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Segmentation of Satellite Images Using Adaptive Histogram Based Statistical Approach

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ABSTRACT: In order to extract details from satellite images, researchers and academics have focused on satellite image processing. Due to the fact that satellite images contain huge amounts of data, poor resolution, and considerable unpredictability, interpreting them is a difficult task for academics. Enhancement and segmentation is an important task to improve foreground objects in the background. It improves the quality of the image. The proposed method, the adaptive histogram threshold method, is improved by statistical It helps reduce the noise from the background and segment the objects from the satellite images. The improvement of remote sensing data obtained by satellite databases is greatly aided by image processing. Quality measurement techniques are applied to the proposed method such as psnr and mse.

KEYWORDS: satellite image, enhancement, histogram

I. INTRODUCTION

The combination of previous map categorization and imagery from satellites is innovative approaches to detecting the globe's ever-changing land/water characteristics. Satellite photos recorded periodically on a certain location are used to determine arise or in the region's area. These data are then utilised to generate precise maps for a variety of practical purposes. There has been an extensive amount of study done for satellite image analysis, ranging from categorization of manufactured characteristics to using high performance computation to satellite photos [1,2,3].

The researchers have had a lot of success with satellite picture analytics. However, a systematic review that will help scholars identify the problem and contribute to this exposed is inadequate. Satellite image processing is a key computing technology that is used in the armed forces, farming, disaster early detection, natural resource identification, and other fields. However, due to the huge size of satellite pictures, satellite image processing is exceedingly difficult. Image processing techniques such as sobel detection, edge detection, and threshold approaches will be used to find objects within the background of satellite images. The intricacy of satellite images creates additional challenges in real-world categorization applications, which can be overcome by using computationally sophisticated paradigms such as algorithmic learning. Image processing algorithms are used to improve satellite image techniques and land change forecasting techniques in remote sensing pictures. The figure 1 shows that the satellite image processing framework.

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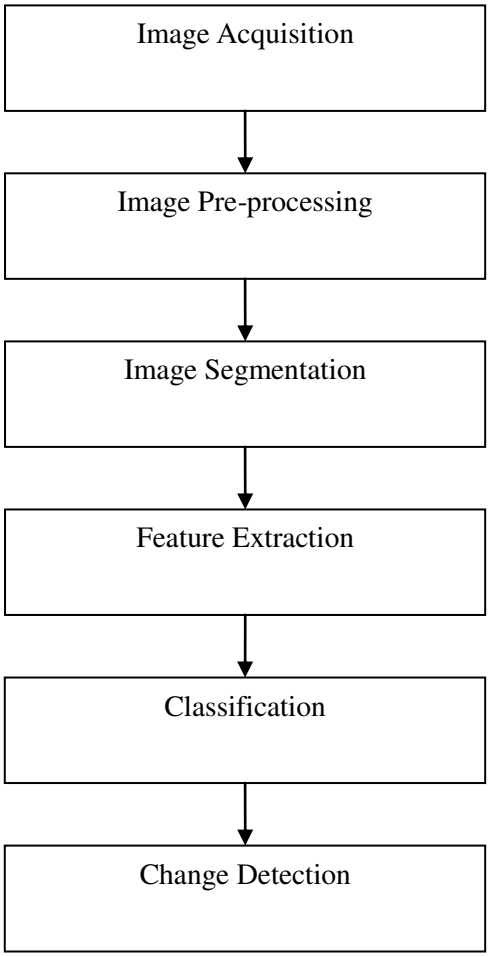

Figure 1 : Satellite Image Processing Framework

This process involves obtaining an image from the database, enhancing it to increase brightness or reduce noise, segmenting the image to identify objects in the background, and then gathering features from the segmented images for use in classification and any differences between remote sensing landcover images. The progression of feature extraction includes creating features for categorization and selection. These traits are distinguishable and are sent to the categorization stage. A crucial factor in determining the effectiveness of the picture classification process is feature extraction.

II. LITERATURE REVIEW

Variations in satellite sensor resolution, such as spatial, wavelength, and radiometric resolution, as well as changes in perspective, result in vast differences in satellite picture interpretations. Image processing refers to the methods and operations used to extract the meaningful information and characteristics from images[1]. These techniques tend to improve or change the image's attributes in order to attain better categorization results. There are various mathematical techniques are employed to conduct operations on photographs in order to extract information from them. Image segmentation is one of the most used image processing techniques for segment the foreground objects.

Images from satellites and geographic information systems (GIS) for surface area and changes in land use are essential in a wide range of applications, including ecology, woodlands, hydrology, agriculture, and geology. Natural resource administration, arranging, and surveillance programmes rely on reliable information on the area's land cover.

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The use of thorough field sampling along with plot inventories to substantial analysis of remotely sensed data has shown to be less expensive for broad areas, minor site evaluation, and assessment[2].

In low-quality image processing, histogram equalisation is a typical approach. This approach is commonly used to reflect the size of each grey level in a picture as well as the likelihood of occurrence of related image pixels. A low-quality image's grayscale range is often limited. The dynamic width of pixel in the picture to be processed is extended after histogram equalisation to increase the overall luminance contrast of the initial images. Multiple research studies, from machine learning to deep learning, have examined land cover. Ten years ago, neural networks were too computationally complicated to be used effectively. While histogram thresholding methods yielded good results, it displayed issues related to the inconsistencies and difficulties in images from satellites[2,5]

Despite breakthroughs in satellite imaging technology, computer-assisted image categorization is still incapable of producing accurate land use and land cover maps and statistics. Although image analysis techniques are quickly improving, many operational and applied remote sensing investigations continue to require the extraction of discrete thematic land surface information from satellite data utilising classification-based approaches [7].

III. METHODOLOGY

In general, image segmentation is defined as the process of dividing an image into homogenous parts in such a way that each region is homogeneous when analysed separately. There can be no homogeneity between two nearby regions. One of the most important phases in image processing is picture segmentation. The last few decades have made significant contributions to advances in processing images. These breakthroughs and newer inventive technologies allowed researchers to embark on massive databases of high resolution (HR) pictures, such as satellite image collections. Image segmentation may be achieved in a variety of methods. Different factors influence each strategy differently [4]. The next section discusses some of the approaches and methodologies used for picture segmentation. Segmentation of images may be divided into a few different groups based on the approach such as threshold based, edge based and then regional based segmentation [5].

Thresholding is one of the most basic, but crucial, aspects of image processing and analysis. The goal of threshold is to separate the image into two distinct sections: the foreground, which is the region of interest, and the background area. This process works on a grayscale picture. An acceptable threshold value is chosen, which is used next to convert all pixel values into either of the two groups, zero or one. If the pixel value is less than the minimum or maximum value, it is set to zero; if the pixel value is greater than the threshold value, it is set to one.

3.1 DATASET

Authorities and legal price forecasting organisations can utilise the three models that together make up AgriFore from Earth2Orbit Analytix, a price forecasting tool. This data is get from Earth2Orbit Analytix's AgriFore. Earth2Orbit Analytix is harnessing imagery from satellites, supplemental data, real-world information and the use of machine learning algorithms" in order to ensure improved forecasts of prices by agribusiness participants. This dataset is used for predict the land crop area from the satellite image [4].

3.2 ALGORITHM OF THE PROPOSED WORK

The proposed method is used to segregate foreground objects in satellite photos. The AgriFore Earth2Orbit satellite image is used to obtain the RGB (red, green, and blue) image, which is then converted to an HSV (hue, saturation, and value) image through prior processing. The suggested segmentation technique is then employed to separate the harness space from the backdrop image. It enhances the agribusiness involved in harvesting. The proposed algorithm steps are given below,

a) Developing image threshold using local first order statistical method.
b) First of all, convert the intensity image to the HSV (hue, Saturation, and Value) image.
c) The statistic value is considered the median value of the hue. It helps estimated the average background illuminations.
d) Separated the land cover areas from the satellite images.

Although several image processing techniques are available for segmenting satellite pictures, we suggest using adaptive threshold color-based segmentation to extract the land area used for crop fields from the satellite image. The suggested effort will assist to enhance the forecasted outcome and subsequent changes in land cover over time [5].

3.3 EXPERIMENTAL RESULTS

The agricultural crop area is detected from the satellite image using proposed algorithm, these result is evaluated by the quality measurements which is helped to agroithm was worked well or not. Manually observation is not enough to quality measurement so PSNR and MSE value is need to measure the segmented image quality.

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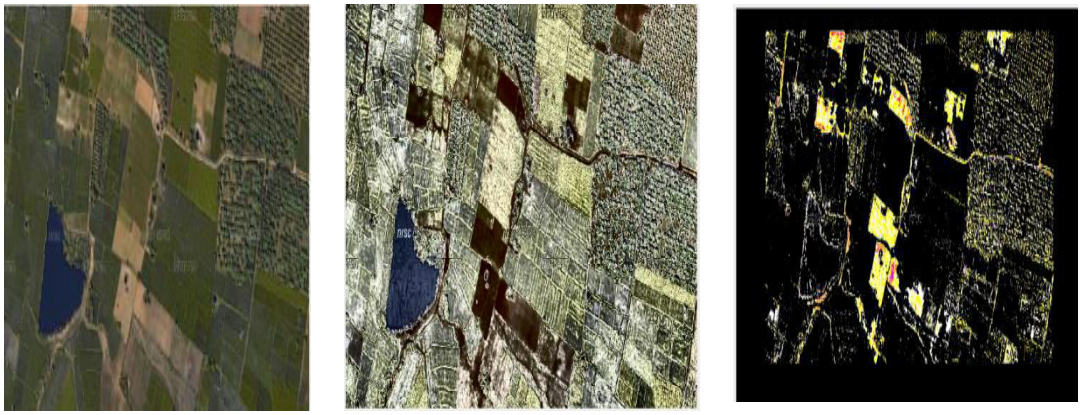

(a) Original Satellite image of agricultural land in Karimnagar, Telangana (Credit: Bhuvan, ISRO)

(b) Enhanced image

(c) Segmented image from background

Figure 2: The proposed work applied to segment the landscape from the satellite image

3.4 QUALITY MEASUREMENTS

Image quality evaluation measures such as MSE and PSNR are commonly used because they are easy to compute, have obvious physical meanings, and are also straightforward to use theoretically in the improvement context. However, they are frequently mismatched in their ability to sense visual quality and are not normalised in representation.

3.4.1Peak Signal to Noise Ratio(PSNR)

The PSNR value is measured based on the color image segmentation using equation (S1 is original image,S2 is segmented image) is given below,

$$\mathrm{PSNR}(S1,S2) = \frac{10\log 10s^2}{\mathrm{mse}(S1,S2)} \quad (1)$$

3.4.2 Mean Square Error(MSE)

The scaling of picture intensity was computed by the MSE, and these numbers need to be nearer to zero. It is more accurately described as the MSE difference between two pictures. $S1(i,j)$ and $S2(i,j)$.

$$\mathrm{MSE}=\frac{1}{mn}\sum_{i=0}^{m-1}\sum_{j=0}^{n-1}[S1(i,j)-S2(i,j)]^2 \quad (2)$$

Several techniques, including PSNR and MSE, are used to calculate the quality-enhanced pictures. Tables indicate that the newly suggested improvement strategy outperformed the values of the tried-and-true procedures in Table 1.

S.NO	Quality metrics	Segmented Satellite Image	Original Image
1	PSNR	67.0	54.20
2	MSE	12.7	34.90

Table 1: Quality measurement for Proposed Satellite Image

The original image's quality is measured before the segmented image from the suggested work is used. According to the measurement results, the suggested picture has lower mse and higher psnr values.

IV. CONCLUSION

One of the important computing techniques used in the armed forces, food production, avoiding natural disasters, finding natural resources, and other fields is satellites image processing. Nevertheless, because satellite photos are so huge, interpreting them is quite complicated. There are several image processing methods for segmenting satellite pictures, however we suggested using adaptive threshold colour based segmentation to determine the land area of crop

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field from the satellite image. This suggested effort will aid in improving forecast results and subsequent land cover changes over time.

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