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The Hong Kong University of Science and Technology

Department of Mathematics

Mathematics Colloquium

Deep Proximal for compressive imaging

By

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Abstract

Recovering high-resolution images from limited sensory data typically leads to a serious ill-posed inverse problem, demanding inversion algorithms that effectively capture the prior information. Learning a good inverse mapping from training data faces severe challenges, including: (i) scarcity of training data; (ii) need for plausible reconstructions that are physically feasible; (iii) need for fast reconstruction, especially in real-time applications.

We develop a successful system solving all these challenges, using as basic architecture the recurrent application of proximal gradient algorithm. We learn a proximal map that works well with real images based on deep networks. Contraction of the resulting map is analyzed, and incoherence conditions are investigated that drive the convergence of the iterates.

I will talk about several experiments under different settings: (a) Compressive sensing (MRI reconstion from undersampled Fourier-space data) (b) Super-resolution of natural images. (c) Image denosing.

Our key findings include: 1. A recurrent ResNet with a single residual block unrolled from an iterative algorithm yields an effective proximal which accurately reveals MR image details. 2. Our architecture significantly outperforms conventional non-recurrent deep ResNets; it is also trained much more rapidly. 3. It outperforms state-of-the-art compressed-sensing Wavelet-based methods, with 100 times speedups in reconstruction time.

Date: **Monday, 14 January 2019**
Time: **4:00p.m. - 5:00p.m.**
Venue: **Room 5510, Academic Building (near Lifts 25 - 26), HKUST**

All are welcome!