**A SSVEP-BCI model to make correct decisions on traffic signs**

R. Hübner1, P. V. O. Miguel2, L. B. R. Aylon3, G. Barreto4

1Computer Department (DACOM), Federal University of Technology – Paraná (UTFPR), 2 Informatics Department (DIN), State university of Maringá (UEM), 3Technical College of Campinas (COTUCA), 4Faculty of Electrical and Computing Engineering (FEEC), University of Campinas (UNICAMP).

**Introduction:** Brain-Computer Interfaces (BCI) has been used to perform an interaction with electrical and electronic devices. Applications in BCI paradigms are used as patterns to map the brain interface and what it will be externally controlled. A widely paradigm used for that purpose is Steady State Visual Evoked Potential (SSVEP), where frequencies evoked by the user can be discriminated through the acquisition of a signal obtained by an electroencephalogram (EEG) positioned in the user's visual cortex. In this study, we used a BCI to assist in potentially risky traffic situations, in this case, traffic signs to make a correct decision. Such decisions may be to stop a vehicle or not, which can bring some danger to the individual making a decision.

**Materials and Methods:** In order to perform the data acquisition, it was used a low cost EEG equipment. The equipment used is the OpenBCI board, in the version with 32 bits of processing. The scenario used to create the decision situations was implemented through a computational simulation, thus preserving the integrity of the users. The software used are: OpenBCI GUI (EEG signal pipeline), OpenVibe (simulation, signal processing and feedback). Eight electrodes were scattered throughout the region in the visual cortex, respecting the 10-20 system and the duration of each experiment was six minutes, with a single user, and it was performed three times. The simulation presents a view of a driver inside a car, who is observing traffic lights that may be red or green. The main filters used are Common Spatial Pattern (CSP) and bandpass filters (Butterworth). The extraction of characteristics was applied in this sequence: squaring, signal average and logarithm. The classifier used was the Linear Discriminant Analysis (LDA).

**Results:** Some results were obtained in this preliminary experiment. The experiment was performed with a simulation with only green and red traffic lights and sound signals (cop whistle), and the user would have to make only one decision: to stop the car or not. This decision is known in the literature as “go” and “no-go”, and it was obtained an accuracy rate of 73% in the best case. Using the SSVEP-BCI paradigm we are able to increase this accuracy significantly.

**Discussion:** The first results demonstrate this methodology can be used to make the correct decision in a situation of risk, which are applied in the simulation of driving a vehicle. Some issues must still be better studied such as standardizing the duration of events, improving signal filtering and compare other classifiers to select the correct stimuli. On the other hand, "plastering" the model to get best results implies that the simulation will be far from reality.

**Conclusion:** Preliminary results and current related works confirm that with the use of an BCI model using Event Related Potential (ERP) paradigm, it is possible to characterize external events with a neural interface. With the current study we want to increase the accuracy of the obtained results using an initially SSVEP-BCI model as well as at the same time to approximate the simulation of real situations.

**References:** [1] D. Valeriani; R. Poli; C. Cinel, "Enhancement of Group Perception via a Collaborative Brain-Computer Interface," in IEEE Transactions on Biomedical Engineering, vol.PP, no.99, pp.1-1; [2] Venthur, B., Dähne, S., Höhne, J., Heller, H., and Blankertz, B. (2014). Wyrm: A Brain-Computer Interface Toolbox in Python. Neuroinformatics. [3] Ignas Martišius and Robertas Damaševičius, “A Prototype SSVEP Based Real Time BCI Gaming System,” Computational Intelligence and Neuroscience, vol. 2016, Article ID 3861425, 15 pages, 2016.