

## HW2: Problem 1

Ian Dover

### 1 Part A

Image converted to greyscale:



Figure 1: Greyscale image.

### 2 Part B

#### 2.1 Subsection 1

Image with zero-mean Gaussian white noise with variance of 0.01:



Figure 2: J1: Greyscale image with gaussian noise applied.

#### 2.2 Subsection 2

Image with salt-and-pepper noise, affecting approximately 5% of pixels:

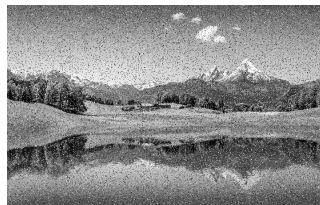


Figure 3: J2: Greyscale image with salt-and-pepper noise applied.

## 3 Part C

### 3.1 Gaussian De-noise: J1

Images with gaussian filter denoise on J1:



Figure 4: Gaussian filter denoised J1.

### 3.2 Gaussian De-noise: J2

Images with gaussian filter denoise on J2:

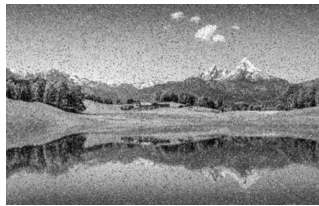


Figure 5: Gaussian filter denoised J2.

### 3.3 Median De-noise: J1

Images with median filter denoise on J1:



Figure 6: Median filter denoised J1.

### 3.4 Median De-noise: J2

Images with median filter denoise on J2:



Figure 7: Median filter denoised J2.

### 3.5 Arithmetic Mean De-noise: J1

Images with arithmetic mean filter denoise on J1:



Figure 8: Arithmetic mean filter denoised J1.

### 3.6 Arithmetic Mean De-noise: J2

Images with arithmetic mean filter denoise on J2:

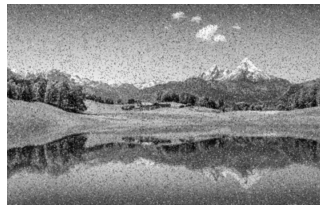


Figure 9: Arithmetic mean filter denoised J2.

### 3.7 Geometric Mean De-noise: J1

Images with geometric mean filter denoise on J1:

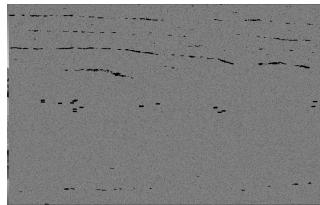


Figure 10: Geometric mean filter denoised J1.

### 3.8 Geometric Mean De-noise: J2

Images with geometric mean filter denoise on J2:

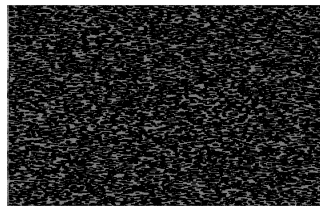


Figure 11: Geometric mean filter denoised J2.

### 3.9 Harmonic Mean De-noise: J1

Images with harmonic mean filter denoise on J1:

Figure 12: Harmonic mean filter denoised J1.

### 3.10 Harmonic Mean De-noise: J2

Images with harmonic mean filter denoise on J2:

Figure 13: Harmonic mean filter denoised J2.

### 3.11 Minimum De-noise: J1

Images with minimum filter denoise on J1:



Figure 14: Minimum filter denoised J1.

### 3.12 Minimum De-noise: J2

Images with minimum filter denoise on J2:

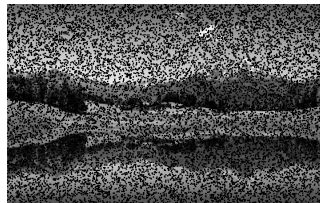


Figure 15: Minimum filter denoised J2.

### 3.13 Maximum De-noise: J1

Images with maximum filter denoise on J1:



Figure 16: Maximum filter denoised J1.

### 3.14 Maximum De-noise: J2

Images with maximum filter denoise on J2:

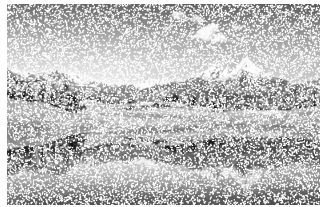


Figure 17: Maximum filter denoised J2.

### 3.15 Mid-point De-noise: J1

Images with mid-point filter denoise on J1:



Figure 18: Mid-point filter denoised J1.

### 3.16 Mid-point De-noise: J2

Images with mid-point filter denoise on J2:



Figure 19: Mid-point filter denoised J2.

## 4 Part D

What denoising technique do you recommend for removing Gaussian noise? What denoising technique do you recommend for removing salt-and-pepper noise?