Project #4: Aquarium

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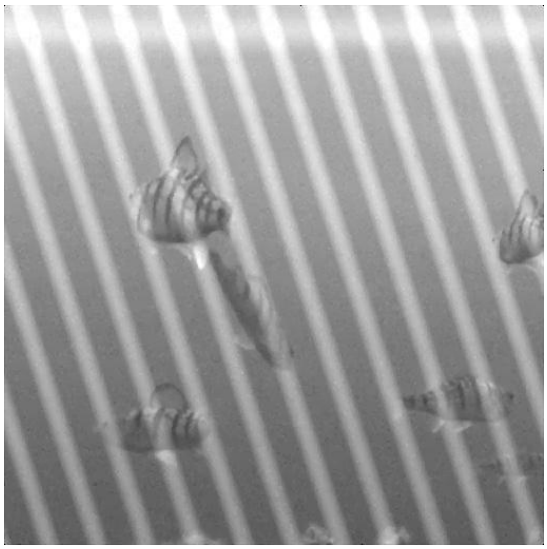
Introduction

We are given a short noisy video. Our task is to remove them and make it as similar to original video as possible. We can notice that there are four types of noise is total: horizontal white stripe moving downwards, salt & pepper noise, diagonal sinusoidal lines and pulse noise.

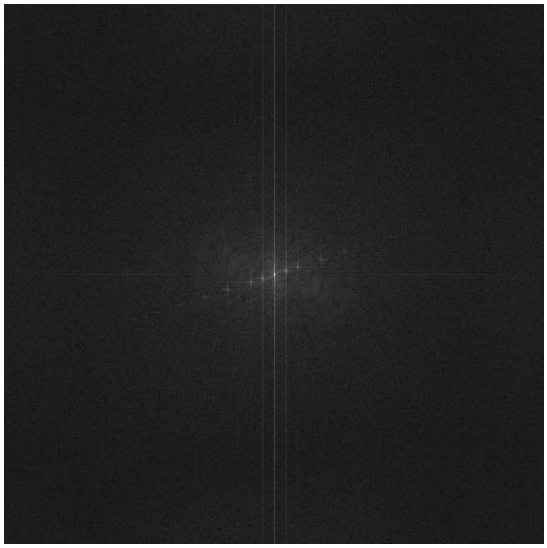
Solution

The easiest part of this assignment was to remove salt & pepper noise. In this type of noise, pure white or black pixels are added to the image. To remove them we can implement median filter with a minimum mask size of 3x3. The reason is, since noise pixels are white or black and when we sort by ascending order and take median of them it will replace that pixel with another which will not be white or black.



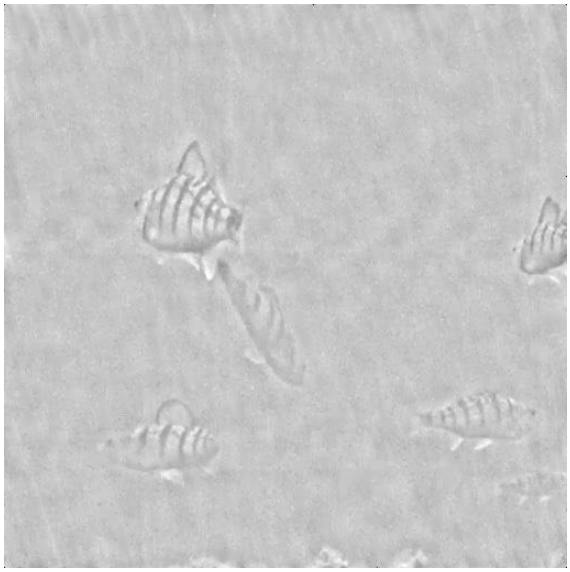
Pic1. Salt&pepper removed.

Next, I tried to understdand the Fourier spectrum of the one frame. So I got a picture below:



Pic2. Fourier Spectre

There we see an increasing linear line. These white dots from that line represent sinusodial noise. By looking to that particular pixels and using simple two equations I obtained the slope of this line. Then by iterating through them I removed these pixels. We can also notice that a white vertical line in the middle also represents a noise which is white stripe moving downwards. However, we can not remove total vertical line because a pixel value in the middle of the picture carries important information of the image. Therefore I left that particular pixel unchanged. Now, I left with this picture:



Pic3. White stripe are removed.

Finally, by the time period we have very dark frames or very bright. To solve this problem, histogram matching is one of the solutions. We simply take a reference image which will have an average grayscale intensity and then we approximately match our frames.

Conclusion

To conclude, the spatial domain and frequency domain filter techniques are applied to remove several types of noise from the video. More or less, I obtained good results. However, this implementation is hard coded, thus provided solution code may not work with other videos.