# Assignment 2 Question 2 Report

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## 1 Grass

### 1.1 Approach

Here the given noisy image was used for bilateral filtering.

### 1.2 Results

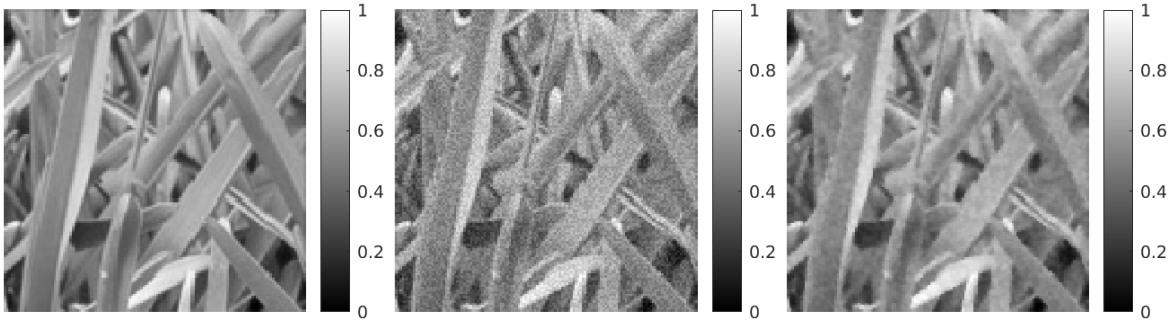


Figure 1: Original Image, Noisy Image and Filtered Image respectively

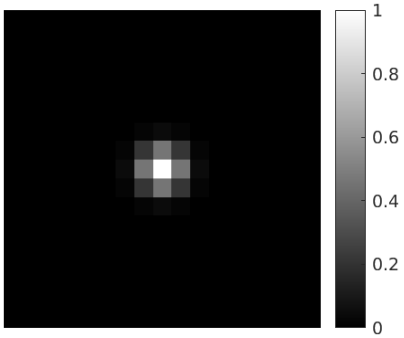


Figure 2: Gaussian Spatial Mask

The Gaussian Spatial Mask displayed is for a range of $10\sigma^*_{space}$ only as otherwise the $\sigma^*_{space}$ is too small for it to be noticeable.
The RMSD observed was 19.5393 at $\sigma^*_{space} = 0.8$ and $\sigma^*_{intensity} = 45$.

The RMSD observed at different values of $\sigma^*_{space}$ and $\sigma^*_{intensity}$ were as follows:-

| | | |
|---|---|---|
| $0.9\sigma^*_{space}$ | $\sigma^*_{intensity}$ | 19.5577 |
| $1.1\sigma^*_{space}$ | $\sigma^*_{intensity}$ | 19.5674 |
| $\sigma^*_{space}$ | $0.9\sigma^*_{intensity}$ | 19.5471 |
| $\sigma^*_{space}$ | $1.1\sigma^*_{intensity}$ | 19.5465 |

# 2 Honey Comb

## 2.1 Approach

Again the given noisy image was used for bilateral filtering.

## 2.2 Results

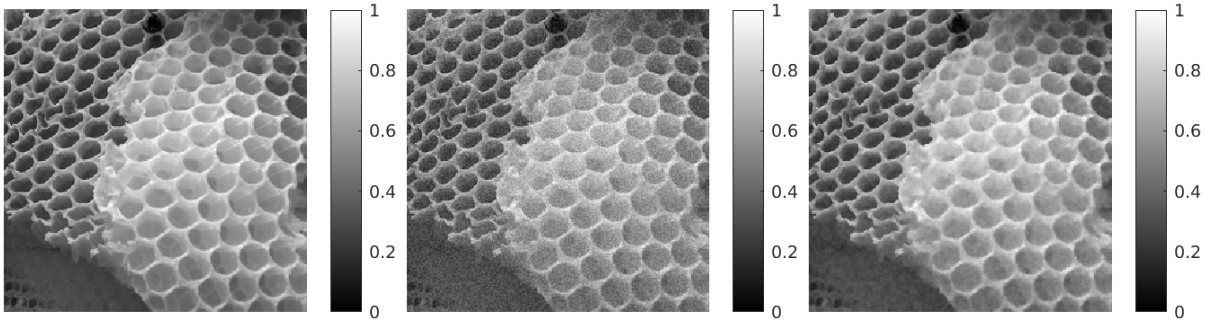


Figure 3: Original Image, Noisy Image and Filtered Image respectively

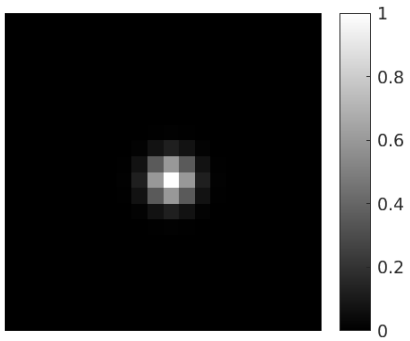


Figure 4: Gaussian Spatial Mask

The Gaussian Spatial Mask displayed is for a range of $10\sigma^*_{space}$ only as otherwise the $\sigma^*_{space}$ is too small for it to be noticeable.
The RMSD observed was 17.5505 at $\sigma^*_{space} = 0.98$ and $\sigma^*_{intensity} = 36$.

The RMSD observed at different values of $\sigma^*_{space}$ and $\sigma^*_{intensity}$ were as follows:-

| | | |
|---|---|---|
| $0.9\sigma^*_{space}$ | $\sigma^*_{intensity}$ | 17.5589 |
| $1.1\sigma^*_{space}$ | $\sigma^*_{intensity}$ | 17.5589 |
| $\sigma^*_{space}$ | $0.9\sigma^*_{intensity}$ | 17.5576 |
| $\sigma^*_{space}$ | $1.1\sigma^*_{intensity}$ | 17.5706 |

# 3 Barbara

## 3.1 Approach

Here random Gaussian noise was added to the image using the method specified in the question. The image is then passed through a bilateral filter as before. Since this image is of the highest resolution, it

takes more than 5 minutes to run. Also the images are not displayed side by side as the differences are not easily visible at such low scale.

### 3.2 Results

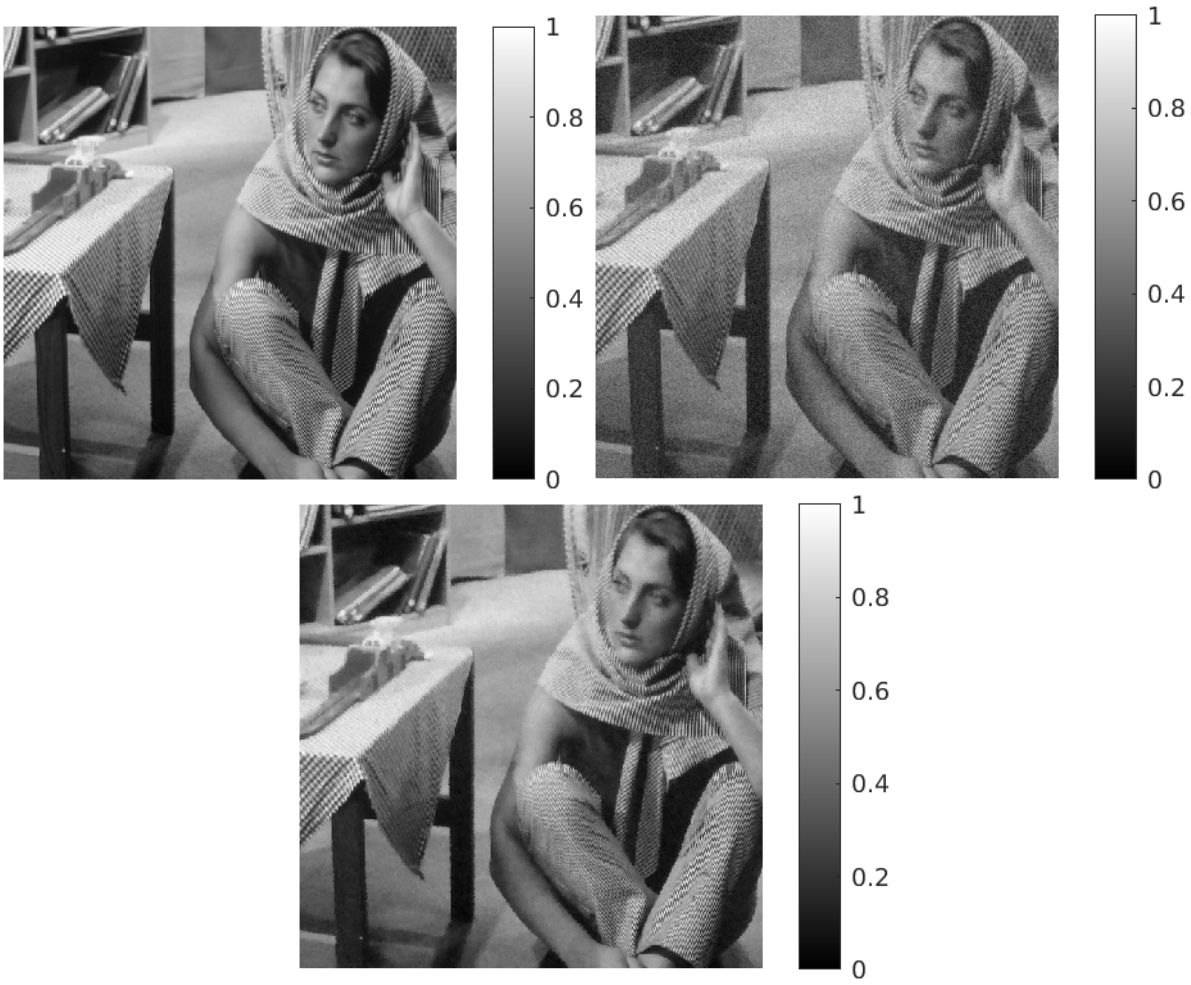


Figure 5: Original Image, Noisy Image and Filtered Image respectively

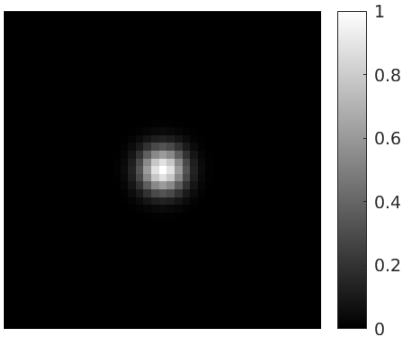


Figure 6: Gaussian Spatial Mask

The Gaussian Spatial Mask displayed is for a range of $10\sigma^*_{space}$ only as otherwise the $\sigma^*_{space}$ is too small for it to be noticeable.
The RMSD observed was 8.3965 at $\sigma^*_{space} = 2$ and $\sigma^*_{intensity} = 24$.

The RMSD observed at different values of $\sigma^*_{space}$ and $\sigma^*_{intensity}$ were as follows:-

| | | |
|---|---|---|
| $0.9\sigma^*_{space}$ | $\sigma^*_{intensity}$ | 8.4458 |
| $1.1\sigma^*_{space}$ | $\sigma^*_{intensity}$ | 8.5456 |
| $\sigma^*_{space}$ | $0.9\sigma^*_{intensity}$ | 8.7728 |
| $\sigma^*_{space}$ | $1.1\sigma^*_{intensity}$ | 8.4854 |

# 4 Inferences

- Bilateral filtering preserves edges very well which can be seen in the image of Grass. However, it has a tendency to blur our details.
- The image 'barbara' had the best balance in between smoothing and preservation of details. This may have been due to the fact that it was the highest resolution image though.
- The other two images also displayed satisfactory results.

# 5 Conclusions

Hence we have performed bilateral filtering on 3 images and observed the results.