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| | **abstract** | | **abstract** | In this paper, we propose multi-scale deep neural networks (MscaleDNNs) using the idea of radial scaling in frequency domain and activation functions with compact support. The radial scaling converts the problem of approximation of high frequency contents of PDEs' solutions to a problem of learning about lower frequency functions, and the compact support activation functions facilitate the separation of frequency contents of the target function to be approximated by corresponding DNNs. As a result, the MscaleDNNs achieve fast uniform convergence over multiple scales. The proposed MscaleDNNs are shown to be superior to traditional fully connected DNNs and be an effective mesh-less numerical method for Poisson-Boltzmann equations with ample frequency contents over complex and singular domains. | | |
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