Adversarial Projections:

Projecting to Manifolds via Unsupervised Learning

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Outline

Upon describing the unprecedented empirical achievements and limited theory of deep learning architectures/algorithms/tricks, a recent paper[1] states:

> *The quests for a theory that could explain these ingredients has become the Holy Grail of data sciences.*

Goal: Fuse data-driven insights with classic optimization theory.

[1] Elad, Simon, Aberdam, *Another step toward demystifying deep neural networks*, 2020

Task: Solve inverse problems with indirect/noisy measurements.

Key Assumption: True data lay on a low dimensional manifold $\mathcal{M}$.

Difficulty: A priori regularization (e.g., sparsity or low TV) do not ensure solution estimates lay on manifold $\mathcal{M}$.

Contribution Overview:

1. Use indicator function for the manifold $\mathcal{M}$ as regularizer
2. Provide method to approximate the projection $P_{\mathcal{M}}$
3. Prove new method can approximate $P_{\mathcal{M}}$ to any precision, with high probability.

Remaining slides will be uploaded this week of December 6.