A Novel Method of Screening for Foot Ailments Using Machine Learning

Vegi, Abhitha (School: Mission San Jose High School)
Jakka, Priyanka (School: Mission San Jose High School)

Arthritis is a common ailment that affects gait and pressure distribution across patients' feet. While current treatments include physical therapy, medication, and surgery, these solutions are only possible after the detection of arthritis. A machine learning model can be utilized to predict arthritis in its early stages and also to monitor patient improvement during rehabilitation. A smart shoe involves a combination of sensors - force sensitive resistors, accelerometer, and magnetometer - to capture data such as orientation, displacement, and pressure distribution using pressure sensors. All of the sensors are built into the soles of the shoe. The raw data is saved on to an SD card and sent to a laptop via Bluetooth for analysis. The data is sent through a curation program, and a machine learning algorithm then compares this data to the data of users (both arthritic and nonarthritic) to classify the walking pattern as arthritic or not. Some common markers of arthritis include larger values for acceleration in the z-axis (tilt of the foot inwards) and also an increase in pressure on the first metatarsophalangeal joint. Using the algorithm's results, a physical therapist would be able to view a 3D rendering of the walking motion to create a more complete diagnosis of the arthritis.

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