MECHANICAL ENGINEERING STUDENT SEMINAR

Thursday, March 9 2023 at 13:00, D. Dan and Betty Kahn Building, Auditorium 1.
Online: https://technion.zoom.us/j/95362697665

Error-Related Potentials in Response to Haptic and Visual Disturbances to Exoskeleton Operation

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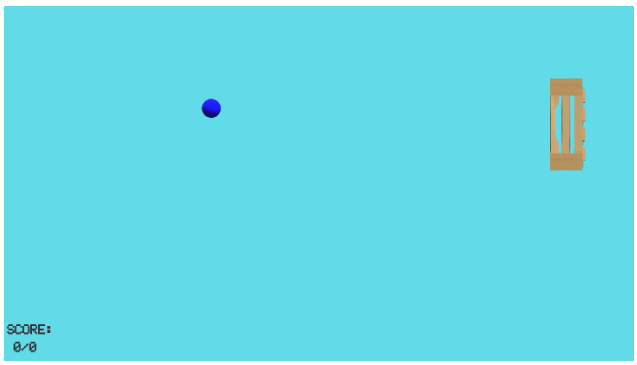
Robotic exoskeletons are electromechanical devices designed to assist with or increase the power of the user's motor functions. In the farming industry for example, exoskeletons have the potential to drastically improve the manual output and reduce injury rate by assisting the upper and lower limbs. However, in order to be beneficial, assistive exoskeletons must apply mechanical power to the body in a way that's intuitive and helpful and does not negatively interfere with the wearer's motion.

Our long-term goal is to develop exoskeleton control algorithms that increase the cooperation between the exoskeleton and the wearer. The specific objective of this study is to identify when there are discrepancies between the expected and actual motion of the exoskeleton based on error-related potentials (ErrPs). ErrPs are electroencephalographic (EEG) correlates of errors evoked in response to different types of errors.

We focused on investigating ErrPs evoked in response to both visual and haptic disturbances to the operation of an exoskeleton that was used to control a computer game. Subjects were instructed to control a crate on a computer screen by moving their arm up and down while wearing a simple robotic exoskeleton on their arm. Their goal was to attempt to catch a ball bouncing across the screen in the crate they controlled. During the game, a variety of errors were introduced, including two distinct haptic errors and two visual errors.

Using machine learning tools, it was possible to detect over 70% or the errors, and to correctly classify over 60% of the errors as haptic or visual. These results are promising and indicate that further research on using ErrPs to improve exoskeleton control is well-warranted.



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