**Prediction of Temporal Decision Based on Electrophysiological Activity of rats Pre-frontal Cortex**

G. C. Tunes1, M. B. Reyes1, D. C. Soriano2,3

1CMCC, UFABC, 2CECS, UFABC, 3Brazilian Institute of Neuroscience and Neurotechnology (BRAINN)

**Introduction:** Time is an intrinsic variable in animal behavior. It isimportant for surviving. For instance, when a predator is hunting, it has to estimate precisely the prey time reaction, so it will have its dinner. The neural basis of time perception has been a target of several studies [1]. The involvement in several regions and some types of neurons was found in animals trained in tasks that require some temporal organizations learning. Neurons that seem to encode a time interval were described on the hippocampus, thalamus, and prefrontal cortex. Furthermore, cells that present several types of electrophysiologic behavior were identified, for instance, some neurons increase (or decrease) their spike rate linearly, or some neurons that fire in specific time instants after a start cue [2,3].By developing a classification algorithm for temporal decision it is possible to study and extract information and features from neurons, and to determine the population that is correlated to time perception.

**Materials and Methods:** We recorded 165 neurons from the prefrontal cortex of 3 implanted rats. The data was recorded while the animal was performing a temporal perception task named DRRD (Differential Reinforcement Response Duration). At this task, the rats should hold his nose at the nose poke through an interval time equal or larger than 1500 ms to win a reinforcement (glucose solution). The data was recorded and processed by TDT (Tucker-Davis Technologies) hardware and software. In order to develop the classification algorithm, we selected the intervals that the rats held on his response through at least 1000 ms up to 2000 ms. By considering a 1 ms bin interval we constructed an adjacency matrix of the delays between spikes of two different neurons. The algorithm developed compared an adjacency matrix of each trial, with a template of trials corrects and incorrect, to classify this as a correct or incorrect trial. To compare the trials with the template we used the mean square error between the adjacency matrixes. To evaluate the algorithm efficacy we constructed a confusion matrix.

**Results:** After repeating the classification procedure one hundred times for each rat, we get the mean and median of the confusion matrixes. The results suggest an aleatory classification algorithm since the percentage of correct judged trials was fifty percent or around this value. Bellow, we present the mean ± standard deviation confusion matrix of one rat.

**Table 1:** Mean Confusion Matrix of one rat.



**Discussion:** The results show that the classification algorithm was not able to distinguish correct from incorrect trials. There are two possible explanations for these results. First, there is no correlation between time perception and firing rate of neuron pairs. Second, the classification algorithm needs to be refined in order to select neurons and bins that are important to distinguish the groups of the trials considered.

**Conclusion:** The classification algorithm developed until now was not able to classify trials correct and incorrect. We intend to implement different types of classification algorithm in the future, to select the relevant features of the data.

**References:** [1] BUHUSI, CV et al., Nature Reviews Neuroscience, 6(10): 755–65, 2005; [2] Komura, Y et al., Nature 412(6846): 546, 2001; [3] EICHENBAUM, H., Nature Reviews Neuroscience, 15(11): 732-744, 2014.