Properties of solutions of periodically forced neural field models

L3 internship Project

Neural fields are continuous assemblies of mesoscopic models arising when modeling macroscopic parts of the brain such as the primary visual area V1. They are modeled by nonlinear integro-differential equations [1]. The study of the stationary solutions of these equations allowed to reproduce neural hallucinations [2] and to model the orientation tuning in V1 simple cells [3] based on symmetry breaking arguments. We propose to go further in this study by looking at dynamical behaviours that are generated by periodic forcing of the equations. This has been used to model flicker induced geometric phosphenes for example in [4]. The goal of this internship is to compute the time periodic solutions of these neural field equations and predict/explain some geometric phosphenes. Depending on the preference of the intern, the study could be more theoretical or more numerical. The theoretical study would take advantage of the symmetries of the network (e.g. tools from equivariant bifurcation theory [5]). For the numerical study, the intern is asked to develop a set of classes in C++ based on the Trilinos library (Sandia Labs) [6] that will be used either on the cluster or on GPUs.

Advisors : This project is located at INRIA, Sophia-Antipolis under the supervision of Romain Veltz (contact: romain.veltz@inria.fr), Olivier Faugeras (contact :olivier.faugeras@inria.fr) and Pascal Chossat.

References

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[6] http://trilinos.sandia.gov/