# Approximation theory, Numerical Analysis and Deep Learning

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The development of new classification and regression algorithms based on deep neural networks coined Deep Learning revolutionized the area of artificial intelligence, machine learning, and data analysis. More recently, these methods have been applied to the numerical solution of high dimensional partial differential equations with great success.

This talk will start with a brief introduction to machine learning and deep learning. Then we will show that the problem of numerically solving a large class of (high-dimensional) PDEs (such as linear Black-Scholes or diffusion equations) can be cast into a classical supervised learning problem which can then be solved by deep learning methods. Simulations suggest that the resulting algorithms are vastly superior to classical methods such as finite element methods, finite difference methods, spectral methods, or sparse tensor methods. In particular we empirically observe that these algorithms are capable of breaking the curse of dimensionality. In the last part of the talk we will present theoretical results which confirm this observation.