NENS Exchange Grant Report

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Period of training stay: February 4th – March 30th 2019
Host lab: Neural Computation lab, Instituto Italiano di Tecnologia, Italy
Home lab: Cognitive and Systems Neuroscience lab, SILS, University of Amsterdam, the Netherlands

From February 4th to March 30th, I conducted a training stay in the Neural Computation lab of dr. Stefano Panzeri at the Instituto Italiano di Tecnologia in Rovereto, Italy. During my 2-month stay in this lab, I focused on learning more about analysis methods based on information theory.

We live in a multisensory world where are constantly creating percepts based on more than one sensory modality. However, how our brain is able to effortlessly integrate information from different sensory modalities is not yet well understood. Therefore, one goal of my PhD is to elucidate mechanisms by which visual responses, as measured in the visual cortex of the domestic ferret, are modulated by external influences, such as the presence of a sound. One of the experiments that I conducted investigated what the effect of the audio on visual processing was, when the audio was presented at different temporal offsets with respect to the visual stimulus. By investigating this stimulus onset asynchrony, the second stimulus could turn into a predictor or a distractor for the first stimulus.

Conventional data analysis methods on LFP signals, such as event-related potential analyses or spectral analyses, rely on prior assumptions, such as linearity and stationarity of the signal. In contrast, information theory methods have close to zero assumptions and try to capture any form of relation between the stimulus and response. Moreover, without many assumptions, the approaches can be considered to be more comparable across different experiments and papers. Although these conventional methods provide a general idea of how the brain processes the outside world, more complex structures underlying brain mechanisms might be unveiled by utilizing analyses based on information theory techniques. This is the goal of the Neural Computation lab where I conducted my training stay, funded by NENS.

Preliminary results that I obtained during my stay, show that the respective timing of the visual and auditory stimuli affect the mutual information signature per trial. Clusters of recorded channels show different patterns, which complement the responses of the classical analysis methods, but also shed new light on non-linear patterns in my data. Currently, I am trying correlate this function with anatomical data to see if these clustered responses are restricted to specific cortical layers, and intend to draft a manuscript about the obtained results and include it in my PhD thesis. The collaboration that I started during my fellowship in the Neural Computation lab, will still continue now that I am back in the Netherlands.

Even though it was at times a bit overwhelming to be an experimentalist in a lab with only computational neuroscientists, the seemingly complex mathematics was broken down in chunks that were easy to chew, and everyone was very willing to answer all of my questions. Even the ones I did not know I had. They taught me about all the interesting analyses you can do when you move a bit more away from the biology towards the mathematics and in turn, I could answer their questions about electrophysiological experiments and add to the discussion about biological interpretability of their abstract measures with my neurobiological background. Directly after my return, I have started to transfer the knowledge I obtained to my co-workers, since the analysis methods that I learned can be utilized on other datasets that me and my colleagues have obtained as well.

With my stay at the Neural Computation lab in Rovereto, I have gained better insight in the field of Computational Neuroscience and I appreciated this interdisciplinary experience a lot. All of this knowledge transfer was of course powered by great Italian coffee, good food and when I was not looking at my computer screen I enjoyed the spectacular views of the mountains. Furthermore, I established a future collaboration, obtained skills and knowledge previously not available (in my lab) and on top of it all met and got to work closely some really nice and talented scientists. I consider my NENS training stay a great success and want to thank the NENS committee for making this financially possible.

