

Title of Seminar: Neural Feature Learning for Engineering Problem



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Thursday, September 26
10:30 A.M. • MSEE 112

Abstract

Using deep neural networks as elements of engineering solutions can potentially enhance the overall performance of the system. Engineering problems are often more complex than the currently popular applications of DNNs, such as image or natural language problems, in that 1) we often have domain knowledge in various forms, including constraints, preference, and loss metrics; 2) we often look for parameterized solutions for a collection of scenarios, which are all different from the one where the training data is collected; 3) we often need to process multi-modal inputs with different time scales, resolutions, or qualities; and 4) because of the tight resource constraints, we often employ more complex sample management techniques such as the use of contrastive negative samples or augmentation. Facing these fundamentally more complex situations, we argue that the existing practices that use DNNs as black boxes can be insufficient.

In this talk, we discuss a new analysis method based on an information theoretic approach to study multivariate dependence. We define a new metric to measure the semantics of the information contents carried by features learned in a DNN and, based on that, a new architecture to separate the contributions of the different variables to the multivariate dependence. We demonstrate how to use this architecture to allow domain knowledge to be incorporated in the learning process. We use the example of symbol detection in wireless fading interference channels to discuss some of the key issues and steps in such solutions.

Bio

Lizhong Zheng is a Professor in the [Department of Electrical Engineering and Computer Science](#) at [MIT](#). He works in the general area of information theory, statistical inference, data processing, wireless communications and networks.

Lizhong Zheng received the B.S. and M.S. degrees from the Department of Electronic Engineering at Tsinghua University, and the PhD degree from the Department of Electrical Engineering and Computer Science at UC Berkeley. Since 2002, he has been teaching at MIT, where he is currently a professor of Electrical Engineering and Computer Science.

Lizhong Zheng is a PI in the [Research Laboratory of Electronics \(RLE\)](#). His current research interest include statistics, information theory, and their applications in data science. He received the NSF CAREER Award, AFOSR Young Investigator Award, the IEEE Information Theory Society Paper Award. He is an IEEE Fellow, and currently an area editor for the IEEE Transactions on Information Theory.

Host

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