Generalized Imaging Augmentation via Linear Optimization of Neurons (LION)

Motivation

- Optimizing combination weights of fixed deep features brings strict constraints that maintain image structure even using aggressive enhancing regularizations
- Application for both learning and non-learning computational imaging techniques

Principle

Two-stage optimization

Stage 1: fitting decoder to output pre-reconstruction (for non-learning methods)
\[
\min_{\theta} \| Net_\theta (I_d, \lambda = 1) - I_p \|^2
\]

Stage 2: weighting deep features
\[
\min_{\lambda} p_c(\text{Net}(I_d, \lambda)) + p_e(\text{Net}(I_d, \lambda))
\]

Color and texture enhancing term
\[
p_c(z) = \exp(-s(z) + c(z) + u(z)) \quad p_e(z) = \exp(-\nabla z)
\]

Experiments

LION outperforms optimizing all weights

LION for various applications

Underwater imaging

Lensless imaging

LightningNet+LION

FlatNet+LION

Zero-DSIpp

Reference

Lensless #1

Lensless #2

Lensless #3

FlatNet

FlatNet+LION

Zero-DSIpp

LCC

LCC+LION

LightenNet

LightenNet+LION

ORBN

ORBN+LION

DRBN

DRBN+LION

Zero-DSIpp

LightenNet+LION

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Lioness #1

Lioness #2

Lioness #3