Assignment 2:

Aim : To implement a Wiener filter to remove additive gaussian noise and defocus blur from an image.

Methodology:

Training:

1. We consider the noise free image , in the training set. We then apply defocus blur by convolving it with a 3*3 gaussian filter. The variance of the gaussian is a random number between 0 and 1.

2. To model noise we add to it an additive Gaussian noise of variance as a random integer between 0 and 1.

3. Now we design the Wiener filter as follows,

$$W(u,v) = E(|XD^*|)/E(|X|^2)$$

Testing:

1. Now we test the Wiener filter by computing the fourier transform of the incoming image. Let X(u,v) be the fourier transform.

$$Y(u,v) = W(u,v)X(u,v)$$

2. Now we obtain the final image by taking the ifft of Y(u,v).

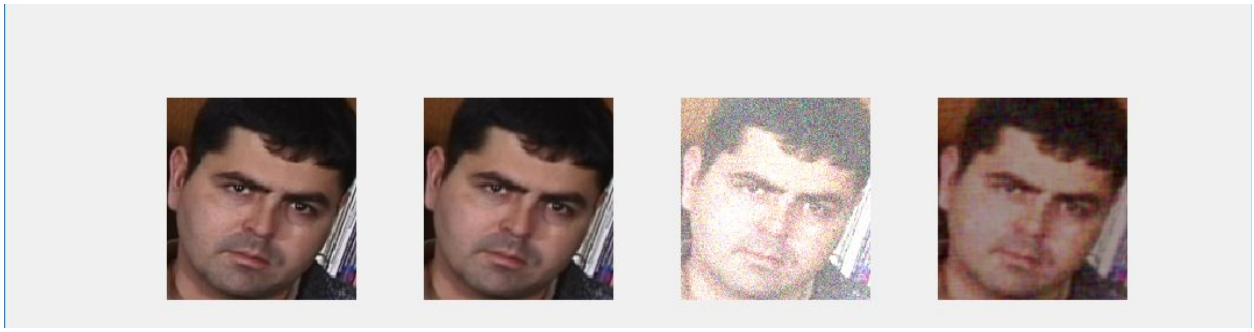
Results: (Original - Blurred - Noised - Filtered)

1. **Noise Variance = 0.6, Blurring variance = 0.1**

2. **Noise variance = 0.3, Blurring variance = 0.1**

3. **Noise variance = 0.3, Blurring variance = 0.8**

4. Noise Variance = 0.5, Blurring Variance = 0.5



Output Metrics:

I obtained the PSNR and MSE on the output image. They were averaged for all the testing images. The values of the noise variance was chosen randomly.

Average PSNR of output ≈ 19dB

Average PSNR of Noisy Image ≈ 9dB

Average value = MSE ≈ 1.6%

The average PSNR and MSE may vary every execution of the code.

Conclusion:

The global method for Wiener filtering produces a decent value of PSNR and MSE after filtering. It is suitable for removing Gaussian Noise and Defocus blur.