Dynamics of interactions between discrete and distributed delays in neural networks

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Time delays are known to be an essential feature of neural networks, having significant effects on neural dynamics. Whilst discrete time delays may provide a more convenient mathematical representation, when considering long-range neural connections it is important to account for variations in associated time delays. In this talk I will discuss the dynamics of a uni-directionally coupled Hopfield-type ring network of neurons with discrete delays in self-coupling, and distributed delays for nearest-neighbour coupling. Analytical and numerical results demonstrate how stability and bifurcations of the trivial steady state are affected by the parameters of the delay distribution and the coupling. I will also show the results of numerical simulations illustrating different types of periodic oscillations, which include fully symmetric and discrete travelling wave (splay-state) solutions.