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BCI with Wimagine®

PATENTS 18 PATENTS

People with serious motor disability can now control complex functional substitution devices

What is BCI?

The Brain Computer Interface (BCI) project intends to prove that, after training, a person with serious motor disability (i.e. tetraplegic subjects), is capable of controlling complex functional substitution devices, such as a 4-limb exoskeleton by decoding brain electrical activity. BCI principle derive from the fact that moving or imagining a movement generates sililar electrical activity in the motor cortex. Electrical signals called ElectroCorticoGrams (EcoG) are recorded and decoded to control complex effectors such as moving exoskeleton's limbs.

Applications

The subject can control the exoskeleton by imagining movements just as if his or her own body was going to execute them. The ElectroCorticoGrams produced by the subject's intentionally imagined movement are recorded by Wimagine® implants, surgically placed into the skull in front of the motor cortex. The ElectroCorticoGrams are decoded to control the exoskeleton's arm and leg joint motors. This application offers prospects of innovative functional substitution solutions ensuring enhanced quality of life for people with serious motor disabilities.

What's new?

The BCI and tetraplegia clinical trial (NCT 02550522) yielded significant results that have been published in the prestigious Lancet Neurology journal.

The team has demonstrated long-term activation of a four-limb neuroprosthetic exoskeleton (almost 3 years) by a complete BCI system using continuous, online epidural ECoG to decode brain activity in a tetraplegic patient. This unique system can control walking and upper-limb movements (eight degrees of freedom). Training environments have been developped both in the laboratory and in naturalistic environments, opening the door for amplifiying clinical trials at home for BCI approaches.

What's next?

The BCI platform including the Wimagine® implant, decoding software and the EMY exoskeleton, complies with European directives on Class III AIMDs for clinical trial usage. The team is currently finalizing the 'BCI and tetraplegia' trial with additional participants. Next steps include an implementation of BCI at home for tetraplegia both by using augmented reality and adapted effectors. Also, BCI with Wimagine® has the potential for uses in motor disability rehabilitation, such as for paraplegia, muscular dystrophy, and stroke.

From the technology side, future efforts will include developing effective and low-power on-chip signal processing approaches based on edge AI, as well as designing and testing high-density implantable systems.

Interested in this technology?

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