Multiresolution Deep Learning

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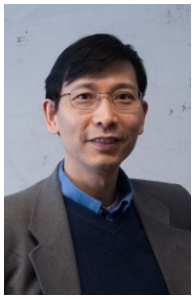
Abstract: Deep learning provides a major breakthrough in AI and has been widely adopted for increasingly complex and large-scale machine learning problems including image classification, speech recognition, language translation, drug discovery, and self-driving vehicles. However, recent studies have shown that deep learning neural networks (i.e., deep neural networks) are highly *vulnerable* to small and imperceptible perturbations in the input space. While there exist numerous studies to attempt to address this challenge, we take a different direction, and introduce multiresolution learning into the deep learning technology. In this talk, I will introduce and review the original idea and work of multiresolution learning, its success in shallow neural networks, and then present our new work on multiresolution deep learning. I will show that multiresolution deep learning can significantly improve the robustness of convolutional neural networks. We demonstrate this improvement in terms of both noise and adversarial robustness using well-known image datasets. Our work suggests that multiresolution learning may offer a simple yet effective solution toward constructing robust deep neural network models for image recognition.

Yao Liang's BioSketch



Yao Liang received his B.S. degree in Computer Engineering and M.S. degree in Computer Science from Xi'an Jiaotong University, Xi'an, China. He received his Ph.D. degree in Computer Science from Clemson University, Clemson, USA, in 1997.

He is currently a Professor in the Department of Computer Science, Indiana University Purdue University Indianapolis (IUPUI), USA. His research interests include wireless sensor networks, Internet of Things, cyberinfrastructure, machine learning, neural networks, open data and model integration, data engineering, and distributed systems. His research projects have been funded by NSF. He has received the 2019 Glenn W. Irwin, Jr., M.D., Research Scholar Award, IUPUI. He was a General Co-Chair of The International Conference on Big Data Engineering (BDE) in 2019-2022. Dr. Liang has given invited talks and lectures at various universities and conferences in US, Europe and China.