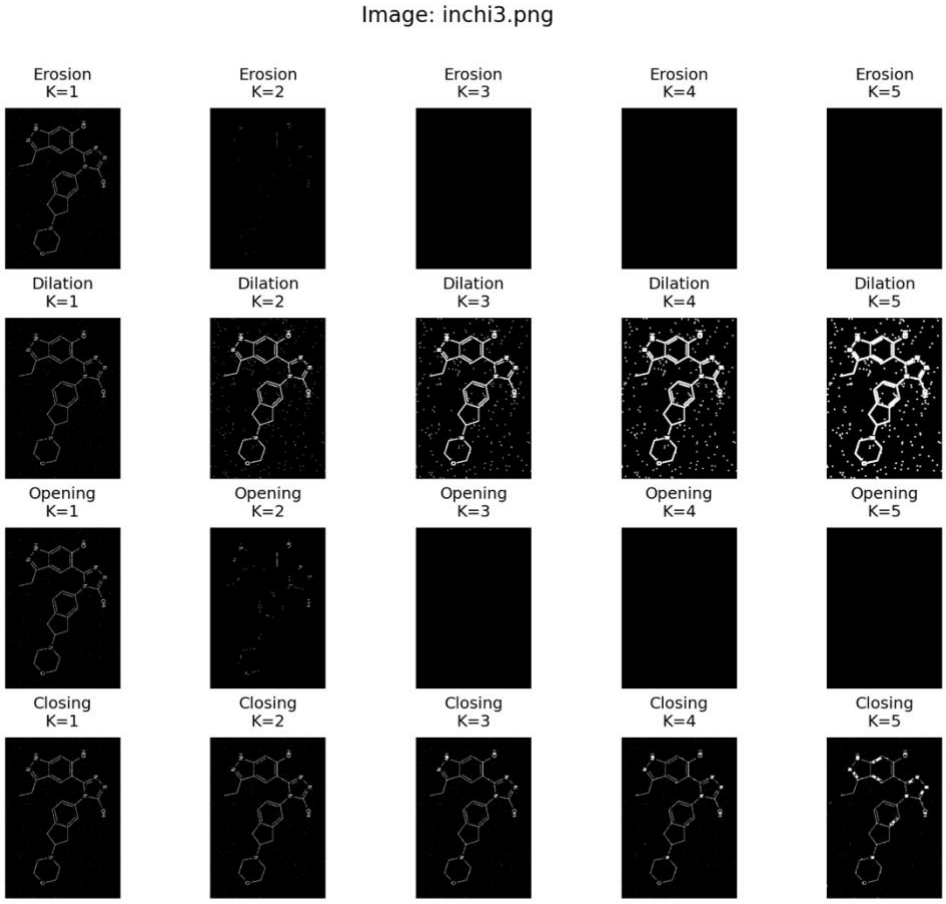
Project Findings Assignment 3

Task 1.

The first task displayed chemical structure images which contained salt-and-pepper noise. The elimination of this particular type of noise requires morphological operations particularly erosion and dilation to retain structural element linearity. I executed a systematic examination to find the best kernel size and morphological combinations through specific testing.



The investigation results showed that setting kernel sizes to k=2 or k=3 produced the best outcomes. The most effective technique emerged from the 'closing' operation which combined dilation sequentially followed by erosion.

The results displayed in the composite image present an initial visual success. The requirement of reducing image size during document display conceals both minor image characteristics as well as remaining noise artifacts. The visual result of this observation made me think that " If blurry image remove the noise for human eyes how it will affect the filter?" then lead me to test a Gaussian blurring implementation before running the closing operation.

Image: inchi3.png

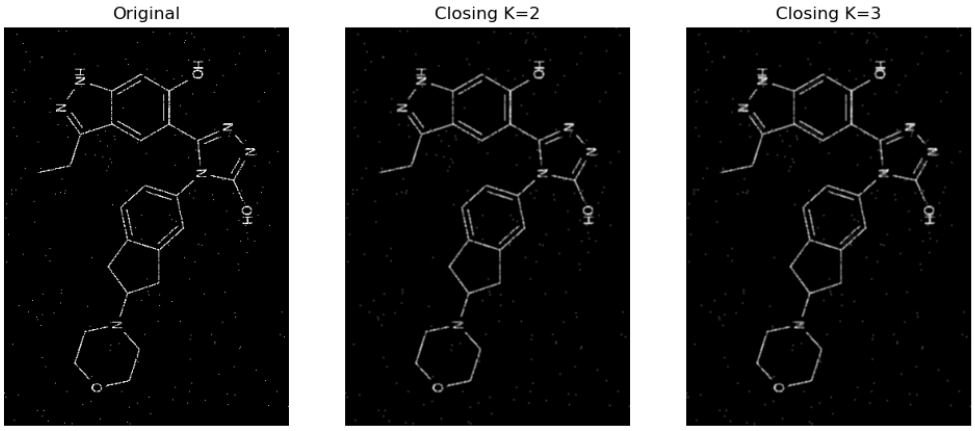
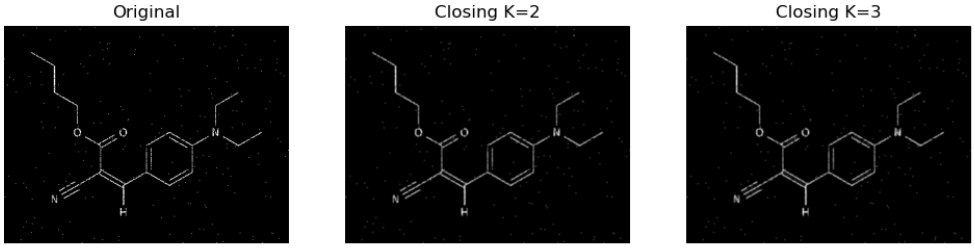
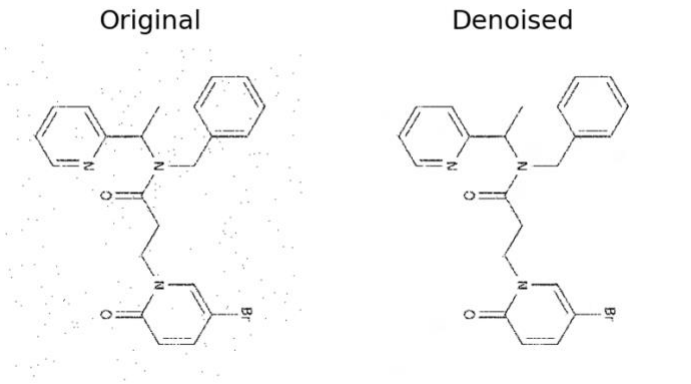


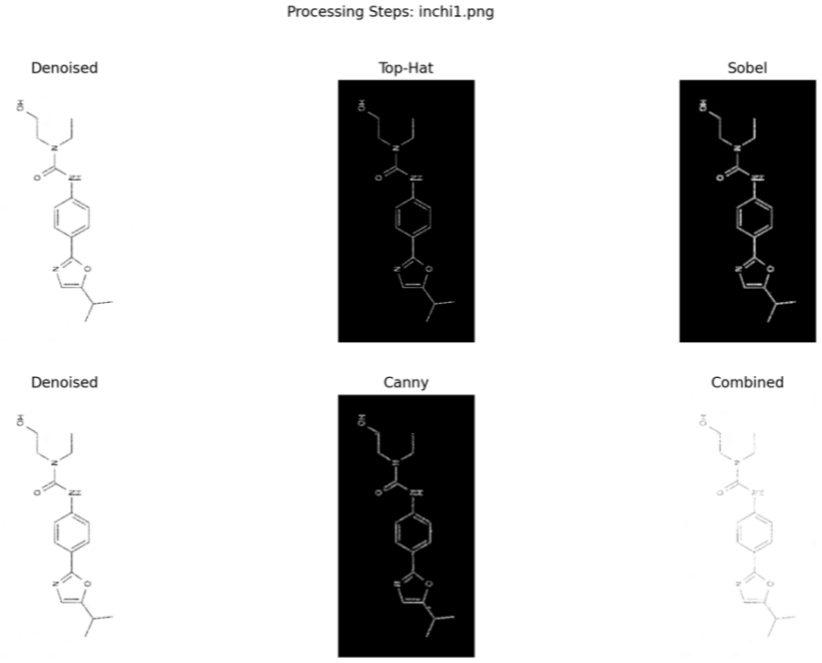
Image: inchi5.png



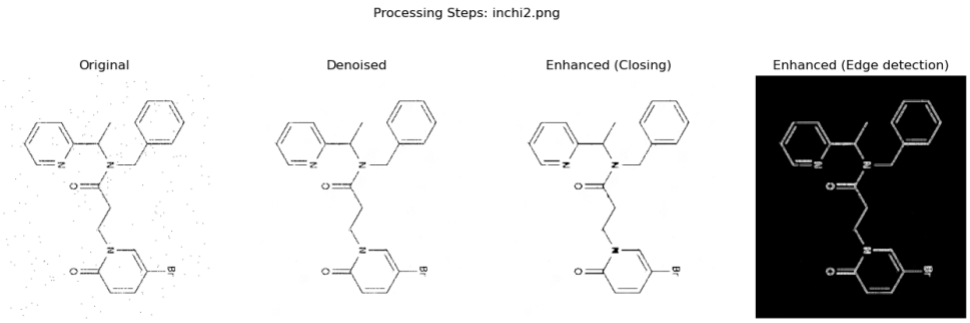
The modified filtering technique decreased noise levels substantially but it also caused the output picture to show unneeded blurring effects. My dissatisfaction led me to explore different approaches for image denoising. The application of Non-Local Means Denoising provided exceptional performance for tackling this particular problem.

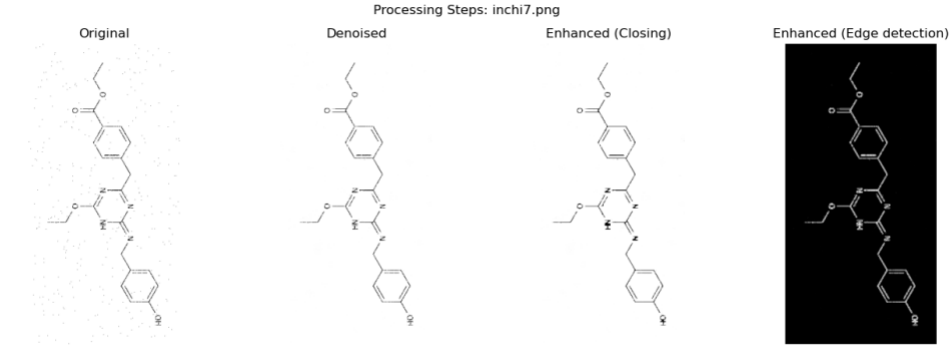


However I aimed to push structural line improvement beyond the current satisfactory noise reduction outcome. The evaluation process included testing several edge detection methodologies that consisted of Sobel, Canny, and Top-Hat.



The Sobel operator stands out due to its desirable execution features therefore the team chose it for integration into the final programming code. Then finally, I wanted to compare closing method with Sobel enhancement to see the difference.





For some cases Sobel outperformed closing ehnacing.

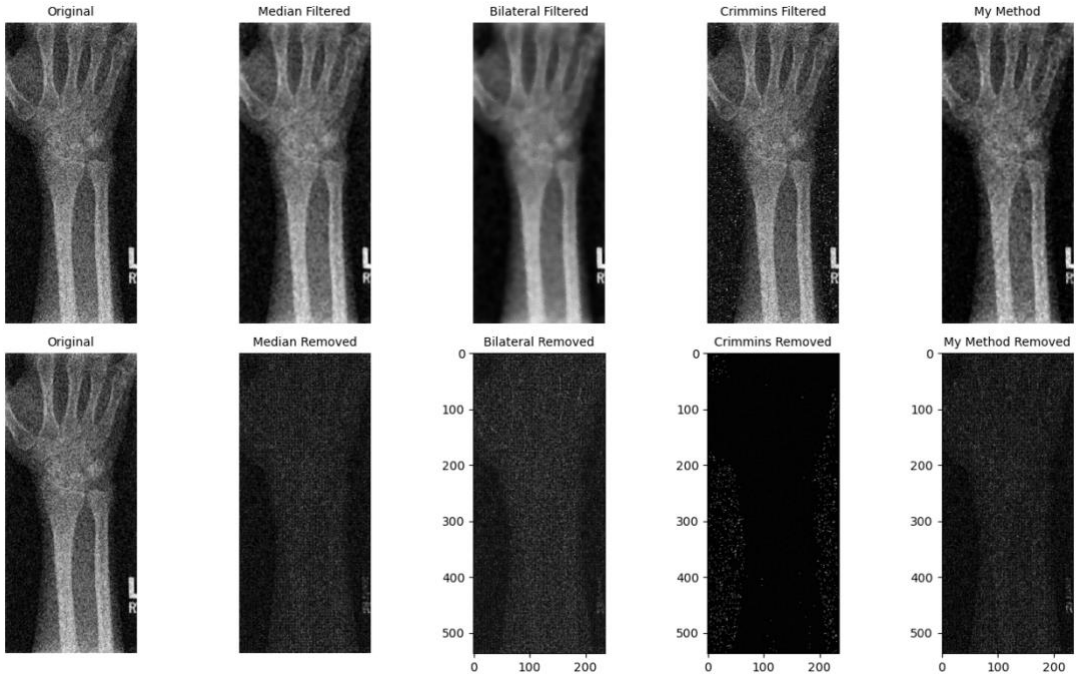
Task 2.

The following image shows different noise reduction methods which apply to X-ray images of distal radius fractures alongside ultrasound scans. Three standard methods for noise reduction testing include the Median Filter which effectively removes noise but may produce blurring effects and the Bilateral Filter dedicated to noise smoothing with edge retention capabilities alongside the Crimmins Filter used in medical imaging to achieve either noise reduction or image sharpening capabilities but potentially strengthening unsought features.

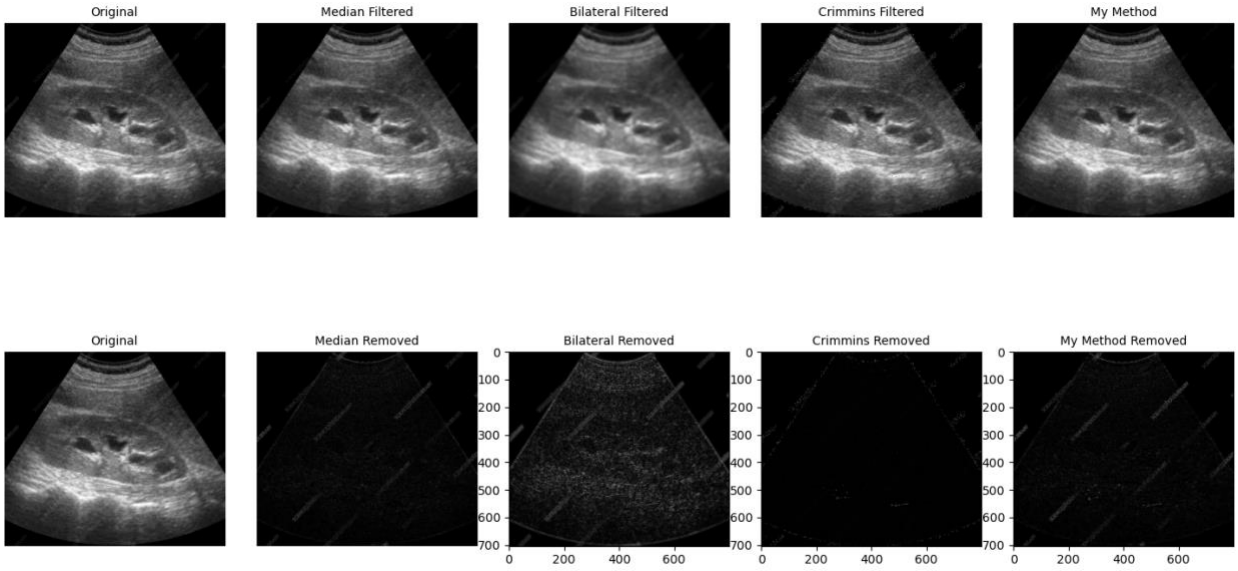
The task demonstrates similar characteristics to an earlier issue regarding the removal of salt-and-pepper noise that led to the development of "My Method." The developed approach uses Crimmins Filter results to concentrate on eliminating remaining salt-and-pepper noise traces. The method requires morphological refinement steps which use opening and closing operations.

The Standard Crimmins Filter yielded a noisier yet sharper output than either the Bilateral Filter or Median Filter which produced substantial blurring effects. "My Method" yield edge-preservation results together with favorable noise reduction outcomes during this particular

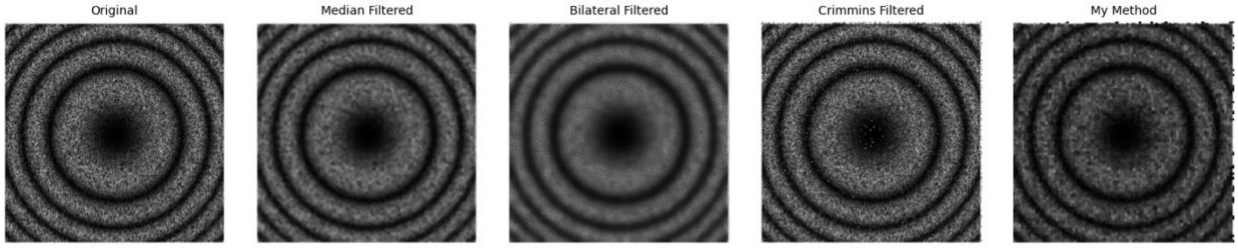
implementation.

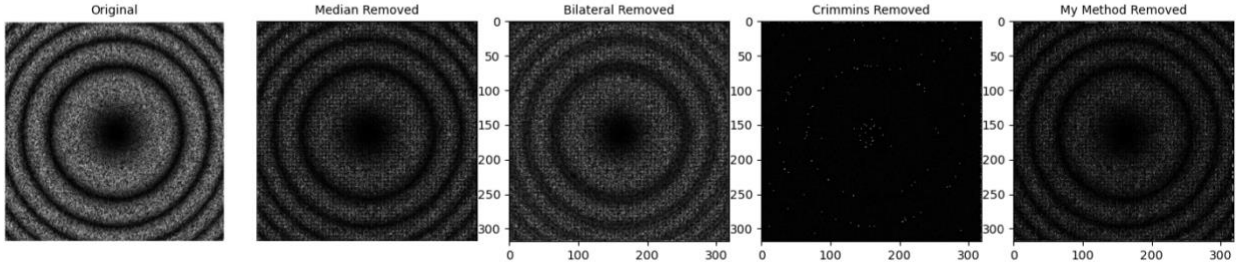


For the ultrasound image, again my method captured the noise in the form of straight light lines better than the others.



However when we applied my method to the concentric circles image we observe that **Bilateral Filter** method seems to be the best among the standard methods. It offers a good balance between noise reduction and detail preservation.


Original
Median Filtered
Bilateral Filtered
Crimmins Filtered
My Method


Original
Median Removed
Bilateral Removed
Crimmins Removed
My Method Removed
0
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