A Low-Cost Prosthetic Hand: Integrating sEMG technology With a Machine Learning Model and a User-Friendly Application for Model Training

Henderson, Will (School: Roanoke Valley Governor's School for Science and Technology)
Noel, Jeremiah (School: Roanoke Valley Governor's School for Science and Technology)

With over 150,000 new amputees each year, the need for more affordable, fully functional prosthetics continues to grow. The aim of this project is to create a cost-effective prosthetic hand that utilizes a machine learning model coupled with non-invasive electromyography technology to predict and perform a user’s hand movements. The prosthetic hand was fabricated with a 3D printer, and a forearm compartment was constructed to house the linear actuators. EMG electrode placement was tested extensively to allow for usable data to be collected. Multiple machine learning models were also created and tested to determine which would most accurately classify a user's hand movements. The machine learning model training and calibration was streamlined by a user-friendly application. The prosthetic hand is able to lift 2.27kg and close in 0.9 seconds. The machine learning model performs with at least 75% accuracy in each finger’s predicted movement. Independent finger movement is achieved, allowing for a human-like design. The use of linear actuators and springs also allow for a more robust and adjustable prosthetic. Artificial devices are needed to improve the day to day life of those who have lost limbs. By using EMG sensors coupled with machine learning, a low-cost, fully functional prosthetic hand is possible. Our novel approach to prosthetic setup and calibration proves to be both effective and time efficient. With continued improvements and testing, this prosthetic could have a real life application at a fraction of the cost to comparable models.

Awards Won: