A Pose Based Gait Analysis System for Cerebral Palsy Patients Using AI and Computer Vision

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Cerebral palsy, the most common motor disability in childhood, causes mobility issues, leading to gait abnormalities. The spectrum of these abnormalities includes having stiff or flaccid muscles, uncontrollable movements, or poor coordination. Around 1 in 3 children with cerebral palsy cannot walk. Current physical therapy solutions, including processes such as clinical gait analysis, are inaccessible and costly. We investigated the research question: how can we create an affordable and effective method using AI to provide gait analysis data to cerebral palsy patients? Machine learning and computer vision were used to develop a mobile application that provides gait analysis data for cerebral palsy patients. The MediaPipe computer vision library was applied to find pose vectors from the patient's walking / jogging / running video, and from an expert's video demonstrating proper form. Using this vector data, matching frames from the two videos were identified with numerous applications of the K-Means algorithm. Joint angle differences were calculated in order to identify gait abnormalities. A complete mobile application was developed to enable patients to monitor, track and get feedback live. The AI model was deployed in the cloud. The frontend was developed using Flutter, and it was designed to accommodate patients' physical/mental limitations. This research demonstrates an application of machine learning and computer vision in an accessible mobile solution. The K-means algorithm showed high accuracy with an average silhouette score 0.514 when used on expert videos. MediaPipe output had 29.2FPS on average, higher than that of competing libraries which was 8.1FPS.

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