ALPEN-ADRIA UNIVERSITÄT KLAGENFURT

Invitation to the Doctoral Seminar

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“Solving partial differential equations with deep learning”

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Abstract

High-dimensional PDEs appear in many fields, such as physics, engineering and finance. Even though they are indispensable in many applications, their numerical solution has been a longlasting computational challenge. The feasibility of widely used finite difference methods is limited due to the "curse of dimensionality", i.e. discretizing the space-time dimension leads to an explosion of grid-points. In the last few years new techniques based on deep neural networks have gained popularity and were successfully used in many areas. Recently, the power of deep neural networks could also be extended to solve large classes of high-dimensional semilinear or nonlinear PDEs. One method makes use of the probabilistic representation of the corresponding PDE solution based on backward stochastic differential equations. In particular the gradient and the Hessian terms showing up in the BSDE are approximated with neural networks. Other methods for so-called "Kolmogorov equations" rely on the representation of PDEs as infinite dimensional stochastic optimization problems, that are spatially discretized by means of fully connected deep neural networks. In this talk, I will give an introduction to deep neural networks and discuss both methods. I will then show how they can be applied to PDEs resulting from stochastic

control problems.

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