UNIVERSITY AT ALBANY
State University of New York

College of Arts and Sciences
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Analysis and Data Science Seminar

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Superconvergence Approximation and Optimal Generalization Analysis of Deep Neural Networks for Solving Partial Differential Equations

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3:00 P.M. in Massry B012

Abstract. Neural networks have emerged as powerful tools for solving partial differential equations (PDEs), with broad applications in engineering, physics, and biology. In this talk, we investigate the performance of deep neural networks for PDE solvers, focusing on two fundamental sources of error: **approximation error** and **generalization error**. The approximation error characterizes the gap between the exact PDE solution and the representational capacity of the neural network hypothesis space, while the generalization error reflects the difficulty of learning from finite samples. We first analyze the approximation properties of deep neural networks under Sobolev norms, where **superconvergence phenomena** can be achieved, and discuss how deep architectures help mitigate the curse of dimensionality. We then present sharp generalization error bounds, providing theoretical insight into when and why deep neural networks can outperform shallow models in the numerical solution of PDEs.