(light) PhD seminar

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Seminar Room, BCAM

Asymptotic behaviour of neuron population models structured by elapsed-time

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We consider two nonlinear partial differential equation models structured by elapsed time for dynamics of neuron population and give some improved results for long time asymptotics. The first model we study is a nonlinear version of the renewal equation, while the second model is a conservative drift-fragmentation equation which adds adaptation and fatigue effects to the neural network model. These problems were introduced in [1] and [2].

We prove that both the problems are well-posed in a measure setting. Both have steady states which may be unique depending on further assumptions. In order to show the exponential convergence to a steady state, we use a technique from the theory of Markov processes called Doeblin's method. This method was used in [3] for demonstrating the exponential convergence of solutions of the renewal equation to its equilibrium. It is based on the idea of finding a positive quantitative bound for solutions to the linear problem. This leads us to prove the spectral gap property in the linear setting. Then by exploiting this property, we prove that both models converge exponentially to a steady state.

References

[1] K. Pakdaman, B. Perthame and D. Salort: Dynamics of a structured neuron population, Nonlinearity, 23 (1), 55-75 (2010)

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[3] P. Gabriel: Measure solutions to the conservative renewal equation, arXiv:1704.00582, (2017)

[4] J. A. Cañizo and H. Yoldaș: Asymptotic behaviour of neuron population models structured by elapsed- time, arXiv: arXiv:1803.07062, (2018)