A Fall Detection and Prevention Shoe for the Elderly and Balance Impaired

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The purpose of this project was to create a shoe that utilizes a neural network to detect falls as they happen and replicate a step that would be used to widen the base of gravity by moving the foot using motors embedded in the shoe. Falls are an important issue, as they are common, dangerous, and expensive, especially among the elderly and balance impaired. The neural network that detects occuring falls uses inputs from four pressure sensors, an accelerometer, and a gyroscope, and was trained from 220 data points, with 50 forward and backward falls, and 120 control data samples. The pressure sensors are placed in the heel and toe of two shoes, and the accelerometer and gyroscope are mounted to a belt. The output of the neural network detects whether the fall is forwards or backwards, and then spins the eight embedded motors in each shoe forwards or backwards, respectively. The system was tested with 220 tests similar to neural network data collection, and a successful fall prevention was marked when the need to step forward was replaced by the autonomous movement of the system. The neural network was 86% accurate in detecting forward falls and 82% accurate in detecting backwards falls. The fall prevention mechanism prevented 82% of forward falls and 74% of backwards falls. The engineering goal was partially achieved but the system could be more accurate with further training and refining, and the results show potential for this technology.

Awards Won: