Certification of physics-informed neural networks for solving PDEs

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Physics Informed Neural Networks (PINNs) have frequently been used for the numerical approximation of Partial Differential Equations (PDEs). We will investigate two topics concerning the certification of PINNs for the solution of PDEs. First, we describe a training process, where the loss function is a rigorous upper bound of the error. This is achieved by a wavelet representation of the residual and an adaptive computation of the dual norm of the residual. The second topic concerns any given PINN for solving a PDE and aims at constructing rapidly computable lower and upper bounds for the error of the PINN approximation. This is achieved by an embedding strategy. We show numerical examples for stationary and instationary problems.

This talk is based upon joint work with Lewin Ernst (Ulm) and Nikolaos Rekatsinas (Heraklion).