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| **Project Name** | *EEG Hyperscanning During Cooperative and Competitive Interaction* |
| **Project Type** | *Replication and Research* |
| **Team Name** | *GEE* |
| **Project Team** | *Artem Sevastopolsky – specializes in deep learning for computer vision and biomedical data analysis*  *Andrei Znobishchev – specializes in classical and novel machine learning methods for analysis of EEG and ECoG, experiment setup;* |
| **Who suggested** | *Atrem Sevastopolsky and Andrei Znobishchev* |
| **Proposal** | *Hyperscanning is the simultaneous recording of brain activity of multiple subjects. High temporal resolution of EEG provides an opportunity to study cerebral processes generated by social interactions. Recent studies showed that such characteristics as Information flow, Granger causality and others can be reliably detected when subjects interact cooperatively [1], [2]. Identified cooperative features might indicate how well a group of people will cope with each other and work as a team. This should be useful for assessing a team of co-workers, sports team members, video-game players and so forth.* |
| **Specific Tasks & Expected results** | * *Replicate one experiment from the paper (“hit the ball” experiment [3] with two conditions: 1) each player vs. PC independently; 2) players cooperate playing against the PC;* * *Conduct 3 novel experiments:*  1. *Prisoner’s Dilemma experiment (also, with two conditions – independently against PC and cooperating against PC);* 2. *Playing a shooter game, i.e. Counter Strike in a simplified map (two conditions – independently against PC and cooperating against PC);* 3. *Reading and listening experiment. Two conditions: 1) a subject reads a piece of text while recording his speech; the other subject listens to the pre-recorded speech; 2) a subject reads a piece of text to the other subject;*  * *Collect data from at least two subjects in the experiments described above;* * *Preprocess data (import, rereference, remove artifacts);* * *Calculate and statistically analyze features such as Information flow between various EEG channels [4], [5], [6], [7];* * *Visualize obtained results.* |
| **Relevant papers** | *[1] Czeszumski A., et al., “Hyperscanning: A Valid Method to Study Neural Inter-brain Underpinnings of Social Interaction”, 2020;*  *[2] Balconi M., Vanutelli M., “Cooperation and Competition with Hyperscanning Methods: Review and Future Application to Emotion Domain”, 2017;*  *[3] Sinha N., et al., “EEG hyperscanning study of inter-brain synchrony during cooperative and competitive interaction”, 2016;*  *[4] Astolfi L., et al., “Imaging the Social Brain by Simultaneous Hyperscanning During Subject Interaction”, 2011;*  *[5] Astolfi L., et al., “Study of the Functional Hyperconnectivity between Couples of Pilots during Flight Simulation: an EEG Hyperscanning Study”, 2011;*  *[6] Babiloni F., et al., “High Resolution EEG Hyperscanning During a Card Game”, 2007;*  *[7] Stone D., et al., “Hyperscanning of Interactive Juggling: Expertise Influence on Source Level Functional Connectivity”, 2019;*  *[8] Sangtae A., et al., "Interbrain phase synchronization during turn*‐*taking verbal interaction—a hyperscanning study using simultaneous EEG/MEG", 2017.* |
| **Grading Scheme** | *Number of experiments implemented and conducted;*  *Appropriateness of the EEG preprocessing pipeline;*  *Quality of the statistical analysis of the features;*  *Comprehensibility of the feature visualization.* |