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More is Less: Understanding Compressibility of Neural Networks via Implicit Regularization and Neural Collapse

Despite their recent successes, most modern machine learning algorithms lack theoretical guarantees, which are crucial to further development towards delicate tasks. One mysterious phenomenon is that, among infinitely many possible ways to fit data, the algorithms often find the “good” ones, even when the definition of “good” is not specified by the designers. In this talk I will approach this from both the microscopic view and the macroscopic view, with empirical and theoretical study of the connection between the good solutions in neural networks and the sparse solutions in compressed sensing. The key concepts are the implicit bias/regularization in machine learning models, and the neural collapse phenomenon induced by the block structure of neural tangent kernel, which can be used for out-of-distribution detection.