RTG 2224

KoMSO

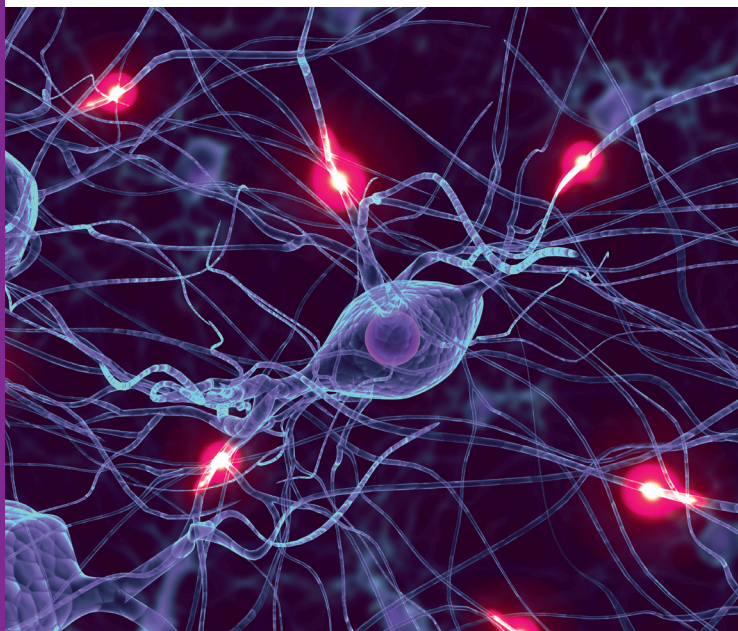
π^3 – KoMSO Training Course

Neural Networks

Dr. Hans-Georg Zimmermann (Siemens AG)
October 12 – 14, 2016 • 10 AM – 5 PM

University of Bremen
Bibliothekstraße 1, Building MZH, Room 1460, 28359 Bremen
For registration please send an email to: hauberg@uni-bremen.de

www.KoMSO.org or www.math.uni-bremen.de/rtg-pi3



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Neural Networks

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 feed forward 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 systems 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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