Single Image Super-Resoluton

& Low Light Enhancement

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Agenda

- **Problem Defination:** Increasing amount of image based data also increased the degradation of image quality. For eg the older the image lower the resolution it may have. On the other hand low light photos taken from various cameras including smartphones struggle to keep color contrast and full with noise.

- **Solution:** Instead of the traditional methods like bilinear, bicubic and Lorenz interpolation, the Use of CNN to accurately predict the higher resolution image with higher metrics and is more perceptually pleasing to the eye. Use of skip connectiona & Network in Network architecture maintaing the compactness with high efficiency. With few changes to the above mentioned CNN based model shows promising resluts to the low light images.

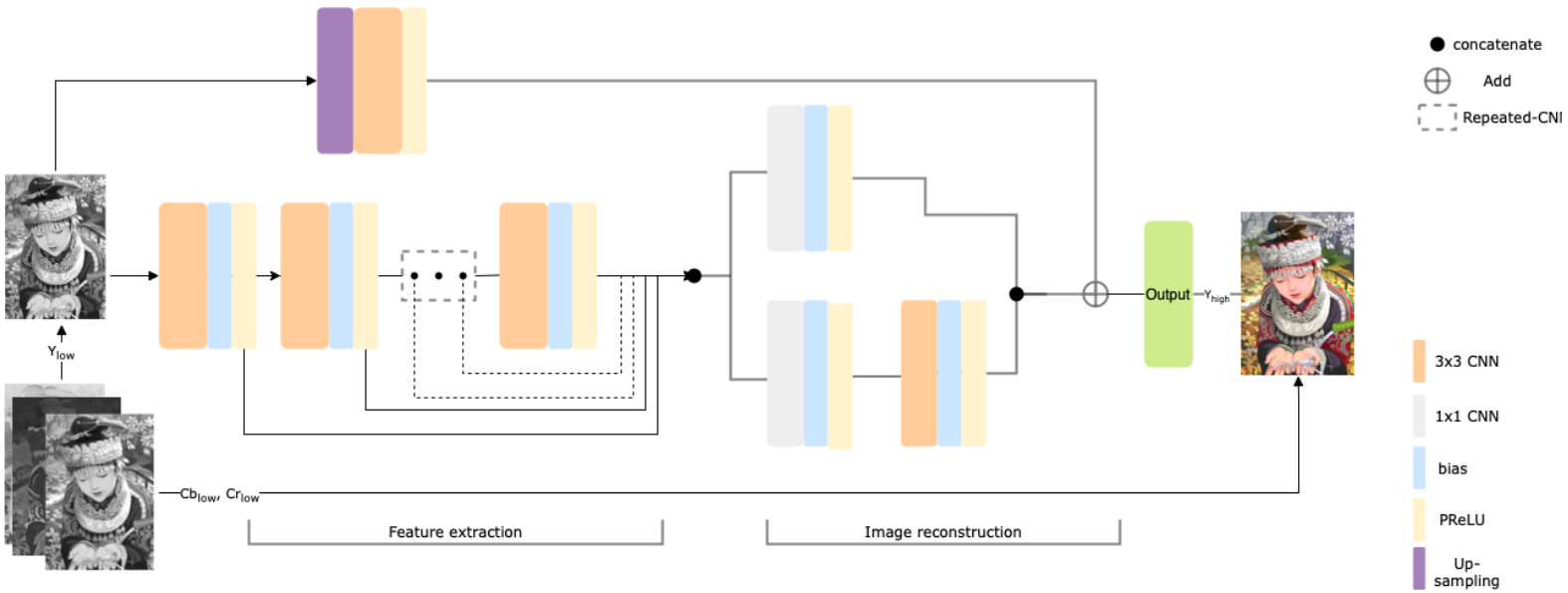
Our Goals

- **High perceptual image** Getting High perceptual image with good PSNR/SSIM result
- **Compactness:** The method should be compact enough to train on any GPU (including inteegrated GPUs) and inference must be fast enough that device like Iot's or embedded system can use it.
- **Balance between above two:** It is important that both of the above-mentioned goals succeed so the decision regarding change in architecture of the model should not affect the performance or efficiency.

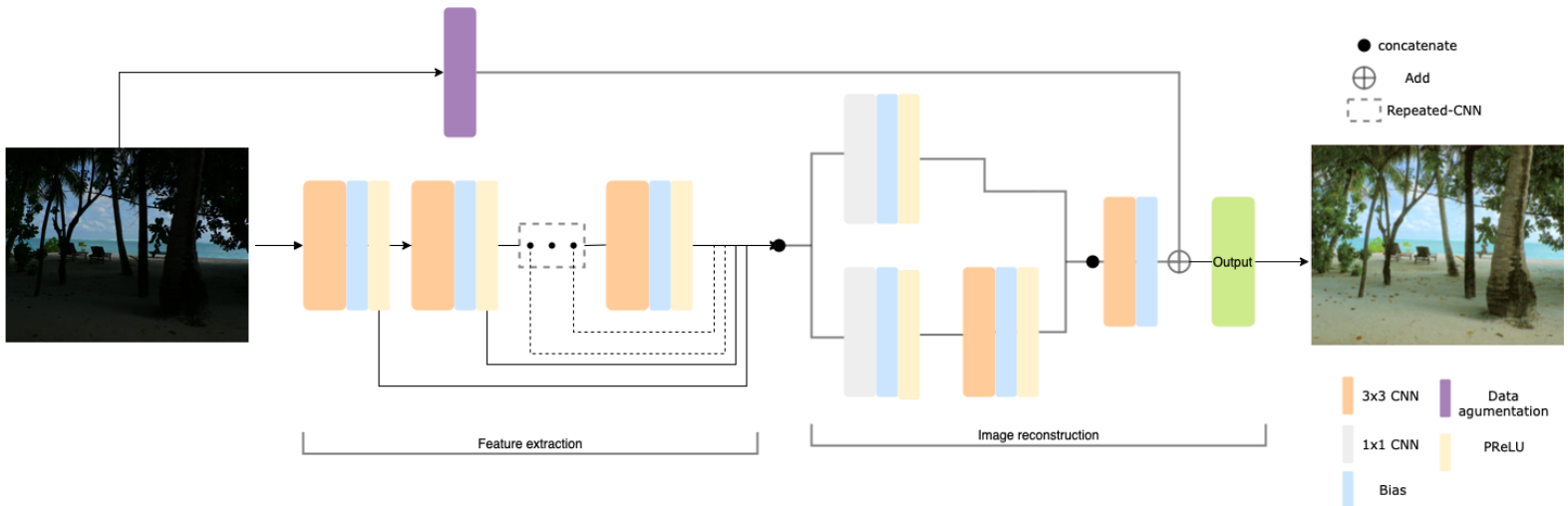
Technologies Used

Languages & Frameworks	**Use**
Tensorflow	For CNN and pre-build functions
Tensorflow-addons	Additional methods like WeightNormalization etc.
Opencv-python	Image processing and video processing
Numpy	Maths related functions
Weights and biases	Tracking the data and result
DIV 2K, BSD100	Datasets for training SISR
LOL, Retinex (Brusted Images)	Datasets for training Low light enhancemnet
Set 5, Set 14, BSD100	Datasets for testing SISR
LOL, VV, ExDark	Datasets for testing Low light enhancemnet

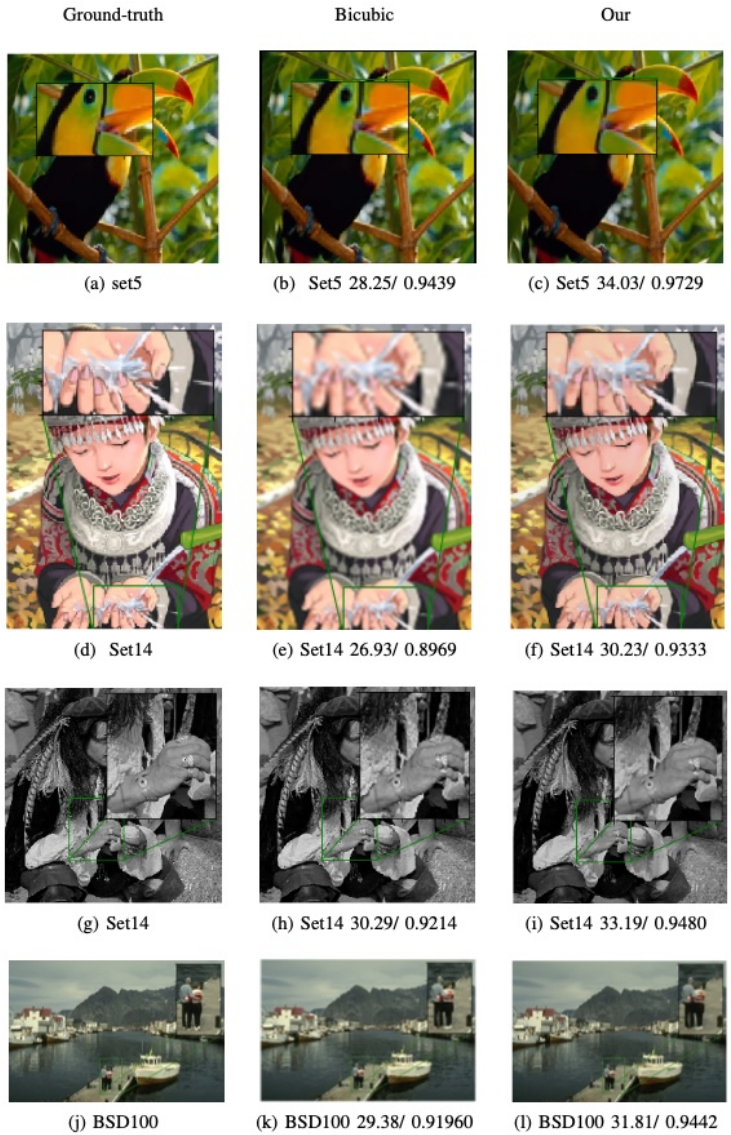
Architecture proposed in the paper for Super-resolution



Architecture proposed in the paper for Low light enhancement



Output on Set5, Set14 and BSD100 dataset for SSIM



PSNR/SSIM Result on datasets for SISR

Dataset (scale=2)	Bicubic	FSRCNN	c-DCSCN	Ours
Set5	33.65/0.9352	37.00/0.9558	37.15/0.9590	37.40/0.9541
Set14	30.24/0.8806	32.63/0.9088	32.74/0.9126	33.09/0.9123
BSD100	29.57/0.8447	31.53/0.8950	31.61/0.8956	32.21/0.9060

Table: PSNR/SSIM of datasets Set5, Set14 and BSD100 for SISR

PSNR/SSIM Result on datasets for Low light enhancement

Metric	PSNR	SSIM
LIME	15.16	0.60
Retinex-net	16.77	0.56
Zero-DCE	14.86	0.54
Enlighten-GAN	17.48	0.65
RUAS	18.23	0.72
Ours	19.23	0.72

Table: PSNR/SSIM result on LOL dataset from LIME, Retinex-net, Zero-DCE, Enlighten-GAN, RUAS and Ours

Output from VV dataset

Output from VV dataset

Output from VV dataset

Future Scope

- The proposed model to perform well on images taken on smartphone in low light wit additional noise added due to the sensors
- Use this model with or without changes on video while maintaining the goals discussed above.
- Improve the performance of the model using methods like self-ensembling etc.

Thank you for listening!

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