

FCIS
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Algorithms Analysis and Design
Image Processing
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Prior to carrying out higher-level processing stages in image processing, a filter is typically required to accomplish a high level of noise reduction in an image. A non-linear digital filter method called the order statistics filter is frequently used to remove noise (also known as salt and pepper noise) from images. In this project, we focus on two popular filters:

The adaptive median filter with the alpha-trim filter

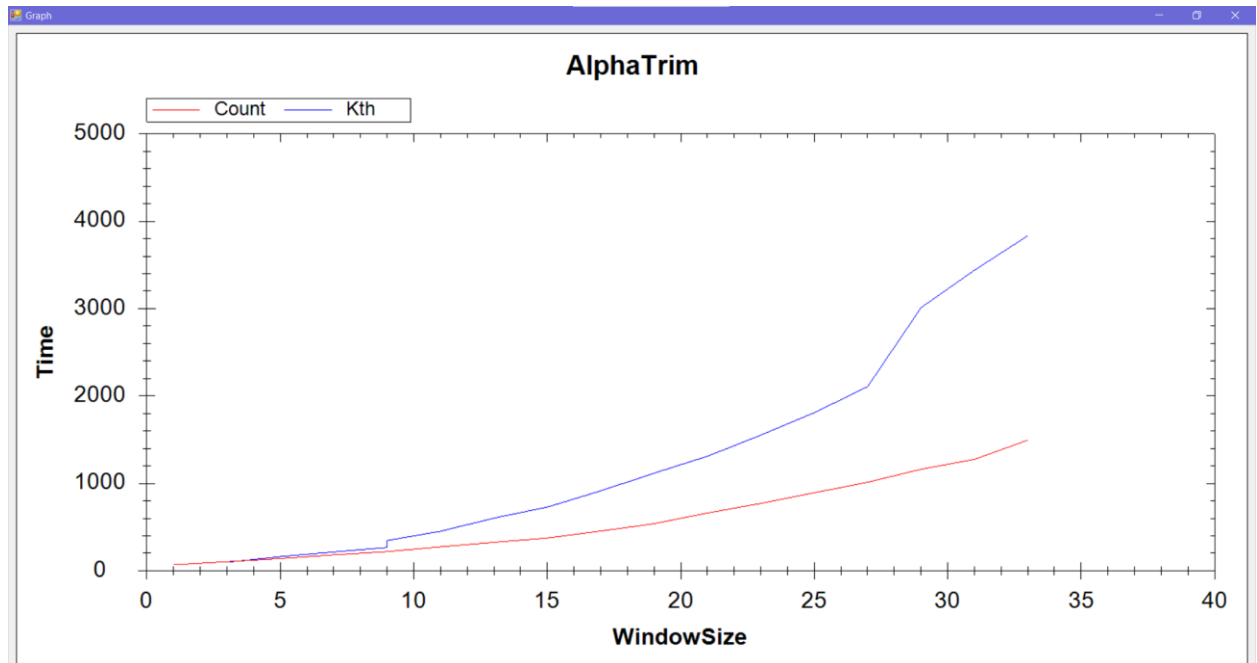
The fundamental principle of both filters is to first sort the pixel values in a neighborhood region with a specified window size, after which a single value is selected or calculated from the group and placed in the window's center in a new image. Each pixel in the original image goes through this procedure once again.

The filter's effect increased with the size of the window.

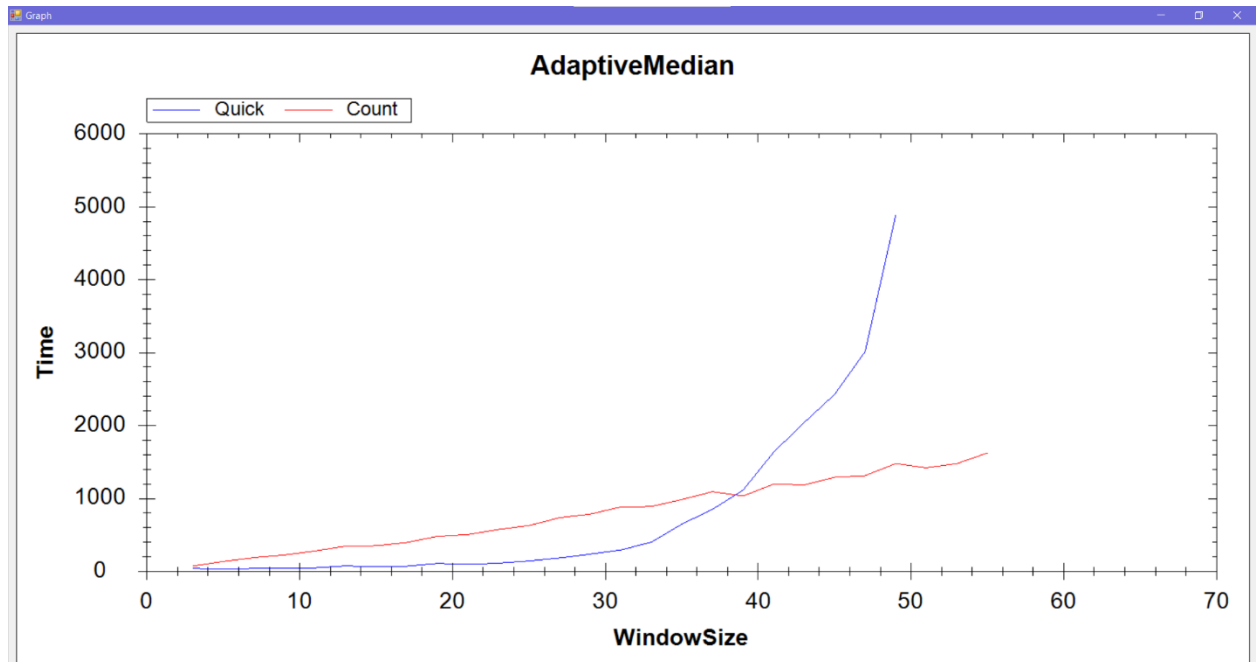
After implementing the two algorithms (Alpha-Trim Filter, Adaptive Med Filter) using their assigned sorting techniques (Counting sort, Select Kth smallest/largest element) for the Alpha-Trim Filter and (Counting sort, Quick sort) for the Adaptive Med Filter, we came to the conclusion that: (the testing was done while maintaining the window size of 3)

```
The Execution time of the count sort in alpha trim is 66ms
'ImageFilters.exe' (CLR v2.0.50727: ImageFilters.exe): Loaded 'E:\V
Module is optimized and the debugger option 'Just My Code' is ena
The Execution time of the kth sort alpha trim is 37ms
The Execution time of the quick sort in adaptive is 30ms
The Execution time of the count sort in adaptive is 79ms
```

- In terms of the time complexity the Alpha Trim filter took more time than the adaptive with 66ms for the count sort and 37 for the Kth element

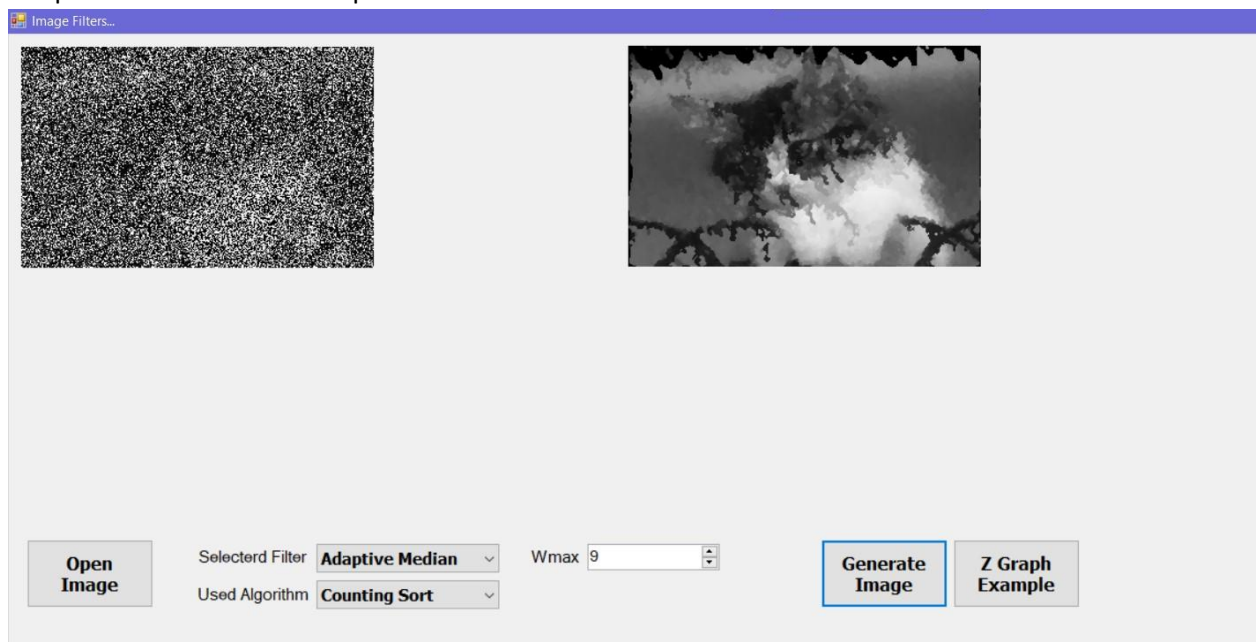


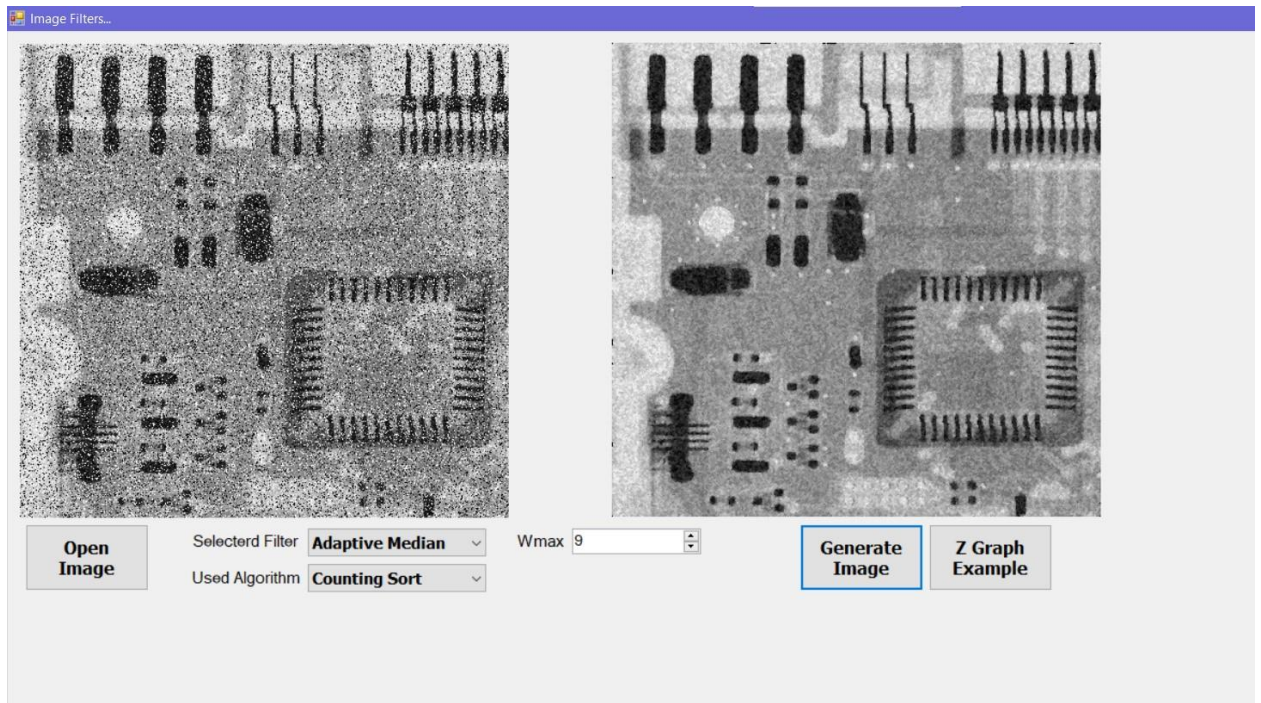
- While for the adaptive median it took 79 for the counting sort and 30 for the quick sort



- In terms of the quality of noise and pepper removal the Adaptive Median has given better result than the Alpha Trim:

Adaptive Results on two samples





Alpha Trim Result on two samples





So, the best complexity and quality must be the adaptive using the quick sort algorithm.

Our code's complexity:

Algorithm	Complexity
Kth element	N^2 **usually is $n \log n$ but to avoid sorting we had it n^2
Count sort	n
Quick sort	$n \log n$