Development of a Video-Based ML Tool to Measure Motor Impairment for Clinical Diagnosis of Cerebral Palsy (CP)

Master's Thesis Defense in Mechanical Engineering

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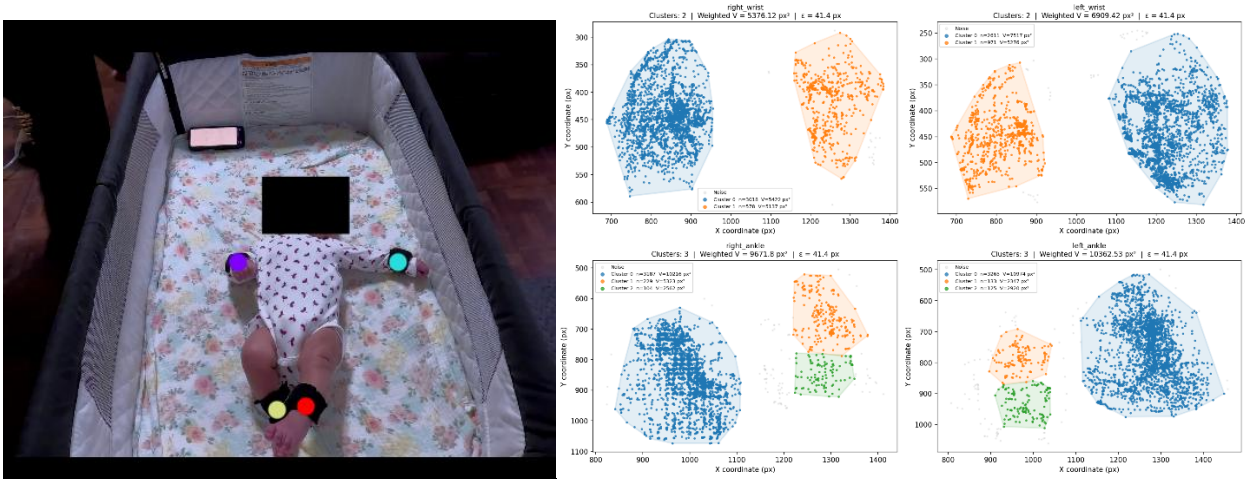
Date and Location: Tuesday, June 2 at 12:10 pm, Building 13, Room 124B

Zoom ID: 586 201 7325 (https://calpoly.zoom.us/j/5862017325?omn=86023583774)



Congenital hemiparesis is a kind of motor impairment that develops around the time of birth and is difficult to detect in early infancy with current clinical tools. Early identification of side-to-side motor differences is crucial for early clinical intervention and rehabilitation efforts. This thesis presents the development and validation of a video-based tool to extract infant limb movement data using DeepLabCut's (DLC) machine learning network. The pipeline was developed using 16 videos of infants with Asymmetric Perinatal Brain Injury (APBI) as well as typically developing infants at various stages during their development. A protocol was developed to crop, label, and process video footage for DLC to extract two-dimensional data of left wrist, right wrist, left ankle, and right ankle positions throughout the video. A data processing pipeline was developed to remove outliers from the two-dimensional limb position data and a comparison between three different outlier detection methods, likelihood percentile, moving averages, and the DBSCAN approach, was conducted. Finally, five metrics were applied to measure asymmetry: the trace of the covariance, principal component analysis (PCA), the convex hull area, the total clustered variance, and the resulting asymmetry indices. The tool developed showed potential of detecting side-to-side motor differences within APBI infants early in their development.