SPARSITY AND ROBUSTNESS IN MACHINE LEARNING: INSIGHTS FROM INVERSE PROBLEMS

LEON BUNGERT

In this talk I will discuss how the training of sparse and robust neural networks benefits from techniques developed in the context of inverse problems. First, I will present a method to train sparse neural networks in an inverse scale space manner based on Bregman iterations, originally developed in the context of compressed sensing and image processing. For this we embed Bregman iterations into a stochastic optimization framework and propose novel momentum-based and Adam-type algorithms. Second, I will explain how adversarial training, a robust training method, can be recast as variational regularization problem with a non-local and data-dependent total variation regularizer. Combining this with Gamma-convergence techniques, one can prove that for vanishing adversarial budget the method converges to a Bayes classifier with minimal total variation. Furthermore, a slight modification of adversarial training leads to a weighted mean curvature flow evolution of the decision boundaries.