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“Delay systems and machine learning applications”

A single dynamical system with time-delayed feedback (DDE) can emulate networks. This property of delay systems made them extremely useful tools for Machine Learning applications. Here we describe several possible setups. The first setup is the reservoir computing where the DDE plays the role of a high-dimensional reservoir that performs specific computational tasks. We discuss which dynamical properties of such a reservoir are important. These properties include the conditional Lyapunov exponents and the eigenvalue spectrum of the linearized DDE. The second setup is the Deep Neural Network, which can be emulated with a DDE. We present a method for folding a deep neural network of arbitrary size into a single neuron with multiple time-delayed feedback loops. This single-neuron deep neural network consists of only a single nonlinearity and appropriately adjusted modulations of the feedback signals. The connection weights are determined via a modified back-propagation algorithm that we have developed for such networks.

The Seminar will take place online via Zoom as part of the Oberseminar “Nonlinear Dynamics” organized by Bernold Fiedler (FU Berlin), Isabelle Schneider (FU Berlin), Eckehard Schöll (TU Berlin) and Matthias Wolfrum (WIAS).

For information on how to access the event, please contact any of the above or:
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