Validating the use of a multiuser brain-computer interface to investigate inter-brain synchronization during a shared robot control task.

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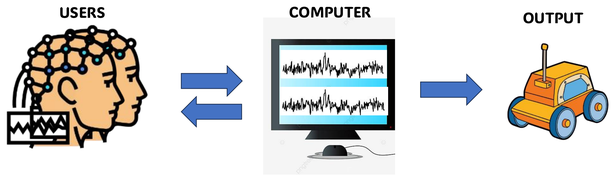
Background

Inter-brain synchronization: neural coordination between individuals, commonly seen during social interaction.

An increasingly popular social interaction activity is recreational robotics.



mBCIs can promote synchrony during shared tasks by recording neural signals from multiple users & translating task-relevant activity into goal-oriented output.

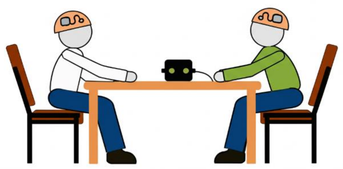
Research Question

Can a shared visual imagery-based robotics task elicit interbrain synchronization in a participant pair?

Methods & Analysis

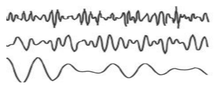
1 Data Collection (1 participant pair)

5s of visual imagery (imagined robot motion), 5s of robot motion, and 5s of rest for 40 offline and 40 online trials.



One non-disabled adult participant pair wearing EEG headsets.

2 Signal Filtering & Preprocessing



3 Validation

Extract average power in different frequency bands.

Train machine learning classifiers to identify visual imagery vs. rest states.

4 Interbrain Synchronization Analysis

Measure brain synchrony via phase-locking values (PLVs).

Average the PLVs between different brain regions.

A shared robot control task driven by a multiuser brain-computer interface (mBCI) shows potential for promoting brain synchrony between paired participants

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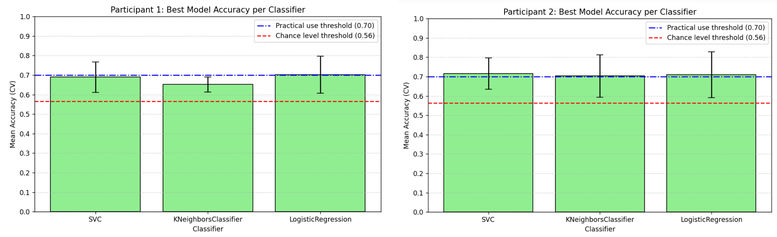
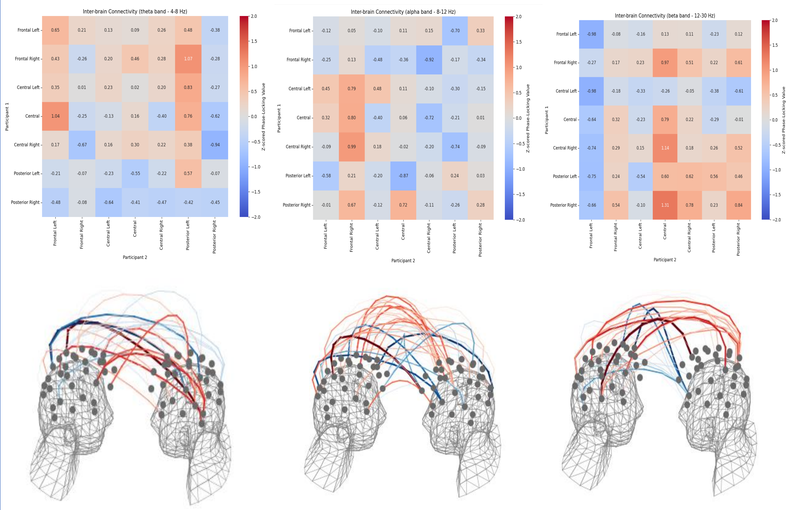
Results

Machine Learning Validation



For each participant, at least one classifier attains practical accuracy (0.70) in distinguishing visual imagery from rest.

Interbrain Synchronization



Preliminary results indicate relatively greater synchronization between central and frontal regions and, to a lesser degree, central and posterior regions.

Conclusion

The mBCI setup enables reliable shared control of a robot through visual imagery alone.

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Promising patterns of neural coordination were observed between participants during this shared visual imagery robotics task.

Next Steps

1. Conduct more sessions to increase data availability.

2. Draw general conclusions about task-specific coordination amongst different brain regions.

Relevance to Holland Bloorview

mBCI technology helps clients with complex communication needs...

Overcome social interaction barriers in shared activities.

Participate to their full capacity in collaborative recreational contexts.