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Online brain machine-interface auto-delete based on motor cortical activity

Stanford researchers at the Shenoy Lab have tested a method that can detect and predict the outcome of brain machine interface (BMI) tasks using motor cortical brain activity. It can improve performance of BMI by auto-deleting incorrect selections using a classifier on neural spiking activity from motor cortex to decode task outcome.
This method has been successfully implemented in an online non-human primate BMI experiment. In real time experiment with closed-loop BMI control, the team identified motor cortical neural signals indicative of task error occurrence. Task outcomes were detected in real time with 93% accuracy and upcoming task outcomes were predicted with 83% accuracy using neural activity alone. This novel strategy can help increase the performance and clinical viability of BMIs.

Stanford researchers develop brain-controlled typing for people with paralysis.

Stage of Research:

- Proof-of-concept
- The study described in the figure above showed that a signal correlated with task outcomes is present in motor cortex and can be used to increase the performance of BMIs.
- Continued research to improve the method and test with human participants

Applications

- Incorporate the algorithm in human brain machine interface (BMI) to increase performance (e.g., virtual keyboard typing rate).

Advantages

- **Increased performance/typing rate by 20%**
- **High accuracy** – 93% accuracy for detecting task outcomes and 83% accuracy for predicting upcoming task outcomes in real time
- **Error detection is based on neural activity alone**
- **Improves upon current BMI technology:**
  - Current BMI only decode kinematic signals, not neural activity
  - Current BMI have reduced typing rates due to wrong characters and errors
- Use of error signal for auto-delete can **help increase the ease of use and clinical adoption of BMIs**

Publications

- Even-Chen N, Stavisky S, Kao JC, Ryu SI, Shenoy KV (2015), "An auto-correcting brain machine interface: Error detection using spiking neuronal activity in the motor cortex." *37th Annual International Conference of the IEEE Engineering in Medicine and Biology Society*, Milan, Italy: 71-75.

Patents

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