Statistics and Actuarial Science Seminar

Title: Understanding priors in Bayesian neural networks at the unit level

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Date: Mon 23rd November 2020 at 12:00PM

Location: Online

Abstract: We investigate deep Bayesian neural networks with Gaussian weight priors and a class of ReLU-like nonlinearities. Bayesian neural networks with Gaussian priors are well known to induce an L2, 'weight decay', regularization. Our results characterize a more intricate regularization effect at the level of the unit activations. Our main result establishes that the induced prior distribution on the units before and after activation becomes increasingly heavy-tailed with the depth of the layer. We show that first layer units are Gaussian, second layer units are sub-exponential, and units in deeper layers are characterized by sub-Weibull distributions. Our results provide new theoretical insight on deep Bayesian neural networks, which we corroborate with simulation experiments.