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Research Article / Araştırma Makalesi

COMPARISON OF THE EFFECTS OF IMAGE SEGMENTATION ON IMAGE PROCESSING PERFORMANCE WITH PARALLEL PROGRAMMING

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ABSTRACT

In this study, the difference between parallel programming and serial programming and the differences between whole image processing and image processing by segmentation was tried be to analysed. In the context of the study, to the image given to the application, which improved with Net framework, median, mean and gauss filters were applied by using single, double and 4 as a separate part serial programming and parallel programming methods. As a result of the study experienced in different computers and processors, it was noticed that parallel programming method performed filter processing in a shorter time both in the whole image and the segmented image. We determined that the whole image processing has higher performance than other method for image.
Keywords: Image processing, parallel programming, median filter, image segmentation.

1. INTRODUCTION

Image processing technology is used in several areas increasingly such as medical visualisation, industrial production, security systems, biometric identification, astronomy, military and satellite visualisation. Image processing techniques are used in several areas such as classification of apples, detecting faults on the produced fabrics, in olive harvesting machines, in health sector, detection of cancerous cell etc. [1-4].

To infer from the obtained images by processing, they should be processed with necessary image processing algorithms. Since the image are processed pixel by pixel, as the image resolution increases as well as the amount of processing increases and thus the processing time increases. Many systems, which use image processing technology, are aimed at short processing times and high performance. For instance; a number plate of a vehicle, which moves along rapidly from electronic toll collection system at the entrance of the bridges and electronic control systems that controls traffic, should be spotted out in a couple of seconds and the penalty should

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be paid. To ensure this to detect the number plate from the image that is taken of the vehicle by processing with serial programming techniques, takes a long time.

In serial programming the processes are performed within mono processor or mono core. The steps in serial programming perform respectively; without completing the process it cannot be started to another one. For this reason, loss of performance occurs and process times extend. Parallel programming has been developed alternatively to serial programming method by augmenting the core in the processors of the computer to reduce the process time and increase the performance.

The processes with parallel programming method are performed by multi processors or cores in contradistinction to serial programming. The processes run simultaneously in the processors or the cores by segmenting small pieces and thus it is ensured performance increase.

Since there is a lot of processing in image processing and required to quick response time, parallel programming methods can be used. Aygün, performed a study to find which of the horizontal, vertical or from the middle segmentation can be selected and sent to which core for the portrait that put in the system in face recognition technologies.(Aygün & Akçay, 2015).

Saxena examined the applications of image processing with parallel programming technique in medical sector and he found that the process became faster than serial programming technique(Saxena, Sharma, & Sharma, 2016). Another study in medical sector done by Peker who found performance increase by using CUDA, which is one of the parallel programming methods, for processing EEG data (Peker & Şen, 2012).

Priyadarshini used the parallel programming for zipping the images and he noticed processing time became shorter and performance increased as in the other studies (Priyadarshini, Sharvani, & Prapulla, 2015). Yenialp, aimed to increase the performance by using image segmentation algorithms graphic process unit(GPU) with parallel programming. He realized that K- Medians, K- centres that he used in his study, the speed of the DBSCAN methods increased with parallel programming(Yenialp & Kalkan, 2013).

In satellite systems received high resolution data image processing method with parallel processing methods were used by Pekin. Following the study, he noticed that the parallel programming had higher performance than serial programming. (Pekin & Oğuz, 2015). Akgün, analysed the performance of the parallel image filter on the multi cores system with Java threads; he realized that performance increases as both the number of the threads and the cores increase. (Akgün, 2013).

Ma et al. worked on GPU based parallel image processing with remote sensing in 2016. They obtained the best performance on pixel level image processing as a result of the implementation that they used in Mpi and Openmp applications (Ma, Chen, Liu, & Lu, 2016). Jin et al. noticed that as the core numbers increasing, the memory used decreasing and found that the time became shorter(Jin, Jespersen, Mehrotra, Biswas, Huang, & Chapman, 2011).

Singh et al. used different parallel programming techniques. They compared with different parallel programming algorithms that were used point, neighbourhood and global operators which are used in image processing in their studies. In their study, they sent the image to different processors by segmenting and determined performance increasing(Singh, Kaur, & Kaur, 2015).

As seen many of the studies, parallel programming increases the performance on image processing. [15-18].

In this study, the performances of serial and parallel programming on several processors was analysed by using median, mean and gauss filters.

2. MATERIAL AND METHOD

The application that can be seen in figure 1 has been executed in Visual Studio 2012 C# programming language. In the application, parallel programming provided with Net framework. In the scope of the study to increase the number of processes, Median, Gauss and Mean filters

were used. Median, Gauss, Mean Filters were applied to the images whose resolution was 3840*2160. Median Filter is to change the value of a pixel by finding the mean value of neighbourhood pixels (Median filter, 2015). Gauss filter is a using new value that is found by taking a pixel on the x,y coordinates of the image, and this value multiplies with neighbourhood ratios. Mean filter works by trying to find a mean value in NxN window. As they are doing this, they use a sliding window method. In the improved application, Median, Gauss, Mean Filters can be applied separately in serial and parallel programming.

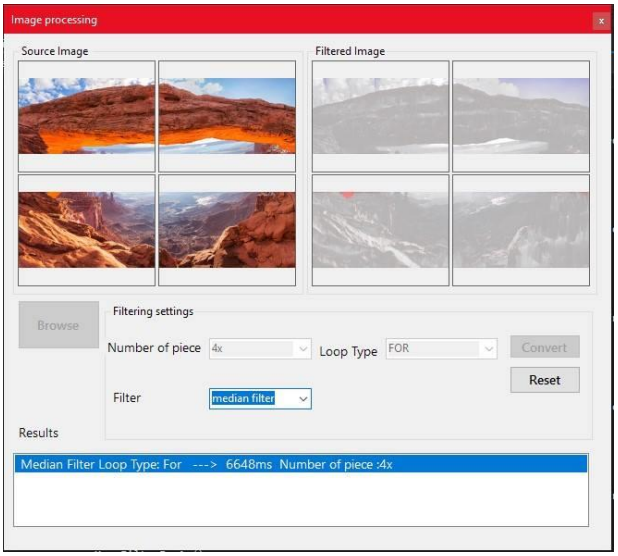


Figure 1. The programme user interface

To see the difference of Parallel programming, single piece of filters were applied to the image. In the second case as seen in Figure 2, firstly the image was divided in two piece and the filters were applied to each piece separately. In the third case, the image was quartered into equal pieces and the filters were applied separately. Process times, processors and core using and processors' heat of all these methods analysed by testing in computers whose features are different from each other.

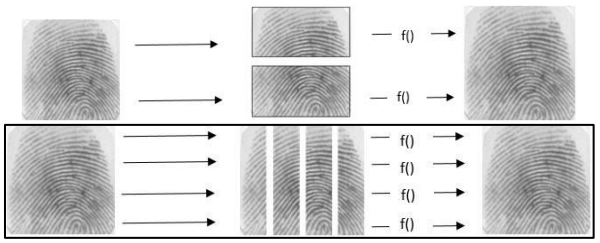


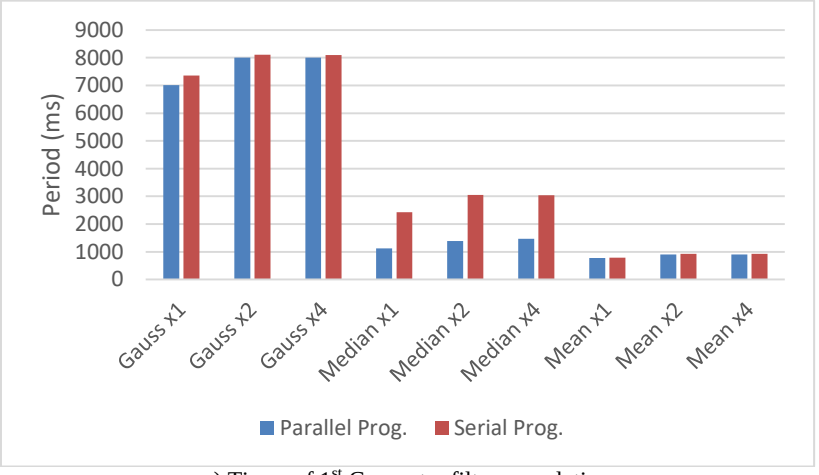
Figure 2. The image which segmented into two and four for filters (left: the dimidiate, right: Quartered pictures for median filter)

To compare the performance of Parallel programming it was made use of current variation of processors. Variation of processes and computer features used in the study listed in Table 1.

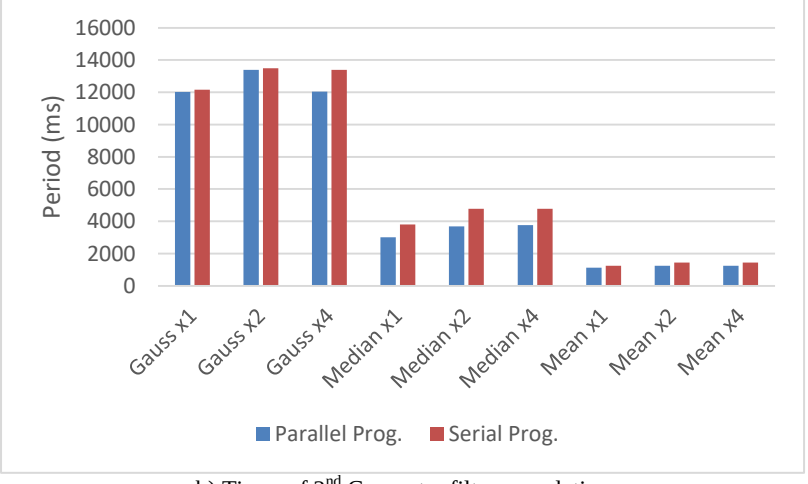
Table 1. Computer features used in the study

	1st Computer	2nd Computer	3rd Computer
Processor	Intel Core i53337U2 GHz	Intel Corei7 5700HQ 2.7 GHz	AMD dual Core el-2100 1GHz
Memory (RAM)	8GB DDR3	8 GB DDR3L 1600 MHz	2 GB DDR3
Graphics card	NVidia GeForce GT 720M 2GB	NVidia GeForce gtx960m 2gb	AMD display card hd8210 1gb

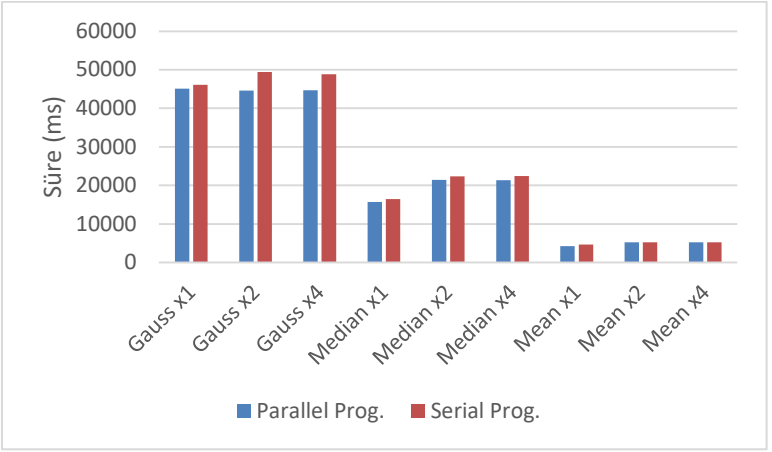
The image was processed in median, mean and gauss filters with helping parallel programming provided by Net framework. The times and techniques of the parallel programming and serial programming are shown in Figure 3.



a) Times of 1st Computer filter completion



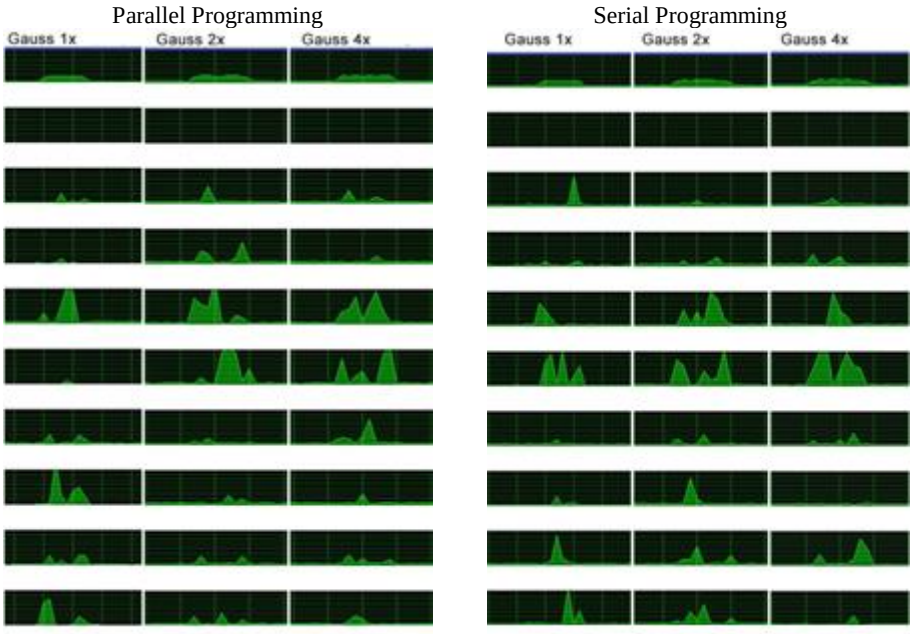
b) Times of 2nd Computer filter completion



c) Times of 3rd Computer filter completion

Figure 3. Processing Time of single, dimidate, quartered pieces filter process time of the images.

As seen in Figure 3 mean filter was completed within the shortest time in all three computers. It was determine increase number of process core decreased the time in both serial and parallel programming from the obtained data. Information from the data is processing single piece of image takes shorter time instead of segmenting into 2 or 4. This reason is consideration of the time of the segmentation included the calculation as its reason. On the other hand Parallel programming method shares the process to all the cores and does the process within a shorter time than the other methods.



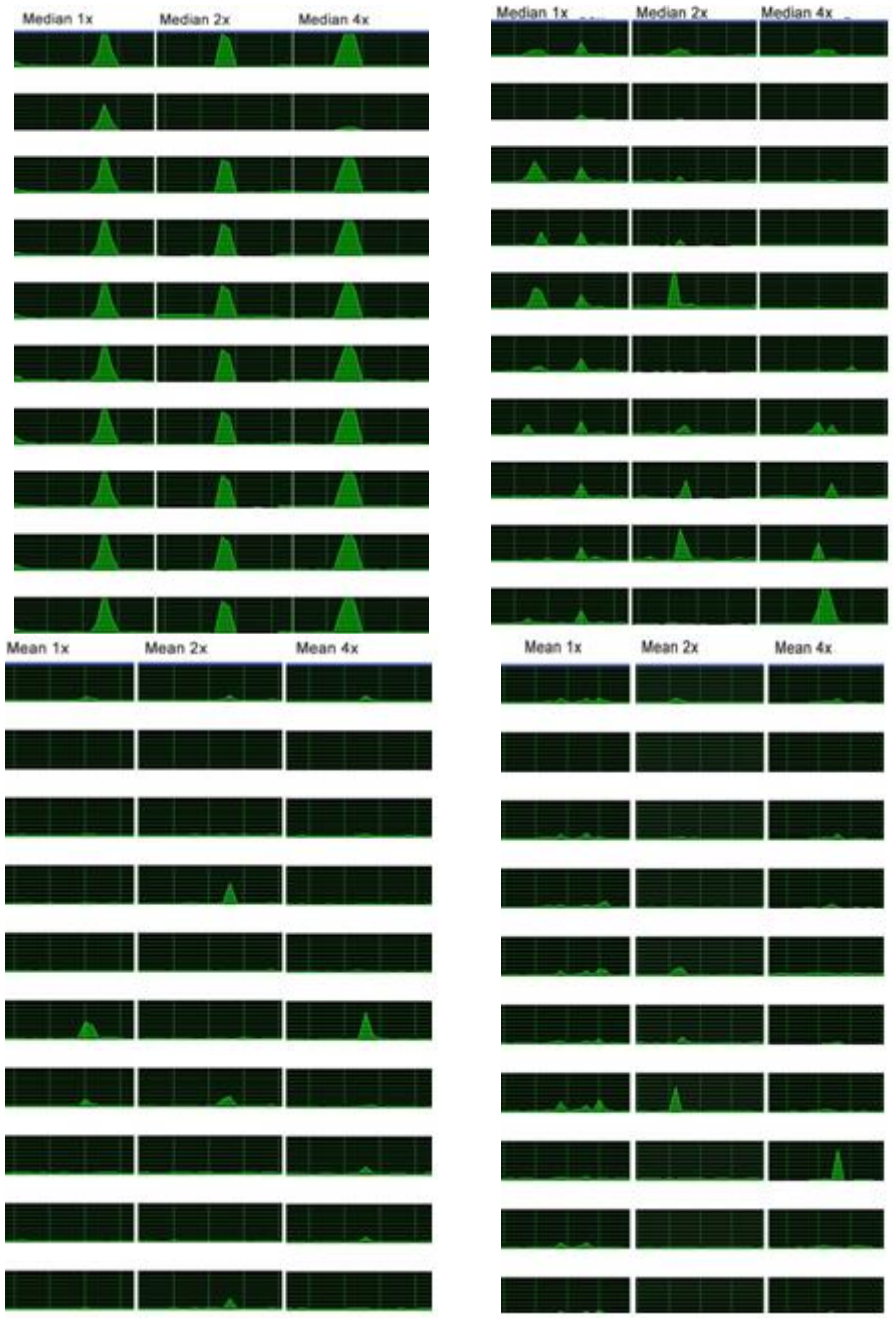
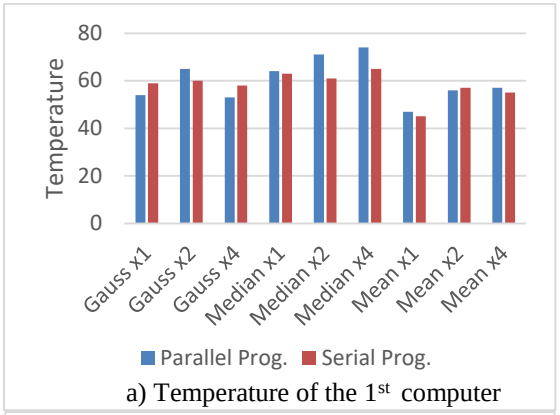


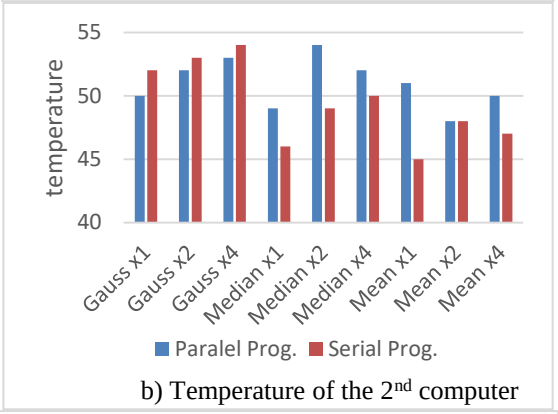
Figure 4. The core usage ratio of programme techniques in image processes. (Left: parallel programming, right: serial programming)

The amount of the processor's core load in filter processes is shown in figure 4. It was realized that the core of the processors used more with parallel programming technique in Median filter. As Mean filter does not need a lot of process, it has not been able to found a difference between serial and parallel programming.

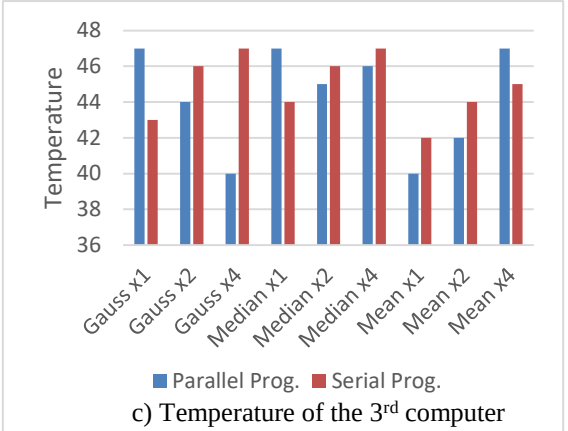
The temperature graphics of the processes that used in comparison are shown in Figure 5. It was observed in Parallel programming method the cores of the processor run higher capacity so that the processor increased temperature more. The temperature of the computer, whose processor is Intel i7, is more balanced than the other computers and run in average level.



a) Temperature of the 1st computer



b) Temperature of the 2nd computer



c) Temperature of the 3rd computer

Figure 5. Temperatures of the proccessors in Programming Techniques

3. CONCLUSIONS

In this study the difference between serial and parallel programming and processing the single or segmented image by using image processing methods have been examined. In the application

which have been used mean filter, it has been observed that parallel programming have shorter time than serial programming. It may be explained the reason for being fast Parallel programming method as all the cores in the processor are used. Since the cores are used in full performance in parallel programming, it is observed the temperature of the processor is higher than the other methods.

It is seen that between single image and segmented image; the single image processed within shorter time in the processors in the study and in all methods. This is because the time that the image segmented into 2 or 4 pieces and directed to the cores is considered. It has been seen that parallel programming technique runs more beneficial than serial programming without considering whether the image is single or segmented. To chose parallel programming in the studies of image processing will increase general system performance.

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