ALPEN-ADRIA UNIVERSITÄT KLAGENFURT

Invitation to the Doctoral Seminar

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"Why deep artificial neural networks overcome the curse of dimensionality in PDE approximation"

I.2.01 | Wednesday, 28 November 2018 | 11:15 a.m.

Abstract

In recent years deep artificial neural networks (DNNs) have very successfully been employed in numerical simulations for a multitude of computational problems including, for example, object and face recognition, natural language processing, fraud detection, computational advertisement, and numerical approximations of partial differential equations (PDEs). Such numerical simulations indicate that DNNs seem to be able to overcome the curse of dimensionality in the sense that the number of real parameters used to describe the DNN grows at most polynomially in both the reciprocal of the prescribed approximation accuracy and the dimension of the function which the DNN aims to approximate in such computational problems. While there is a large number of rigorous mathematical approximation results for artificial neural networks in the scientific literature, there are only a few special situations where results in the literature can rigorously explain the success of DNNs when approximating high-dimensional functions. In this talk it is revealed that DNNs do indeed overcome the curse of dimensionality in the numerical approximation of Kolmogorov PDEs with constant diffusion and nonlinear drift coefficients. The presented ideas for proving this crucially

rely on the fact that the artificial neural network used to approximate the solution of the PDE really is a deep artificial neural network with a large number of hidden layers. This talk is based on a joint work with Arnulf Jentzen and Diyora Salimova [https://arxiv.org/abs/1809.07321].

Michaela Szölgyenyi and the Department of Statistics look forward to seeing you at the talk!