Physics-Inspired Convolutional Neural Network for Solving Inverse Scattering Problems

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The talk aims to solve a full-wave inverse scattering problem (ISP), which is a quantitative imaging problem, i.e., to reconstruct the permittivities of dielectric scatterers from the knowledge of measured scattering data. This is also referred to as an inverse medium problem. This talk proposes the convolution neural network (CNN) technique to solve full-wave ISPs. In order to make machine learning more powerful, a deep understanding of the corresponding forward problem is desirable. In solving ISP, the concept of induced current plays an essential role in the proposed CNN technique, which enables us to design architecture of learning machine such that unnecessary computational effort spent in learning wave physics is minimized or avoided. Numerical simulations demonstrated that the proposed CNN scheme outperforms a brute-force application of CNN. The proposed deep learning inversion scheme is promising in providing quantitative images in real time.

References:

[1] Z. Wei and X. Chen, "Deep Learning Schemes for Full-Wave Nonlinear Inverse Scattering Problems," *IEEE Trans. on Geoscience and Remote Sensing*, to appear, 2019.