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Extraction of Texture Features from Panchromatic Images

Sanjeevi P, Marlapalli Krishna

Abstract: A Framework for Delineation of Trees is used to detect the trees of the urban area and it is a desirable framework in urban are management. Delineation and detection of trees from satellite images is important for the estimation of the trees of the urban and rural area. In existing literature, most of the studies only deal with particular tree crown or tree species detection. There is no particular framework for detecting major tree species of urban area collectively from visually distinguishable satellite images and also there is a major problem of distinguishing trees from their shadows. In this paper we used the texture-based feature extraction methods and proposed new algorithms to extract simple texture features from the panchromatic images. The proposed methodology is divided into three phases. Pre-processing was done in first phase to minimize the unnecessary deformations. Quality of Image is increased by eliminating the dark spots and shadows etc. in second phase image segmentation was done to identify the image boundaries and objects in the image. Finally, in the third phase, a framework for delineation of trees was done using image enhancement and segmentation algorithms. The ultimate purpose that the knowledge obtained from the study is to developing a framework that can process shadows and then effectively detect and extract trees from satellite images.

Index Terms: Image processing, Haralick feature, panchromatic images, Texture features.

I. INTRODUCTION

Remote detecting is exertion information identifying with articles or inaccessible regions, for the most part from satellites. It tends to be connected to earth science, land estimation and most applications in regular science, knowledge, and business, monetary, military, arranging and compassionate. Remotely distinguished planetary pictures make it simpler for analysts to detect things about the planet. Remote detecting is that two or three separation advancement is the workmanship and study of account, estimating and investigating information. Woodland stock, be that as it may, could be an in all respects exorbitant and time - expending task.

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* Correspondence Author
Sanjeevi P*, M.Tech Student, Dept. of Computer Science & Engineering, Sir C.R.Reddy College of Engineering, Eluru-534007, Andhra Pradesh, India. (perurisanjeevi@gmail.com).
Dr. Malapalli Krishna, Professor, Dept. of Computer Science & Engineering, Sir C.R.Reddy College of Engineering, Eluru-534007, Andhra Pradesh, India. (marlapallikrishna@gmail.com).

A scope of picture handling procedures for the machine-controlled discovery and depiction of individual tree crowns have been created with the expanding openness of high spatial goals airborne and satellite pictures. While the vast majority of the current examinations just focused on tree crown outline and they utilized various calculations. The identification and specification of tree crowns has a bit of leeway in surveying the size of tree crowns and encourages the order of species.

Such strategies pre-process the deduction of woods stock parameters, example, limits of backwoods stands. Similarly elective parameters can be effectively distinguished, example, sizes, height and tree crown [10, 11].

II. LITERATURE SURVEY

Bhavana, B. L., N et.al [1], made some studies on satellite images with high resolution to extract the tree crowns in hectic areas. The authors explain the workflow perfectly about discovery, extraction and the tree crown identification from urban vegetation area from the satellite images. First the authors documented the vegetation areas in the urban environment, vegetation area delineation and sorting out the trees area from lawn areas. For this purpose authors had taken Color infrared (CIR) composite image of Bangalore town as input. To identify the grasslands and trees space they used the texture Analysis algorithms. They evaluated the results obtained from the segmentation and presented the realistic capacity of geometric description about the urban tree crown. Tree crown shape, its height and 3D model of crown delineation are the three important parameters used for classification tree species.

In the investigation of Wen, Dawei et.al [2], a novel pixel-object-fix three-level system has been proposed for the semantic arrangement of urban trees from an urban environment point of view utilizing VHR remote detecting symbolism. The outcomes got from both the Shenzhen and Wuhan Perspective 2 informational indexes affirm the potential and viability of the proposed strategy. The outstanding favorable circumstances of the proposed strategy are as per the following: 1) The vegetation extraction at the pixel level is the key advance for lessening the computational expense in the further advances, since the data file (VEVI) can be utilized to effectively veil out other urban structures. 2) In accordance with past research, object-explicit ghostly and textural highlights are utilized for the vegetation mapping. At the article level, the non vegetation data is further sifted through, and segregation among trees and ground vegetation is accomplished. 3) A progression of fix level measurements that delineate the zone, shape, structure, and spatial relationship are considered for the urban natural surroundings type arrangement.

The trial results demonstrate that these measurements are viable as they can catch the inborn attributes of the diverse appearance styles. 4) Through the scene arrangement and design of the three tree classes, more prominent discontinuity and spatial heterogeneity for private institutional trees is watched, also, park trees will in general demonstrate the most extreme physical connectedness and conglomeration.

The proposed structure enables the client to guide park, roadside, also, private institutional trees in a summed up way, which could educate approaches identified with urban biological systems. Be that as it may, significant extra work is expected to test the power and appropriateness of the proposed technique in other urban zones with various biological structures. It will likewise be important to discover progressively compelling highlights or classifiers for the semantic arrangement of urban trees. Likewise, the three urban environment types may have shifting degrees of urban warmth island moderation, also, they could be identified with financial elements (e.g., land costs), which should be dissected quantitatively in our future work.

Individual tree crown outline (ITCD), which incorporates treetop recognition or potentially tree crown outline, plays a noteworthy job in present day woods assets the board and exact ranger service. Late years, measure of ITCD calculations have been proposed dependent on aloof and dynamic remotely detected information. Be that as it may, since there is no institutionalized precision evaluation system for ITCD, it is incredibly hard to look at ITCD calculations except if different methodologies are tried on a solitary report region utilizing the equivalent datasets and precision measurements. Zhen, Zhen et.al, [3], made Correlation of ITCD calculations is testing when there are contrasts in study center, study region, information connected, and precision evaluation technique utilized. In spite of the fact that there is no institutionalized appraisal system for ITCD ponders, an assessment with two- levels (i.e., plot level and person tree level) of precision evaluation is suggested. A straightforward and repeatable evaluation technique is fundamental to gauge ITCD precision. This examination builds up a proficient instrument of two-level precision appraisal for ITCD system (counting treetop identification and tree crown depiction) with Python, which makes it simpler for global examination of ITCD calculations. Later on, the exactness appraisal instrument for ITCD could be extended and improved by joining a complete arrangement of exactness measurements and adaptable clients' interfaces. Clients could choose a fitting arrangement of measurements as indicated by research destinations and necessities. The instrument is required to help wide-examination of ITCD calculations what's more, effectively encourage ITCD concentrates and afterward woods stock. Pollock model was one of the prevalent layout coordinating calculations, which develops a 3-D portrayal of every individual tree-crown envelope. Tragically, it is continually testing to decide parameters since each tree has distinctive developed condition. Chao-Cheng wu et.al [4], an iterative least square fitting calculation to frame a Pollock model best fitting every individual tree for tree recognition and crown depiction. The proposed calculation gives a answer for stay away from challenges of finding the best arrangement of parameters for each tree crown. Thus, it improves the discovery rate and diminishes the processing time as appeared in the exploratory investigations. The proposed least square fitting calculation is progressively appropriate for useful applications.

Baoxin Hu [5], made investigation to develop individual tree crown outline by completely abusing the crown data displayed in multi-wavelength LiDAR information. The information utilized in this investigation was acquired by an Optech's Titan instrument with three wavelengths: 532 nm, 1064 nm, and 1550 nm. Strategies were created to utilize both ghostly and basic data of tree crowns to separate crowns from other spread sorts and from one another. The strategies were tried utilizing an informational collection got over an investigation region in Toronto, Ontario, Canada. Fundamental outcomes demonstrate that with both the shelter tallness model and forces comparing to the three wavelength, trees were recognized from other spread sorts with a high precision what's more, trees were isolated from one another with a sensible exactness (in view of visual perception).

The assess procedure for recognizable proof and outline of individual tree crowns, utilizing Lidar and multispectral information combination. Linda G [6] developed techniques actualizing information combination depend on picture binarization (thresholding) what's more, area developing division calculation. Results were contrasted and format coordinating strategy for multispectral information and locale developing calculation utilizing only one information source. For an example set, information combination approach gave 78 % tree ID precision with 5 false positives; however layout coordinating furnished 72 % precision with 25 false positives. Information combination approach in the outline overcome brightening impacts.

Mechanized individual tree crown recognition and depiction (ITCD) is fundamental for woods mapping, feasible urban arranging and 3D city model. In the studies of Xiaojing Huang et.al, [7] ITCD utilizing high resolution optical Worldview-2 satellite symbolism over Singapore is exhibited. The article based multi resolution approach for tree mapping including tree positions, crown sizes and shade holes is depicted. Precision evaluation is performed with ground truth information. Decent variety of trees frames a significant segment in the timberland biological systems and requirements appropriate inventories to help the woodland staff in their every day exercises. Be that as it may, tree parameter estimations are frequently obliged by physical unavailability to site areas, staggering expenses, and time. With the headway in remote detecting innovation, for example, the arrangement of higher spatial and otherworldly goals of symbolism, various created calculations satisfy the requirements of precise tree inventories data in a savvy and convenient way over bigger timberland zones. N Khalid et al [8], Planed to produce tree dispersion map in Ampang Forest Reserve utilizing the Local Maxima and Multi-Resolution picture division calculation.

The usage of late perspective 2 symbolism with Local Maxima and Multi-Resolution picture division demonstrates to be fit for recognizing and depicting the tree crown in its precise standing position. To address the issue of picture surface component extraction, a bearing measure measurement that depends on the directionality of picture surface is constructed, and another strategy for surface element extraction, which depends on the course measure and a gray level co-occurrence matrix (GLCM) combination calculations was proposed by Xin Zhang et al [9].

This strategy applies the GLCM to remove the surface component estimation of a picture and coordinates the weight factor that is acquainted by the heading measure with get the last surface element of a picture. A lot of characterization tests for the high-goals remote detecting pictures were performed by utilizing support vector machine (SVM) classifier with the bearing measure and gray level co-occurrence matrix combination calculation. Both subjective and quantitative methodologies were connected to survey the characterization results [12]. The test results exhibited below shows that surface component extraction dependent on the combination calculation accomplished superior picture recognition, and the exactness of order dependent on this strategy has been essentially improved.

III. DATA SET

For experimental work done on the dataset consisting of panchromatic images taken from a cartosat2 satellite, provided by the National Remote Sensing Centre (NRSC) Hyderabad. The dataset has 100 images of file format .tif and few of them are shown in Fig. 1. The Input image from chittore region and Chhattisgarh region of cartosat 2 satellite data were shown in Fig. 2 and Fig. 3 respectively.

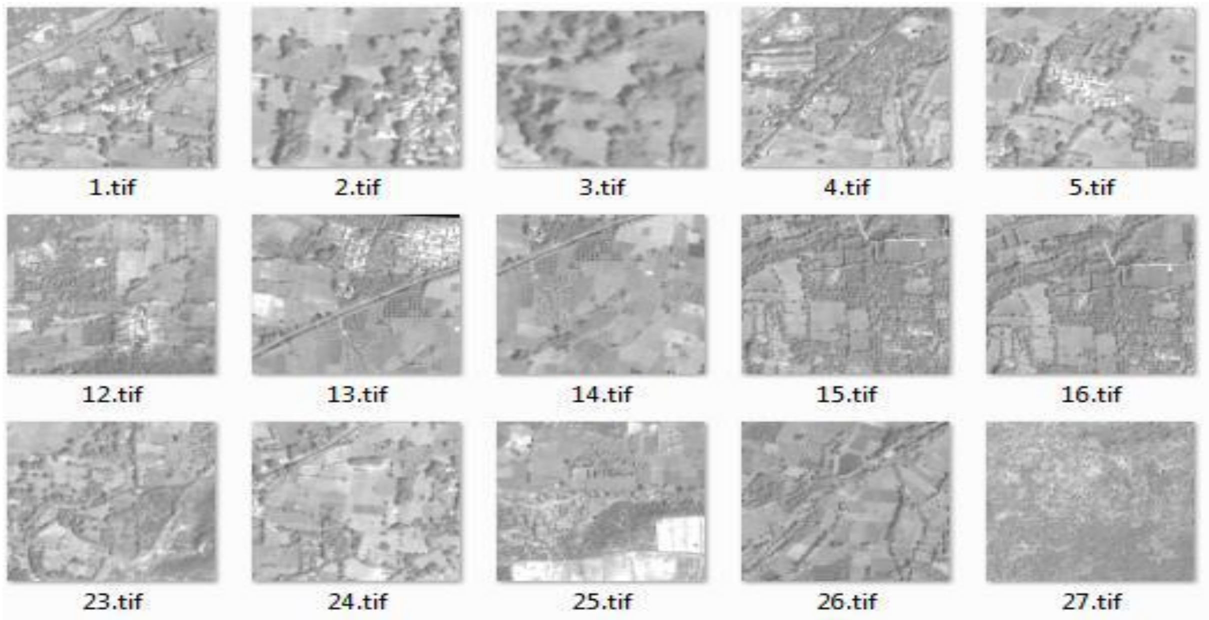

Fig. 1. Cartosat-2 Data Set

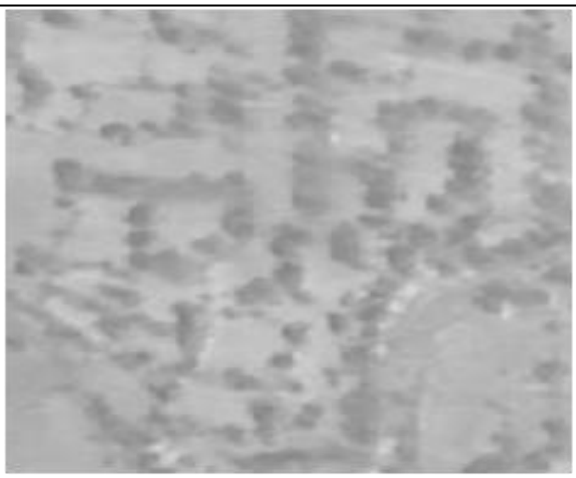

Fig. 2. Input image from chittore region.

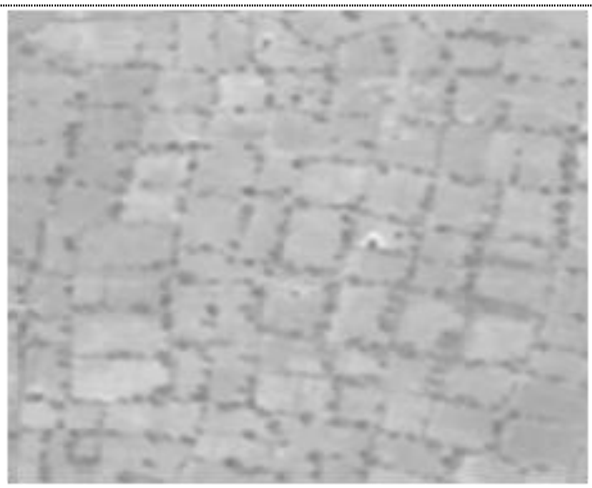

Fig. 3. Input image from Chhattisgarh region.

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IV. PROPOSED METHODOLOGY

The proposed methodology mainly involves three phases, namely Pre-Processing, Segmentation and texture Features Extraction. The Flow diagram of the proposed methodology is publicized in Fig. 4. Input is a panchromatic picture which is basically a highly contrasting picture.

It is one single band and normally it has a wide transmission capacity [13, 15] of two or three hundred nanometers. These pictures are made when the picture sensor is delicate to wide scope of light wavelengths, normally covering a large part of the visible spectrum.

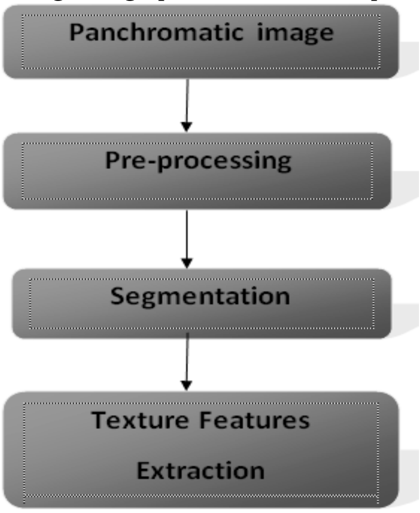

Fig. 4. Block diagram of proposed methodology

In the course of recent decades, the Indian earth perception professional program has development and a progression of Indian remote sensing satellites with coarse, medium and high-goals sensors. ISRO propelled the cartosat-2 satellite the subsequent national mapping satellite since 2005, to furnishing data with a goal of very one meter. Cartosat-2 could be an inconspicuous remote detecting satellite that may convey grand spot pictures [14] and the determinations of Cartosat-2 satellite information are referenced in the above Table I.

Table I: Specifications of Cartosat2 satellite data

Curve	630.6km
Normal Large Axis	7008.74km
Impulse	97.91degrees
Apparent Time	9.30AM
Frequent	4 or 5 Days
Repetitive	310Days

V. EXTRACTION OF TEXTURE FEATURES

In this section, the quality of the image was enhanced by doing some pre-processing to eliminate the unwanted distortions like shadows and dark spots etc. In this phase Histogram equalization algorithm plus binary thresholding algorithm used in enhancement process, the result of enhancement technique will be added to contours algorithm in segmentation phase (the algorithms are presented below).

Algorithm-1: Image Enhancement Histogram Equalization + Binary Thresholding

Step1: Consider an image whose pixel values are limited to a certain range of values. Estimate the standardized histogram h input k.
Step2: Measure the function of cumulative distribution of h, cdf-f**.**
Step 3: Encounter transformation T;0, L-1.

$$T(r) = (L-1)\ CDF(r)$$

Step 4: Apply the transformation of the input image to each pixel.
Step 5: segment the image using t to generate two pixel groups g1, g2
Step 6: estimate the average gray pixel levels in g1 for 1 and g2 for 2 and calculate the new threshold

$$\mathbf{T} = \frac{\boldsymbol{\mu 1+\mu 2}}{\mathbf{2}}$$

Step7: Repeat steps 2 to 4 until the difference in T is less than a pre-determined limit T.

Algorithm-2: Image segmentation Histogram Equalization + Binary Thresholding+ Contours

Step1: Consider the output of enhanced image
Step2: Calculate some features like center of mass of the object, area of the object. From this moments, you can extract useful data like area, centroid etc.
Step3: Calculate contour area using the Function cv2.contourArea ()
Step4: Calculate perimeter of contour using cv2. Arc Length () function
Step5: Generate the shape of tree crown and Edge detection of tree crown.

The Extraction of the texture features are performed on the enhanced image [19]. Image improvement ways square measure utilized in this section to get free of unnecessary deformations like shadows and dark spots etc. the image data content was not increased by the Pre-processing. Image enhancement and image segmentation methods are normally used for eliminating noise from an image and to discover objects and boundaries of tree crown respectively. The gray-level co-occurrence matrix (GLCM) is the mathematical technique applied for feature extraction. The GLCM could be a tabulation of however; typically totally different combos of grey levels may occur in an image. Using KHARALICK() function texture features were extracted. The list of texture features are specified in given below.

ASM: $\sum_i \sum_j \{P(i,j)\}^\wedge 2$

Contrast: $\sum_{n=0}^{Ng-1} n^\wedge 2 \sum_{|i-1|)} = Pd(i,j)$

Correlation: $\frac{\sum_{i=1}^{Ng} \sum_{j=1}^{Ng} (i-\mu i) Pd(i,j)}{\sigma i \sigma j}$

Entropy: $\sum_{i=1}^{Ng} \sum_{j=1}^{Ng} Pd(i,j) \log (Pd(i,j))$

Sum of Squares: Variance: $\sum_i \sum_j (i-\mu)^2 P(i,j)$

Inverse Difference Moment: $\sum_i \sum_j \frac{1}{1+(i-j)^2} P(i,j)$

Sum Average: $\sum_{i=1}^{2Ng} i\ Px + y\ (i)$

Sum Variance of Variance: $\sum_{i=2}^{2Ng} (i - fg)^\wedge 2\ Px + y(i)$

Sum of Entropy: - $\sum_{i=2}^{2Ng} Px + y\ (i)\ log\{Px + y(i)\}$

Difference Of Variance: variance of Px-y

Difference of Entropy: $-\sum_{i=0}^{Ng-1} Px - y\,(i) log\{Px - y(i)\}$

Information Measures Of Correlation

$$\frac{HXY - HXY1}{max(HX, HY)}$$

Maximal Correlation Coefficient

(Second largest high variance Q)^2

Where Q (i,j)= $\sum_k \frac{P(i,j)P(j,k)}{Px(i)PyK}$

In this work we have taken one meter resolution of panchromatic images from the cartosat-2 satellite data. We can extract the texture feature by using the extraction function and the results are tabularized in Table II. The delineation of trees will be done after extracting the texture features of the image [16, 17]. The relationship between the number of tree crowns and the texture features is independent of the algorithms we use [18].

Table II. Extracted texture Features using enhanced image

Asm	Contrast	Correlation	Variance	I.D.M	S.A	S.V	S.E	Entropy	D.V	D.E	I.C	M.C.C
0.002	12.47	0.981	335.45	0.448	325.7	1329.3	7.1961	9.69	0.0007	2.764	-0.438	0.997
0.001	28.32	0.957	335.46	0.324	325.7	1313.5	7.1939	10.33	0.0005	3.312	-0.335	0.992
0.001	16.39	0.975	335.36	0.368	325.7	1325.4	7.1967	10.00	0.0006	3.000	-0.389	0.994
0.003	25.60	0.961	335.46	0.324	325.7	1316.2	7.1951	10.30	0.0005	3.280	-0.340	0.993
0.002	12.47	0.981	335.55	0.448	325.7	1329.3	7.1961	9.69	0.0007	2.764	-0.438	0.997
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0.001	25.60	0.961	335.46	0.324	325.7	1316.2	7.1951	10.30	0.0005	3.280	-0.340	0.992

VI. CONCLUSION

In our paper, we developed a framework for delineation of trees. This framework is used to detection and delineation of individual tree crowns and to estimate the size of the tree crown. In our proposed methodology, the texture features were also extracted using KHARALICK ( ). These features are used in our methodology of segmentation phase, and to detect and extract the trees from panchromatic images effectively.

The feature extraction table 2 specifies the values of input images and every four row values related to one input image respectively. The ultimate purpose that the knowledge obtained from the study is to developing a framework that can process shadows and then effectively detect trees from satellite images.

FUTURE ENHANCEMENT

Texture features are used for classification can sort image data into more readily interpretable information. Which are in turn used in industrial inspection, image retrieval medical imaging, remote sensing and a wide range of applications.

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