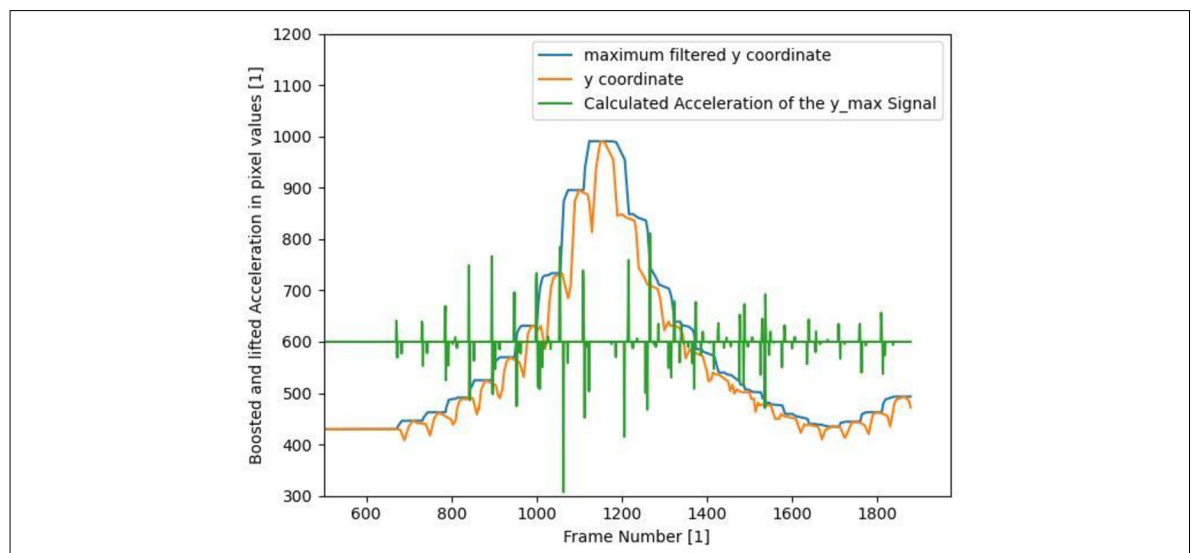
GaitUp system used for gait analysis.
Own presentation



Video frame which displays the participant with BlazePoses skeleton drawn on top
Own presentation



Plot which shows crucial signals which are used for feature calculation.
Own presentation



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Subject Area
Data Science