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A COLLABORATIVE BCI TRAINED TO AID GROUP DECISIONS INA VISUAL SEARCH TASK WORKS WELL WITH SIMILAR TASKS

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ABSTRACT: This study tests the possibility of using collaborative brain-computer interfaces (cBCIs) trained with EEG data collected during a decision task to enhance group performance in similar tasks.

INTRODUCTION

Collaborative brain-computer interfaces (cBCIs) have recently been used to enhance human performance in decision making [1-3]. For instance, [2,3] estimated the confidence of each user in each decision from a combination of neural common spatial patterns (CSP) features and response times (RTs), and used this estimate to weigh individual responses and obtain superior group decisions. In this abstract, we explore the possibility of using a cBCI trained with data gathered in a decision task to estimate the decision confidence of participants doing a different visual search task.

METHODS

Ten participants took part in two visual search experiments in counterbalanced order. In Exp. 1, participants had to say if a vertical red bar was present in a display with 40 bars shown for 250 ms (Fig. 1(left)) [2], while Exp. 2 involved more realistic scenes shown for 250 ms with many penguins and observers had to say if a polar bear was present (Fig. 1(right)) [3]. Decision confidence was estimated by least angle regression (LAR) using four EEG CSPs (extracted from stimulus- and response-locked epochs lasting 1.5 s and recorded from 64 channels) and RTs. Data from Exp. 1 were used to compute the CSP matrices and to train LAR of each participant, while data from Exp. 2 were used to evaluate the performance of groups of increasing sizes formed off-line [2], and *vice versa*.

RESULTS

Fig. 1 shows the mean error rates of groups of increasing sizes making decisions using (a) the majority rule, (b) a cBCI trained and tested on data from the same experiment (using 10-fold cross-validation), and (c) a cBCI trained on data from one experiment and tested on data of the other. Results show that the latter cBCI, albeit worse than the former cBCI, is still significantly better than majority (Wilcoxon signed-rank test $p < 0.05$) for all even group sizes in Exp. 1 and all group sizes 2–8 in Exp. 2.

a)

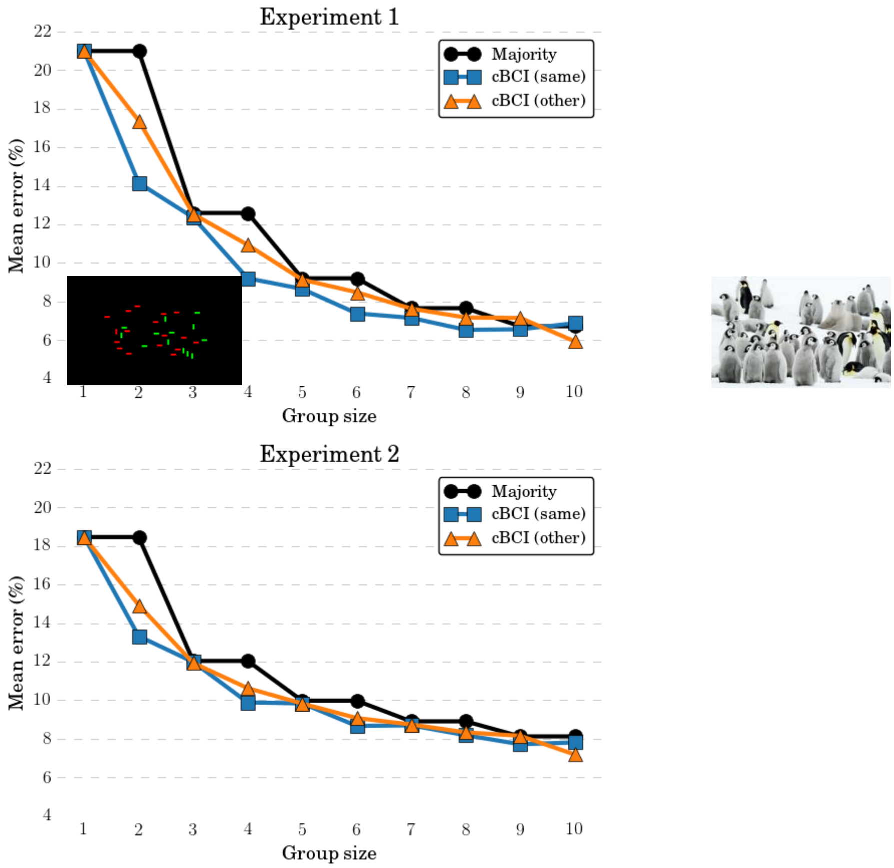

Figure 1. Percentage of erroneous decisions made by groups of increasing sizes using standard majority (black line), and the proposed cBCIs trained on data from the other (orange line) or the same (blue line, used for reference) experiment. Examples of stimuli used are also shown.

CONCLUSIONS

We showed that our cBCI improves group performance in a visual search task over majority even when trained on data gathered in a different search task. This suggests that a form of transfer learning is possible, which may, in the future, lead to marked gains in practicality (e.g., training times).

REFERENCES

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