Abstract:
Compressed sensing is a new field that arose as a response to inefficient traditional signal acquisition schemes. Under the assumption that the signal of interest is sparse, one wishes to take a small number of linear samples and later utilize a reconstruction algorithm to accurately recover the compressed signal. Typically, one assumes the signal is sparse itself or with respect to some fixed orthonormal basis. However, in applications one instead more often encounters signals sparse with respect to a tight frame which may be far from orthonormal. In the first part of this lecture, we will introduce the compressed sensing problem as well as recent results extending the theory to the case of sparsity in tight frames. The second part of the lecture focuses on dictionary learning which is also a new field, but closely related to compressive sensing. Briefly speaking, a dictionary is an overcomplete and redundant system consisting of prototype signals that are used to express other signals. Due to the redundancy, for any given signal, there are many ways to represent it, but normally the sparsest representation is preferred for simplicity and easy interpretability. A good analog is the English language where the dictionary is the collection of all words (prototype signals) and sentences (signals) are short and concise combinations of words. In this lecture, we will introduce the problem of dictionary learning, its origin and applications, and existing solutions.