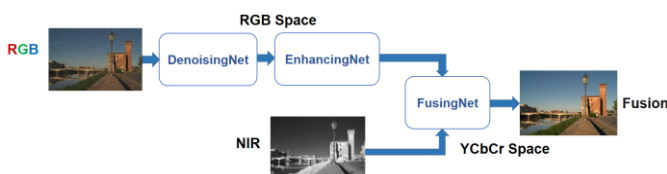


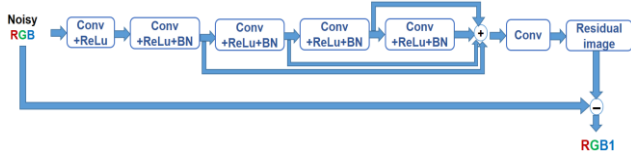
Deep Fusion of RGB and NIR Paired Images Using Convolutional Neural Networks

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Proposed Method

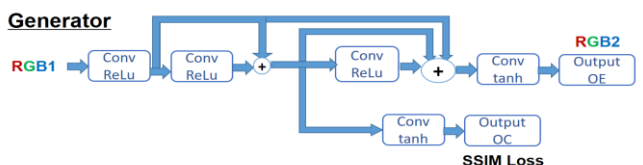


1) DenoisingNet by DnCNN [1]:

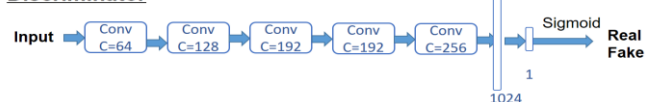


Residual learning & Batch normalization
RGB=Noisy RGB-Residual image

2) EnhancingNet by MCRN [2]:

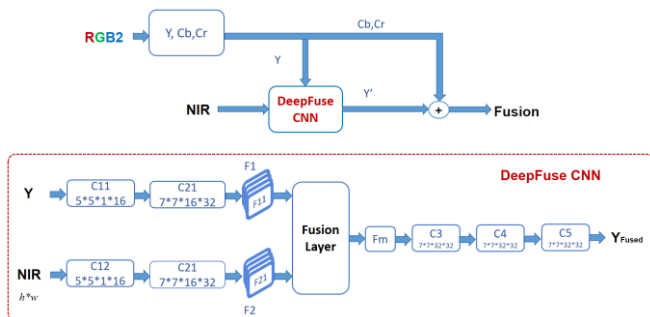


Discriminator



- Generator:** Consist of 5 layers in training and 4 layers in testing.
- Discriminator:** Consist of 5 convolutional layers and 2 fully connected layers.

3) FusingNet by DeepFuse [3]:



Input → Feature extraction → Fusion → Reconstruction.

Experimental Results



(a) Input RGB, (b) Input NIR, (c) BM3D, (d) WLS [4], (e) LD [5], (f) DF [6], (g) DFE [7], (h) DEF [8].

TABLE I
BIQE COMPARISON AMONG DIFFERENT FUSION METHODS.

Method	BM3D	WLS	LD	DF	DFE	DEF
<i>bowl</i> s	29.996	26.645	27.248	27.325	26.768	26.591
<i>teapot</i>	29.452	27.963	28.812	26.132	28.481	25.903

Conclusions

We propose deep fusion of RGB and NIR paired images. The proposed method consists of three subnetworks: DenoisingNet, EnhancingNet, and FusingNet (DEF). The proposed method removes noise while preserving details and recovering color.

References

- [1] Zhang et al., "Beyond a gaussian denoiser: Residual learning of deep cnn for image denoising," IEEE TIP, 2016.
- [2] Liu and Jung, "Multiple connected residual network for image enhancement on smartphones," Proc. ECCVW 2018.
- [3] Prabhakar et al, "Deepfuse: A deep unsupervised approach for exposure fusion with extreme exposure image pairs," Proc. ICCV 2017.
- [4] Zhuo et al., "Enhancing low light images using near infrared flash images," Proc. ICIP 2010.
- [5] Son and Zhang, "Layer-based approach for image pair fusion," IEEE TIP, 2016.
- [6] DF: DenoisingNet + FusingNet
- [7] DFE: DenoisingNet + FusingNet + EnhancingNet
- [8] DEF: DenoisingNet + EnhancingNet + FusingNet