

Kinetic Theory for Neuronal Networks

The mammalian cerebral cortex is highly recurrently connected. This makes understanding the dynamical states which arise in cortical tissue a difficult computational problem. One way to address this problem, which has proven fruitful, is to consider a statistical ensemble of neurons bombarded by a large number of inputs. Therefore, one recasts the problem in terms of a probability distribution over the internal states of the neurons, and enforces self-consistency in the network by matching inputs and outputs. The main limitation of this approach in general is that it is not convenient when the dynamics are non-stationary.

Here I will highlight the example of a network of so-called quadratic integrate-and-fire neurons. For this case we have just discovered that this approach can actually give an exact description of the network firing rate in the large network limit.