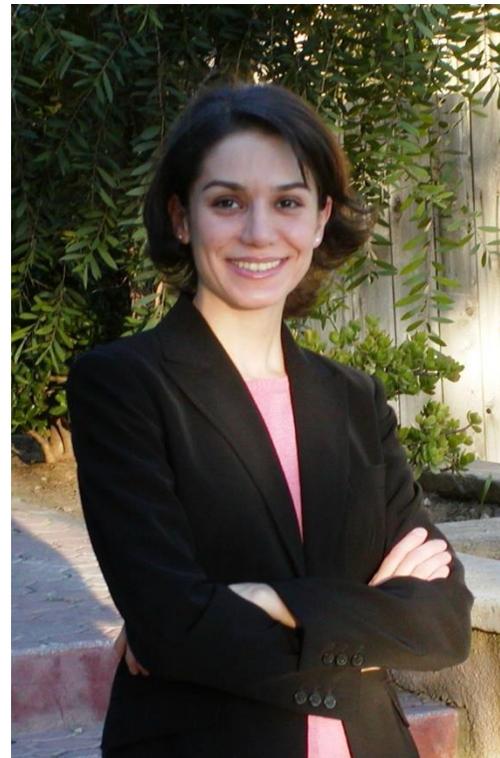


The Many Faces of Regularization: from Signal Recovery to Online Algorithms

ABSTRACT - Regularization plays important and distinct roles in optimization. In the first part of the talk, we consider sample-efficient recovery of signals with low-dimensional structure, where the key is choosing the right regularizer. While regularizers are well-understood for signals with a single structure (ℓ_1 norm for sparsity, nuclear norm for low rank matrices, etc.), the situation is more complicated when the signal has several structures simultaneously (e.g., sparse phase retrieval, sparse PCA). A common approach is to combine the regularizers that are sample-efficient for each individual structure. We present an analysis that challenges this approach: we prove it can be highly suboptimal in the number of samples, thus new regularizers are needed for sample-efficient recovery.

Regularization is also employed for algorithmic efficiency. In the second part of the talk, we consider online resource allocation: sequentially allocating resources in response to online demands, with resource constraints that couple the decisions across time. Such problems arise in operations research (revenue management), computer science (online packing & covering), and e-commerce (?Adwords? problem in internet advertising). We examine primal-dual algorithms with a focus on the (worst-case) competitive ratio. We show how certain regularization (or smoothing) can improve this ratio, and how to seek the optimal regularization by solving a convex problem. This approach allows us to design effective regularization customized for a given cost function. The framework also extends to certain semidefinite programs, such as online D-optimal and A-optimal experiment design problems.



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SPEAKER BIO - Maryam Fazel is an Associate Professor of Electrical and Computer Engineering at the University of Washington, with adjunct appointments in Computer Science and Engineering, Mathematics, and Statistics. Maryam received her MS and PhD from Stanford University, her BS from Sharif University of Technology in Iran, and was a postdoctoral scholar at Caltech before joining UW. She is a recipient of the NSF Career Award, UWEE Outstanding Teaching Award, UAI conference Best Student Paper Award (with her student), and coauthored a paper selected as a Fast-Breaking paper by Science Watch (2011). She co-leads the NSF TRIPODS Institute at UW on Algorithmic Foundations for Data Science (ADSI) and is an associate editor of SIAM journal on Optimization and SIAM journal on Mathematics of Data Science.