Improved color image segmentation based on RGB and HSI

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***Abstract* - In this paper we uses the two color space system for color image segmentation i.e. RGB and HSI.Both follows the same procedure. It divided into five steps. In first step the traditional Otsu method for grey channel image segmentation is applied to all R, G and B channel separately to get the automatic threshold for each channel. These thresholds of each channel are integrated to formulate a new colored image. The new integrated image is suffers from distortion. In second step, to avoid this distortion median filter is applied to smoothened and the increase the segmented regions of the image. In third step, Otsu method is also applied to the each channel of HSI separately to determine the automatic threshold .And then to remove the distortion in step four median filters is applied. In fifth step, the median filter of RGB image is subtracted from the HSI image, which gives difference between the values of the RGB image .Experimented results are presented on a variety of images which support the purposed algorithm.**

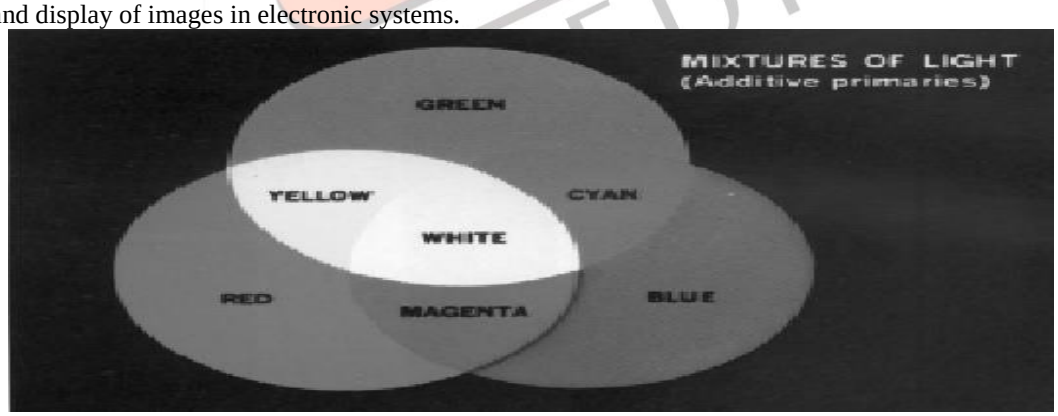
***IndexTerms* - Color Image segmentation, RGB and HIS color model, thresholding, Median filter**

I. INTRODUCTION

Image segmentation plays an important role to get the information from the images. For an image analysis images segmentation is the first step e.g. Finding injurious tissues from body scan, brain tumor, and navigation of robot. A problem arises in the segmentation of grayscale images when an image has a varying grey level background. In a grayscale images, the differences between the two pixels can be easily determined by the differences between the brightness of these two pixels. But in case of color image ,brightness is not enough because any two distinct color have same brightness[1].There are several segmentation technique for grayscale images such technique are edge detection, neural networks, histogram thresholding, feature clustering and fuzzy methods have extended for color image segmentation by RGB,HIS and CYM color space etc.

RGB Model

RGB color model is known as additive color modal in which red green and blue color are added in various way results to produce various array of colors. This can be shown in the Figure:-1 in which with different weights of RGB, their combination can indicate different results. In RGB, colors are represented with a set of three numbers ranging from (0-255).Black has the lowest RGB value of (0, 0, 0) while white has the highest value (255,255,255). The main purpose of RGB model is for sensing, representation and display of images in electronic systems.



HSI model

HSI model describes more exact color than RGB model describes for human interpretation [2].HSI model defines a color model in terms of its component. Color can be specified by the three quantities hue, saturation and intensity. Hue indicates the measure of color purity; saturation indicates the degree premated the white color. If the color has a high saturation it means color contains low white color.

Converting color of RGB to HIS

For converting the image of RGB to HSI, the image should be normalized to the range of [0, 1].
BY applying the equation [3]:
$H=\theta$ if $B \leq G$ and $H=360-\theta$ if $B>G$ (1)

With

θ= cos^-1–(0.5[(R-G) +(R-B)]/ [(R-G) ^2+(R-B) (G-B)] ^1/2) (2)

S=1-3*([min(R, G, B)]/(R+G+B)) (3)

I=(R+G+B)/3 (4)

Where:

R: Red band, G: Green band, B: Blue band.

H: Hue band, S: Saturation band, I: Intensity Band.

II. MEDIAN FILTER

Median filter is a non-linear filter that can be used to smooth the images [4].Median filter changes the noise pixel in such a way to be look like its nearby neighbors [5].Median filter has one disadvantages, when the large window size of the image is implemented there is a high blurring in the image occur. Therefore when the median is applied after applying the traditional Otsu method the resulted segmented image is highly acceptable for color image segmentation [6].

III. RELATED WORK

In this purposed work first we apply the median filter on both RGB and the HIS image and then RGB image of median filter is subtracted from the HIS median filter this results formation of a new image. Which gives the result of the distorted image of RGB after applying the median filter? First the RGB channels of the image are separated and then apply Otsu automatic thresholding method for each channel I, e RGB for thresholding the image. Then these separated threshoding image are combined together to form a new color image. As result image contain the noise so median filter is applied to smooth the image. Median filter is applied to each channel of the result image and then combined .The formation of the new image is resulted contain less noise. After that same procedure follows for the HSI.For HSI, first the RGB image is converted into HSI by applying the above formula given in HIS model. When HSI image is obtained then apply the traditional Otsu method [7] for each channel i.e. HSI and combined the image. After that median filter is applied to each channel of the obtained image. When the RGB median filter image is subtracted from this HSI median filter image then noise value are obtained which cannot see on the RGB resulted image.

1. f”(x, y) = Σ³ i=1fi(x, y)

2. f”’(x, y) = Σ³i=1fi(x, y)

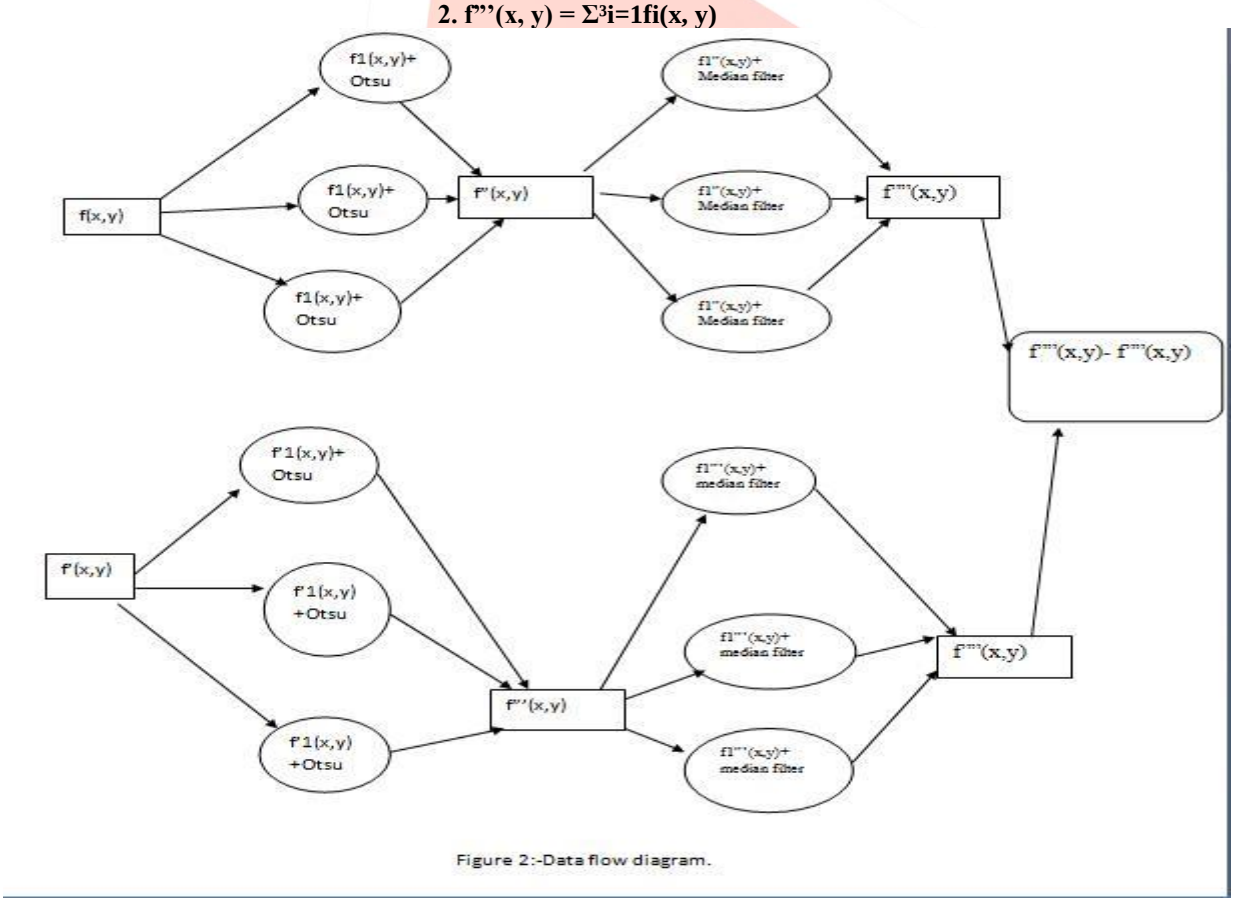


Figure 2:-Data flow diagram.

Here f(x,y) and f’(x,y) are RGB and HSI image having coordinates x and y.An f’(x,y)= Σ³ i=1fi(x,y), f”’(x,y)= Σ³i=1fi(x,y) are the values of each channel 1-3.When i-1 then it means red channel in case of RGB and in case of HSI is hue and same for the others I.e.(2-green,saturation,3-blue,intensity).When we increase the block size of a image then there is a increase in smoothness also. Image Blocks that are applied are 3*3, 7*7, 11*11 and15*15.These can be seen in the experimental results.

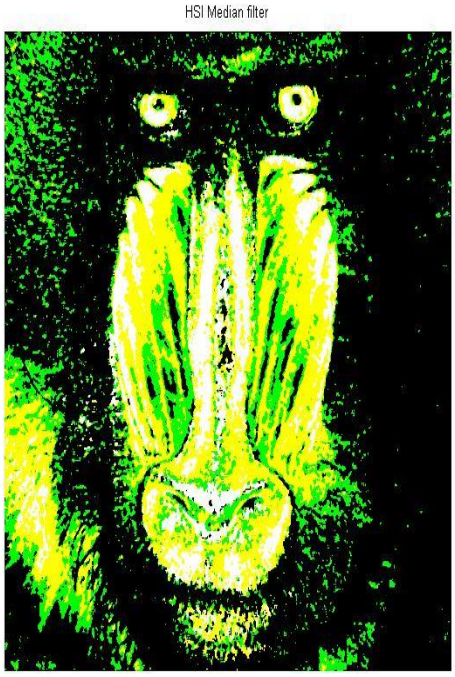
IV. EXPERIMENTAL RESULTS

Variety of test images are:-

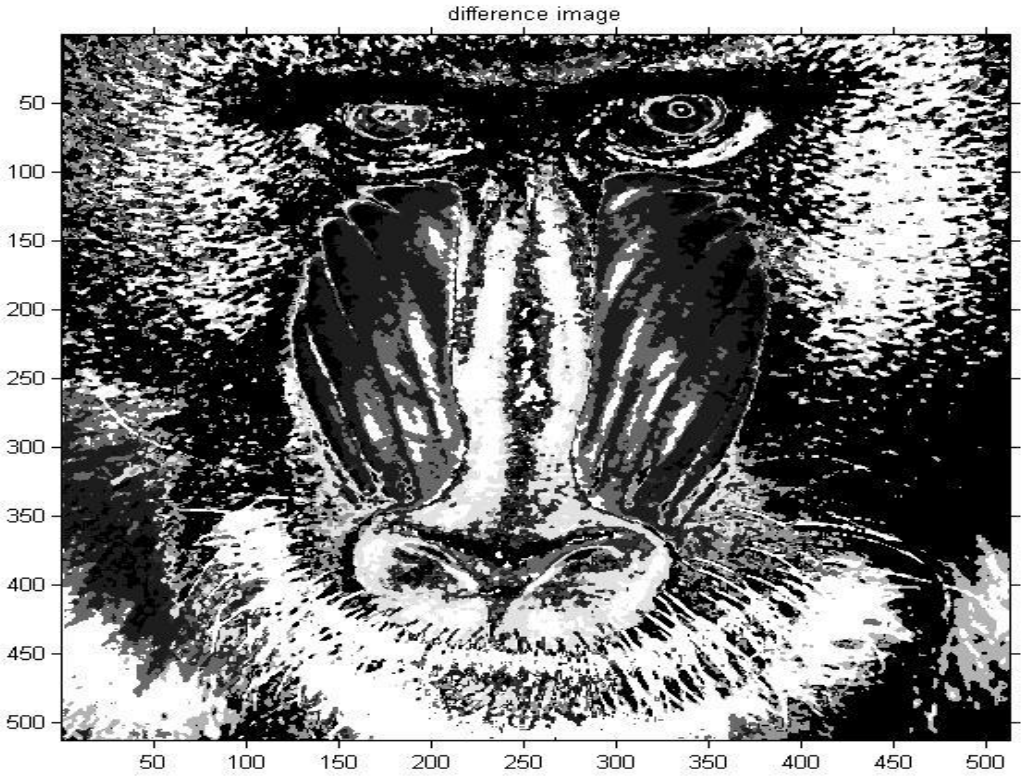
Figure 3:- Baboon, Lena, Pepper and Airplane

3X3 Median filter of RGB, HIS and Difference Image:-

1. Baboon:


HSI Median filter


RGB Median filter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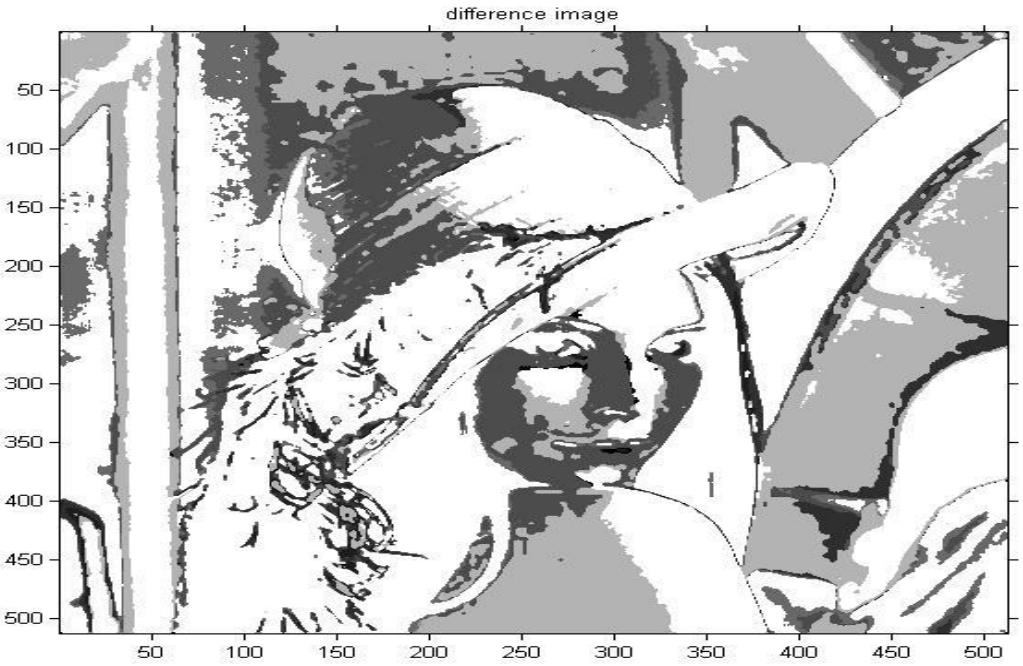
2. Lena:-


RGB Median filter


HSI Median filter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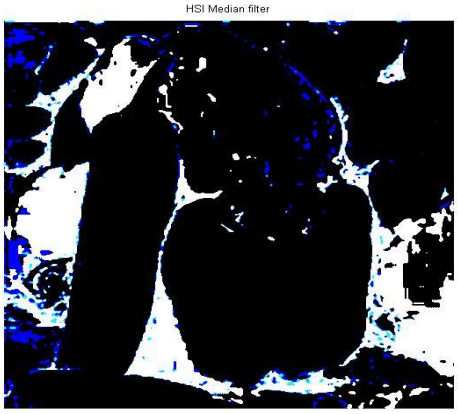
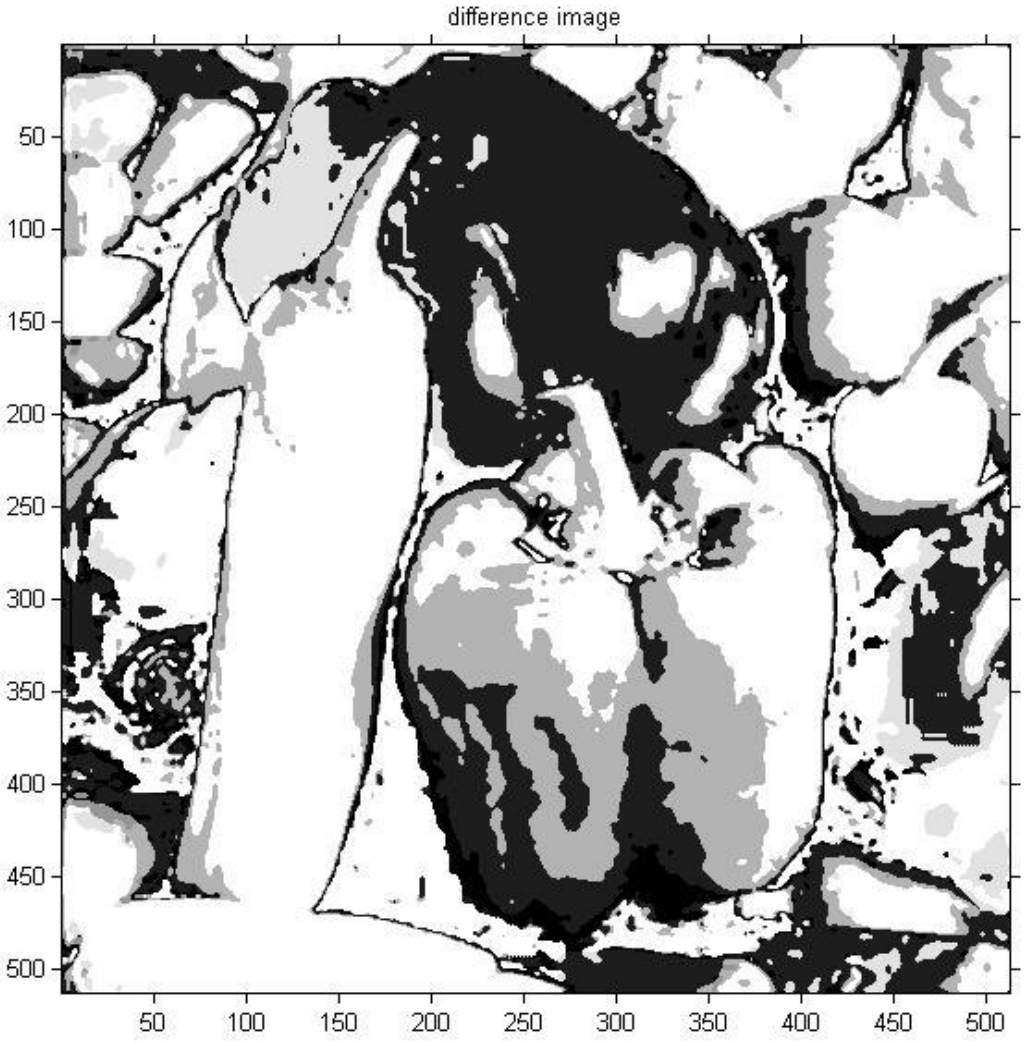
3. Pepper:-


HSI Median filter


RGB Median filter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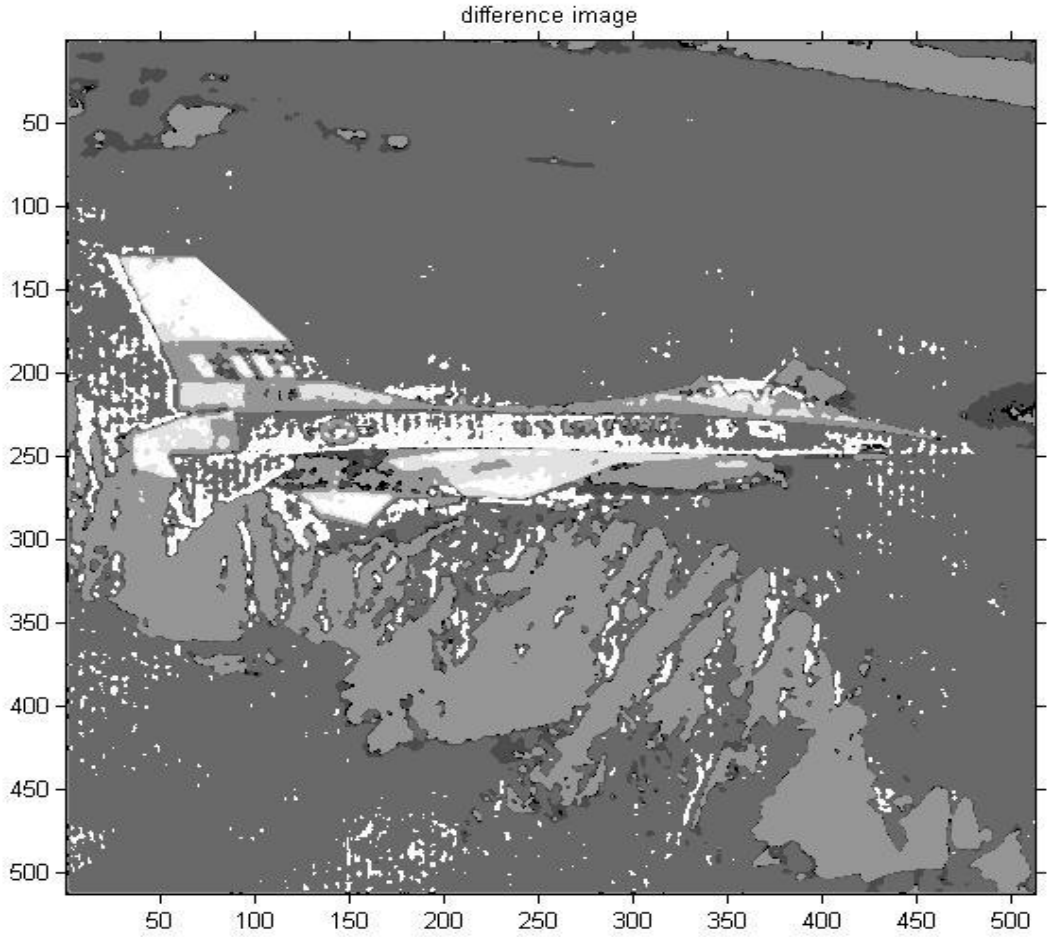
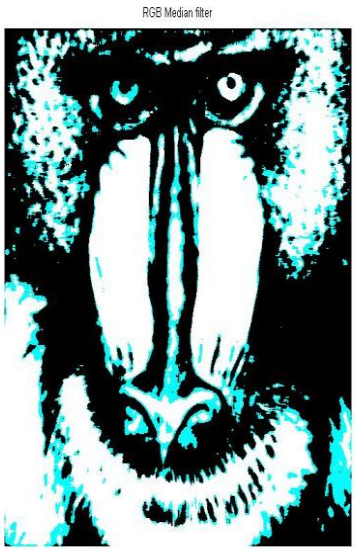
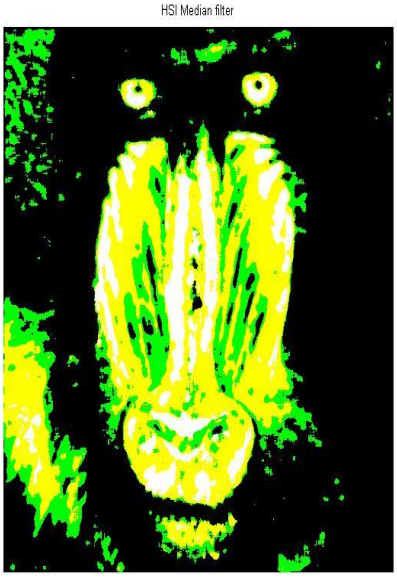
4. Aeroplane:-

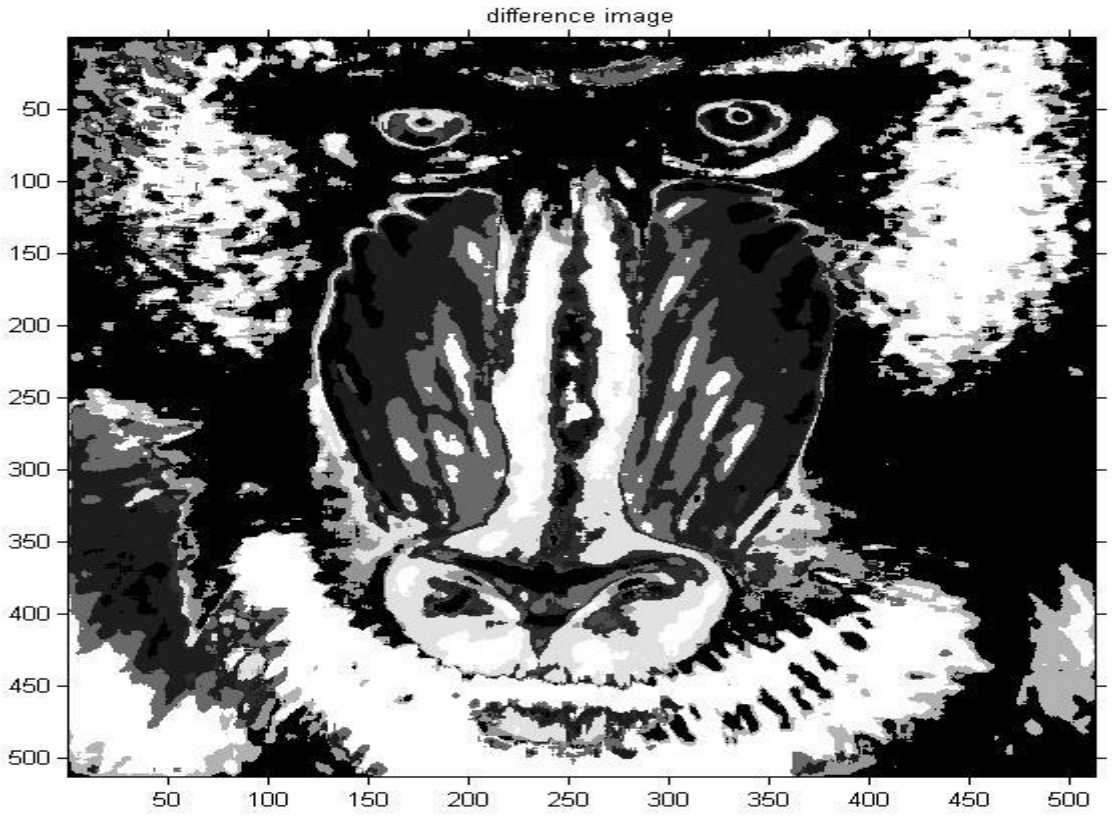


7X7 Median filter of RGB, HIS and Difference Image:-

1. Baboon:-


RGB Median filter


HSI Median filter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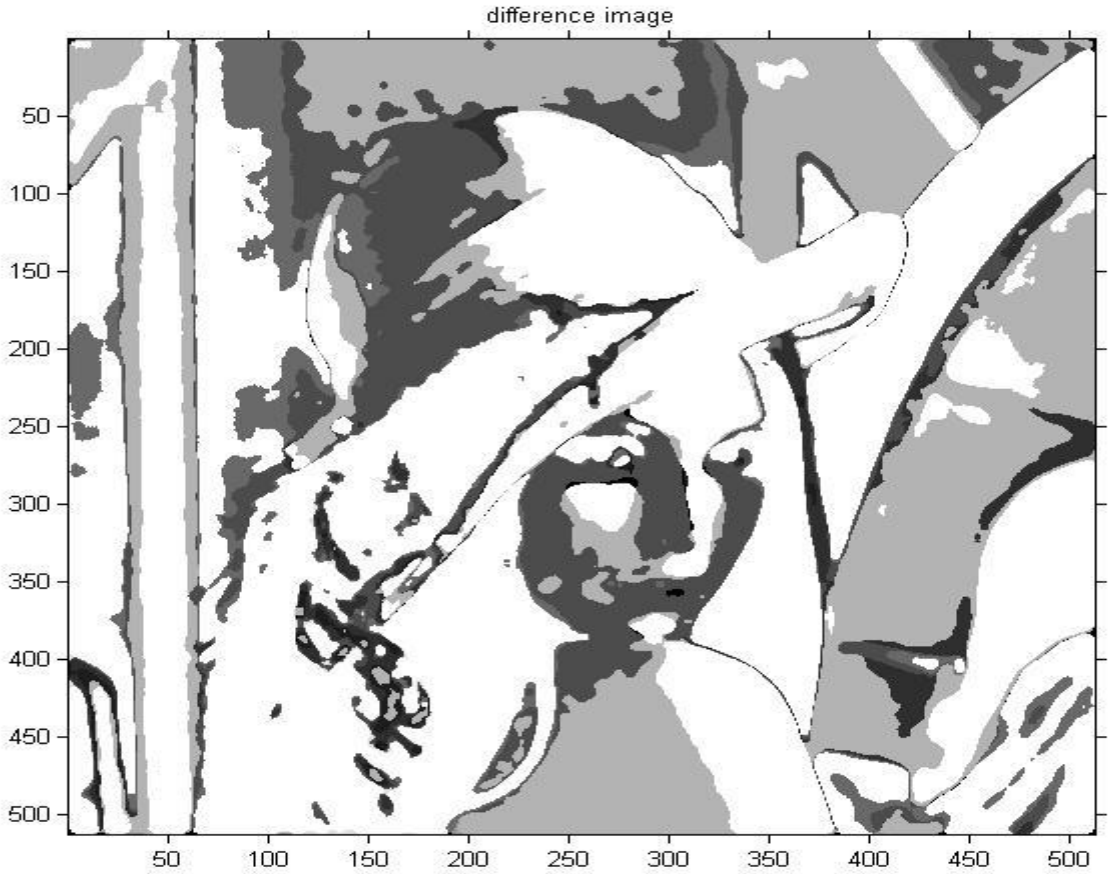
2. Lena:-


RGB Median filter


HSI Median filter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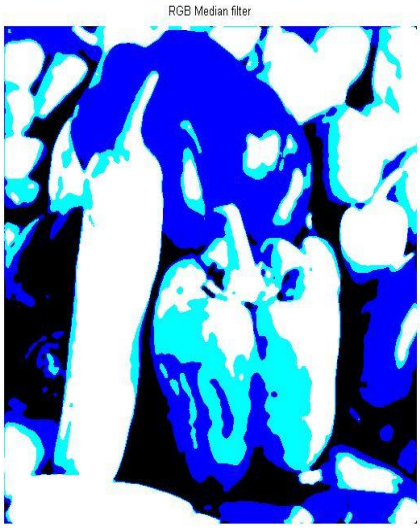
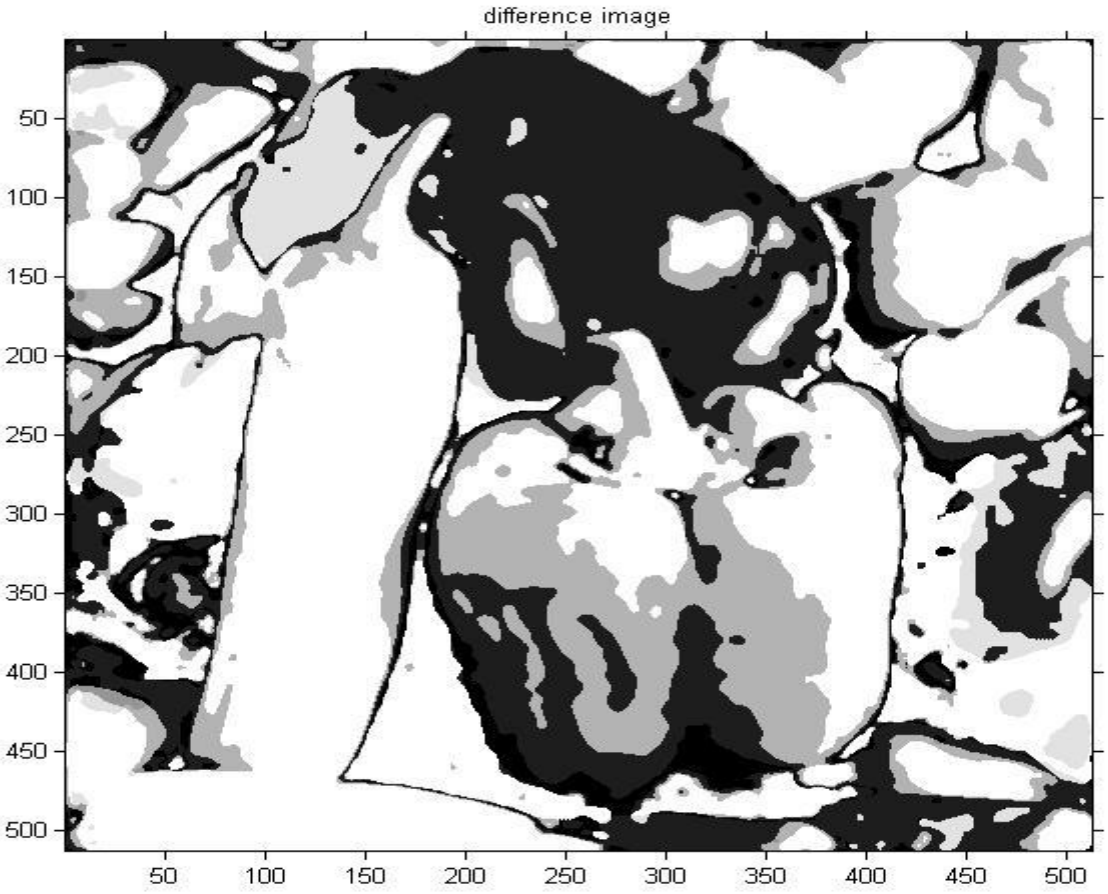
3. Pepper:-


HSI Median filter


RGB Median filter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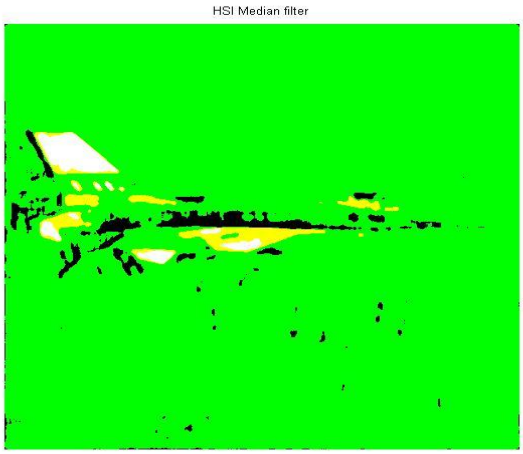
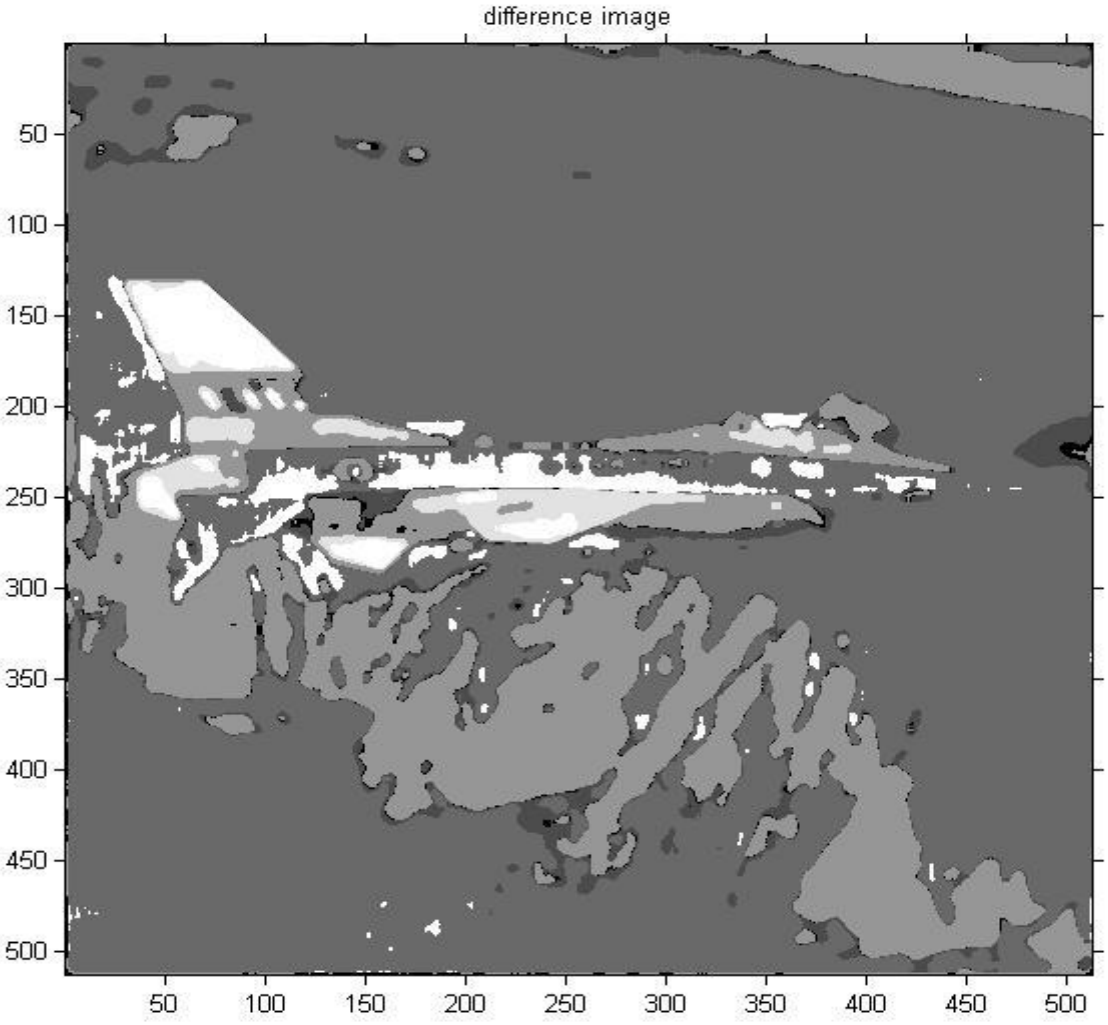

HSI Median filter


RGB Median filter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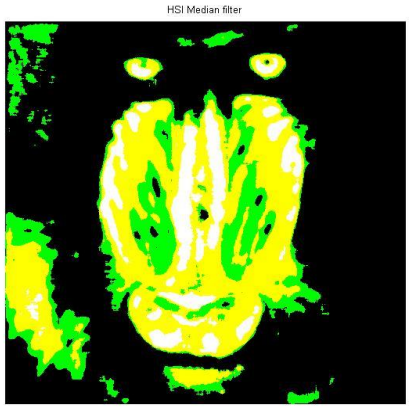
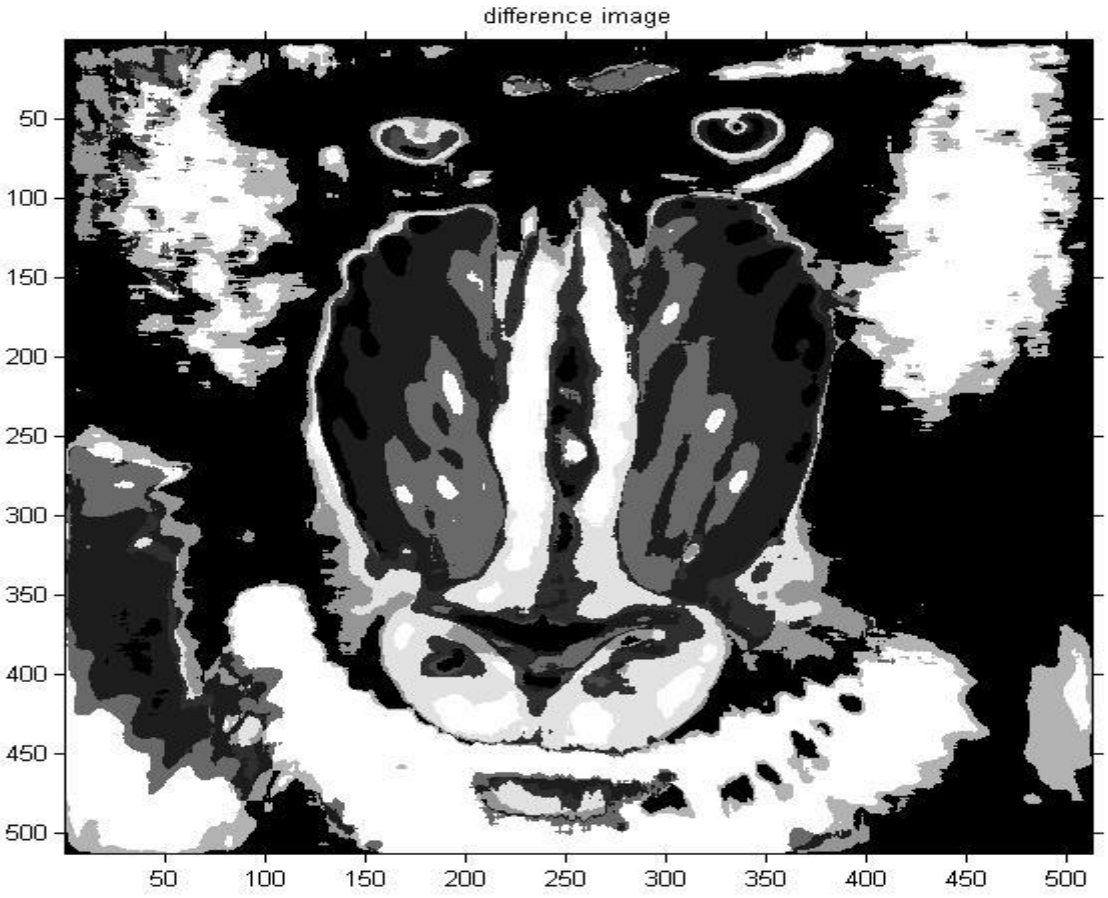
11X11 Median filter of RGB, HIS and Difference Image:-

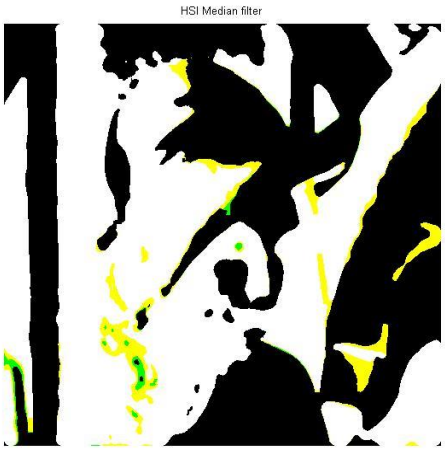
1. Baboon:-

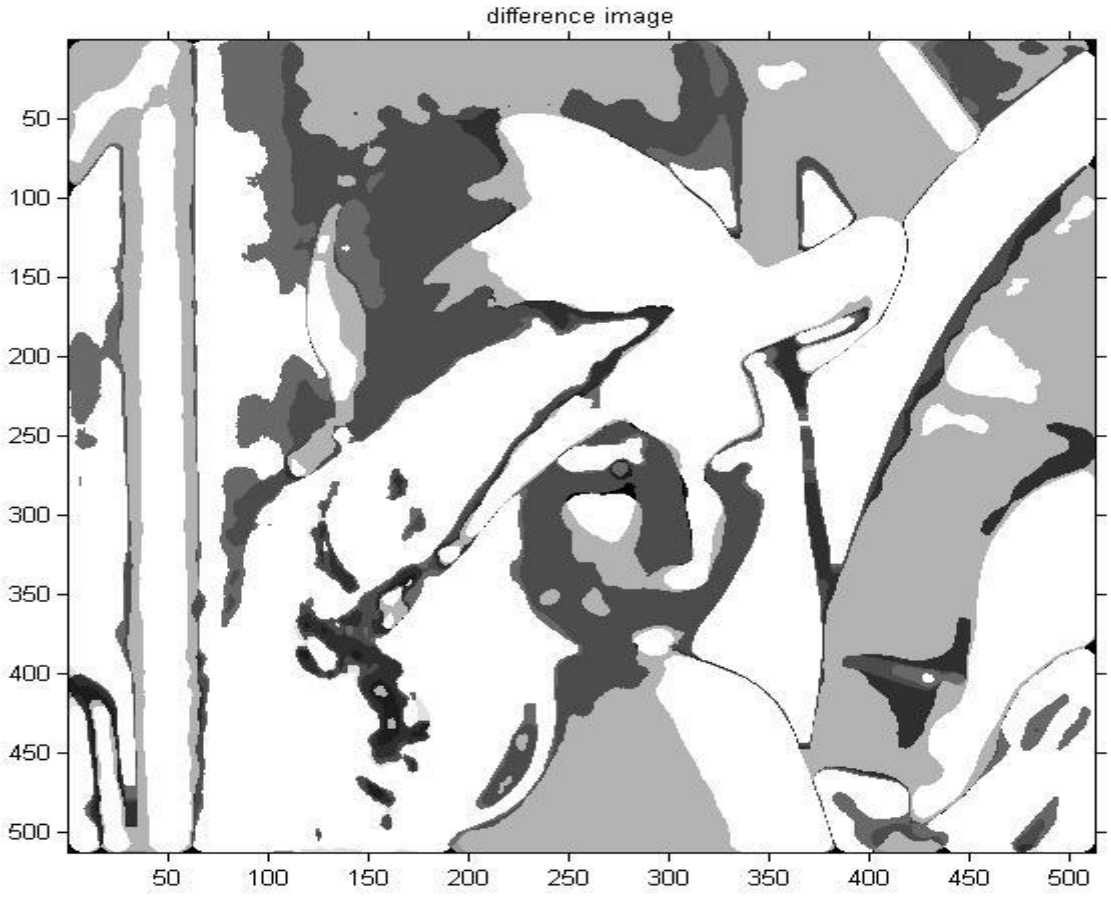




2. Lena


RGB Median filter


HSI Median filter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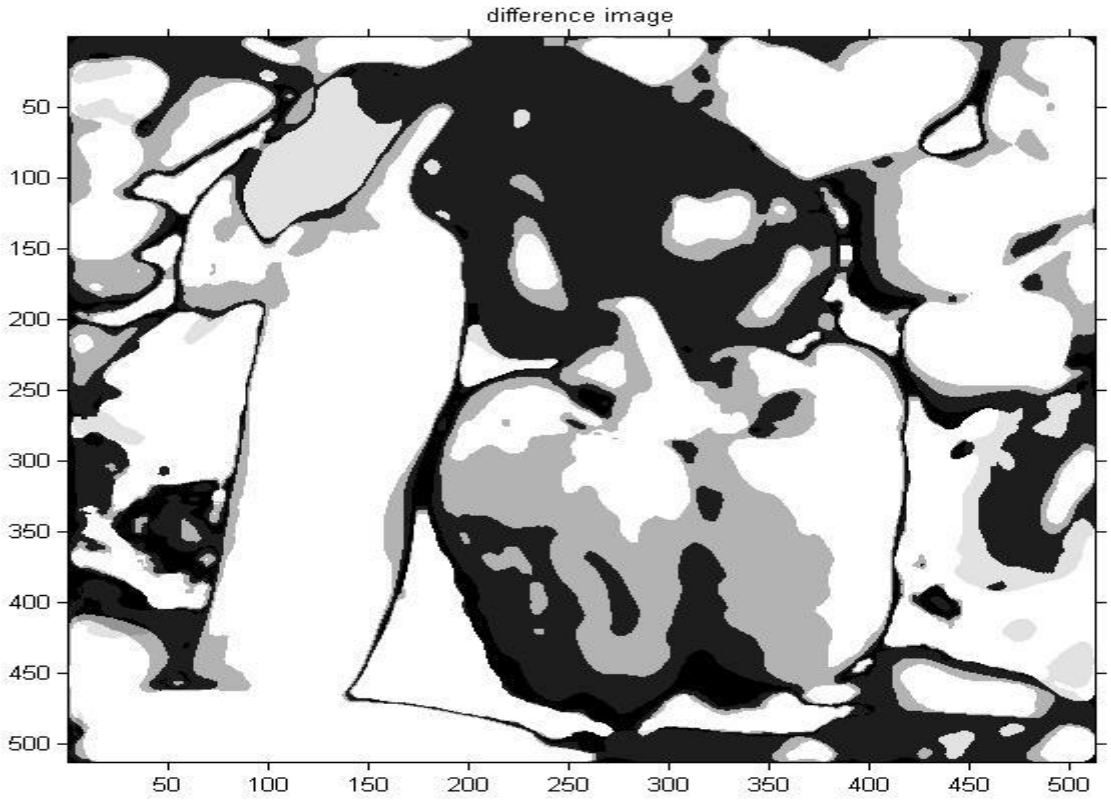
3. Pepper:-


HSI Median filter


RGB Median filter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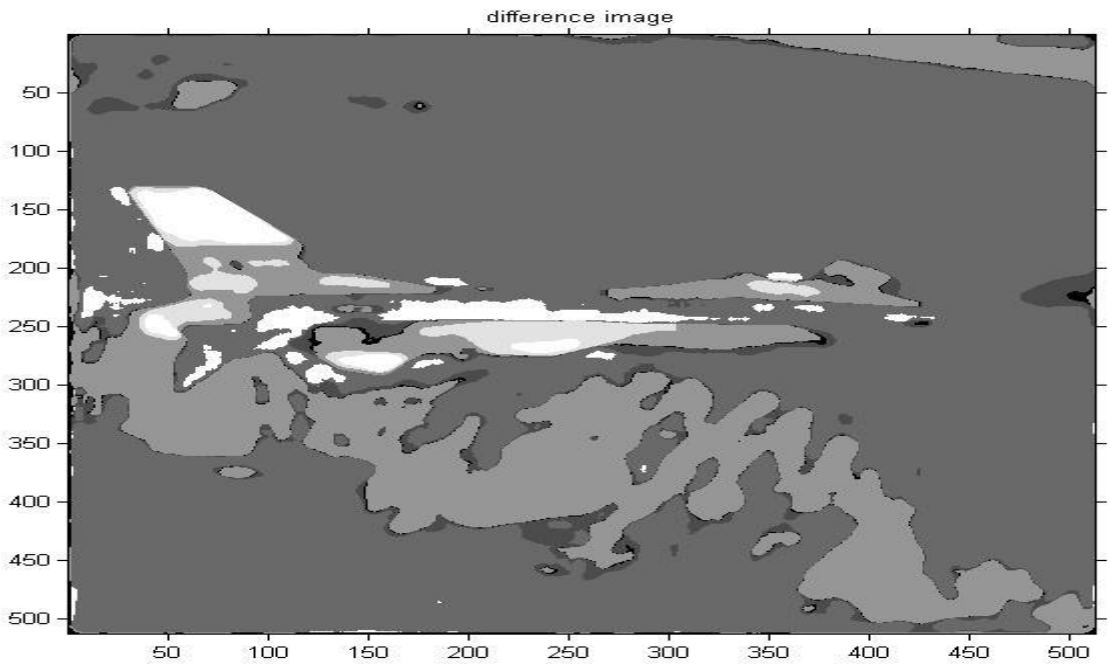
4. Aeroplane:-


HSI Median filter


RGB Median filter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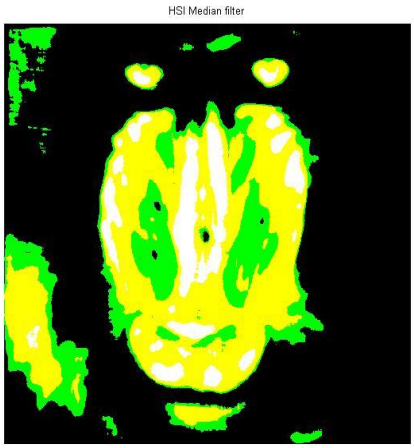
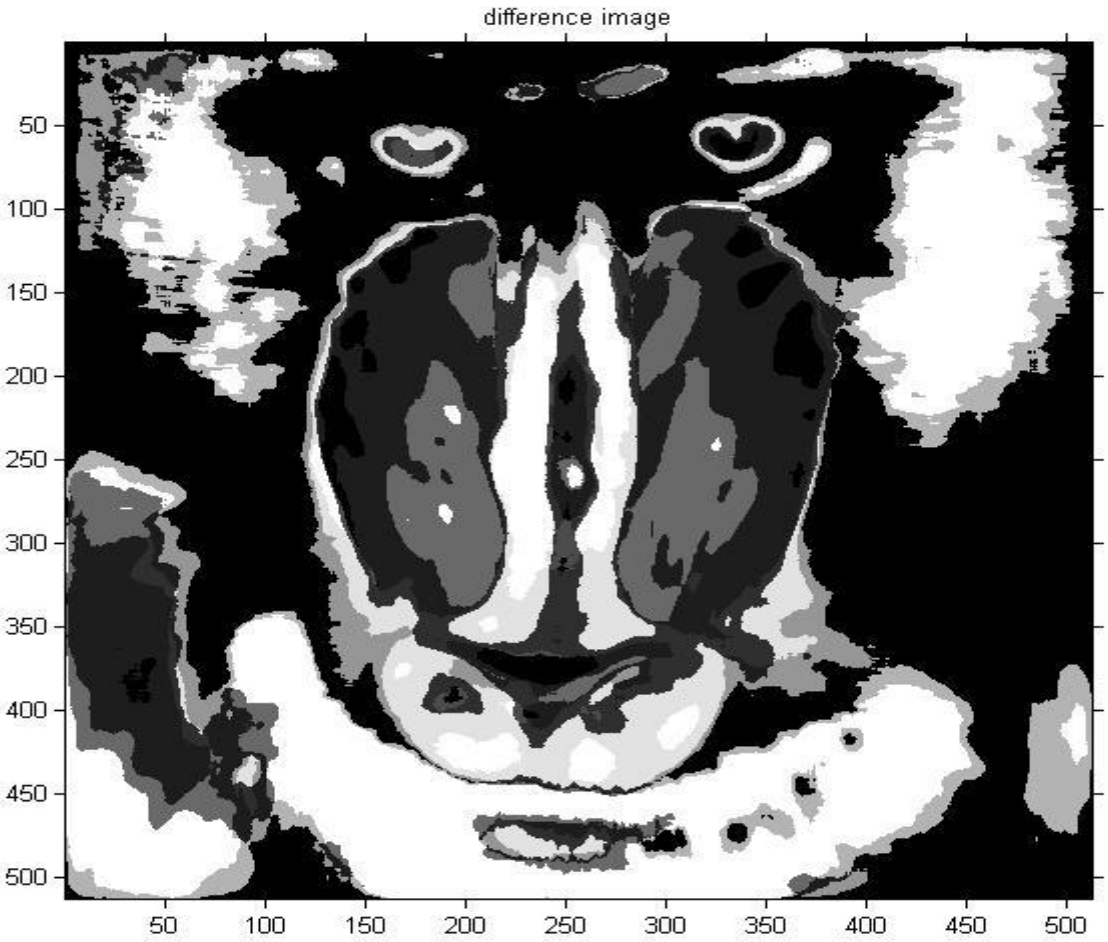
15X15 Median filter of RGB, HIS and Difference Image:-

1. Baboon:-

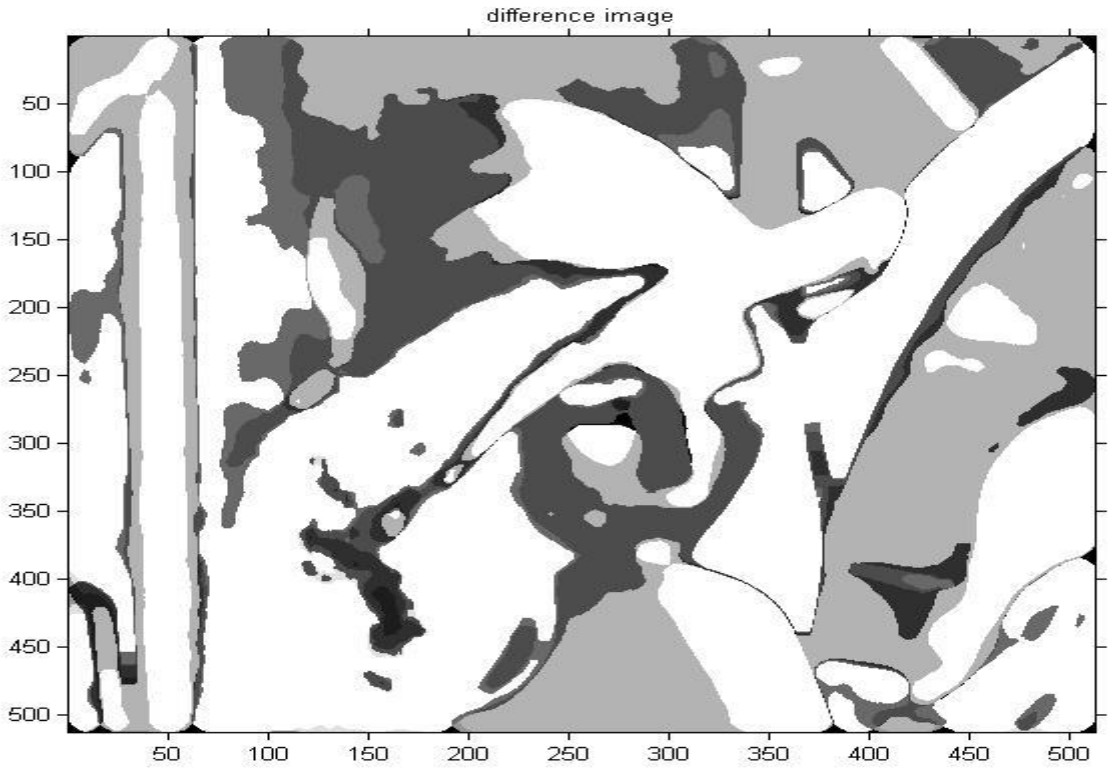




2. Lena:-


RGB Median filter


HSI Median filter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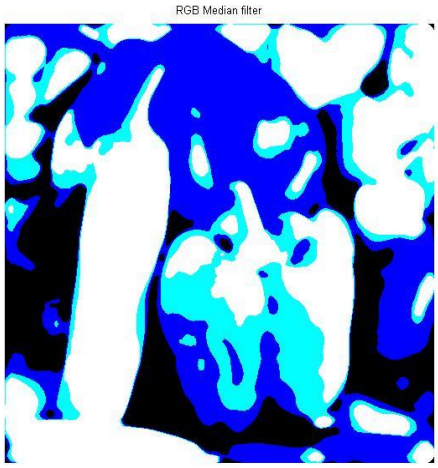
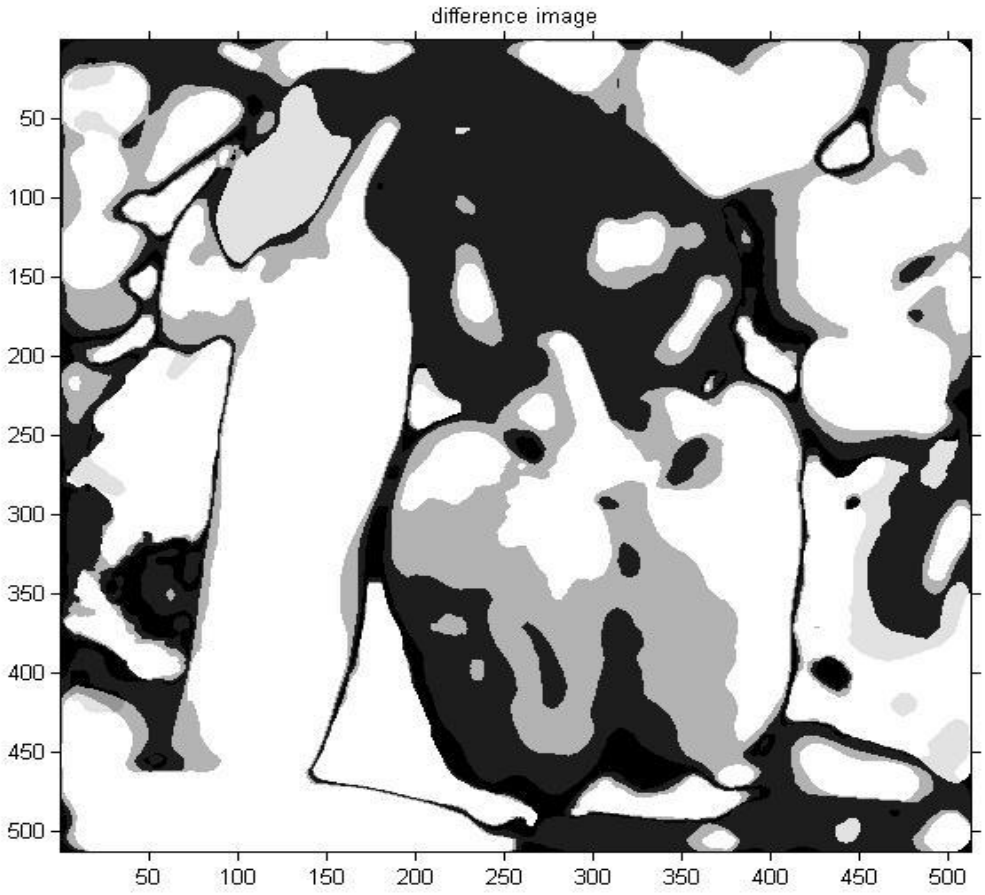
3. Pepper:-


HSI Median filter


RGB Median filter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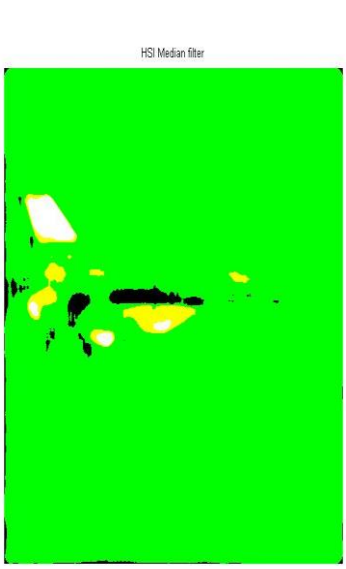
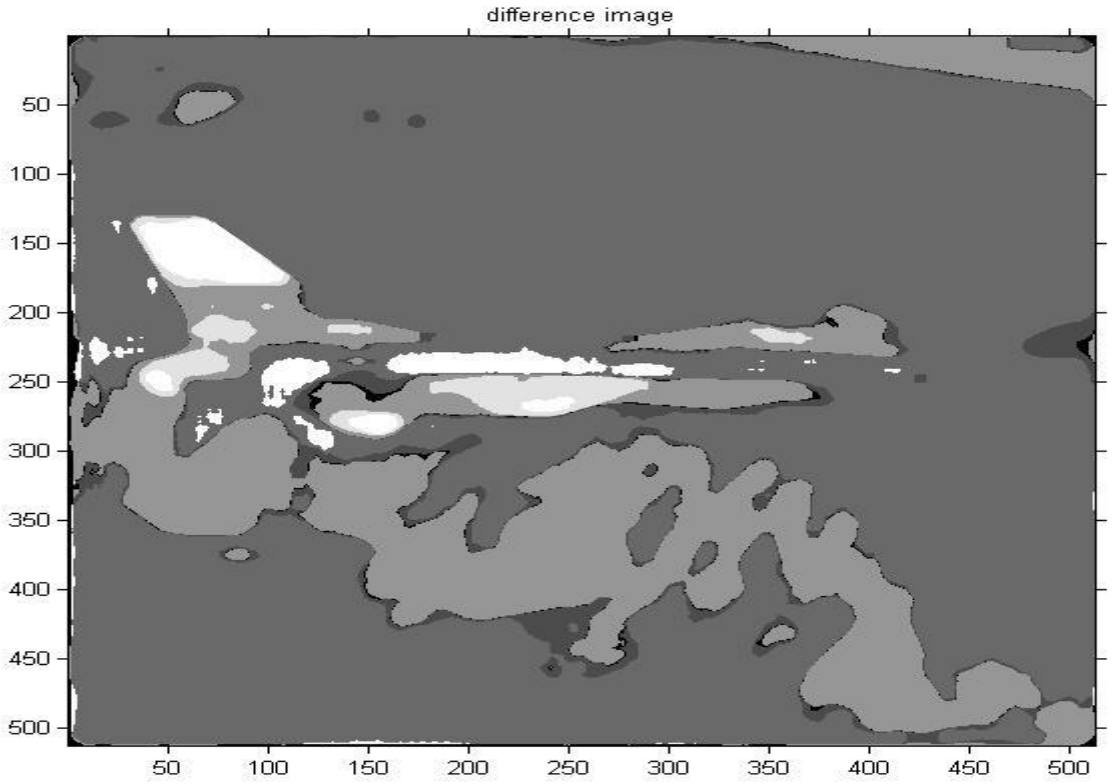
4. Aeroplane:-





V. CONCLUSION AND FUTURE WORK

In this paper we purposed a new method to make image with a noise free by difference between the RGB image from HSI image and we get the better result. Bases on these differences we can calculate the quality of the images. The window size of 15*15 image give good quality of image as compared to other window size. So it is easy to use in the application fields of digital world e.g. in medical image processing, biometric recognisation and inspection of fruits and vegetables in agriculture. In future scope these methods can be applied to other color space such as CYM, HSV etc for better results.

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