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Identification of Complex Dynamical Systems with Neural Networks (1/2) ^[1]

Date:

Monday, 5 December, 2016 - 12:00 to 14:00

Location:

[IT Amphitheatre](#) ^[2]

The identification and analysis of high dimensional nonlinear systems is obviously a challenging task. Neural networks have been proven to be universal approximators but this still leaves the identification task a hard one. To do it efficiently, we have to violate some of the rules of classical regression theory. Furthermore we should focus on the interpretation of the resulting model to overcome its black box character. First, we will discuss function approximation with 3 layer feedforward neural networks up to new developments in deep neural networks and deep learning. These nets are not only of interest in connection with image analysis but are a center point of the current artificial intelligence developments. Second, we will focus on the analysis of complex dynamical system in the form of state space models realized as recurrent neural networks. After the introduction of small open dynamical systems we will study dynamical systems on manifolds. Here manifold and dynamics have to be identified in parallel. Third, we will move on to large closed dynamical systems with hundreds of state variables and will compare causal versus retro-causal models of the observations. The combination of these models will lead us to an implicit description of dynamical systems on manifolds. Fourth, we will discuss the quantification of uncertainty in forecasting. In our framework the uncertainty appears as a consequence of principally unidentifiable hidden variables in the description of large systems. Finally we will end up with a discussion on causality and predictability.

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