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Research Article

Comparison Of Filters (Dwt, Ksvd) And Edge Detection Methods (Canny And Sobel) On Medical Images

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ABSTRACT
Application of Digital Image Processing on medical images could greatly contribute in the discovery of diseases and it would provide the physicians with valuable inputs in the process of diagnosing the diseases without any flaws. This is an experimental paper in which some of the filtering methods and edge detection methods have been applied and the results are being reviewed. Some of the important filtering techniques will be discussed in this paper and the results I have worked on will also be illustrated. Two types of edge detection methods have also been reviewed and their results are being illustrated.

Keywords*:* Filters, KSVD, DWT, Edge detection, Sobel, Canny.

INTRODUCTION:

In Digital Image processing filtering and edge detection are being considered as important pre-processing steps. Filtering is the process of enhancing or modifying an image in which either we highlight certain features or remove other features. Edge detection techniques are being used in image processing for reducing the unnecessary information in an image thereby preserving the structure of the image. There are many types of filtering that have been used in Image processing in order to remove noises on an image. Filtering and edge detection methods have been used to improve the quality of images since it is vital to carry out the further operations on images.

LITERATURE SURVEY:

Ahmed S. Negm et al. (2019) Osama A. Hassan et al. (2019) have identified a method known as K-means clustering. It was compared with LBG and KPE for blast detection in acute leukemia images. The K-means algorithm was superior to theLBG and KPE algorithms. In their research work the prediction of k value was difficult.

Friedhelm Schwenker et al. (2019) have analyzed methods such as SVM, MLP and CNN for their research work. They have used CNN classifier to explore the feasibility of deep learning approach to identify lymphocytes. They did not encode the position and orientation of objects in to their predictions.

T. T. P. Thanh, Caleb Vununu et al. (2019) have introduced Convolutional Neural Network (CNN) based method to distinguish normal and abnormal blood cell images. Their network model was computationally expensive .

Ying Liu1 and Feixiao Long et al. (2019) have introduced Ensemble model prediction method. Efficient for tackling the challenges. It is less robust and did not work well with small data sets. The metrics used were accuracy,precision and recall.

Sarmad Shafique et al. (2018) have investigated a method called as a pretrained DCNN was deployed for automatic detection and classification of its subtype. They need huge amount of data to learn robust features.

NiranjanChatap, SiniShibu et al. (2018) have proposed iterative thresholding algorithm for the segmentation of noisy images. Their work had overcome the problems associated with segmentation of heavy noisy images, when compared with an algorithm known as watershed algorithm. Based on the prior information when thresholding approach was appliedthe algorithm has derived blood smear images.

S.Jagadeesh, Dr.E.Nagabhooshanam et al. (2018) have introduced an algorithm known as watershed algorithm for the segmentation of the bone marrow images .The algorithm has also performed the cancerouscell extraction from the blood image. Different features of the cells were also generated automatically. The feature quality of the cells was carried out by using some methods such as PCA and correlation. In their research work classification was done by the traditional classifier known as SVM.

TYPES OF FILTERS

There are many types of filters in digital image processing. The most prominent filters are

COMPARISON OF FILTERS:

Average Filters:

Average filtering is a filtering method in which it would smooth pictures by decreasing the measure of power variety between neighboring pixels. A normal filter works by travelling through the image pixel by pixel.

Median filters:

In digital image processing it is very important to reduce noise on an image. The median filtering is a type of non-linear filtering method. The good thing about median filter is that it preserves the edges while removing the noises on an image. Median filter works by replacing the value of the center pixel with the median with all the pixel values in the window. Median filter is also known as sliding-window spatial filter. This filter has been used as a pre-processing step to improve the results of further processing such as edge detection on an image.

DWT

DWT is discrete Wavelet Transform filtering. DWT has been widely used in the field of digital image processing. DWT works by decomposing an image into a multi resolution subban structures through a two channel filter bank. The decomposition of images took place by continuously implementing low pass

filters, high pass filters . The decomposition can also take place by using down sampler to the image in the horizontal as well as vertical directions.

KSVD FILTERING

KSVD is basically an iterative method in which it alternates between the current dictionary sparse coding and also updating the dictionary to perform better by fitting in the data. All the updates that took place in the dictionary columns is being combined with the updated sparse representations. One of the major advantages of the KSVD method is that it is flexible.

KSVD filtering has been widely used in the field of image processing in which the method has a slow convergence rate for sparse coding .The method also has complexity in dictionary updating using singular value decomposition. Thus in turn the efficiency of the filtering would be low if we consider large images. These are some of the disadvantages of KSVD filtering method.

RGB to GRAY SCALE CONVERSION:

Before we could do the filtering operations on images the image which is in the form of rgb needs to be converted to gray scale so that we can carry out the pre processing techniques.

EDGE DETECTION:

Sobel and canny are the two methods that have been used in medical images for the process of edge detection. The two methods have been explained in the following session.

Sobel method:

Sobel edge detection operator is basically a differentiation operator in which it will compute the gradient of the image intensity function. The result of the sobel opeartor would be either the corresponding gradient vector or the norm of that vector. The operator works by convolving the image with a small integer valued filter in both vertical as well as the horizontal directions. The sobel operator emphasizes the region of high spatial gradient corresponds to the edges by using 2D gradient measurement of the image. The sobel operator basically uses intensity values in a 3*3 region in order to approximate the corresponding image gradient and the sobel operator uses only integer values as coefficients.

Advantages of sobel operator:

a) When the operator is combined with average filter it will have some soothing effect to the random noise present in the image.

b) Since sobel operator is the differential of two rows or columns the edges would appear more thicker and brighter.

Canny method:

When canny method has been applied the algorithm works by the following five steps associated with it. The steps are,

a) Smoothing and Blurring of the image to remove the noise.

During the first step of the Canny edge detection method the images will be blurred and removal of the noise will take palce and it is known as smoothing.

b) Finding Gradients

The next step followed by smoothing is to find the gradients. The edges should be marked if the gradient of the image has larger magnitudes.

c) Non maximum suppression and Double Thresholding

The next step is the non maximum suppression. The local maximas have to be marked as edges. The potential edges will get identified during the phase of double thresholding.

d) Tracking of edges by hysteresis.

Finally the edges will be deterned,by suppressing all the edges that are not connected to a strong edge.

Canny edge detection technique has been used to extract useful information from different objects and it would reduce the amount of data to be processed. The canny edge detection method has got some criteria's they are,

The edges with low error rate will be detected first and also it will accurately detect many edges in the given input image. The edge point that is being detected by the by the canny operator will be placed in the center of the edge. The given egde in the image should only be marked once and the noise present in the image should not create false edges.

In order to to stisfy the requirements mentioned above ,canny has used the calculus of variations. The sum of the four exponential terms has been used to find the optimal function in canny detector which could be the first derivative.

Canny edge detector is one of the most efficient edge detection techniques and it provides reliable and good results. Thus it has become one of the most popular algorithm for edge detection.

It was found that canny yields better results during visualization. The results are shown below.

RESULTS AND DISCUSSIONS

When two filtering methods DWT and KSVD were applied and compared the performance of the two filters were evaluated using the PSNR ratio. PSNR is the Peak Signal to Noise Ratio.This ratio is used as a quality measurement. During the experiment it was found that the PSNR ratio is high in KSVD filtering compared to DWT. The results when DWT and KSVD were applied and the PSNR table is given below.

Image	DWT	KSVD
Image 1	32.6 db	34.8 db
Image 2	34.5 db	36.7 db
Image 3	32.8 db	37.4 db
Image 4	35.4 db	38.3 db
Image 5	33.6 db	36.4 db

Images	Gray scale image	Noisy image	Filtered image using DWT

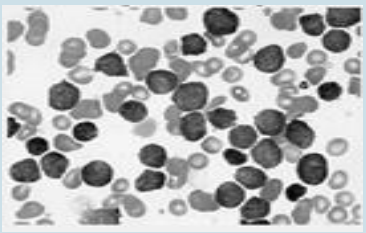
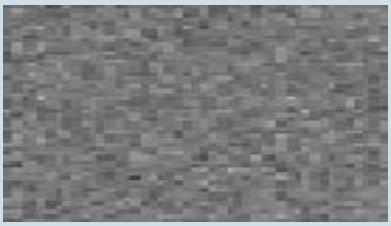
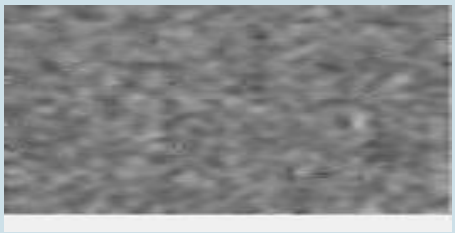
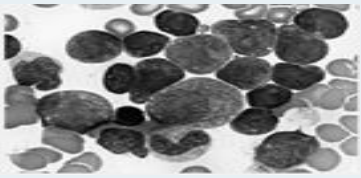
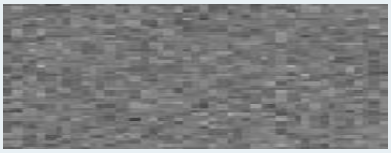
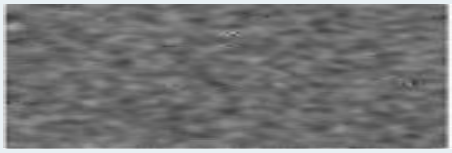
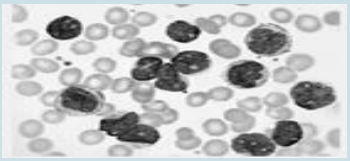
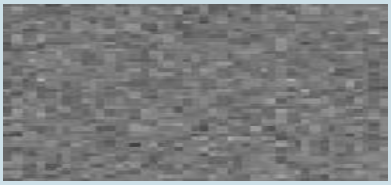
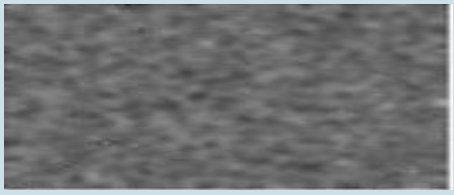
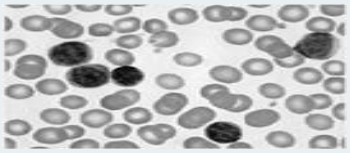
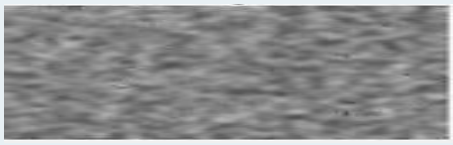
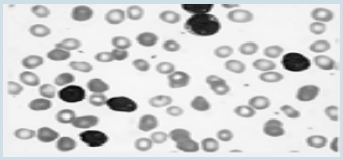
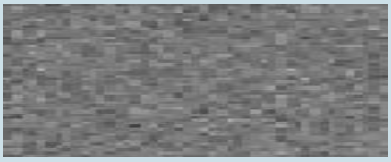
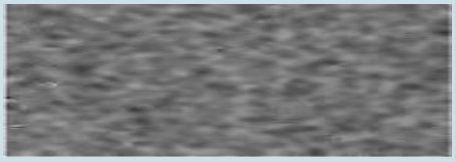
Image 1			
Image 2			
Image 3			
Image 4			
Image 5			

Table 1.PSNR ratio of images in db.

Table 2: Filtering using DWT

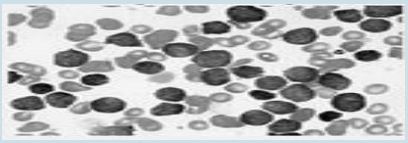
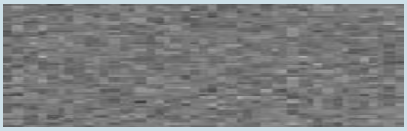
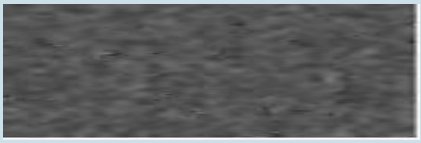
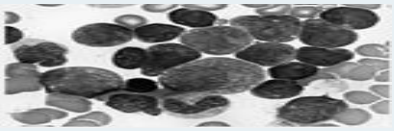
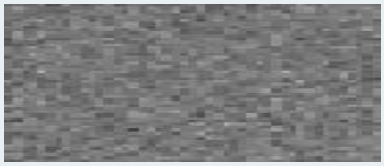
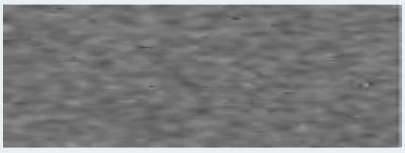
Images	RGB image	Noisy images	Filtered image using KSVD
Image 1			
Image 2			

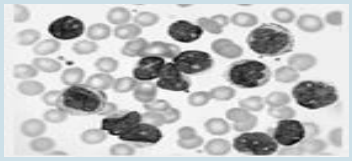
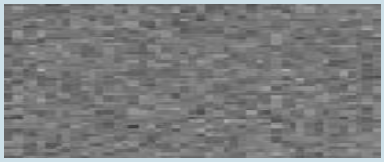
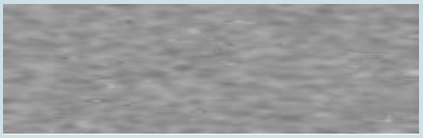
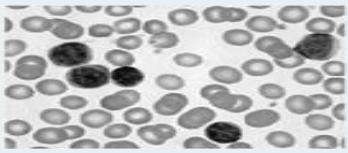
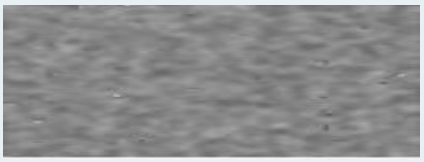
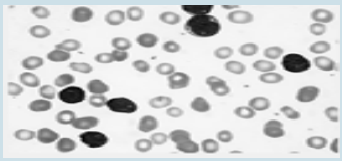
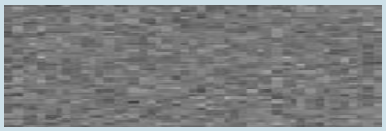
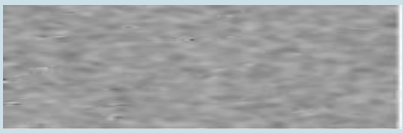
Image 3			
Image 4			
Image 5			

Table 3: Filering using KSVD.

The resultant images when sobel edge detection and canny edge detection were applied is given below. It was found that Canny yields better results when compared with Sobel during visualization.

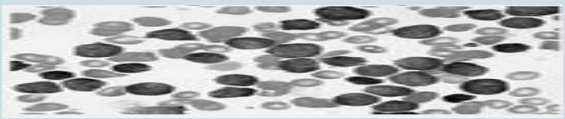
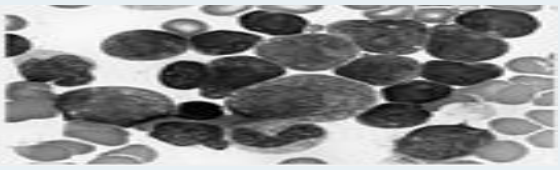
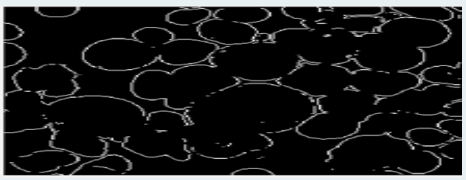
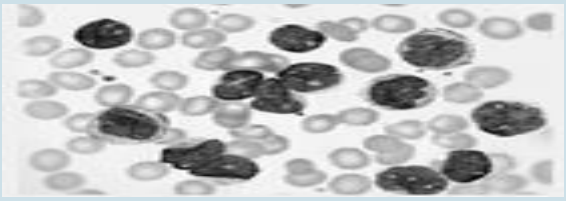
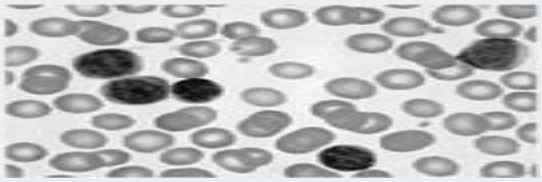
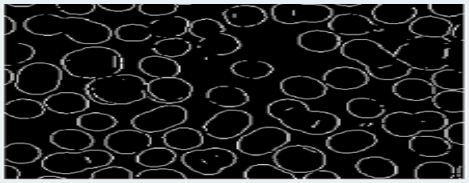
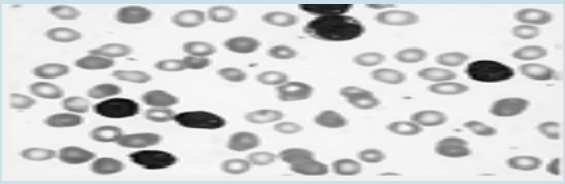
Images	Adaptive Histogram equalised image	Sobel edge detection
Image 1		
Image 2		
Image 3		
Image 4		
Image 5		

Table 4: Sobel edge detection

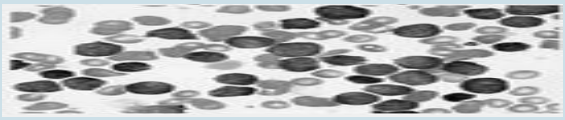
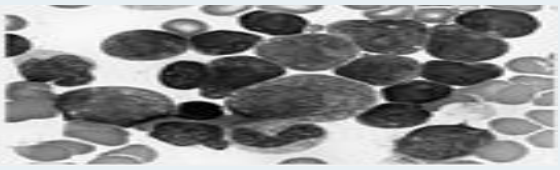
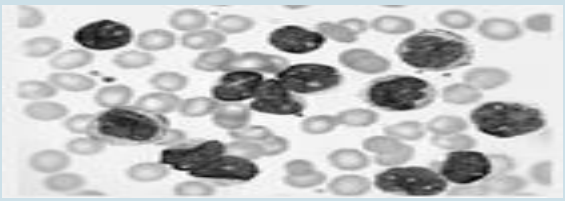
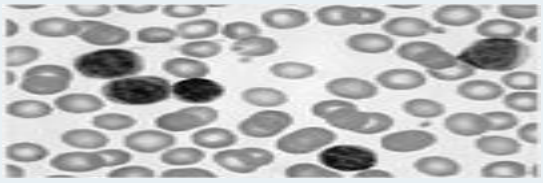
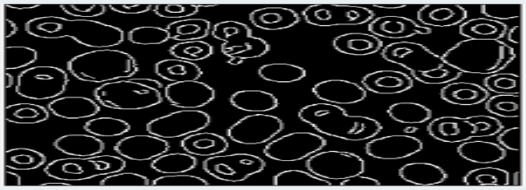
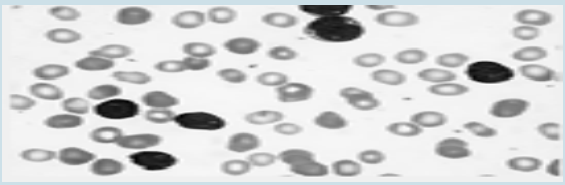
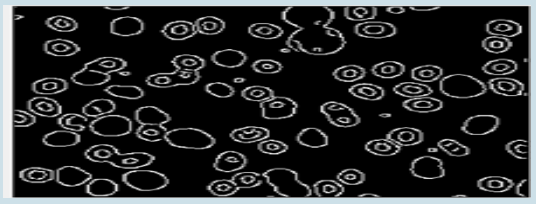
Images	Adapive histogram equalised image	Canny edge detection
Image 1		
Image 2		
Image 3		
Image 4		
Image 5		

Table 5: Canny edge detectiom

CONCLUSION:

This paper has compared two of the efficient filtering methods in digital image processing. Two of the efficient edge detection methods are also applied and compared. The results and the findings are also being described. The filtering methods used were are DWT and KSVD, it is being proved that KSVD outperforms the DWT method since it has high PSNR value.The edge detection methods such as Sobel method and Canny method have also been applied and the resultant images were compared to find out the better method for edge detection.

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