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Learning to Optimize: Training Deep Neural Networks for Wireless Resource Management

by

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Abstract: In this work, we propose a new learning-based approach for wireless resource management. The key idea is to treat the input and output of a resource allocation algorithm as an unknown non-linear mapping and to use a deep neural network (DNN) to approximate it. If the non-linear mapping can be learned accurately and effectively by a DNN of moderate size, then such DNN can be used for resource allocation in almost real time, since passing the input through a DNN to get the output only requires a small number of simple operations. In this work, we first discuss a few theoretical issue related to this approach. We characterize a class of 'learnable algorithms' and then design DNNs to approximate some algorithms of interest in wireless communications. Further, we rigorously characterize how the approximation error scale as a function of the size of DNN. Finally, we use extensive numerical simulations to demonstrate the superior ability of DNNs for approximating a state-of-the-art algorithm that is designed for power allocation in wireless transmit signal design, while giving orders of magnitude speedup in computational time.

Biography: Mingyi Hong received his Ph.D. degree from University of Virginia in 2011. Since August 2017, he has been an Assistant Professor in the Department of Electrical and Computer Engineering, University of Minnesota. From 2014-2017 he has been a Black & Veatch Faculty Fellow and an Assistant Professor with the Department of Industrial and Manufacturing Systems Engineering, Iowa State University. Since Jan. 2017, he has been serving on the IEEE Signal Processing Society Signal Processing for Communications and Networking (SPCOM) Technical Committee. His works have been selected as finalists for the Best Paper Prize for Young Researchers in Continuous Optimization by the Mathematical Optimization Society in 2013, 2016. His research interests are primarily in the fields of optimization theory and applications in signal processing and machine learning.

***** ALL are welcome *****

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