This is the title of your abstract for the 12th Scientific FORTH Retreat

Andrew Zacharakis [12#], **Manthos Kampourakis** [2], **Orestis Mousouros** [12], **Ganna Palagina** [35], **Jochen Meyer** [4], **Ioannis Smyrnakis** [2], **Strelios Manolis Smirnakis** [35], **Maria Papadopouli** [12]

[1] Department of Computer Science, University of Crete, Heraklion Greece

[2] Institute of Computer Science, Foundation for Research and Technology-Hellas, Heraklion, Greece

[3] Brigham and Womens Hospital, Harvard Medical School, Boston, MA 02115

[4] Department of Neurology, Baylor College of Medicine, One Baylor Plaza, Houston, TX, USA

[5] Boston VA Research Institute, Jamaica Plain Veterans Administration Hospital, Harvard Medical School, Boston, United States

Presenting author: Andrew Zacharakis, email: csd3762@csd.uoc.gr
* Corresponding author: Maria Papadopouli, email: mgp@ics.forth.gr

ABSTRACT

Absence epilepsy is a common childhood disorder featuring frequent cortical spike-wave seizures with a loss of awareness and behavior. Using the calcium indicator GCaMP6 with in vivo 2-photon cellular microscopy and simultaneous electrocorticography, we examined the collective activity profiles of individual neurons and surrounding neuropil in layer 2/3 (L2/3) of the visual cortex during spike-wave seizure activity over prolonged periods in 2 different stargazer mice. Our long-term objective is to predict in real-time a seizure. In this work, we focused on identifying the neuronal networks activated during epochs of interictal activity (i.e., between seizure activities) and seizure activity and analyzed their functional network connectivity. During interictal activity, most neurons are functionally connected with a large number of neighbors within the field of view, while in seizure epochs, the connectivity is reduced substantially. We also examined the discriminating power of groups of neurons in identifying seizure events. An SVM model based on the firing activity of neurons can reasonably accurately classify the interictal activity vs. seizure (e.g., 69.5% for interictal activity, 89% for seizure windows). We are in the process of examining further whether the activity of specific groups of neurons, with distinct temporal dynamics, can further improve the classification of seizure events and enable the prediction of seizure events in real-time. Specifically, we examine how STTC analysis can help us define neuronal groups whose activity as a group differs between seizure and interictal state for further improving classification. We observed that the networks take changes before EEG absence seizure onset, and therefore, there is a time window that makes detection possible. Moreover, the integration of the history of the previous successive windows can further improve the prediction accuracy of seizure events.

REFERENCES

[1] A. Zacharakis, M. Kampourakis, O. Mousouros, G. Palagina, J. Meyer, I. Smirnakis, S. M. Smirnakis, M. Papadopouli, "Functional Network Connectivity Analysis in Absence Epilepsy Using Stargazer Mice".