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:

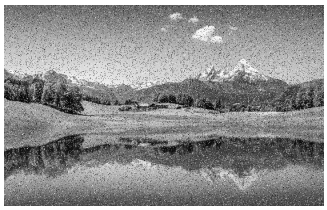

Figure 3: J2: Greyscale image with salt-and-pepper noise applied.

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:

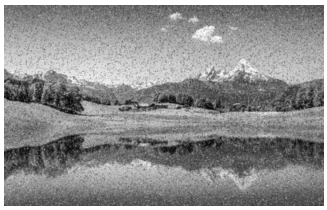

Figure 5: Gaussian filter denoised J2.

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 Arithematic Mean De-noise: J1

Images with arithematic mean filter denoise on J1:

Figure 8: Arithematic mean filter denoised J1.

3.6 Arithematic Mean De-noise: J2

Images with arithematic mean filter denoise on J2:

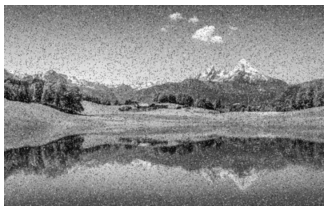

Figure 9: Arithematic mean filter denoised J2.

3.7 Geometric Mean De-noise: J1

Images with geometric mean filter denoise on J1:

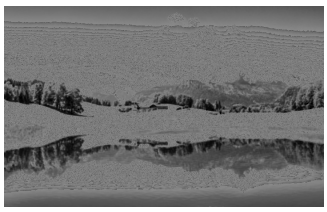

Figure 10: Geometric mean filter denoised J1.

3.8 Geometric Mean De-noise: J2

Images with geometric mean filter denoise on J2:

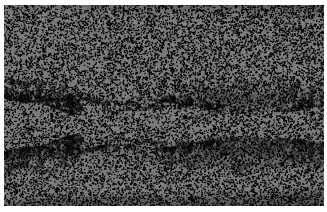

Figure 11: Geometric mean filter denoised J2.

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 Contraharmonic Mean De-noise: J1 and Q = -1

Images with contraharmonic mean filter denoise on J1 and Q = -1:

Figure 14: Contraharmonic mean filter denoised J1 and Q = -1.

3.12 Contraharmonic Mean De-noise: J2 and Q = -1

Images with contraharmonic mean filter denoise on J2 and Q = -1:

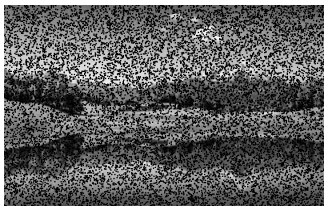

Figure 15: Contraharmonic mean filter denoised J2 and Q = -1.

3.13 Contraharmonic Mean De-noise: J1 and Q = 0

Images with contraharmonic mean filter denoise on J1 and Q = 0:

3.14 Contraharmonic Mean De-noise: J2 and Q = 0

Images with contraharmonic mean filter denoise on J2 and Q = 0:

Figure 16: Contraharmonic mean filter denoised J1 and Q = 0.

Figure 17: Contraharmonic mean filter denoised J2 and Q = 0.

3.15 Contraharmonic Mean De-noise: J1 and Q = 1

Images with contraharmonic mean filter denoise on J1 and Q = 1:

Figure 18: Contraharmonic mean filter denoised J1 and Q = 1.

3.16 Contraharmonic Mean De-noise: J2 and Q = 1

Images with contraharmonic mean filter denoise on J2 and Q = 1:

Figure 19: Contraharmonic mean filter denoised J2 and Q = 1.

3.17 Minimum De-noise: J1

Images with minimum filter denoise on J1:

3.18 Minimum De-noise: J2

Images with minimum filter denoise on J2:

Figure 20: Minimum filter denoised J1.

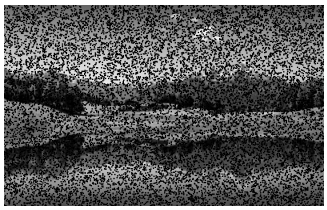

Figure 21: Minimum filter denoised J2.

3.19 Maximum De-noise: J1

Images with maximum filter denoise on J1:

Figure 22: Maximum filter denoised J1.

3.20 Maximum De-noise: J2

Images with maximum filter denoise on J2:

Figure 23: Maximum filter denoised J2.

3.21 Mid-point De-noise: J1

Images with mid-point filter denoise on J1:

3.22 Mid-point De-noise: J2

Images with mid-point filter denoise on J2:

Figure 24: Mid-point filter denoised J1.

Figure 25: 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?The best denoising technique for removing gaussian noise is the gaussian denoise. The gaussian denoise performs the inverse operation of the gaussian noise, thus resulting in the best result.The best denoising technique is the median filter. The median filter is superior because all mean filters will preserve information on the salt-and-pepper noise; additionally, the minimum and maximum filters will also preserves some salt-and-pepper noise.