Neuroergonomics Approach to Investigate Dynamic Whole-Body Movement During Skateboarding ～Toward Prediction and Enhancement of Human Performance ～

概要

Neuroergonmics investigates human brain function in real-world situations to develop technologies that enhance performance and well being. This research focuses on understanding the brain and biomechanical processes behind skateboarding maneuvers on a quarter-pipe ramp. By employing neuroergonomic techniques to record EEG brain activity, EMG muscle activity, foot forces, and full body motion capture, this research aims to identify neural correlates of performance. These insights, during both task execution and mental imagery, can be leveraged by neuromdulation techniques to enhance skill and performance.
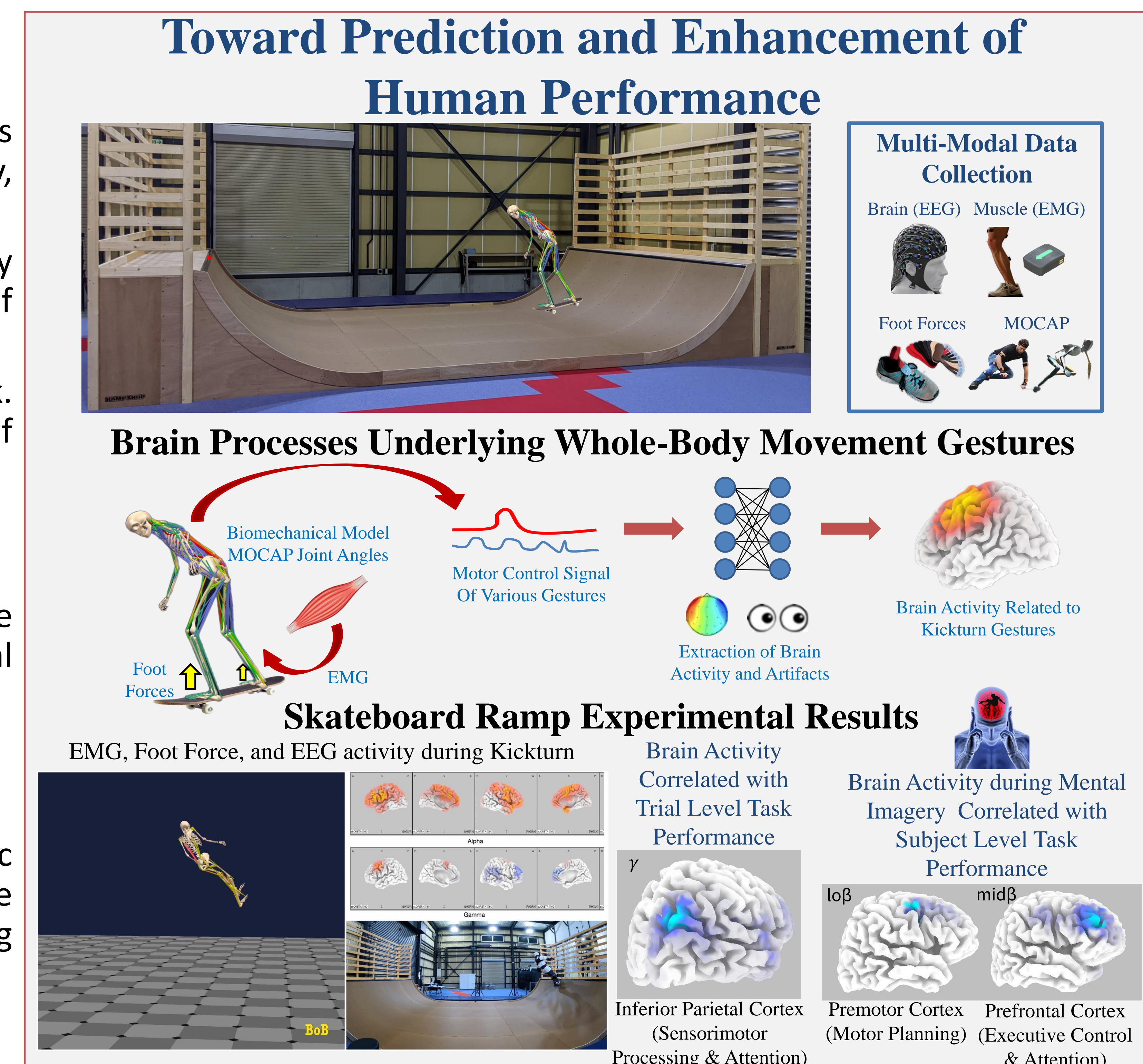
特徴

- This research utilizes synchronized acquisition and synthesis of multiple modalities including whole body motion capture, multi-channel foot force, EMG muscle activity, and EEG brain activity to investigate transitions and dynamics of gestural synergies.

- Skateboarding lends itself well to a neuroergonomic investigation of whole-body movement. Skateboarding is a dynamic task requiring transition and sequencing of multiple whole-body gestural synergies.

- Performance of various types of kickturns are evaluated on a precision targeting task. Neural correlates of performance during the task as well as subject level correlates of performance during mental imagery of the skateboarding task are investigated.

今後の展開

- The future objective is to utilize information regarding neural correlates of performance together with neuromodulation techniques (e.g. decoded neural feedback, transcranial brain stimulation tACS, FUS) to enhance task related skill.

テーマ「万博、そしてその先へ ～科学技術が描く未来～」との関連

- This research has considerable implications for the development of neuroergonomic technology that can be applied beyond enhancing athletic performance to also include treatment for rehabilitation after injury as well as for skill learning in the ageing population.

Toward Prediction and Enhancement of Human Performance

Multi-Modal Data Collection
Brain (EEG)　Muscle (EMG)
Foot Forces　MOCAP

Brain Processes Underlying Whole-Body Movement Gestures

Biomechanical Model MOCAP Joint Angles
Motor Control Signal Of Various Gestures
Foot Forces
EMG
Extraction of Brain Activity and Artifacts
Brain Activity Related to Kickturn Gestures

Skateboard Ramp Experimental Results
EMG, Foot Force, and EEG activity during Kickturn

Brain Activity Correlated with Trial Level Task Performance
Alpha
Gamma
γ
Inferior Parietal Cortex (Sensorimotor Processing & Attention)

Brain Activity during Mental Imagery Correlated with Subject Level Task Performance
loβ　midβ
Premotor Cortex (Motor Planning)　Prefrontal Cortex (Executive Control & Attention)

3 すべての人に健康と福祉を
16 平和と公正をすべての人に
4 質の高い教育をみんなに
9 産業と技術革新の基盤をつくろう

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