The Walk Again Project: Brain-Controlled Exoskeleton Locomotion

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ABSTRACT

- We designed a robotic exoskeleton to restore locomotion in patients with complete spinal cord injuries.
- EEG and EMG were used as inputs for discrete state control.
- The user dictates high level state transitions while the exoskeleton performs low level control of movement and ensures stability and safety.

- Eight patients were trained for about 600 hours with this control scheme.
- The system was demonstrated at the 2014 FIFA World Cup by having a paralyzed individual deliver the opening kick.
- This was the first BMI demonstration in a large public setting.

The Exoskeleton

- Roughly 130,000 new spinal cord injuries (SCI) occur each year (http://www.campaignforcure.org).
- SCI increases the risk of premature death by a factor of 2 to 5, and socioeconomic participation.

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Conclusion

Using our control scheme, a total of eight participants with spinal cord injury were able to brain-control the exoskeleton to walk, stop, and kick without the need of an external operator.

Our results indicate that BMI-based control of an exoskeleton can become a feasible assistive or rehabilitative tool for patients with SCI. By using this training paradigm, we were able to prepare all participants for use of the exoskeleton in a real world setting.

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