



## **Deep Learning Program Opening Workshop August 12-16, 2019**

### **SPEAKER TITLES/ABSTRACTS**

**Veronika Rockova**  
University of Chicago

“Posterior Concentration for Sparse Deep Learning”

We introduce Spike-and-Slab Deep Learning (SS-DL), a fully Bayesian alternative to dropout for improving generalizability of deep ReLU networks. This new type of regularization enables provable recovery of smooth input-output maps with unknown levels of smoothness. Indeed, we show that the posterior distribution concentrates at the near minimax rate for Hölder smooth maps, performing as well as if we knew the smoothness level  $\beta$  ahead of time. Our result sheds light on architecture design for deep neural networks, namely the choice of depth, width and sparsity level. These network attributes typically depend on unknown smoothness in order to be optimal. We obviate this constraint with the fully Bayes construction. As an aside, we show that SS-DL does not overfit in the sense that the posterior concentrates on smaller networks with fewer (up to the optimal number of) nodes and links. Our results provide new theoretical justifications for deep ReLU networks from a Bayesian point of view. (joint work with Nicholas Polson)