Partial Differential Equations Seminar

Title Spectral Barron Space and Convergence Analysis of Deep Ritz Method

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Date Aug 30th 2022, 11:00 ~ 13:00

Location Zoom 강연

Abstract

This talk mainly concerns the analysis of Deep Ritz Methods (DRM) proposed in "Weinan E and Bing Yu. The deep ritz method: a deep learning-based numerical algorithm for solving variational problems. *Communications in Mathematics and Statistics*, 6(1):1-12, 2018", a popular neural-network-based method for solving high dimensional PDEs. We first define the spectral Barron space, a suitable function space for the analysis of neural networks. Then we present some functional-analytic properties of spectral Barron spaces and discuss the well-posedness of the Poisson equation in this function space setting. In the second part of this talk, we will utilize the Barron space framework in order to prove the convergence of DRM. More precisely, we derive the generalization error bounds of two-layer neural networks in the framework of the DRM for solving Poisson equation on the d-dimensional unit hypercube, and prove that the convergence rates of generalization errors are independent of the dimension d. The main references of this talk are "Andrew R Barron. Universal approximation bounds for superpositions of a sigmoidal function. *IEEE Transactions on Information theory*, 39(3):930-945, 1993" and "A Priori Generalization Analysis of the Deep Ritz Method for Solving High Dimensional Elliptic Partial Differential Equations, Proceedings of Machine Learning Research vol 134:1-46, 2021".

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