Sobel Edge Detection Techniques for Identification of Virus using Microscopic Images

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Abstract — In this concept describes a various techniques of edge detection by using image segmentation. The several techniques are Roberts Edge detection, Sobel Edge Detection, Prewitt Edge Detection, LOG Edge Detection, and Canny Edge Detection. This Paper mainly focused Sobel edge detection and Threshold edge detection techniques are implemented using MATLAB and result is obtained. We have taken different types of microscopic images in web site which affects human body by making diseases in virus and bacteria. Now we analyze this paper defines compare using Sobel Edge Detection and Threshold Edge Detection and demand assures which provides better performance on edge detection using microscopic image.

Index Terms— Edge Detection, Microscopic, Sobel edge detection, Threshold edge detection

I. INTRODUCTION

Image Segmentation is used to partition a digital image into multiple regions, which represents a set of regions of entire image. The result of this image segmentation is extracted images [1]. All of the pixels in a region are similar with some characteristic or parameter like color, intensity, and texture [2],[3]. Edge detection is a most often used techniques in digital images processing. The outline of the object surface in a scene has some changes in intensity value of an image called edges. This search considers a research to detect a robust edge detection technique. Many edge detection algorithms are available in image processing. This paper gives description, and comparison of result of recent soft computing approaches for edge detection on segmentation.

The paper is organized as follows. Section II provides a general description of the method and the five test data sets that were used. Section III describes the Sobel Edge Detection and Section IV describes the Threshold Edge Detection that was performed. Section V provides the Experiment and Result. Finally, Section VI discusses about conclusions.

II.EDGEDETECTION

The image segmentation has different kinds of techniques. It is sub divided the image into several parts, the main goal of image segmentation that can be modified and easier to analyze [4]. Image segmentation is specifically used to locate the object and boundaries. The boundaries are called as lines curves etc. Absolutely we can assign each and every pixel defines as label using edge detection techniques.

The result of image segmentation is a set of segments that collectively fulfill and it will cover the total image. A contours line also called isoclines a set of contours describes from the image segmentation [5]. Each of the pixels in a region is corresponding to some characteristics or computed properly. The image processing has the color, intensity, and texture. Adjacent regions are importantly several with similar to the same principle.

Now we discuss about the main concept of edge detection. Edge detection is a highly developed in the image processing. Region boundaries and edge are one of the techniques which are closely related with edge detection using segmentation. We need to find out the edges after it disconnected. The edges consists of several mathematical methods to target at co ordinates in digital image segmentation and also image brightness with changes accuracy are more professionally as discontinuous using various methods of edge detection. These are step detection & change detection. Edge detection is a tool of image processing, machine vision and computer vision. It mainly focused on feature detection and feature extraction.

A. Roberts Edge Detection

The Roberts method is used in image processing and computer vision. The Roberts operator is the one of edge detectors technique. Thus operator specifically proposed by Lawrence Roberts [6]. As a various operator, the suggestion is behind with the Roberts operator is to inexact of the magnitude of an image through discrete differentiation which are gained by computing at the sum of squares of various between diagonally on adjacent pixels.

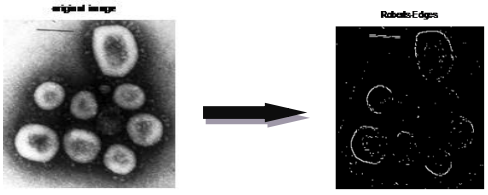


Fig.1: Corona Virus

B. Sobel Edge Detection

In this system are also known as sobel feldman operator or sobel filter. It is used in the image processing and computer vision [7]. This method is based on convolving the image. The sobel image has small, separable and integer valued filter, occur the horizontal and vertical direction. It is also low expansive in the term of computation, another type the great is approximate to find the relatively crude in a particular high frequency at various image.

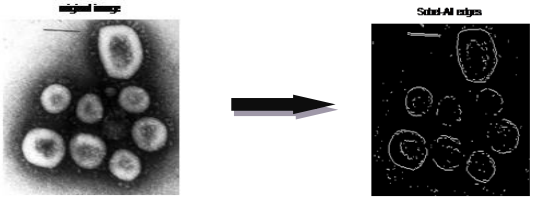


Fig.2: Corona Virus

C. Prewitt Edge Detection

In this operator perform various methods and technique using edge detection. This technique finding image with small portion, separable and integer value filter in horizontal and vertical directions and similarly reasonable in terms of computations like sobel operator, on another type is the grade approximately to find the relatively crude, in the particular for increased frequency difference in an image.

Fig.3: Corona Virus

D. LOG (Laplacian of Gaussian) Edge Detection

An image Laplacian is a 2-Dimensional isotropic measure of the second spatial derivative. The Laplacian of an image indicates the regions of the fast intensity variation and is consequently time and again used for the edge detection. The Laplacian is frequently applied to an image that has the first be curved with something approximate in order to decrease its concern to noise, and therefore the 2 variants will be explained together at here. The operator usually taking a single gray level image as the input and it produces a new gray level image as the output.

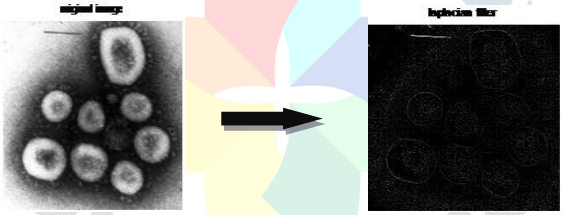


Fig.4: Corona Virus

E. Canny Edge Detection

Canny edge detection is a method to extract useful structural in sequence from dissimilar vision objects and considerably decrease the quantity of data to be processed. It has been generally practical in various computer vision systems. Canny has found that the necessities for the application of edge detection on varied vision systems are comparatively related. Hence, an edge detection explanation to concentrate on these requirements can be implemented in a broad variety of the positions.

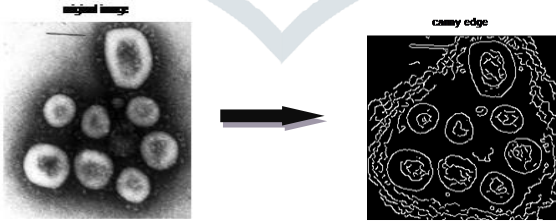


Fig.5: Corona Virus

III.SOBEL EDGE DETECTION

. The Sobel operator performs a 2-D spatial slope measurement on an image and so emphasizes regions of high spatial frequency that correspond to edges [1]. Typically it is used to find the similar absolute gradient magnitude at each point in an input grayscale image.

This edge detection series use matlab in built utility edge () which takes px and py are sobel x and y direction masks which are convolved with the input image and are the output for sobel x and y masks. The masks extort edges in dissimilar directions from innovative images. A manual sobel x masks and sobel y masks and compare the sobel after combining both directions and also detect Edge at 45 with sobel mask and Edge at -45 with sobel mask is used to get the output of microscopic images.

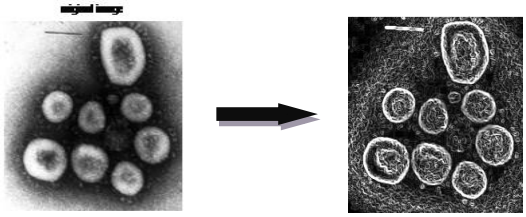


Fig.6: Corona Virus

IV.THRESHOLD EDGE DETECTION

They have calculate a measure of edge strength, the next stage is to apply a threshold to make a decision whether the edge is nearby or not at a identify point in an image. Extra images with detected the edges in microscopic images and the lower threshold values and output comes susceptible to noise resulting in detecting edges for required facial exterior in the images. They take the original microscopic images and apply with binary image with a manual threshold of 0.5 and vertical edges specified threshold and determined automatically within that microscopic images. But the higher threshold values in that sobel edges of the microscopic images.

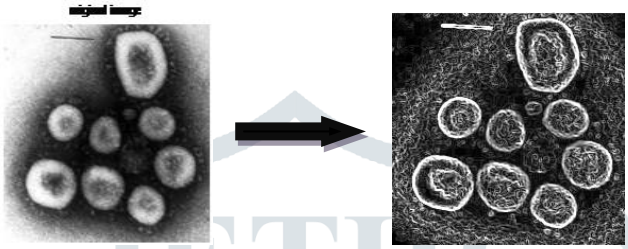
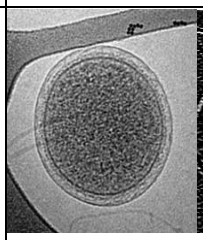
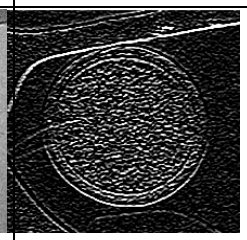
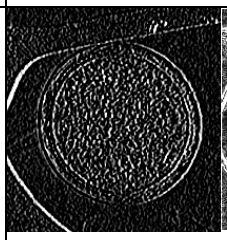
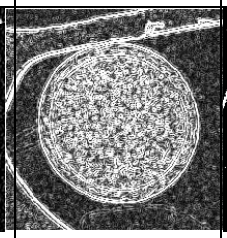
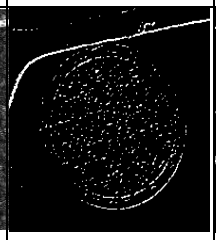
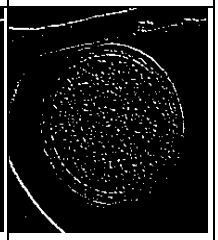
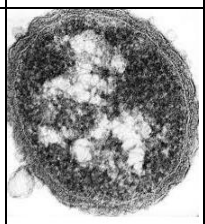
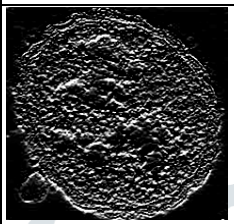
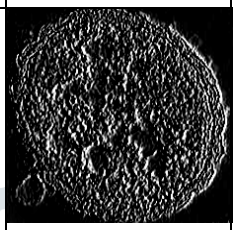
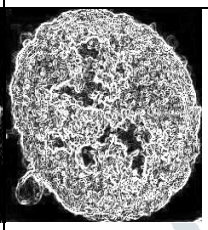
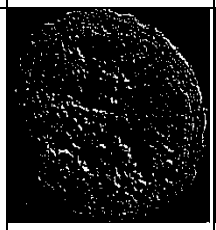
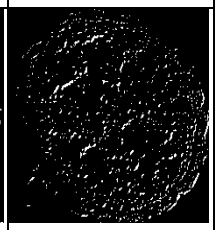
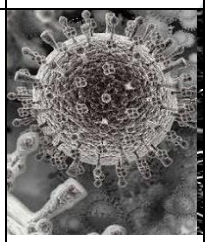
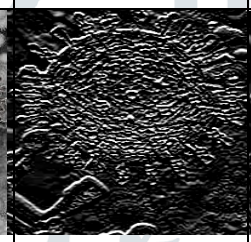
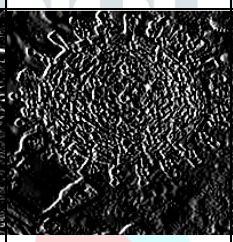
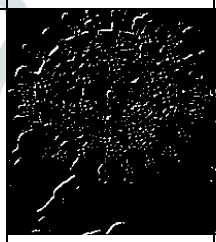
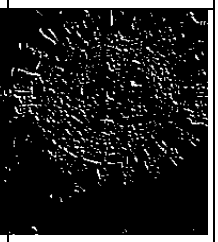
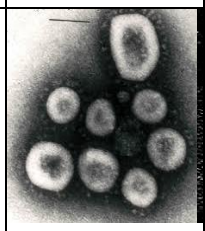
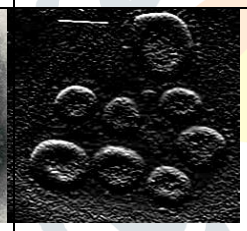
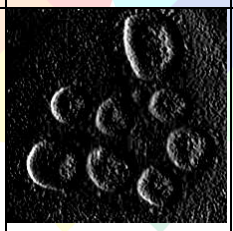
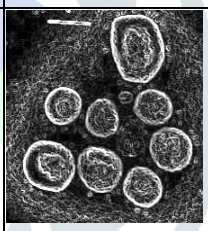
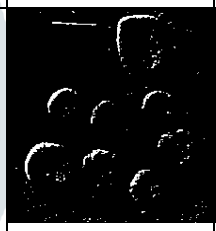
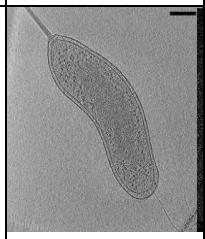
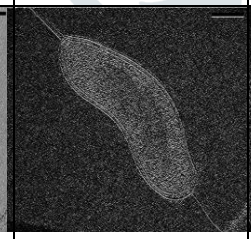
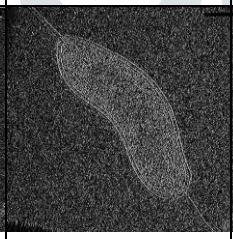
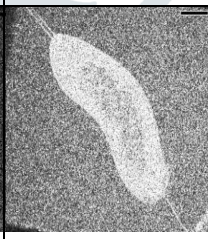
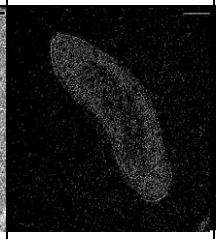
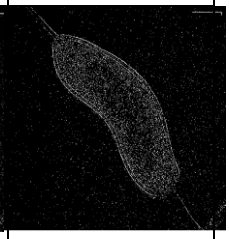


Fig.7: Corona Virus

Equations

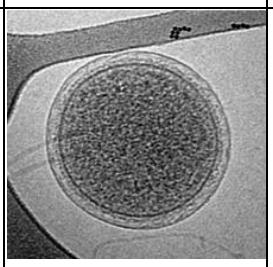
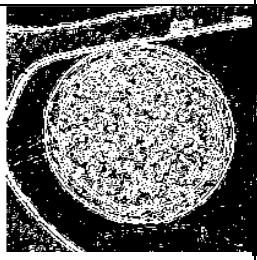
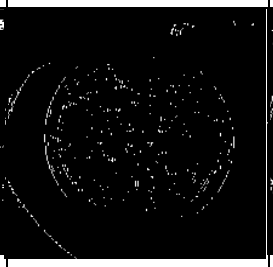
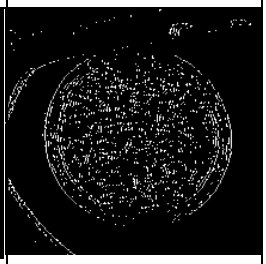
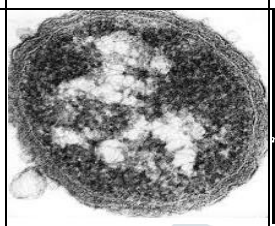
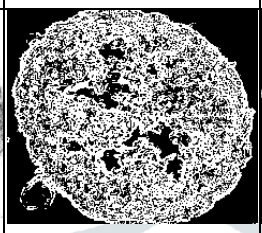
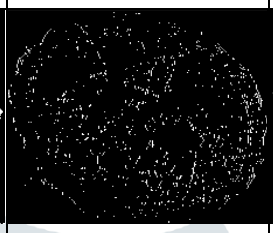
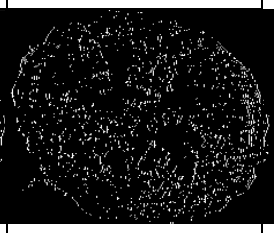
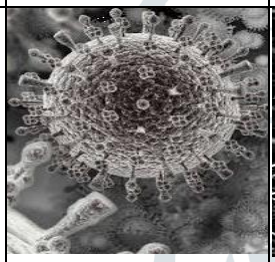
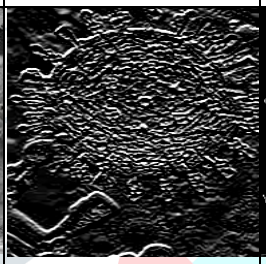
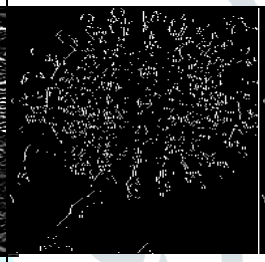
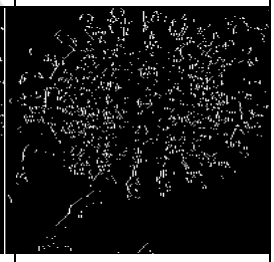
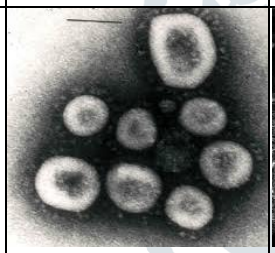
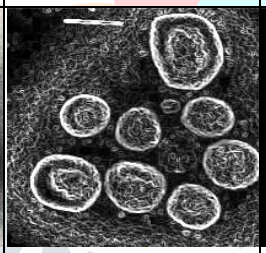
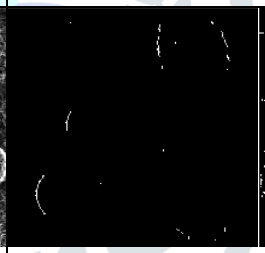
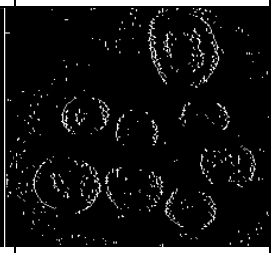
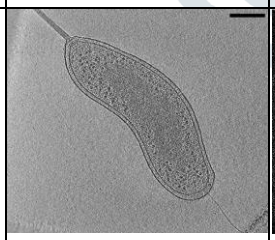
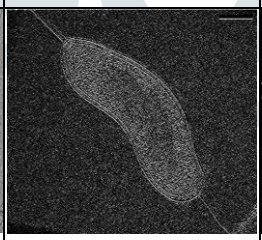
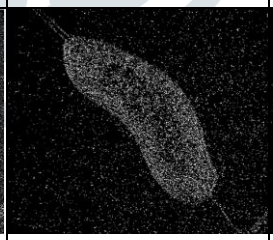
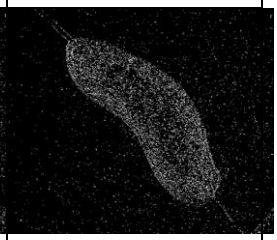
Similarity Coefficient (X,Y)	**Actual Formula**
Mean Square Error Coefficient	MSE = Sum(Sum((Input Image-Reconstructed Image).^2))/(M*N);
Peak Signal Noise Ratio Coefficient	PSNR=10*log10(256*256/MSE);

V. RESULTS AND DISCUSSION

Image Name	Original Image	Sobel Direction X Mask	Sobel Direction Y Mask	Sobel After Combining Both Direction	Edge at 45 with Sobel Mask	Edge at -45 with Sobel Mask
Ultramicro bacteria						
Bacteriophage MS2						
Avian flu virus						
Corona Virus						
Bdellovibrio Bacterio Vorus Cell						

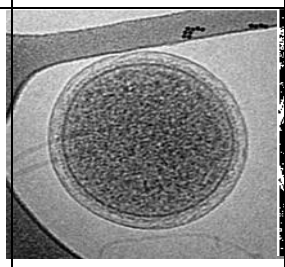
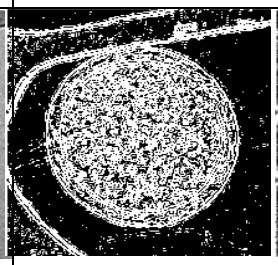
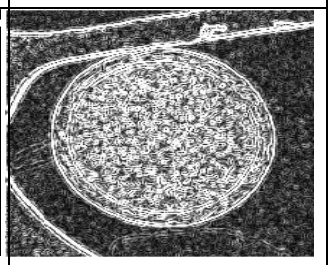
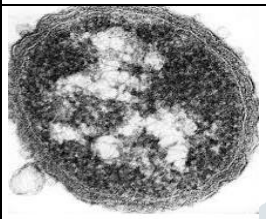
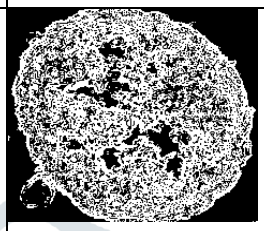
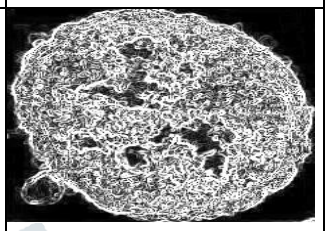
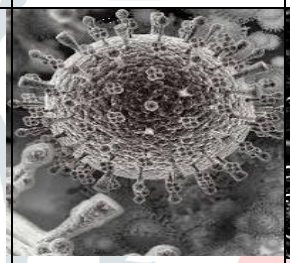
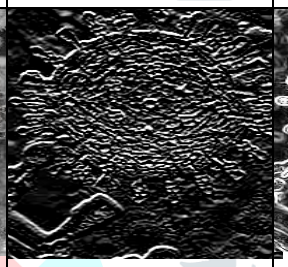
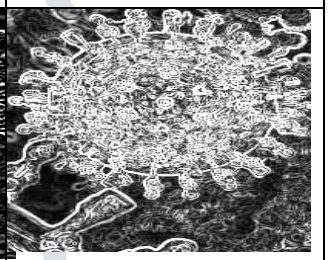
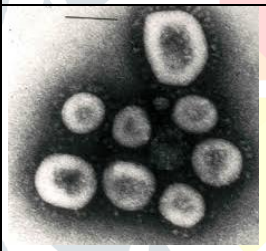
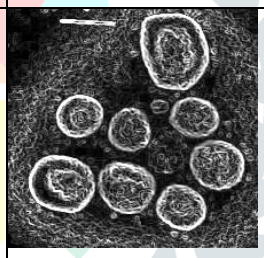
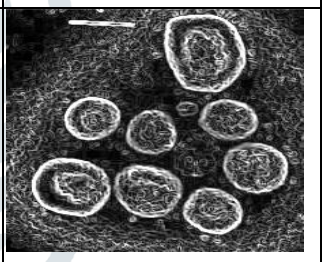
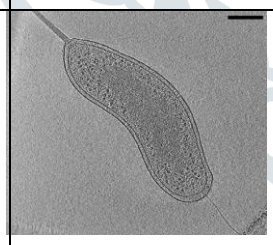
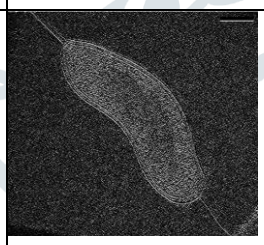
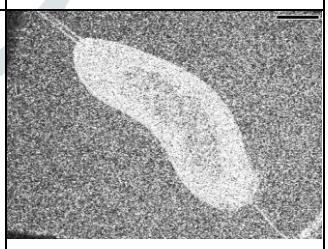
(a) (b) (c) (d) (e) (f) (g)

Fig.8: Edge Detection Techniques (a). Images Name (b). Original Image (c). Sobel Direction X Mask (d). Sobel Direction Y Mask (e). Sobel after Combining Both Directions (f). Edge at 45 with Sobel Mask (g). Edge at -45 with Sobel Mask

Image Name	Original Image	Binary Image with a Manual Threshold of 0.5	Vertical edge with a specified Threshold	Vertical edge with threshold determined automatically
Ultramicro bacteria				
Bacteriophage MS2				
Avian flu virus				
Corona Virus				
Bdellovibrio Bacterio Vorus Cell				

(a) (b) (c) (d) (e)

Fig.9**:** Edge Detection Techniques (a).Images Names (b).Original Image (c). Binary Image with a Manual Threshold of 0.5 (d). Vertical edge with a specified Threshold (e). Vertical edge with threshold determined automatically

IMAGE NAME	Original Image	Binary Image with a Manual Threshold of 0.5	Sobel After Combining Both Direction
Ultramicro bacteria			
Bacteriophage MS2			
Avian flu virus			
Corona Virus			
Bdellovibrio Bacterio Vorus Cell			

(a) (b) (c) (d)

Fig.10:Comparison Edge Detection Techniques (a). Images Names (b). Original Image (c). Binary Image with a Manual Threshold of 0.5 (d). Sobel after Combining Both Directions

Tables:

IMAGE NAME	METRICS	SOBEL EDGE DETECTION	THRESHOLD EDGE DETECTION
Ultramicro bacteria	MSE	141.59	155.25
Bacteriophage MS2	MSE	118.13	130.17
Avian flu virus	MSE	105.98	201.73
Corona Virus	MSE	140.67	140.71
Bdellovibrio Bacterio Vorus Cell	MSE	108.24	228.32

Table 1: MSE Metrics for Edge Detecting of Microscopic Images

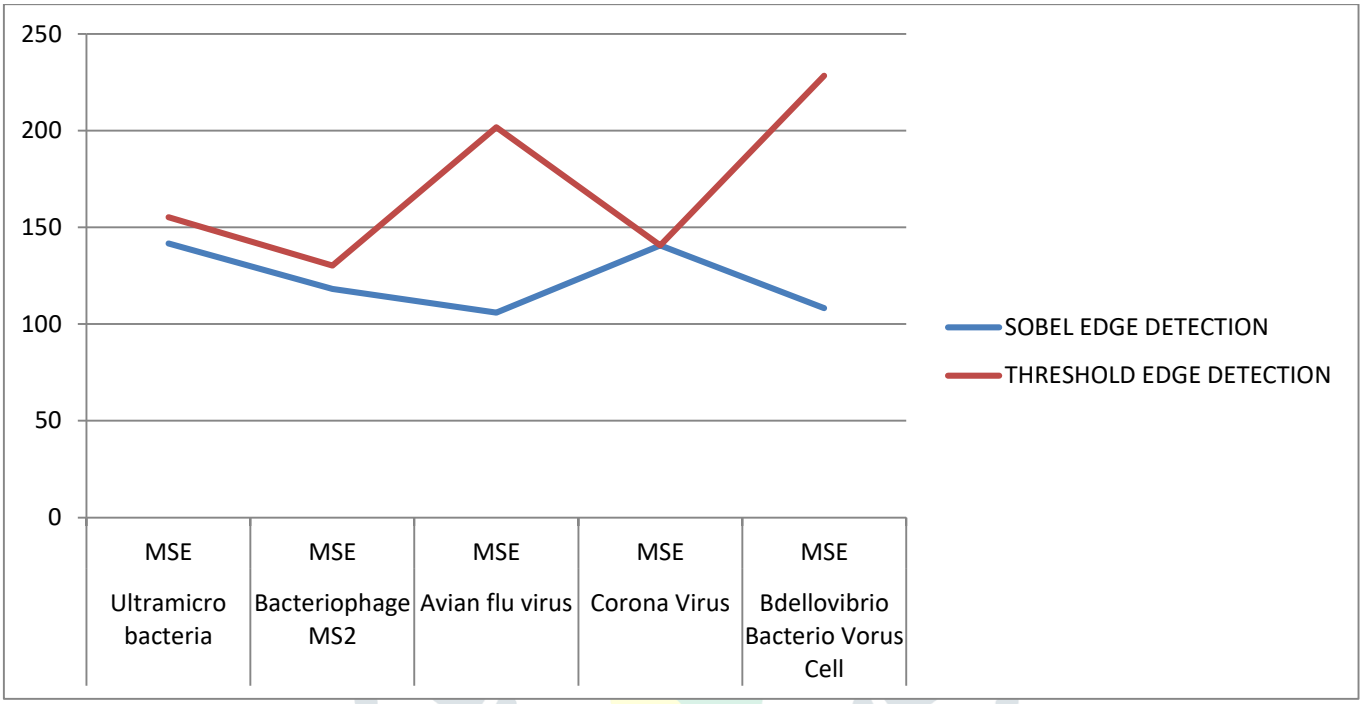


Fig 11: MSE Metrics for Edges Detecting of Microscopic Images

IMAGE NAME	METRICS	SOBEL EDGE DETECTION	THRESHOLD EDGE DETECTION
Ultramicro bacteria	PSNR	26.654667	26.254394
Bacteriophage MS2	PSNR	27.4412672	27.0196465
Avian flu virus	PSNR	27.9123646	25.1170282
Corona Virus	PSNR	26.6828085	26.6814322
Bdellovibrio Bacterio Vorus Cell	PSNR	27.8209745	24.5794336

Table 2: PSNR Metrics for Edge Detecting of Microscopic Images

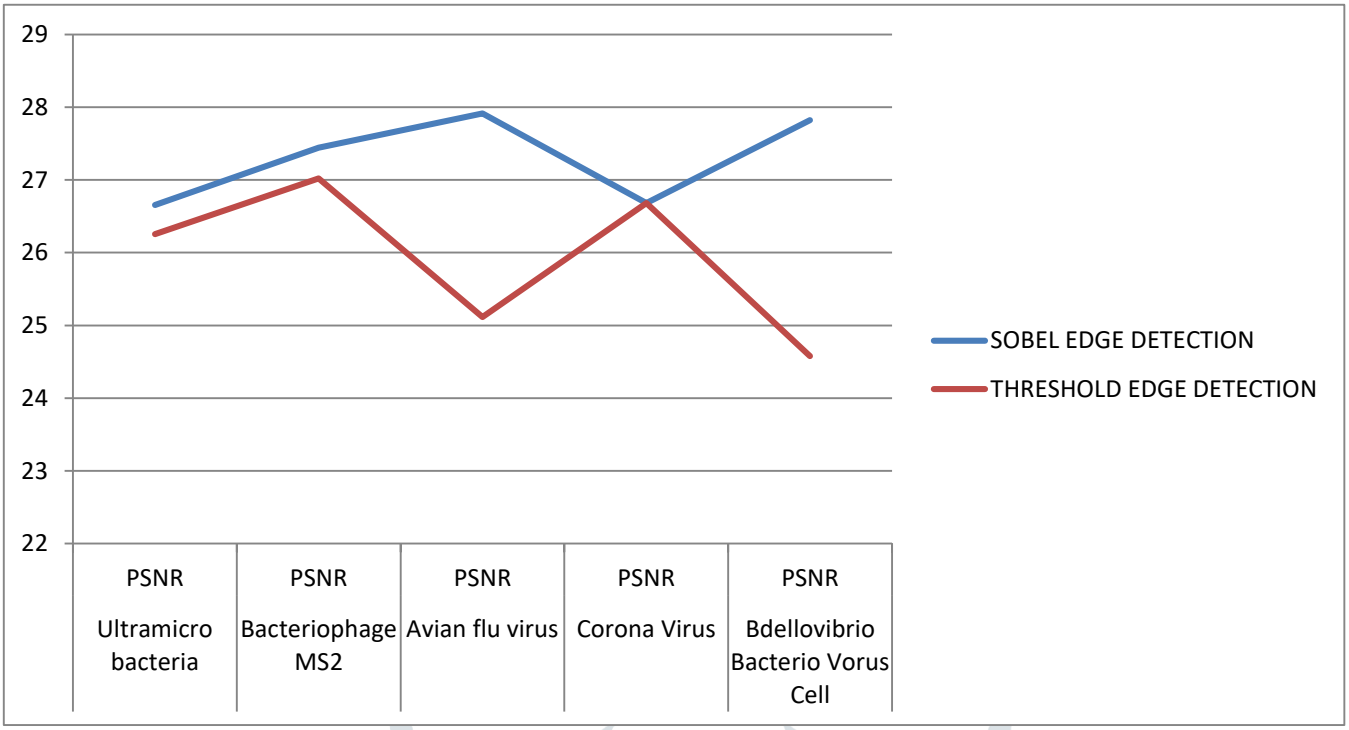


Fig 12: PSNR Metrics for Edges Detecting of Microscopic Images

VI. CONCLUSION

In this paper, we have used several techniques for edge detection in microscopic images segmentation. We have taken the microscopic images to detect the edges using Matlab software. Finally, we compared the standard Sobel edge detection and Threshold edge detection techniques with based on the metrics of MSE and PSNR, the threshold edge detection reduce the noise and give accuracy inferred produces the better result when compared to standard edge detection techniques.

References

[1] Dr.Vipula Singh Digital Image Processing with MATLAB and LabVIEW, ELSEVIER A Division of Reed Elsevier India Private Limted Pg.No:629-644 2013

[2] Gooya A, Pohl KM, Bilello M, Cirillo L, Biros G, Melhem ER, Davatzikos C. "GLISTR: glioma image segmentation and registration". IEEE transactions on medical imaging.;31(10):1941-54, 2012 Oct.

[3] Antonios Makropoulos, Ioannis S. Gousias, Christian Ledig, Paul Aljabar, Ahmed Serag, Joseph V. Hajnal, A. David Edwards, Serena J. Counsell*, and Daniel Rueckert ieee transactions on medical imaging "Automatic Whole Brain MRI Segmentation of the Developing Neonatal Brain", vol. 33, no. 9, september 2014.

[4] Lakshmi S, Sankaranarayanan DV. "A study of edge detection techniques for segmentation computing approaches". IJCA Special Issue on "Computer Aided Soft Computing Techniques for Imaging and Biomedical Applications" CASCT. 2010 Aug 20:35-40.

[5] N.Senthilkumaran and R.Rajesh, "Edge Detection Techniques for Image Segmentation - A Survey of Soft Computing Approaches", International Journal of Recent Trends in Engineering Vol. 1, No. 2, May 2009.

[6] Y.Ramadevi, T.Sridevi, B.Poornima, B.Kalyani, "Segmentation and object recognition using edge detection techniques" International Journal of Computer Science & Information Technology (IJCSIT), Vol 2, No 6, December 2010.

[7] Rosenfeld. A "The Max Roberts Operator is a Hueckel-Type Edge Detector", IEEE Transactions on Pattern Analysis and Machine Intelligence, PAMI-3(1), 101–103, February 1981

[8] [8] Singh T, Kharma N, Daoud M, Ward R." Genetic programming based image segmentation with applications to biomedical object detection", InProceedings of the 11th Annual conference on Genetic and evolutionary computation, ACM, pp. 1123-1130.8 Jul 2009 .

[9] Moeskops P, Viergever MA, Mendrik AM, de Vries LS, Benders MJ, Išgum I." Automatic segmentation of MR brain images with a convolutional neural network". IEEE transactions on medical imaging.;35(5):1252-61, May 2016

[10] Hole KR, Gulhane VS, Shellokar ND. "Application of genetic algorithm for image enhancement and segmentation", International Journal of Advanced Research in Computer Engineering & Technology (IJARCET)., 28;2(4):1342, Apr 2013.