New Algorithms for Learning Incoherent and Overcomplete Dictionaries
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In sparse recovery we are given a matrix $A \in \mathbb{R}^{n \times m}$ ("the dictionary") and a vector of the form $AX$ where $X$ is sparse, and the goal is to recover $X$. This is a central notion in signal processing, statistics and machine learning. But in applications such as sparse coding, edge detection, compression and super resolution, the dictionary $A$ is unknown and has to be learned from random examples of the form $Y = AX$ where $X$ is drawn from an appropriate distribution — this is the dictionary learning problem. In most settings, $A$ is overcomplete: it has more columns than rows.

A popular algorithm (K-SVD) for dictionary learning uses top singular vectors in alternating minimization. However, no provable guarantee was known until recently. In this talk we show there is a simple algorithm for dictionary learning with provable guarantees. Moreover, K-SVD converges even when the current guess for the dictionary is only slightly correlated with the true dictionary.