Model-Based Optimization Framework for Pan-Sharpening USING PAN CHROMATIC

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Abstract **- Satellite data has been successfully used in various application fields, as it provide a perfect view of a desired region. Satellite images of different resolutions are commercially available. . To obtain more precise and meaning full data from satellite image different preprocessing techniques are available. Panchromatic sharpening is one of the most used technique in remote sensing imaginary. This Sharpened image can be used in various application such as vegetation detection, water bodies detection, highways detection etc. and to extract important features from image data such as area calculation. This will make a description, implementation or understanding of the scene more informative and user friendly by machine.**

Index Terms **- Satellite Images, Image Processing, Satellite Images, Spectral Resolution, Spatial Resolution, Image Sharpening, Panchromatic Image, Pan-Sharpening Method, Feature Extraction**

I. INTRODUCTION

Remote sensing imaginary can used widely in many field of applications. This includes monitoring of global environmental conditions, for geographical and geological applications, for weather prediction etc. Detail information about earth‘s surface can be obtained by satellite images, as they cover large area of surface. Satellite Image processing becomes more advantageous as we can frequent re-visits to almost any part of the globe, regardless of its remoteness. To obtain more precise and meaning full data from satellite image different preprocessing techniques are available nowadays. Panchromatic sharpening is one of the most used techniques in remote sensing imaginary. Google Maps and mostly nearly every map creating company use this technique to increase image quality. In Pan sharpening process, high-resolution panchromatic and lower resolution multispectral images are merged to create a single high-resolution color image. Further, this Sharpened image can be used in various application and to extract important features from image data such as BW area calculation [1-5]

II. SYSTEM IMPLEMENTATION

Figure 1 shows, the block diagram of this dissertation work. This is carried out in three different modules.

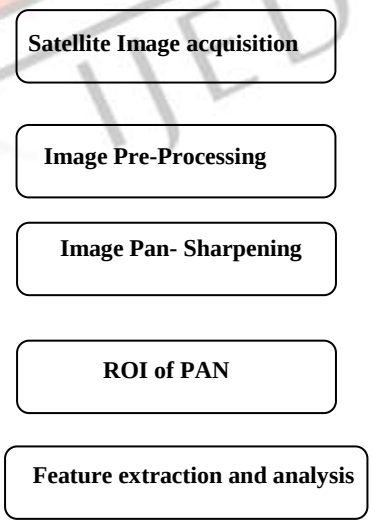

Fig.1: Block Diagram of system to sharpen satellite image and extract the feature.

They are:

MODULE 1:

A. Image Acquisition

This is the first and the fundamental steps of digital image processing. It is the action of retrieving an image from some source. The required multispectral and panchromatic images can be obtained from mentioned data references. [20] and also from internet. The database contains total 30 Images.

Pan sharpening process needs two images at its input.

I. Multispectral Image

II. Panchromatic Image

A multispectral image is an image captured at different range of frequencies over an electromagnetic spectrum. Panchromatic image is a single band image generally displayed as shades of gray. In contrast to the multispectral image, a panchromatic image contains only one wideband of reflectance data[2,1].

Figure: 2(a)

Figure: 2(b)

Figure 2: a) Multispectral Image with high spectral resolution and low spatial resolution;
b) Panchromatic Image with low spectral resolution and high spatial resolution.

B. Image Pre-processing

Database available from image acquisition, may be in the different image format such as .jpg, .mat etc. The present system works on .mat image format. In this file format written information of image is present as R, G, B, NIR and PAN content of input image not direct images. So, if source data is available in other format, it is preprocessed to convert it into .mat file format.

MODULE 2:

C. Image Sharpening

Image Sharpening is an efficient process of transformation which brings out more details of image than before. To obtain more precise data from source image, image sharpening operation is performed. In this, image sharpening is carried out by using pan sharpening technique. To perform pan sharpening of image different algorithms are available such as, IHS algorithm, PCX algorithm, Brovery algorithms etc. In this work IHS algorithm is used for sharpening of an image. Now, this sharpened image can be used for further applications.

MODULE 3:

D. Region of Interest (ROI)

Image obtained from satellite covers maximum region of earth‘s surface. Numerous applications are present in satellite image processing. Depending upon the particular application required data from the obtained image has to be considered. In this

work, green content and blue content of an image are considered. This will extract vegetation area and water body content from image respectively.

E. Feature Extraction

From selected ROI, the different features can be extracted depending upon particular application. Here BW area of ROI is calculated.

III. IHS PAN SHARPENING

In remote sensing imaginary, image fusion has wide range of application areas. An important domain is the multi-resolution image fusion, commonly referred to pan-sharpening. In satellite imagery two types of images are considered:

a. Panchromatic images –It is an image captured in thebroad visual wavelength range but appeared in black and white.

b. Multispectral images - It is an image captured in more than one spectral or wavelength interval. Each individual image is usually of the same physical area and scale but of a different spectral band.

In the Image fusion, these two images are merged to produce a single high resolution multispectral image. The standard merging methods of image fusion are based on Red-Green-Blue (RGB) to Intensity-Hue-Saturation (IHS) transformation. [7]

The usual steps involved in satellite image fusion are as follows:

1 Step-I: Resize the low resolution multispectral images to the same size as the panchromatic image.

2 Step-II: Transform the R, G and B bands of the multispectral image into IHS components, using following linear transformation.

$$\begin{pmatrix} I_v \\ v_1 \\ v_2 \end{pmatrix} = \begin{pmatrix} \frac{1}{\sqrt{3}} & \frac{1}{\sqrt{3}} & \frac{1}{\sqrt{3}} \\ -\frac{\sqrt{2}}{\sqrt{6}} & -\frac{\sqrt{2}}{\sqrt{6}} & \frac{2\sqrt{2}}{\sqrt{6}} \\ \frac{1}{\sqrt{2}} & -\frac{1}{\sqrt{2}} & 0 \end{pmatrix} \begin{pmatrix} R \\ G \\ B \end{pmatrix}$$

Where, I_v =Intensity of visual image

R, G, B =color information of visual image respectively.

v_1 And v_2 = components to calculate hue H and saturation S as,

Implementing the IHS fusion method in this manner is very efficient and is called the fast IHS technique (FIHS), making IHS ideal for the large volumes of data produced by satellites.

Ideally the fused image would have a higher resolution and sharper edges than the original color image without additional changes to the spectral data.[6],[8] &[12]

IV. CONCLUSION

Remote sensing imaginary, has wide range of applications in different areas. To obtain more precise details of particular region, Pan sharpening operation is performed. In Pan sharpening process, high-resolution panchromatic and lower resolution multispectral images are merged to create a single high-resolution color image. Further, this image is used to obtain, Green (vegetation) and Blue (water bodies) BW area. These are useful for applications such as mapping of transportation network, disaster management and urban monitoring.

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