Dynamics and bifurcations of a map-based neuron model

Frank Fernando Llovera Trujillo
Gdansk University of Technology
frankllovera91@gmail.com
Justyna Signerska-Rynkowska
Gdansk University of Technology
justyna.signerska@pg.edu.pl

The Chialvo Model is a well known 2D discrete scheme to describe the dynamics of single neurons. However the existing analytical and numerical results do not yield complete picture of its dynamics. In some parameters regime this system can be viewed as singularly perturbed

(nonlinear) discrete system. Observing, that the fast-subsystem is given by the S- unimodal map, we are able to precisely describe the dynamics of the reduced 1D model

and extend some of these results to the full model. In particular we study flip and saddle-node bifurcations and chaotic behaviours in the model, interpreting them in terms of Izhikevich-Hoppensteadt classification of bursting mappings which is important from the point of neuron's electrophysiology and excitability properties. Our analytical findings are illustrated numerically.