CRUNCH Seminars at Brown, Division of Applied Mathematics

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Paper review: DBSN: MEASURING UNCERTAINTY THROUGH BAYESIAN LEARNING OF DEEP NEURAL NETWORK STRUCTURES

Xuhui Meng

Bayesian neural networks (BNNs) introduce uncertainty estimation to deep networks by performing Bayesian inference on network weights. However, such models bring the challenges of inference, and further BNNs with weight uncertainty rarely achieve superior performance to standard models. In this paper, we investigate a new line of Bayesian deep learning by performing Bayesian reasoning on the structure of deep neural networks. Drawing inspiration from the neural architecture search, we define the network structure as gating weights on the redundant operations between computational nodes, and apply stochastic variational inference techniques to learn the structure distributions of networks. Empirically, the proposed method substantially surpasses the advanced deep neural networks across a range of classification and segmentation tasks. More importantly, our approach also preserves benefits of Bayesian principles, producing improved uncertainty estimation than the strong baselines including MC dropout and variational BNNs algorithms (e.g. noisy EK-FAC).