Karlsruhe Institute of Technology

Communications Engineering Lab (CEL)
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Noise Learning-Based Denoising for Approximate Message Passing

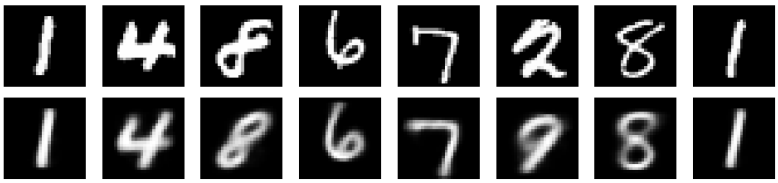
Master's Thesis

Project

Approximate Message Passing is a modern and powerful signal processing method that can recover signals from under-sampled measurements. An essential part of the AMP algorithm is the denoiser. The performance of AMP depends heavily on the choice of the denoiser, which must be selected according to the characteristics of the signal being recovered.

To accommodate complicated signals that cannot easily be defined in a closed form, deep-learning-based denoisers can be used. One such choice is autoencoders, which are already widely used for denoising. However, autoencoders tend to distort the images that they are used on. This makes them suboptimal denoisers for low-noise scenarios, which significantly affects the performance of the AMP.

Noise learning-based autoencoders overcome this flaw by learning the noise instead of the signal, therefore reducing the distortion in the high-SNR regions. In your master's thesis, you will investigate how noise learning-based autoencoders can be used to improve the performance of the AMP.



Tasks

1. Training autoencoders in Python,
2. Finding ways to optimize the performance of these autoencoders to work as a denoiser with the AMP.
3. Comparing the performance of the trained neural networks to existing works.

Requirements

- ✔ Foundations in probability theory and linear algebra,
- ✔ Interest in approximate message passing and neural networks,
- ✔ Interest in Python.

Institute

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