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Abstract: Sparse graphical models can capture uncertainty while promoting parsimony and simplicity - two attributes that can be utilized for identification of interactions and control of processes defined on a network. I will first advocate this modeling approach in the context of learning the sparse structure of gene-regulatory networks, which is critical not only to understand how cells differentiate and behave, but also to decipher mechanisms triggering diseases with a genetic component. The impact here is on the development of a new generation of drugs designed to target specific genes. As drug targeting efforts entail expensive laboratory tests, judicious planning of experiments is instrumental, and sparsity of their chemical-genetic interactions is the key enabler of an optimal design. In the context of wireless networks, I will subsequently demonstrate how sparsity emerges due to the geographical distribution of sources, and also due to the scarce RF spectrum utilized for transmission. Learning the characteristics of sparse wireless signal sources can markedly impact spectral efficiency, through the collaboration of cognitive radios reaching consensus in a decentralized network. If time allows, I will finally demonstrate that even traffic load prediction becomes possible by leveraging sparsity of the network structure along with historical data.