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IMAGE RESTOREATION

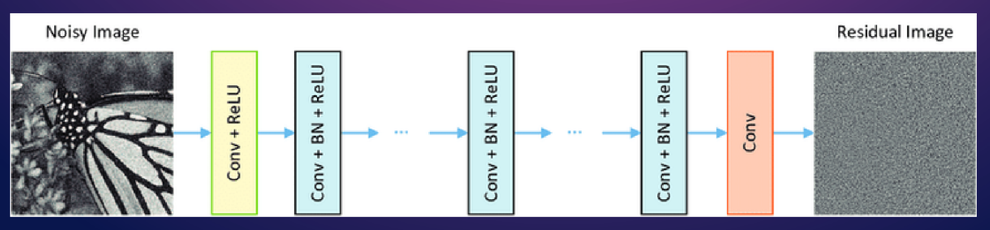
01 Problem Description

Historical images and prints tend to have noisy resolutions in comparison to present day. Other images, online or in-print, might have distorted colors or deteriorated segments. Images as such can be enhanced and restored back to its original format if not better through deep machine learning.

02 Original Model

- Paper Model: The Denoising Convolutional Neural Network (DnCNN) model is used to detect patterns in images, such as noises.
- Filter Type: Gaussian Filter
- All the datasets provided below are used frequently in image denoising and super-resolution.
- Paper Training Dataset: • Set12 • BSD - 100 • Urban100 • Set14 • Set5

Architecture -



03 Proposed Updates

- Supports RGB Images
  - Model accommodates 3D images instead of 2D only. The model is used to remove noise from colored images. Edits were made in the the input shape and the data preprocessing stage before running the model.
- Supports Heterogenous Data Sizes
  - Model accepts data of different sizes by padding the image to be 1020 x1020.
- Improves accuracy using Dropout Regularization
  - Dropout regularization has improved the accuracy from 161 to 155 using SSE.

04 Current Architecture

DnCNN - Denoising Convolutional Neural Network
Depth:- 17 Layers
No. of Filters:- 64
Image Channels:- 3
Layer 1: Conv + ReLU
Layers 2 - 16: Conv + BN + ReLU + Dropout
Layer 17: Conv
Output: Restored Image

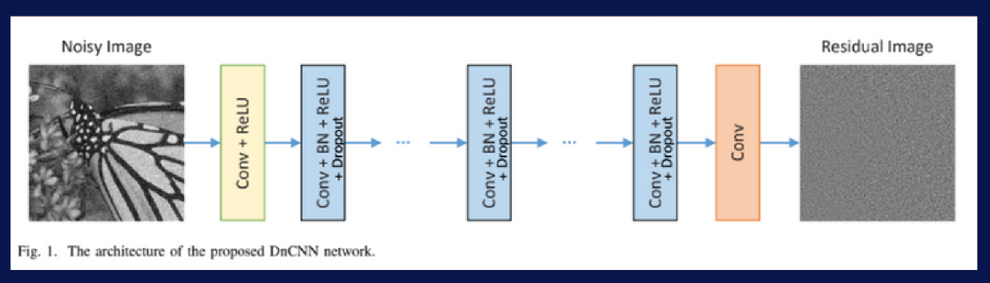


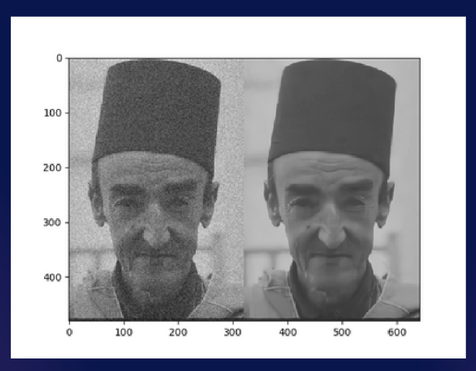
Fig. 1. The architecture of the proposed DnCNN network.

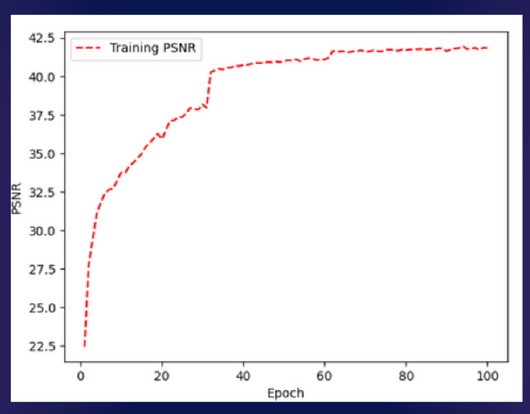
05 Dataset

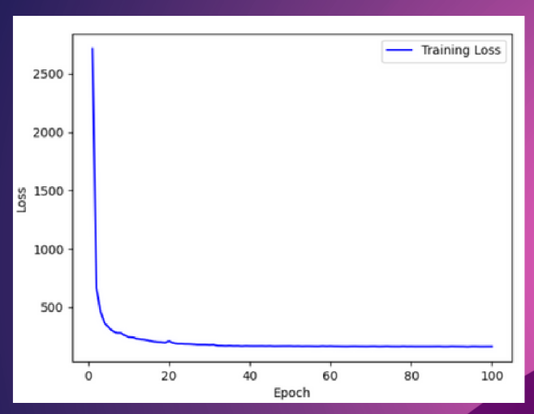
Dataset:- DIV2K dataset - 1000 RGB images with different color intensities. Only 10 images were used as those images are augmented into 565060 patches.

04 Results

Below is the results in terms of SSE, PSNR, & Output vs Input.







05 Conclusion

The model now is able to enhance noisy RGB images of different sizes into high resolution images with the help of using 2D CNN of 3 channels and padding any heterogeneous image sizes. The model is also measured using the PSNR metrics.

06 Future Work

1. Be able to enhance the accuracy.
2. Allow the model to accept videos and reduce its noise
3. Eliminate any noise from images
4. Enhance the resolution of medical scans

07 References

[1] Zhang, K., Zuo, W., et al. Beyond a Gaussian Denoiser: Residual Learning of Deep CNN for Image Denoising. Papers With Code, 2016.
[2] Wan, Z., Zhang, B., et al. Old Photo Restoration via Deep Latent Space Translation. Papers With Code, 2020.