

EE610 Project :

Low Light Noise Removal Using CNN

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Aim of the project

- Restore high quality image content from low level degraded version
- Our CNN model works by combining both the low resolution as well as high resolution analysis of the degraded image
- We try to maintaining a semantically meaningful high resolution representations
- We also use the contextual information from the low resolution representation which is then analysed with the above to get an improved model

Example of Noise Removal



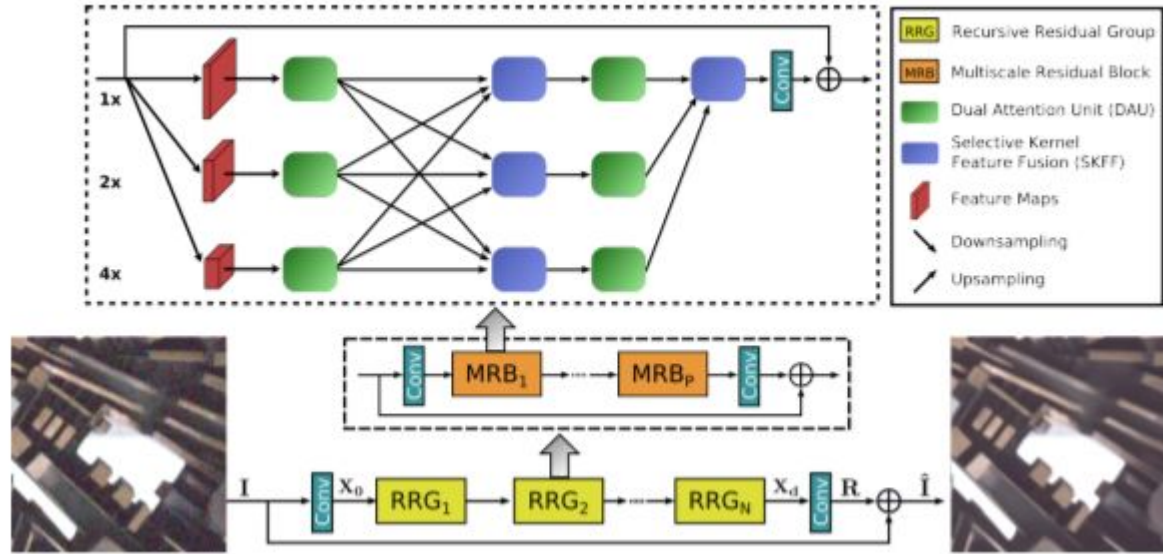
Image on the left is the low light image, which is then improved upon by deep learning to give the image on the right with more contrast.

Ref:
https://www.youtube.com/watch?v=b5Uz_c0JLMs

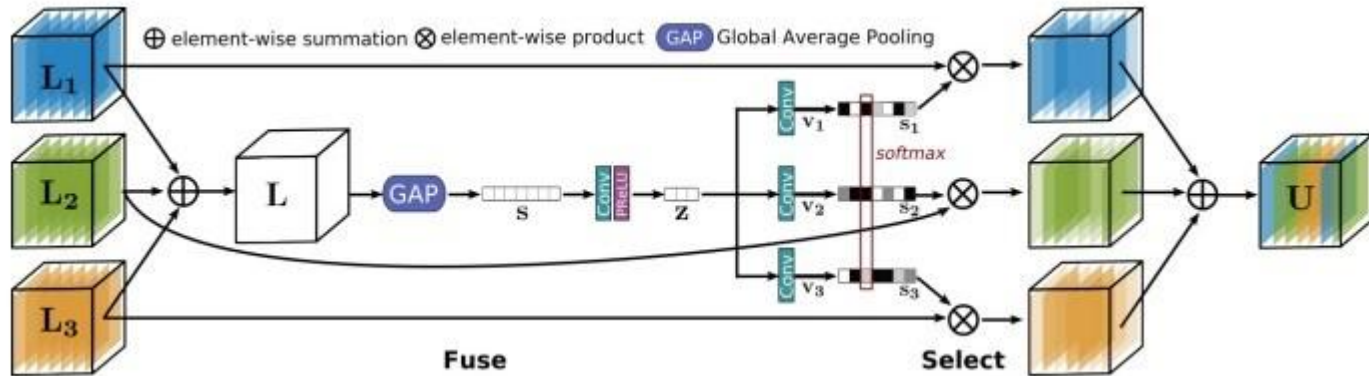
Use Case of our Model

- The number of images produced in recent times is growing humongously due to presence of cameras everywhere on various devices.
- During image acquisition, degradation of varying severity often gets captured along with the actual image.
- To remove these degradations, our model can be implemented

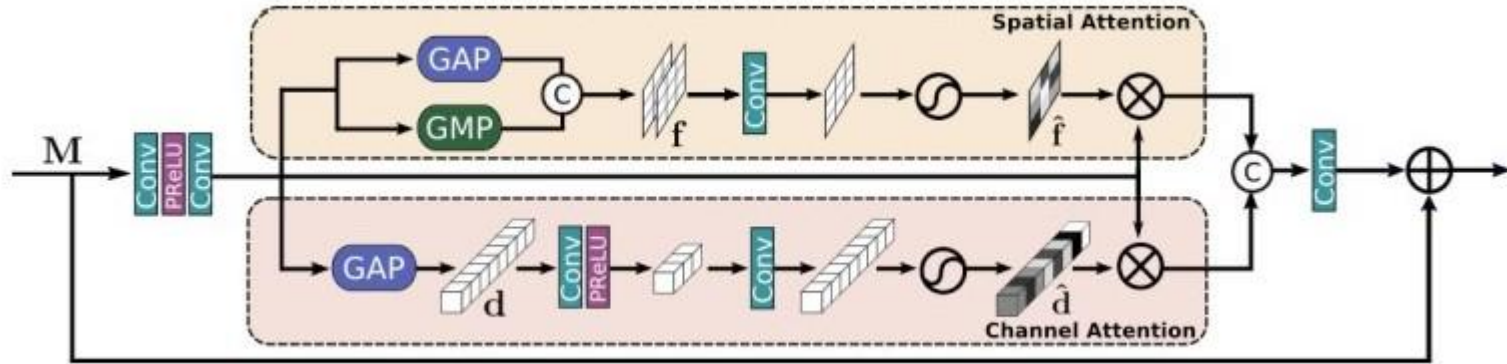
MIRNet



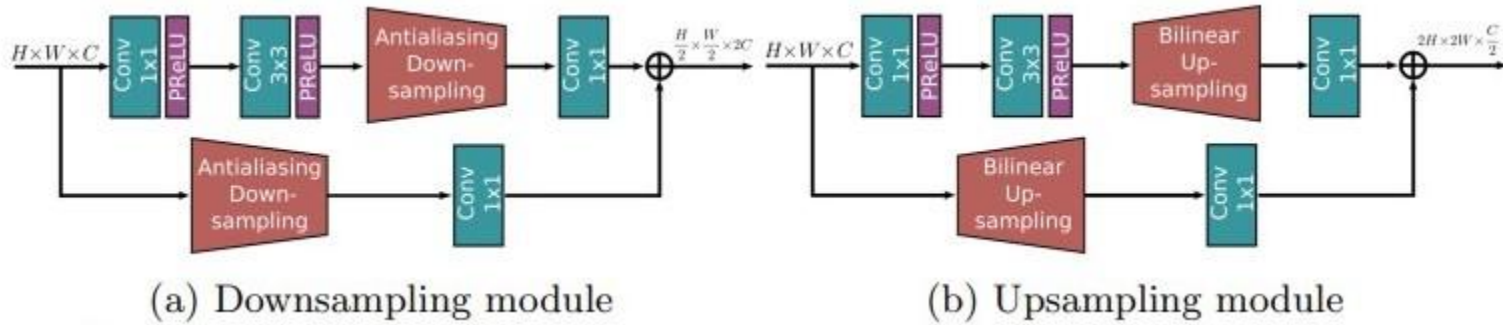
SKFF Module



DAU Unit

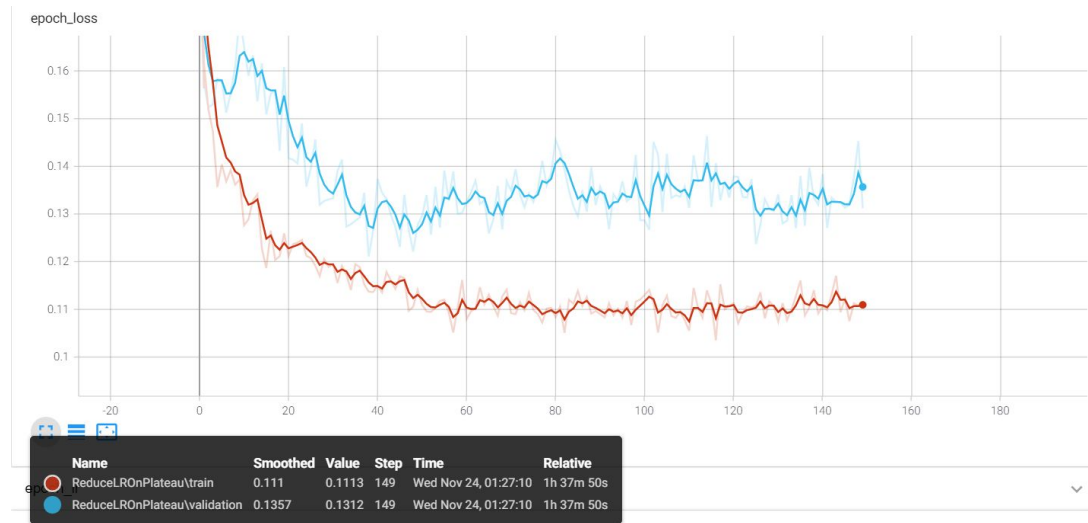


Upsampling and Downsampling



Experiments

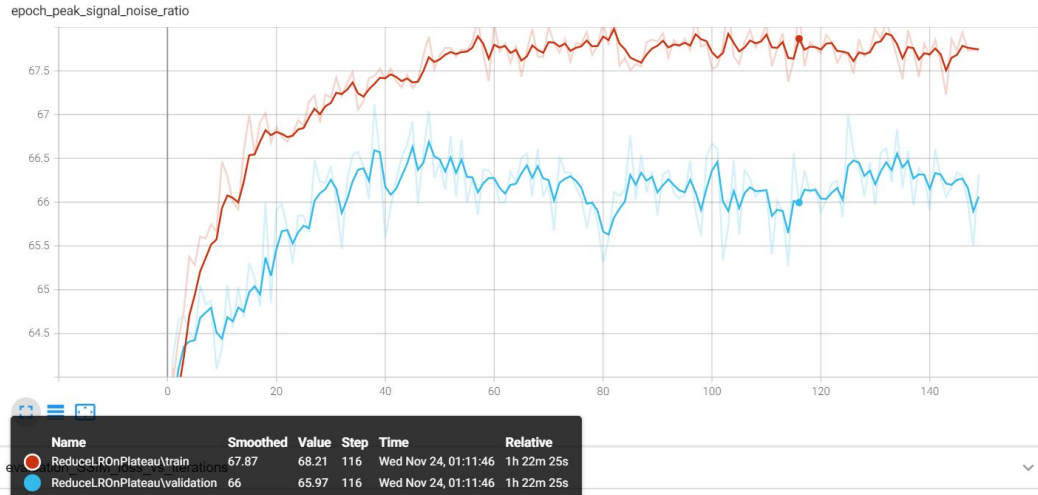
Original MIRNET Architecture



Loss Vs Epochs for the Original MIRNET architecture

Experiments

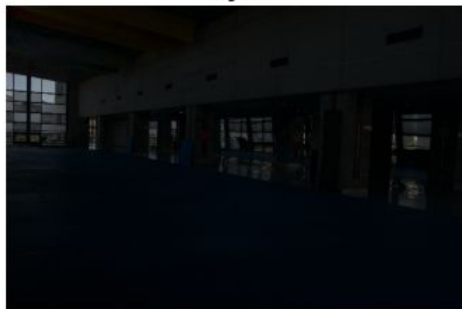
Original MIRNET Architecture



PSNR Vs Epochs for the Original MIRNET architecture

RESULTS FOR MIRNET

Original



PIL Autocontrast

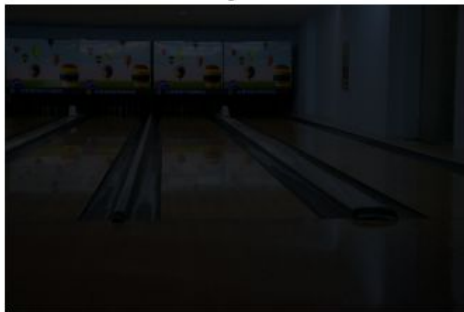


MIRNet Enhanced



RESULTS FOR MIRNET

Original



PIL Autocontrast

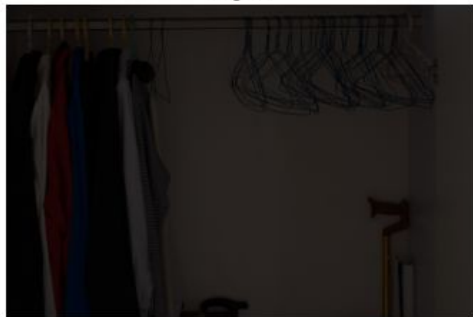


MIRNet Enhanced

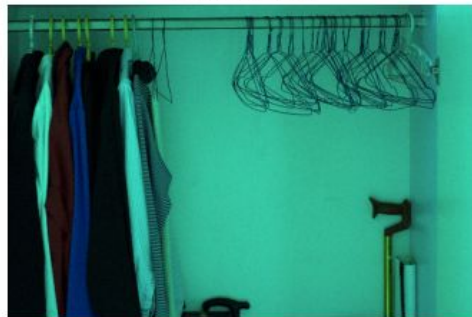


RESULTS FOR MIRNET

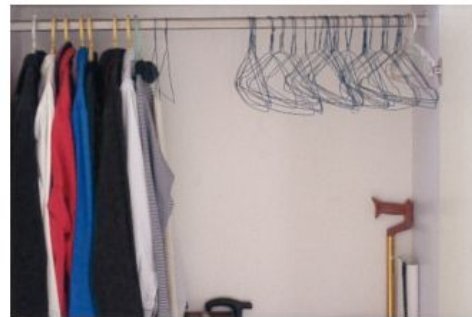
Original



PIL Autocontrast



MIRNet Enhanced



Experiments

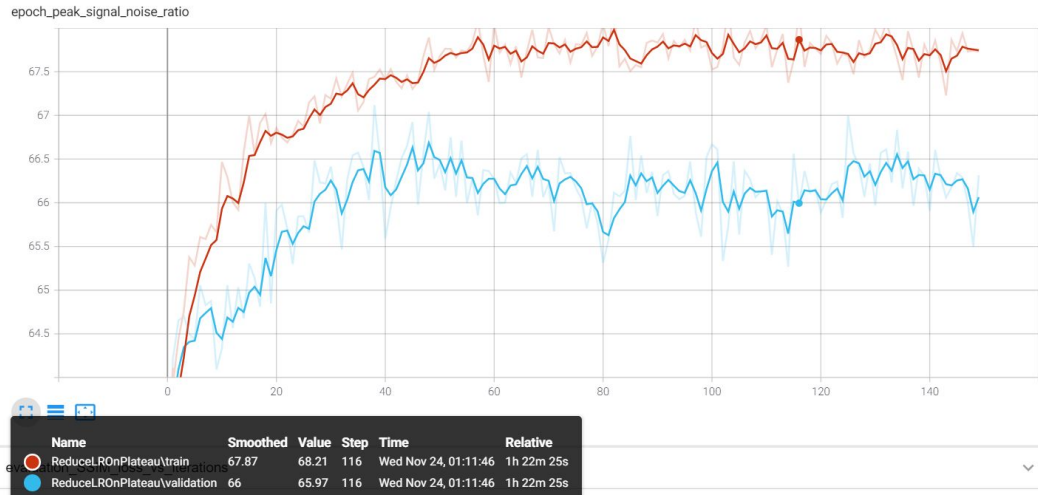
Modified MIRNET Architecture (with 4 scales)



Loss Vs Epochs for the Modified MIRNET architecture

Experiments

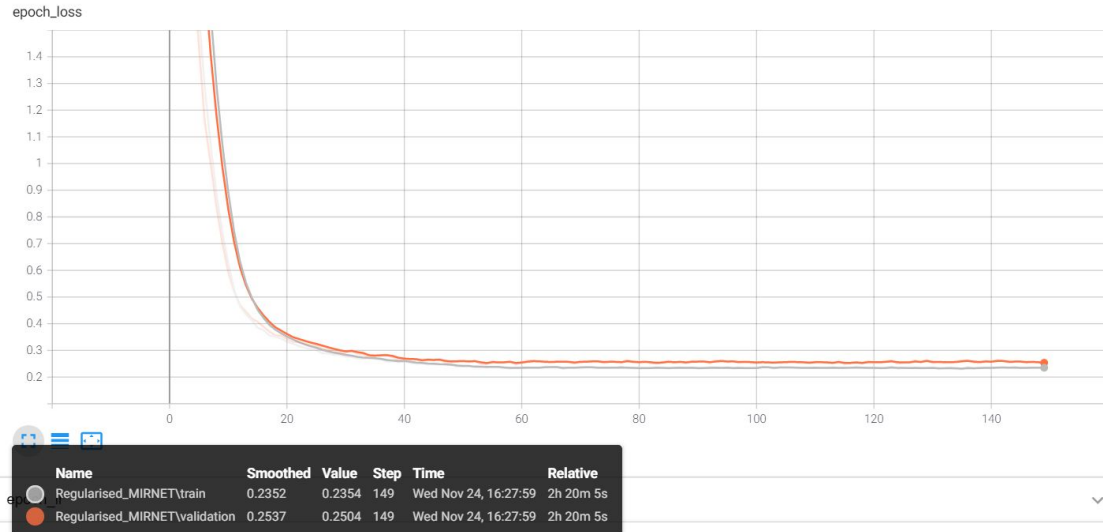
Modified MIRNET Architecture



PSNR Vs Epochs for Modified MIRNET architecture

Experiments

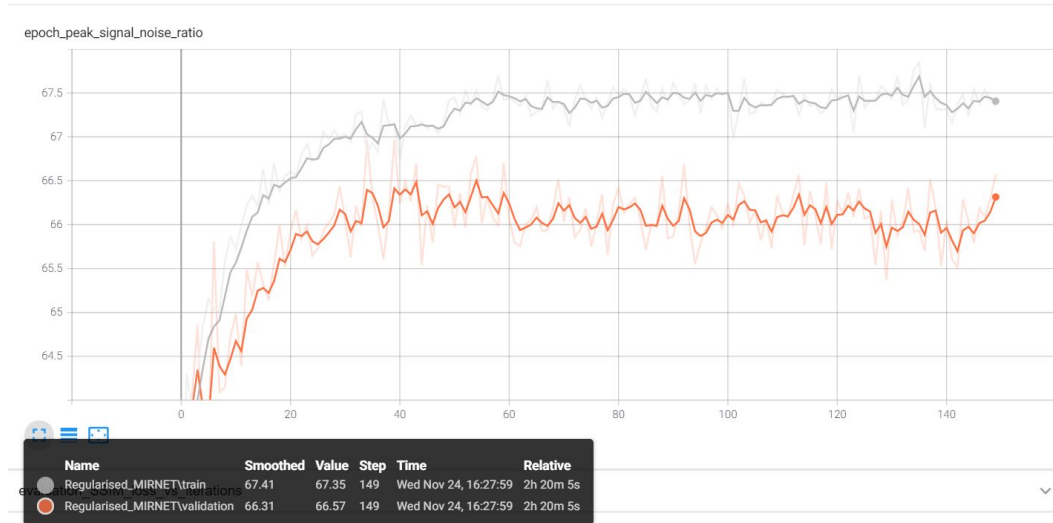
Modified MIRNET Architecture with Regularization(L1 and L2)



Loss Vs Epochs for Modified MIRNET Architecture with Regularization

Experiments

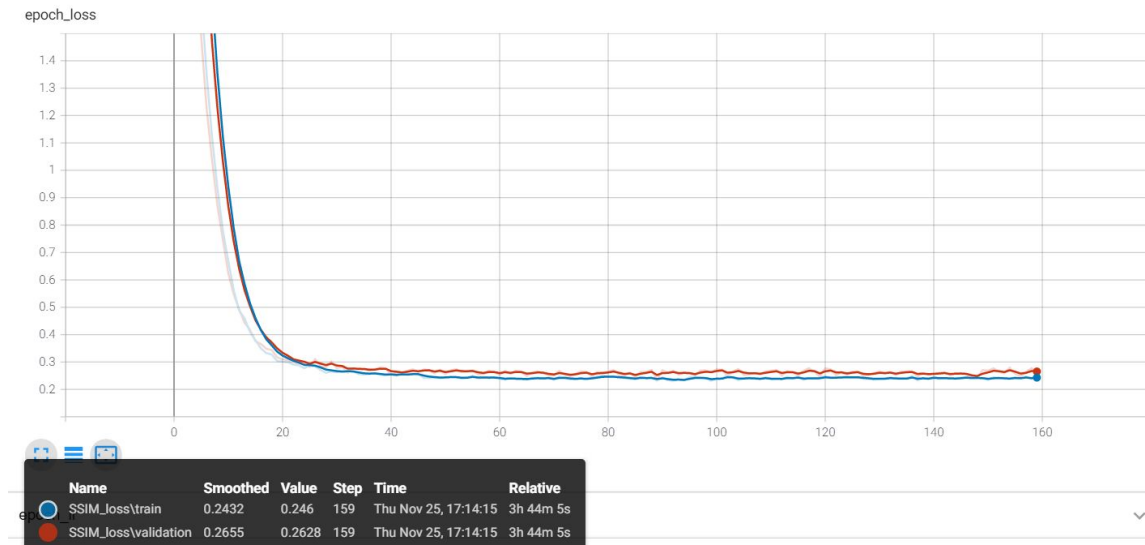
Modified MIRNET Architecture with Regularization(L1 and L2)



PSNR Vs Epochs for Modified MIRNET Architecture with Regularization

Experiments

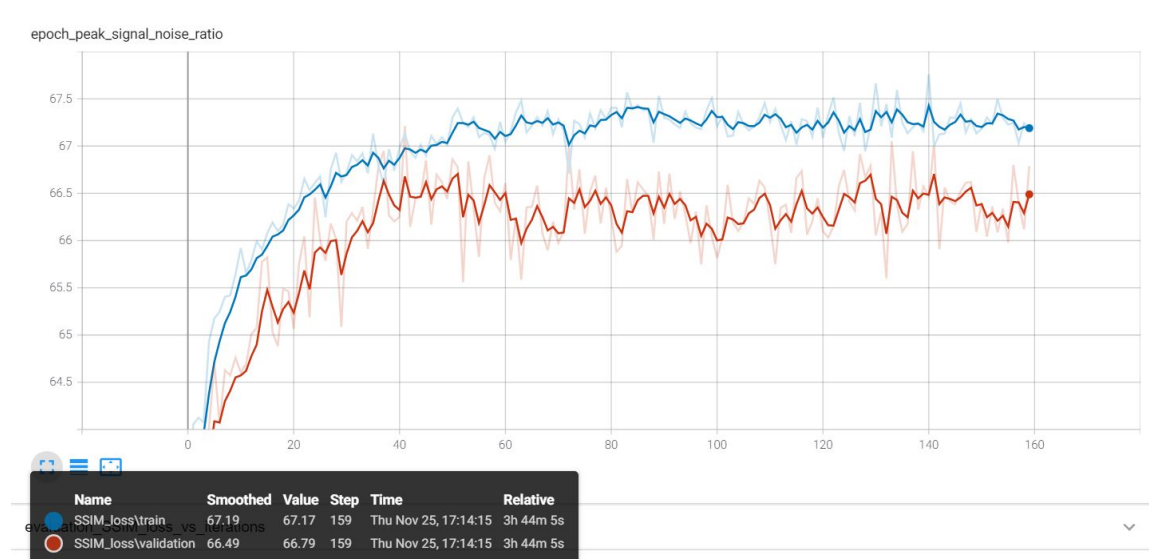
Modified MIRNET Architecture with Regularization using SSIM Loss



Loss Vs Epochs for Modified MIRNET Architecture with Regularization using SSIM Loss

Experiments

Modified MIRNET Architecture with Regularization using SSIM Loss



PSNR Vs Epochs for Modified MIRNET Architecture with Regularization using SSIM Loss

RESULTS OF OUR EXPERIMENTS

Original



PIL Autocontrast



MIRNet Enhanced (Batch Normalisation)



MIRNet Enhanced (Regularisation)

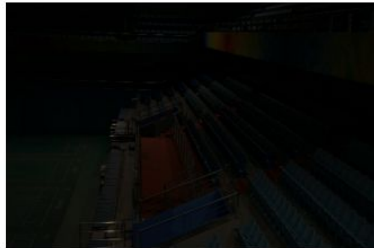


MIRNet Enhanced (SSIM Loss)

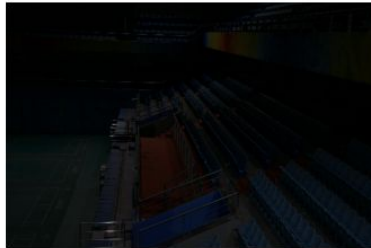


RESULTS OF OUR EXPERIMENTS

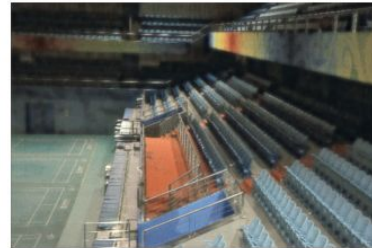
Original



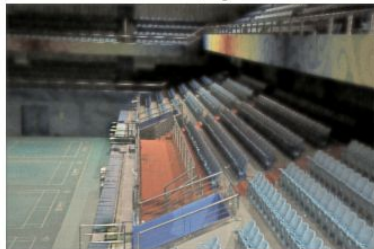
PIL Autocontrast



MIRNet Enhanced (Batch Normalisation)



MIRNet Enhanced (Regularisation)

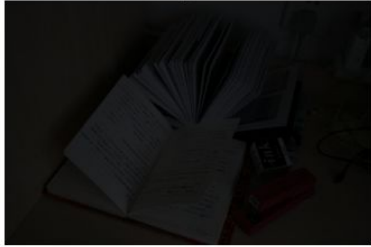


MIRNet Enhanced (SSIM Loss)



RESULTS OF OUR EXPERIMENTS

Original



PIL Autocontrast



MIRNet Enhanced (Batch Normalisation)



MIRNet Enhanced (Regularisation)



MIRNet Enhanced (SSIM Loss)



Future Work

- Weight normalisation can replace batch normalisation in our model (since batch normalisation wasn't giving good results).
- Wavelet Transform can be used instead for MRA
- Other types of attention layers could be used (custom)
- We didn't get enough time to tune the hyperparameters properly, so there is some scope for improvement there as well

THANK YOU