Development of a Machine Learning Algorithm to Predict the Path of Joints for Gait Rehabilitation

Gupta, Sejal (School: Hicksville Senior High School)

Globally, clinicians, like physical therapists and physiatrists, aid individuals with gait issues in their journey towards recovery. However, they do not have a valid prediction as to what the individual's desired gait should be and an accurate treatment plan cannot be devised. My approach was to develop a machine learning algorithm to trace the trajectory of desired joints based on an individual's age, mass, leg length and gait speed, which were determined to be the most influential in gait variation. Using a public gait data set from 42 individuals, I trained a supervised learning algorithm to trace the paths of the joints. The goal was to obtain a prediction model that could attain the desired trajectories for a person's gait cycle based on their demographics. With a neural network, a relationship between the human physiology data and the trajectories was sought and found. The reconstruction loss was the quantitative analysis to gear the algorithm towards optimization with the Adaptive Moment Estimation Optimizer. With several configurations of the data, the desired paths were retrieved after 1.2 million iterations; there was a training loss of 9.2 and testing loss of 8.9. The algorithm was validated using a random participant from the public dataset, an individual with Parkinson's disease and the first author's data. A mechanism was developed to demonstrate the practicality of the algorithm and the projections it had predicted for the student researcher. This work is the foundation for future gait rehabilitation research, especially in terms of cost and effectiveness.

Awards Won: