# Development of Gray Scale Image Processing computing Technique to Remove the Unwanted Frequency Patches on Sodar Facsimiles

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*Abstract:* Gray Scale Image Processing (GSI) technique has developed using MATLAB's Digital Signal Processing toolbox to remove the unwanted frequencies present in the SODAR facsimiles and also to enhance the pixel quality (intensity) of the facsimiles for a better view. In general, the sources of these noises (unwanted frequencies) are airplanes, Choppers, Hi-frequency sound systems and man-made noises nearby SODAR antenna. Already some filtering techniques like Gaussian filter, median filter, and other DSP filter techniques are employed to remove the noises from facsimiles but these techniques are incapable of enhancing the pixel clarity. This GSI computing techniques could be applied directly to SODAR facsimiles, which is not possible with other filtering techniques. The beauty of the technique is that time was taken to complete the process within 10 to 20 seconds. Here in this paper, all mathematical computing techniques are designed and developed through MATLAB.

## I. INTRODUCTION

The SODAR (Sound Detection And Ranging) is a remote sensing instrument that to measure the wind profile in the lower atmosphere of the earth. The volume measurement of the wind profile by the remote sensing device, like SODAR, has a great advantage compared to point measurements in one height. In SODAR, acoustic pulses with particular time duration are sent vertically and at a small angle to the vertical. A thus transmitted sound pulse is scattered by the fluctuations and gradients as well as wind shear. A backscattered signal has received by the receiver of the SODAR antenna, typically a preamplifier will be used as the receiver of the antenna. Here this backscattered signal may have a probability of mixing with another signal, which has fallen into backscattered signal frequency range. These backscattered signal fed to the computer and later directed to SODAR software. Here the software will take the responsibility to store and plot the graph. Here these graphs are known as facsimiles. So this facsimile is the combination of original backscattered signal and unwanted signal. Generally, this backscattered signal get filtering before fed to the computer but this filters will be designed for a band of frequencies, not restricted for the single frequency. Therefore a band of frequencies will be fed to a computer as

backscattered signal. Actually, problems arise here with identifying that original backscattered signal.
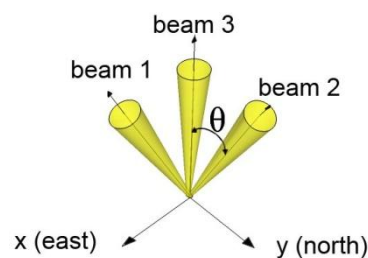


Figure.1: Anatomy of SODAR System Signal Direction.

Here it is not possible to stop the same frequency signals which are generated by the other sources through the hardware setup. In general, the sources of this noise (same frequencies generated by the other sources) are aeroplanes, Choppers, Hi-frequency sound systems and man-made noises nearby SODAR antenna. For most of the SODAR applications will use a range of 1.75 to 2.5 kilo-Hertz frequency signal to propagate into an atmosphere.
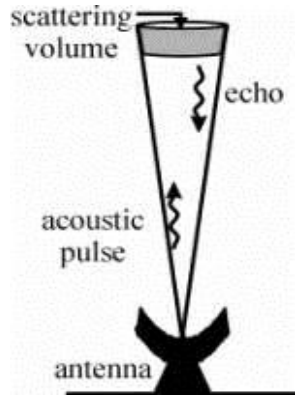
Figure.2: Phenomenon of the backscattered signal process.



Figure.3: SODAR antenna at Dept. of Systems Design, Andhra University. Sponsored by UGC and ISRO.

Here, In this paper, the Fast Fourier Transformation technique has used to develop the computing techniques, which is an important image processing tool. In this technique, an image is decomposed into its sine and cosine components. The result of the transformation represents the image in the Fourier or frequency domain, while the original or input image is the spatial domain equivalent. In Fourier domain image, each point represents a particular frequency contained in the spatial domain image. This Fourier Transform is also used in a wide range of applications such as image analysis, image filtering, and image filtering with histogram technique, image reconstruction and image compression. This paper is totally programmed depending on the image filtering with histogram techniques and

reconstruction by using Digital Image and Digital Signal processing toolbox in the MATLAB.

## II. DESIGN AND DEVELOPING TECHNIQUE.

The entire paper is categorized into four sections. 1. Reading the facsimile from the database. 2. Applying the FFT technique and converting the given facsimile into gray scale image mode. 3. Calculating the histogram values of the facsimile and rearranging the histogram values of facsimile. 4. Reconstruction of Image.

TYPES OF STORED FORMAT OF IMAGES

| S. No | File Type | Acronym | File-Extension-Name |
|---|---|---|---|
| 1. | MBMP | Monochrome Bitmap | *.bmp & *.dib |
| 2. | BMP16 | 16-colour Bitmap | *.bmp & *.dib |
| 3. | BMP24 | 24-colour Bitmap | *.bmp & *.dib |
| 4. | BMP256 | 256-colour Bitmap | *.bmp & *.dib |
| 5. | JPEG | Joint Picture Expert Group | *.jpg & *.jpeg *.jpe & *.jfif |
| 6. | GIF | Graphic Interchange Format | *.gif |
| 7. | TIFF | Tagged Image File Format | *.tiff & *.tif |
| 8. | PNG | Portable Network Graphics | *.png |

Table.1: Type of still image formats.

*Reading the facsimile from the database:*

In Reading the facsimile from database section describes that what type of facsimile image can read by MATLAB program. There are different standards exist for different applications. For instance, the JPEG (Joint Photographic Experts Group) standard has been designed for coding still images, whereas the H.261 standard which is designed for video-conference and the MPEG.1, MPEG.2 and MPEG.4 (Moving Pictures Experts Group) standard are designed to support more advanced video communication applications.
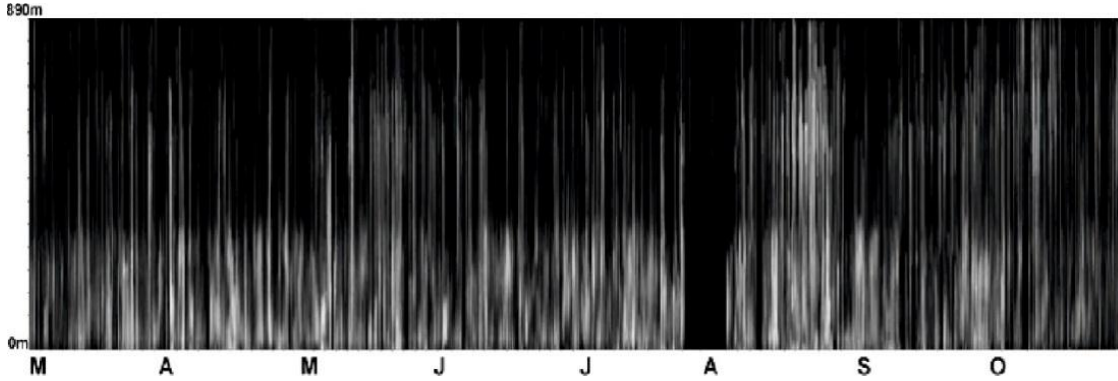
Figure.4: SODAR Facsimile in Raw format.

Properties of the original facsimile are given below, which are computed by *whos* function in the MATLAB.

| | |
|---|---|
| Name | : facsimile.jpg |
| Size | : 371x1272x3 |
| Bytes | : 1415736 |
| Class | : uint8 |

*Converting the given facsimile into GSI mode:*

Here in This section is going to explain the programming concept of how an image is going to convert and what are basic changes are going to take place in the image while the program has run. The function *rgb2gray* is going to the read *rgb* file into grayscale mode. Basically, the picture which is read by the function *imread*, which can stores the values of an image into *rgb* format, thus we need to convert it into the grayscale mode. *rgb2gray* converts RGB values to grayscale values by forming a weighted sum of the R, G, and B components:

$$0.2989 * R + 0.5870 * G + 0.1140 * B$$
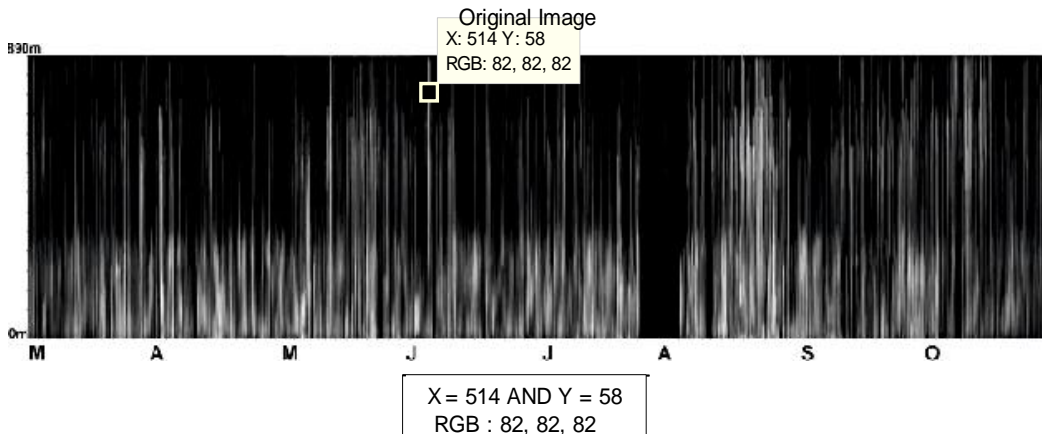
Equation.1: Calculation of gray scale values.



Figure.5: SODAR Facsimile in after reading from database and its intensity values at particular point format.
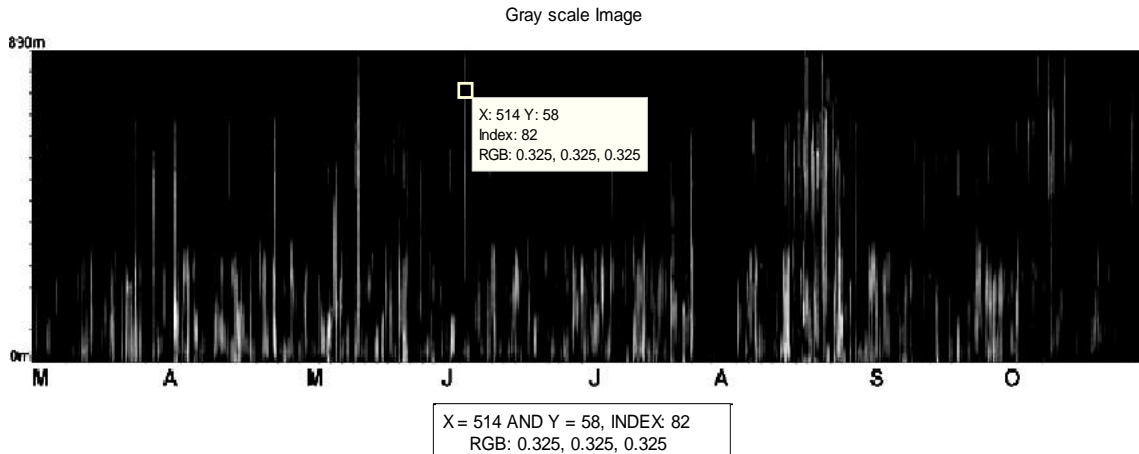
Gray scale Image



Figure.6: SODAR Facsimile in after converting into the gray scale format and its intensity values at particular point format.

From the above two figures we have calculated the RGB values at same point i.e., X = 514 & Y = 58, the original facsimile has RGB values as 82, 82, 82 and in converted facsimile (grayscale image) these values are identified as 0.325, 0.325, 0.325. Therefore we concluded that the image has transferred into grayscale mode. Properties of the gray scale mode facsimile are given below, which has converted into grayscale mode through *rgb2gry()* MATLAB function.

| | |
|---|---|
| Name | : facsimile.jpg |
| Size | : 371x1272 |
| Bytes | : 471912 |
| Class | : uint8 |

*Calculating and rearranging of the histogram values:*

Due to the increasing need of image processing concept mainly depends on the concept of how an accurate image is going to reconstruct and what are basic techniques are used for compression, transmission and reconstruction sections have explained in this third sections. Here the grayscale image values modified into new values in such that values between *low_in* and *high_in* map to values between *low_out* and *high_out*. Properties of the rearranged grayscale mode facsimile are given

below, which has adjusted into gray scale mode through *imadjust()* MATLAB function.

| | |
|---|---|
| Name | : facsimile.jpg |
| Size | : 371x1272 |
| Bytes | : 471912 |
| Class | : uint8 |

*Reconstruction of facsimile Image:*

Here in this reconstruction of facsimile Image section need to reconstruct the image, which has modified by previously mentioned sections. Basically, any image can be shown by function *imshow*(I). There are around eight types of MATLAB functions which can be useful for open/shown/reconstruct the image. *imshow* (I,[low high]) displays the grayscale image I, specifying the display range for I in [low high]. The value low (and any value less than low) displays as black; the value high (and any value greater than high) displays as white. Values in between are displayed as intermediate shades of gray, using the default number of gray levels. If you use an empty matrix ([]) for [low high], *imshow* uses [*min*(I(:)) *max*(I(:))]; that is, the minimum value in I is displayed as black, and the maximum value is displayed as white.
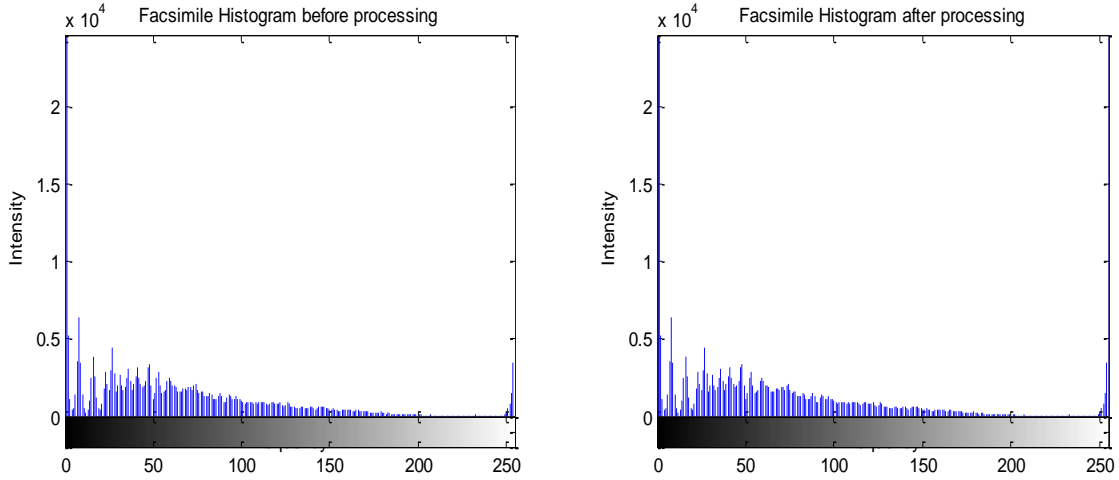
Figure.7: SODAR facsimile's histograms before and after converting facsimile into gray scale mode.
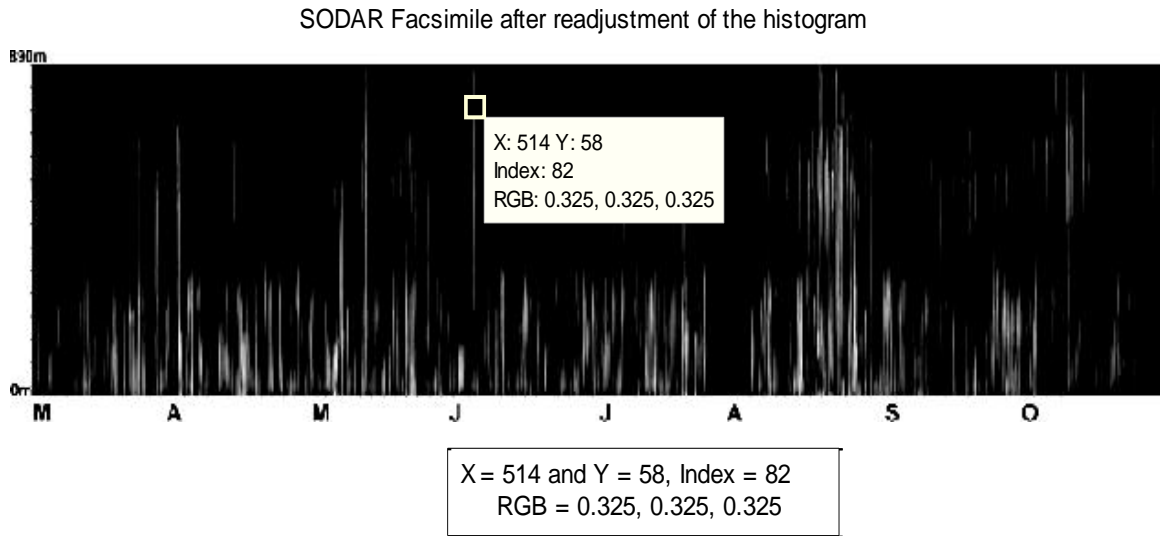


X = 514 and Y = 58, Index = 82
RGB = 0.325, 0.325, 0.325

Figure.8: SODAR Facsimile after reconstruction from the gray scale format and its intensity values at particular point format.

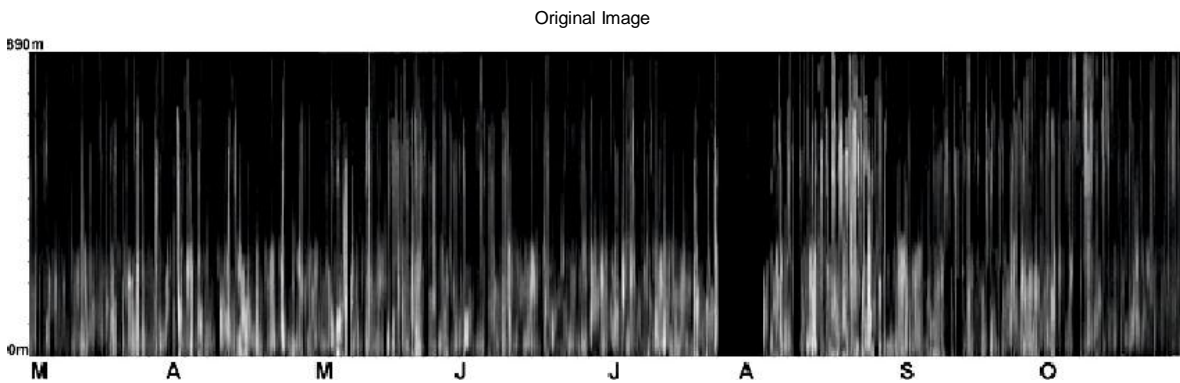## III. EXPERIMENT GRAPHS AND RESULTS



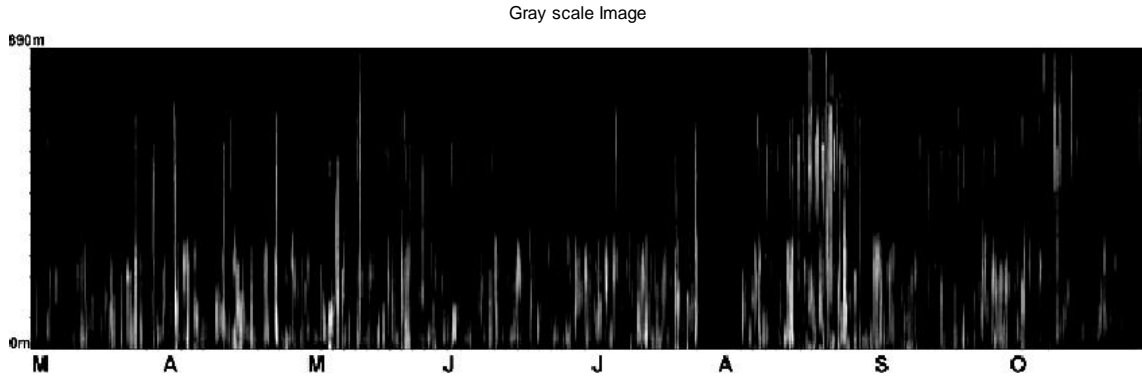Figure.9: SODAR Raw Facsimile after reading from the database.

Figure.10: SODAR Facsimile after conversion from the jpg format to gray scale format.
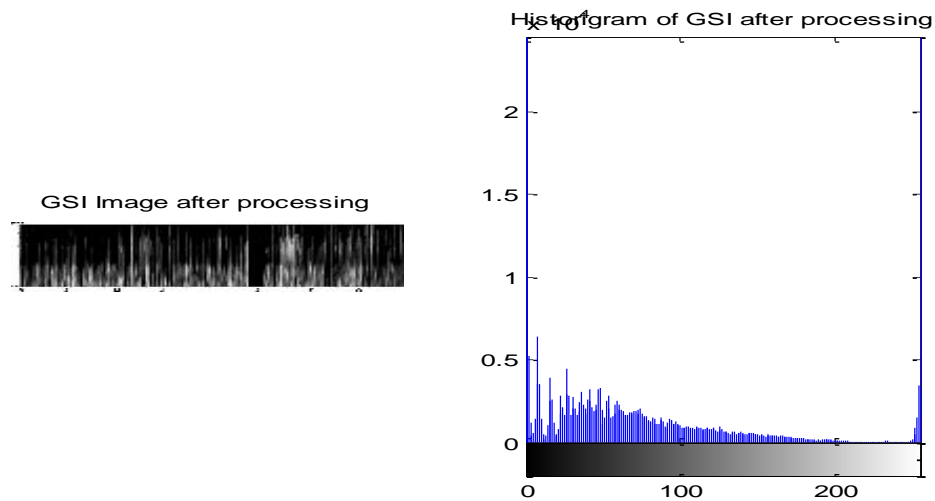


Figure.11: Final facsimile and its histogram after reconstruction of the facsimile.

## IV. CONCLUSIONS

Any backscattered signal will undergo certain effects due to same frequency signals propagate through the path of the backscattered signal. These signals also made represent in the report of the SODAR system as a facsimile. Removing of these patches are not possible with hardware filter, therefore a unique computing technique has developed with software to remove these patches and which can also help to enhance the clarity of the facsimile for better identification of signals in the facsimiles. Here in this paper, the processed facsimile has recorded by SODAR antenna installed at, Department of the System Design, Andhra University, Visakhapatnam. Here in our experiment concluded that there are no noise patches in this particular facsimile by observing the RGB values before and after processing of computing technique. When compared with other filtering techniques, the advantage of this novel computing technique is that time taken to complete the whole process is lesser than the 25 seconds.

## V. ACKNOWLEDGEMENT.

## VI. REFERENCES.

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