

Super-Resolution Landscape

Ajinkya Indulkar

aindulkar@cs.umass.edu

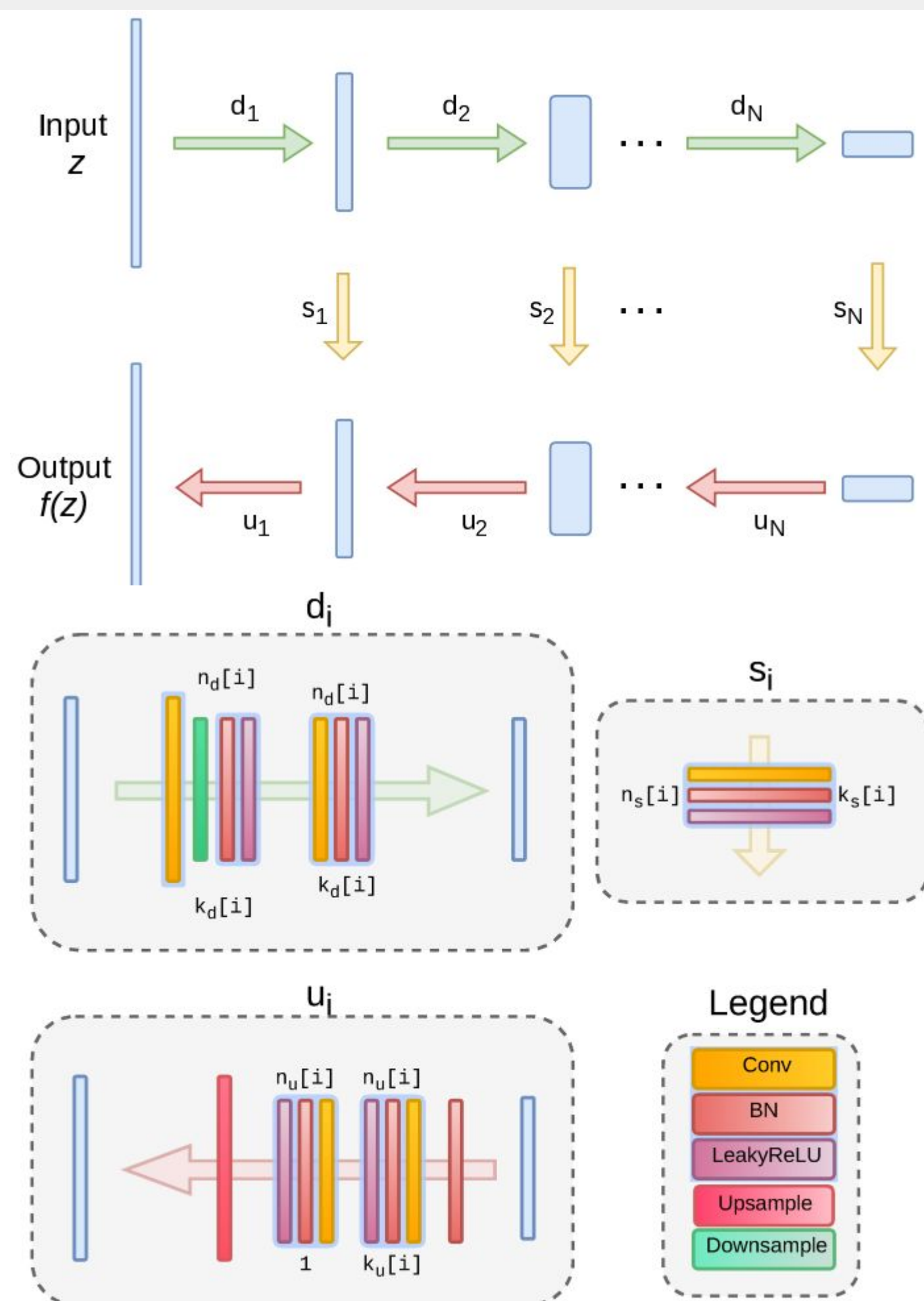
Sarvesh Upadhyay

supadhyay@cs.umass.edu

Problem

Convert **Low-res** to **High-res** (4x)Dataset = BSDS300^[1]Images of **Natural Scenes** with **200:100** split

Deep Image Prior^[2]



- No training dataset
- Random Initialization
- High inductive bias of generator neural network architecture
- CNN as natural image prior
- High noise impedance, low signal impedance
- Hourglass Architecture with skip connections

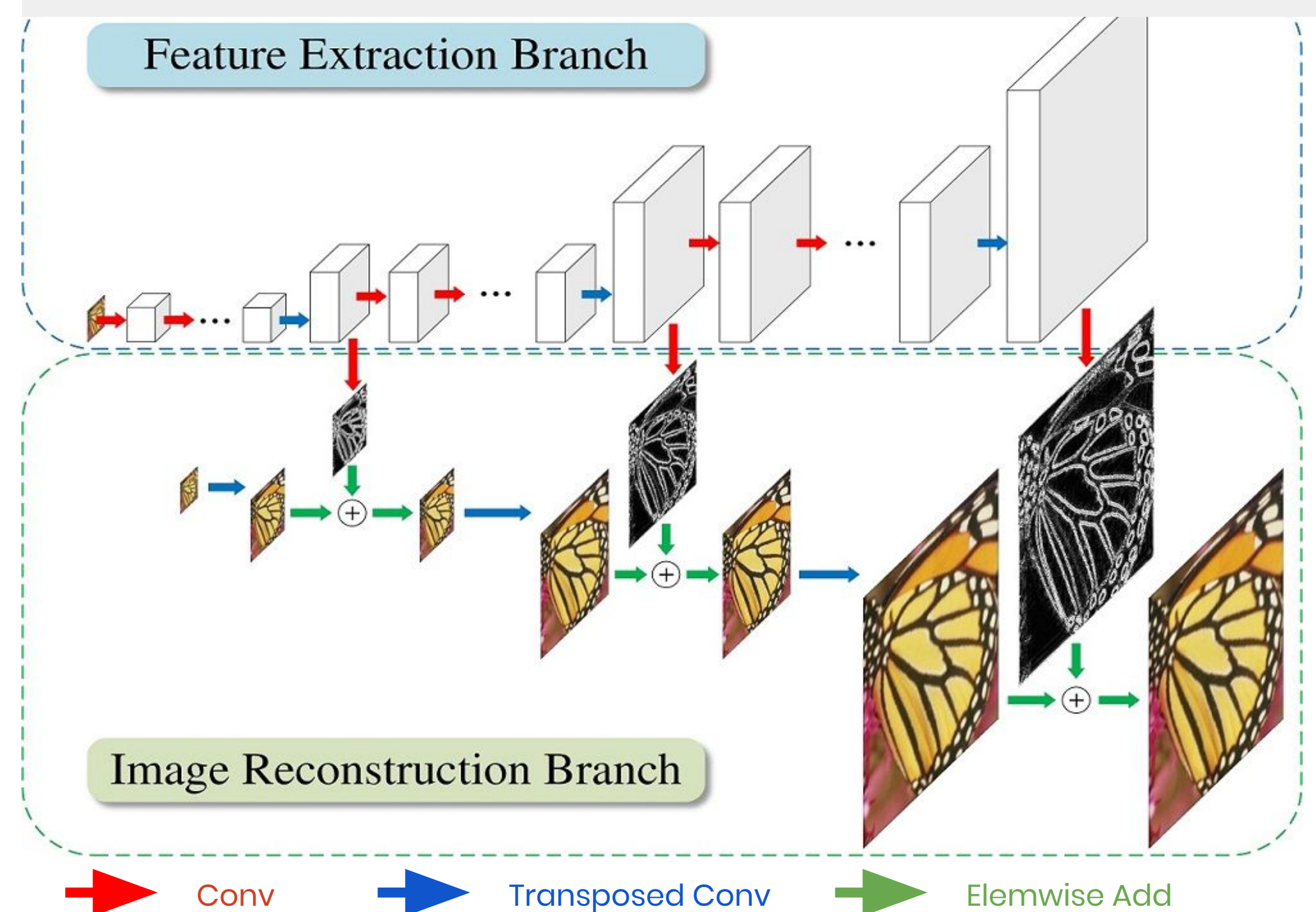
$$E(x; x_0) = \|d(x) - x_0\|^2$$

$$d(\cdot) : \mathbb{R}^{3 \times tH \times tW} \rightarrow \mathbb{R}^{3 \times H \times W}$$

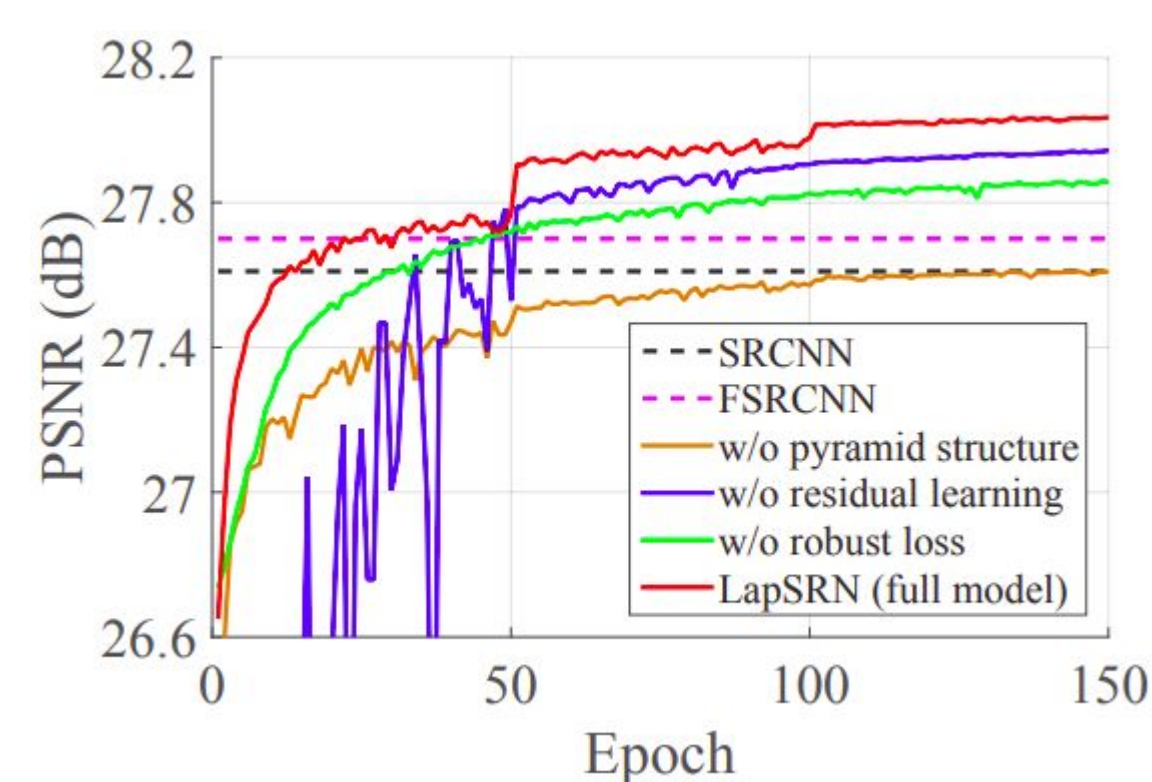
Solution

- Bicubic Interpolation (Baseline)
- LapSRN**
- Deep Image Prior**

LapSRN^[3]



- No predefined upsampling
- Multiple upsampling steps
- Data augmented training
- Joint Training
- Intermediate predictions 2X, 4X, 8X
- Charbonnier Loss



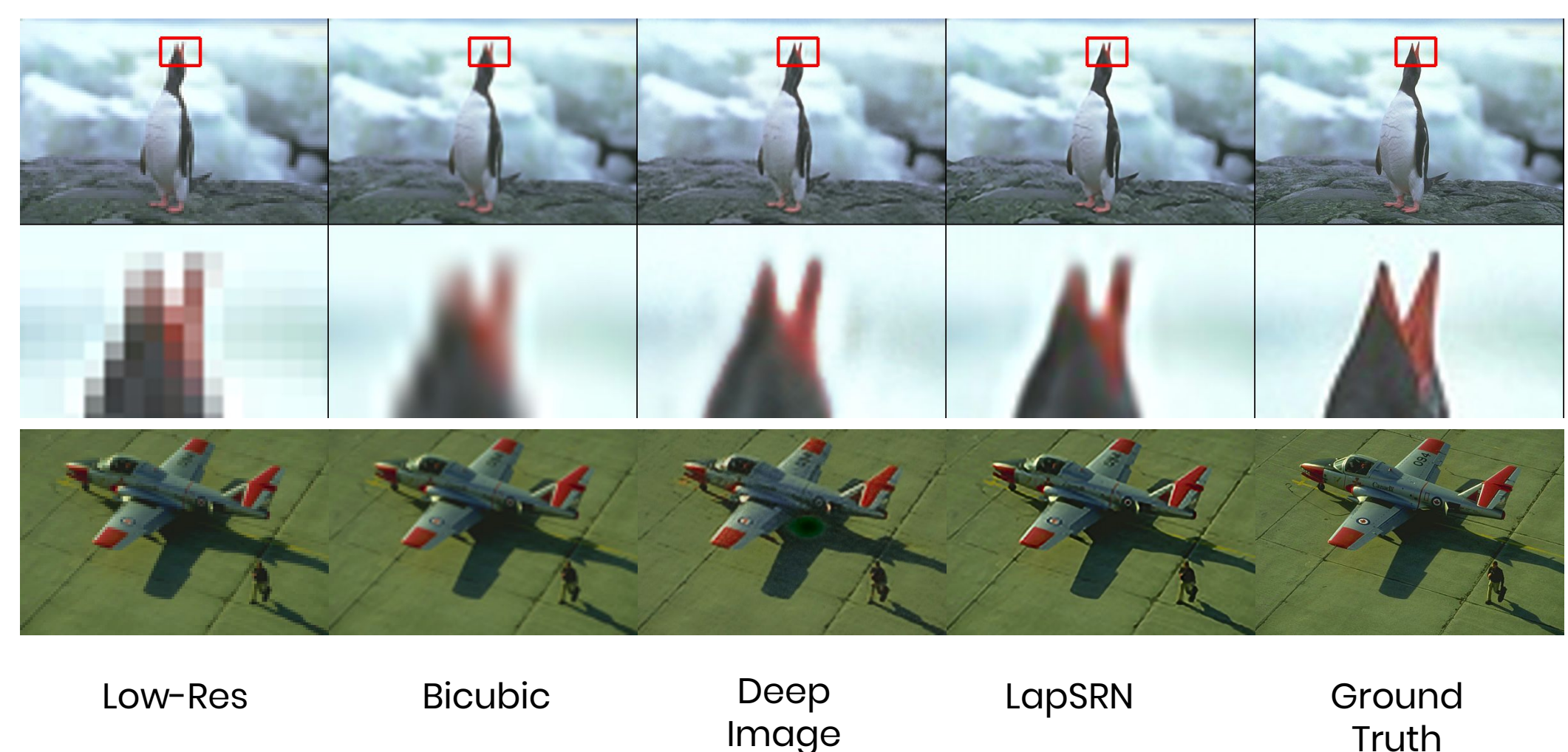
$$\mathcal{L}(\hat{y}, y; \theta) = \frac{1}{N} \sum_{i=1}^N \sum_{s=1}^L \rho(\hat{y}_s^{(i)} - y_s^{(i)})$$

$$\text{where } \rho(x) = \sqrt{x^2 + \varepsilon^2}$$

- Each level has individual loss functions

Results

Model	PSNR
Bicubic	25.09
Deep Image Prior	25.45
LapSRN	26.07



Low-Res

Bicubic

Deep Image

LapSRN

Ground Truth

Low-Res

Bicubic

Deep Image

LapSRN

Ground Truth

References:

- [1] Martin, David, et al. "A database of human segmented natural images and its application to evaluating segmentation algorithms and measuring ecological statistics." Computer Vision, 2001. ICCV 2001. Proceedings. Eighth IEEE International Conference on. Vol. 2. IEEE, 2001.
- [2] Ulyanov, Dmitry, Andrea Vedaldi, and Victor Lempitsky. "Deep Image Prior." arXiv preprint arXiv:1711.10925 (2017).
- [3] Lai, Wei-Sheng, et al. "Deep laplacian pyramid networks for fast and accurate super-resolution." Proc. IEEE Conf. Comput. Vis. Pattern Recognit.. 2017.