Training Image Estimators without Image Ground-Truth

Motivation

• CNN-based Image Estimators can reconstruct full images from incomplete or imperfect measurements (blurry, low-res, compressive).
• High-performance imaging with practical hardware.
• Training these estimators requires a large training set with ground-truth images. (chicken-and-egg)

Non-Blind Training

Supervision with a Swap-Loss:
Apply network on each measurement, take output estimate, synthetically measure with parameter of the other measurement, and compute loss.

Blind Training

• We need the measurement parameters to compute our swap-loss. But in blind training, these parameters (e.g., blur kernels) for the training set are unknown.
• We use another network to estimate measurement parameters from observations. But need training data to train this parameter estimation network!
• We generate a proxy training set on the fly using current estimates of full images, and measuring them with randomly generated training parameters.

Experiments: Compressive Sensing

Ground truth

[Ground Truth Image]

RecNet [12]

ISEA-Net [8]

Supervised Baseline (Ours)

Unsupervised Training (Ours)

PSNR:

24.89 dB

25.63 dB

24.34 dB

24.05 dB

Contribution

• We introduce unsupervised training method that works with only pairs of measurements, without any GT! (as in Noise2Noise, but for general linear measurements)
• Support for "blind training": when measurement parameters (like blur kernel) in the training set are unknown.

Experiments: Blind Face Deblurring

Ground truth

[Ground Truth Image]

Sharpened input

Unsupervised Training (Ours)

Blurred (Ours)

PSNR:

27.00 dB

25.60 dB

25.39 dB

25.39 dB

[Comparison Table]