Bioimaging Assignment -1

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Report

In this assignment, your task is to provide technical inputs on the idea given by the start-up for the following specific points:

i) Feasibility of the idea purely from technical angle,

ii) What technical factor(s), if any, will affect the claims made and to what extent?

Answer=>

i) The proposed idea by startup is feasible, Dl has promising results in field of computer vison and image mapping and restoration. In this idea we take images captured by high aperture contain more information than lower aperture image. Here DL can be used to learn the lost information and map it into high quality image.

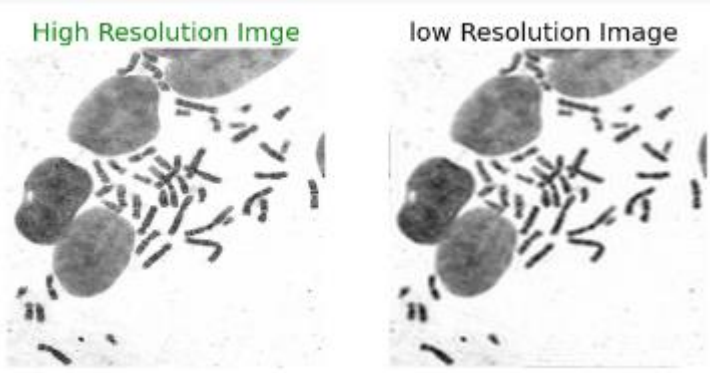
ii) Technical factors that can affect it:

1. Architecture of Model: it should be designed to handle the specific task of mapping image with different apertures.
2. Dataset: it is hard to obtain good dataset for these types of tasks, even if available it is expensive.
3. Lack of computation power: DL model takes more time to train, and in dataset like this, if we you RAM instead of GPU, it will take very long time to give results.
4. Mapping function: we generally assume in this case the relationship between high and low images is linear. If the relation between images gets complex, model will overfit and performance will suffer.

Report

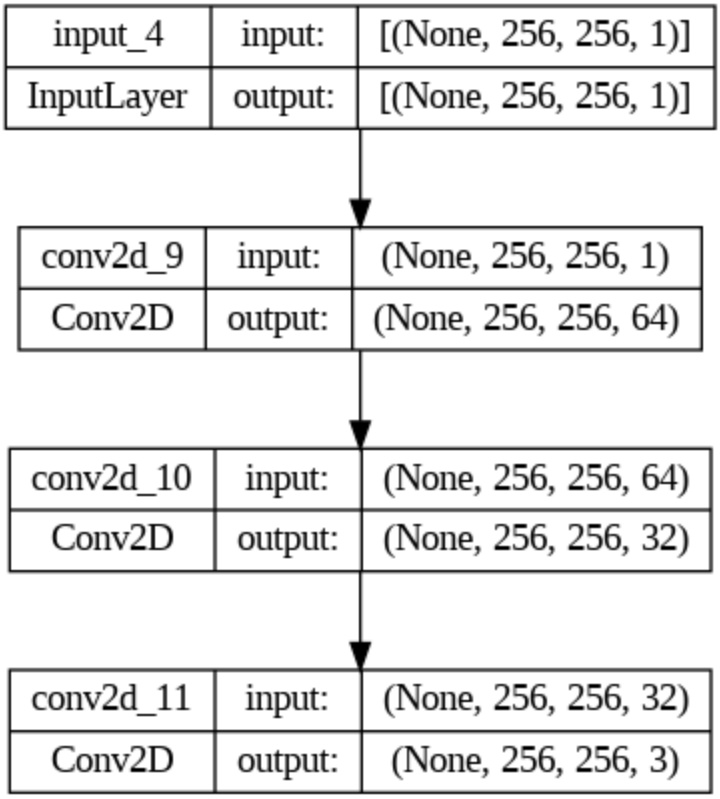
Code overview: Link

1. Unzipped the dataset
2. Uploaded the dataset using OpenCV.



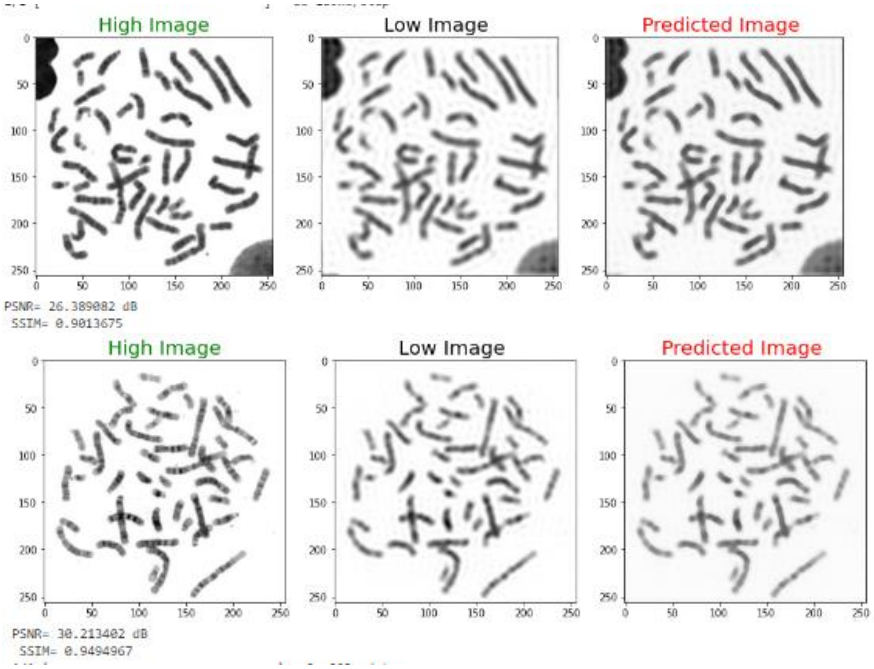
3. Plotted the dataset

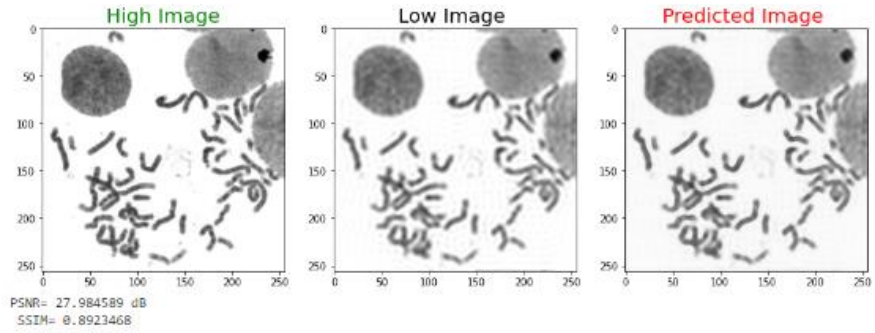
4. Divided the dataset into 80:10:10 as train, validation and test data, respectively.
5. Created the architecture of SRCNN model:



6. Trained the model on training the data on above created model. And validated on validation data.
7. Created the plot function and PSNR and SSIM metrics funtions to evaluate the results.
8. Predicted on test data (completety unknown to model) and obtained the result.
9. Then saved the model for future use.

Analysis





1. Above images tell about, high aperture, low aperture and predicted image.
   It can be seen PSNR for images is between 26 to 35 dB . And SSIM is between 88 to 96.05.

PSNR (Peak Signal to Noise Ratio): PSNR is a traditional metric that measures the ratio of the peak signal power to the mean squared error (MSE) between two images. It can provide a good indication of overall image quality and is commonly used in image processing and computer vision tasks.

PSNR above 30 dB is considered good quality image.

SSIM (Structural Similarity Index): SSIM is a more complex metric that takes into account the structural similarity of two images, in addition to their pixel-wise similarity. SSIM is designed to better capture the perceptual quality of images and is often more accurate than PSNR in predicting the quality of images as perceived by humans.

SSIM value above 0.9 is considered better.

2. Most of our images in test dataset were good quality and both score metrics was good for those. Some of the Images had less PSNR or SSIM value, reason for this is, I splitted the data in a linear way took first 4132 images as Train then 516 as Validation and 517 as Test. Due to data not able to shuffle, the model was not able to learn all details and gave not that good result on some images.
3. I run only for two epochs, I was able to achieve training loss of 0.0013 and Validation loss of 0.0011, which is good for results.