Department of Mathematics

The Chinese University of Hong Kong

數學系

香港中文大學

Applied and Computational Mathematics Seminar

Physics-Assisted Machine Learning for Solving Inverse Scattering Problem

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Abstract

The talks address inverse scattering problem (ISP) using physics-assisted machine learning (ML). Solving wave imaging problems using ML has attracted researchers' interests in recent years. However, most existing works in this direction directly adopt ML as a black box. ML approaches have not yet had the profound impact on scientific computation problems as they have had for object classification. In fact, researchers have gained, over several decades, much insightful domain knowledge on wave physics and in addition some of these physical laws present well-known mathematical properties (even analytical formulas), which do not need to be learnt by training with a lot of data. The talks demonstrate that it is of paramount importance to address the problem of how profitably combining ML with the available knowledge on underlying wave physics.

This talk introduces some engineering inverse problems that my team has addressed using physics-assisted machine learning, as well as fundamentals of machine learning. In solving ISP using machine learning, to effectively apply available knowledge on underlying wave physics, we find that it is important to discuss the mathematical and physical principles of the corresponding forward problem.

Bio: Xudong Chen received the B.S. and M.S. degrees from Zhejiang University, China, and the Ph.D. degree from the Massachusetts Institute of Technology, USA. Since 2005, he has been with the National University of Singapore, Singapore, where he is currently a Professor. He has published 170 journal papers on inverse scattering problems, material parameter retrieval, microscopy, and optical encryption. He has authored the book Computational Methods for Electromagnetic Inverse Scattering (Wiley-IEEE, 2018), which has been adopted as a textbook by more than 10 undergraduate- and graduate-level courses worldwide. His research interests include mainly electromagnetic wave theories and applications, with a focus on inverse problems and computational imaging. Dr. Chen was a recipient of the Young Scientist Award by the Union Radio Scientifique Internationale in 2010 and a recipient of the Ulrich L. Rohde Innovative Conference Paper Award at ICCEM 2019 conference. He was an Associate Editor of the IEEE Transactions on Microwave Theory and Techniques during 2015-2019 and is currently an Associate Editor of IEEE Transactions on Geoscience and Remote Sensing and IEEE Journal of Electromagnetics, RF and Microwave in Medicine and Biology. He has been members of organizing committees of more than 10 conferences, serving as General Chair, TPC Chair, Award Committee Chair, etc. He was the Chair of IEEE Singapore MTT/AP Joint Chapter in 2018. He is a Fellow of IEEE and a Fellow of Electromagnetics Academy.

Date: 11 August 2022 (Thursday)
Time: 10:00am – 11:00am (Hong Kong Time)
ZOOM link: https://cuhk.zoom.us/j/93608693812
Meeting ID: 936 0869 3812
Passcode: 917808

All are Welcome