Design an Ankle Exoskeleton for Rehabilitation After Injury

Mao, Wenqing (School: Princeton International School of Math and Science)

This project aims to develop a wearable ankle exoskeleton that allows real-time, adaptive rehabilitation after injury. Most existing devices are either fixed or lack support for complex ankle movements such as abduction and adduction. To address these issues, I have designed a lightweight, 3DoF (Degree of Freedom) exoskeleton using electromyography (EMG) and inertial measurement unit (IMU) sensors. By using a host computer and an embedded system, the device classifies gait phases using AI models trained with Support Vector Machine (SVM) and predicts actuator torque using Gaussian Process Regression (GPR), allowing smooth and customized movement assistance. Experiments showed the system effectively improved gait symmetry and reduced muscle strain during walking. SVM achieved high accuracy in phase classification, and GPR ensured responsive torque adjustment based on real-time gait deviations. Comparative trials confirmed more consistent steps and better weight distribution with the device. This exoskeleton system demonstrates strong potential for clinical use, offering low-cost, portable, AI-powered, and personalized support for users with ankle impairments.

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