Abstract: This talk presents a set of tools based on a Bayesian framework to address the general problem of sparse signal recovery, and discusses the challenges associated with them. Bayesian methods offer superior performance compared to convex optimization-based methods and are largely parameter tuning-free. They also have the flexibility necessary to deal with a diverse range of measurement modalities and structured sparsity in signals than hitherto possible. We discuss recent developments towards providing rigorous theoretical guarantees for these methods. Further, we show that, by re-interpreting the Bayesian cost function as a technique to perform covariance matching, one can develop new and ultra-fast Bayesian algorithms for sparse signal recovery. As example applications, we discuss the utility of these algorithms in the context of (a) 5G communications with several case studies such as wideband time-varying channel estimation, low-resolution ADCs, etc, and (b) controllability and observability of linear dynamical systems under sparsity constraints.

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