International Journal of Recent Technology and Engineering (IJRTE)
ISSN: 2277-3878 (Online), Volume-8, Issue-1, May 2019

A Framework for Delineation of Trees

Sri Harsha Rompicharla, Sree Vijaya Lakshmi Kothapalli, Suvarna Vani Koneru

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 framework simple texture features were extracted from the panchromatic images, texture-based feature extraction methods were used and new algorithms were proposed in our methodology. In this, the methodology consists of three phases. In the first phase of our methodology, the input images will be pre-processed to suppress unwanted distortions like shadows and dark spots etc. and enhance the image quality. Then in the second phase, the image segmentation is performed on the enhanced image and to detect objects and boundaries. 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 sensing is an effort data relating to objects or distant areas, usually from satellites. It can be applied to earth science, land measurement and most applications in natural science, military, intelligence, commercial, economic, planning and humanitarian. Remotely detected planetary images make it easier for researchers to "sense" things about the planet. Remote sensing is that a couple of distance development is the art and science of recording, measuring and analyzing data. Forest inventory, however, could be a very costly and time - consuming task. A range of image processing techniques for the machine-controlled detection and delineation of individual tree crowns have been developed with the increasing accessibility of high spatial resolution aerial and satellite images. While most of the existing studies only concentrated on tree crown delineation, and existing authors used regular algorithms [8] [9] [10] [11] [12]in image processing. The detection and enumeration of tree crowns has an advantage in assessing the size of tree crowns and facilitates the classification of species [13]. In addition, such techniques pre - process the inference of forest inventory parameters such as boundaries of forest stands. Alternative parameters can also be easily detected, such as gap distribution and sizes, height and tree crown.

Revised Manuscript Received on 30 May 2019.
***** Correspondence Author
Sri Harsha Rompicharla*, Computer Science and Engineering, Velagapudi Ramakrishna Siddhartha Engineering College, Vijayawada, India.
Sree Vijayalakshmi Kothapalli, Computer Science and Engineering, Velagapudi Ramakrishna Siddhartha Engineering College, Vijayawada, India.
Suvarna Vani Koneru, Computer Science and Engineering, Velagapudi Ramakrishna Siddhartha Engineering College, Vijayawada, India.

II. RELATED WORK

Bhavana, B. L., N [1] et.al, have planned tree crown extraction from high-resolution satellite pictures in a populated area. During this paper, they planned to observe extracts the urban vegetation indexes and those they had taken input as color infrared (CIR) composite image of Bangalore town. The texture Analysis algorithms are used for looking for the grasslands and trees space. This approach is employed to tree crowns detection and extraction from satellite pictures. The benefits of their planned methodology were the trees are detected with prime quality, a lot of correct compared to alternative classification technique, Vegetation indexes are accustomed to observe vegetation areas.

Linguistics classification of urban trees exploitation terribly high-resolution satellite representational process by Wen, Dawei et.al, is introduced [2]. In this, a unique three-level (texture-object-patch) framework for linguistics classification of trees of the populated area was planned to reason urban trees like a park, roadside, and residential institutional trees exploitation VHR remote sensing representational process. The input was taken from digital images of trees. The benefits are so as to help with ecological surroundings protection and supply property development steerage for urban planners. Development of accuracy assessment tool of individual tree crown delineation. During this, they planned a regular accuracy assessment procedure for individual tree crown delineation, together with the assessments for tree high detection and crown delineation. The accuracy assessment tool was conjointly developed exploitation texture feature algorithms Zhen, Zhen et.al, [3]. Minimum square pole model fitting for tree detection and crown delineation Chao-Cheng wu [4] et.al. They planned unvaried least square fitting during this study.

Algorithmic rule to create a Pollock model that best fits each individual tree for LiDAR information for tree detection and crown delineation. The input they took digital photographs of trees.

Baoxin Hu et.al had rising individual tree delineation using multiple-wavelength [5] LiDAR information. The target of this study was to enhance individual tree crown delineation by totally exploiting the crown data.The identification and delineation of individual tree crowns using LiDAR data and multispectral information fusion [6]. During this, the objective of this study is to propose and evaluate the methodology for the identification and delineation of tree crowns by Baoxin Hu et.al, had rising.

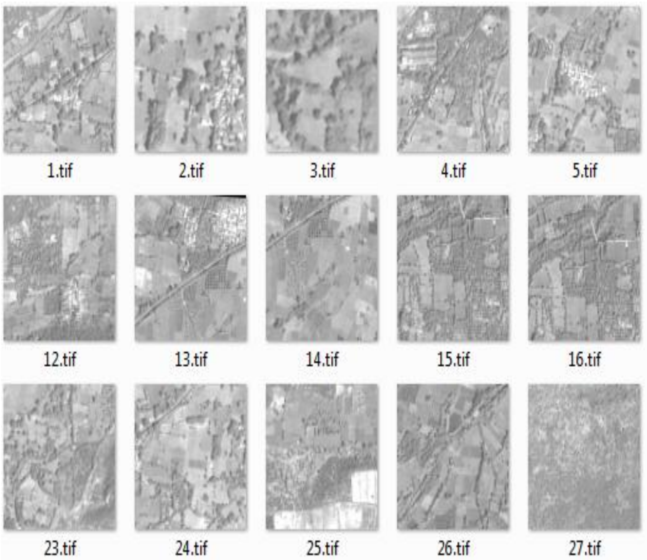
Detection and delineation of the crowns of the tree using optical satellite data. They introduced a technique for the recognition of individual trees via tree crown / bole detection during this paper Xiaojing Huang had planned. [7] Worldview-2 satellite tree height and crown boundary delineation using watershed segmentation and combined NDVI and higher than the aforementioned spectral index classification methods.

III. DATA SET

The dataset was provided by NRSC Hyderabad, which contains panchromatic images taken from a cartosat2 satellite, the data set contains around 100 images and it is in the form of .tiff file format. And in this methodology we are taken an input from Chittoor and Chhattisgarh region of cartosat2 satellite data.

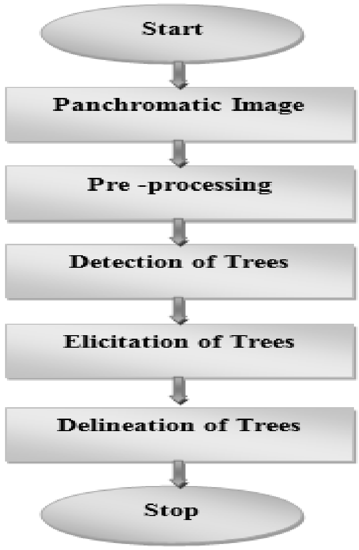
"Table 1.Specifications of cartosat-2 satellite data"

Mission Category	Remote sensing
Curve	630.6 km
Nominal large axis	7008.745 km
Impulse	97.914 degrees
apparent time	9:30 A.M
Frequent	4/5 days
Repetitive	310 days



"Fig1. Cartosat-2 Data Set"

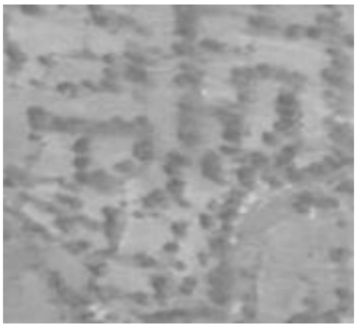
IV. PROPOSED METHODOLOGY



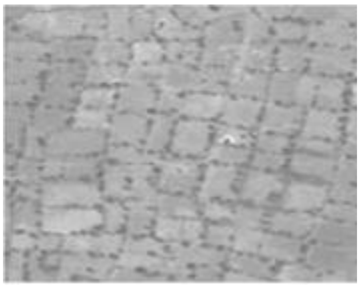
"Fig2. Proposed Methodology"

A. Panchromatic Image

A panchromatic image is essentially a black and white image. It is one single band and typically it has a wide bandwidth of a couple of hundred nanometers. These images are created when the image sensor is sensitive to wide range of light wavelengths, typically covering a large part of the spectrum visible.



"Fig3. Input image from chittore region"



"Fig4. Input image from Chhattisgarh region"

1) *Cartosat-2 Satellite Data*

Over the past three decades, the Indian earth observation pro-gram has with success launched and operated a series of Indian remote sensing satellites with coarse, medium and high- resolution sensors. ISRO launched the cartosat-2 satellite the second national mapping satellite since 2005, to providing information with a resolution of quite one meter. Cartosat-2 could be a subtle remote sensing satellite that may deliver scenic spot images [14] and the specifications of Cartosat-2 satellite data are mentioned in the above Table I.

B. Pre-processing

In this phase, the input images will be pre-processed to suppress unwanted distortions like shadows and dark spots etc, and enhance the image quality and image enhancement and segmentation methods are used in this phase to remove unwanted distortions like shadows and dark spots etc. Pre-processing does not increase the image information content. After completing the enhancement process, the given enhanced image will be going to extracting texture features will be extracted. These texture features are used to texture segmentation, it divides the image into a set of texture-based disjoint regions so that each region is homogeneous to certain texture characteristics. For further image processing and analysis, for example, object recognition, segmentation results can be applied. Results of segmentation can be applied to further detection of trees and elicitation of trees, delineation of trees respectively. The required texture features are ASM, Contrast, Correlation, Entropy, Sum of Squares, Sum average, Sum variance, Sum Entropy, Difference of variance, Difference of Entropy, Information Measures of correlation, Maximum correlation coefficients.

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	335.362	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
0.001	28.32	0.957	335.46	0.324	325.7	1313.5	7.1939	10.33	0.0005	3.312	-0.335	0.993
0.001	16.39	0.975	335.462	0.368	325.7	1325.4	7.1967	10.00	0.0006	3.000	-0.389	0.996
0.001	25.60	0.961	335.36	0.324	325.7	1316.2	7.1951	10.30	0.0005	3.280	-0.340	0.995
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	0.994
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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

"Fig5. Extracted texture Features using enhanced image"

In enhancement process we use combination two methods for better performance of getting an image. They are Histogram equalization plus Binary Thresholding.

C. Detection and Elicitation of Trees

Algorithm: Histogram equalization + Binary Thresholding.
Input: Original CARTOSAT-2 Satellite Image.
Output: An image with Histogram Equalization + Binary Thresholding.
step1: Read Satellite Image.
step2: Split the image into tiles (based on the dimension of the Image) and Convert the input image into a gray image.
step3: Find occurrence frequency for each pixel value i.e. an Image histogram (values for any grayscale image are in the Range [0, 255]).
step4: Calculate all pixel values cumulative frequency.
step5: The cumulative frequencies are divided by the total number of pixels and multiplied by the maximum pixel value in the image.
step6: Apply Binary Thresholding for an image histogram

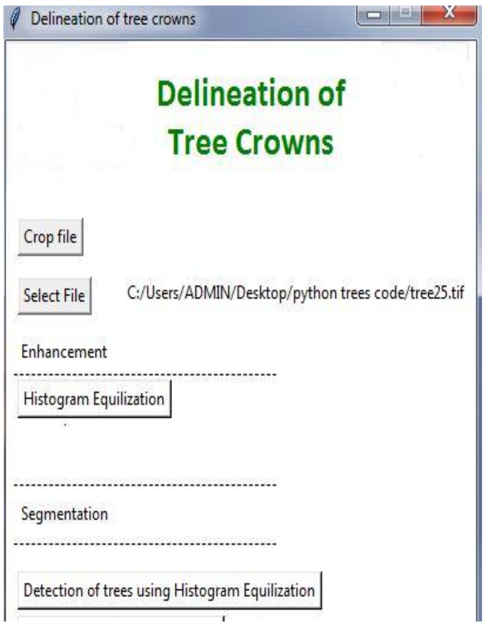
In segmentation phase texture features are extracted using enhanced image and then image segmentation methods are applied for required enhanced image.

Algorithm: Histogram equalization + Binary Thresholding+ Canny Edge detection
Input: Enhanced Image.
Output: An image with Histogram Equalization + Binary Thresholding + Canny Edge Detection
Step1: Read Satellite Image.
Step2: Split the image into tiles (based on the dimension of the Image) and Convert the input image into a gray image.
Step3: Find occurrence frequency for each pixel value i.e. an Image histogram (values for any grayscale image are in the Range [0, 255]).
Step4: Calculate all pixel values cumulative frequency.
Step5: The cumulative frequencies are divided by the total number of pixels and multiplied by the maximum pixel value in the image.
Step6: Apply Binary Thresholding for an image histogram.

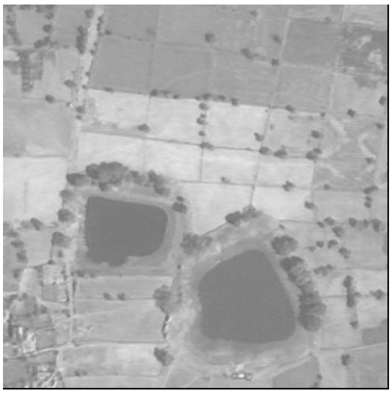
D. Delineation of trees

In this, the total number of trees was calculated, after completing the detection and elicitation of trees respectively. In this, the proposed methodology to on the process improvement of enumeration of trees of urban area and extracting simple texture features from panchromatic image.

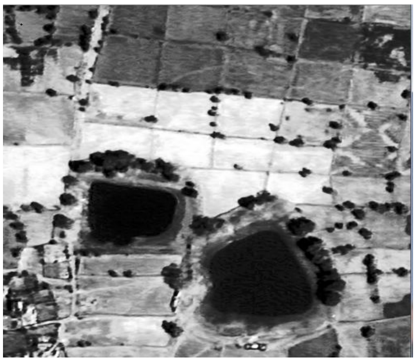
V. RESULTS AND DISCUSSION



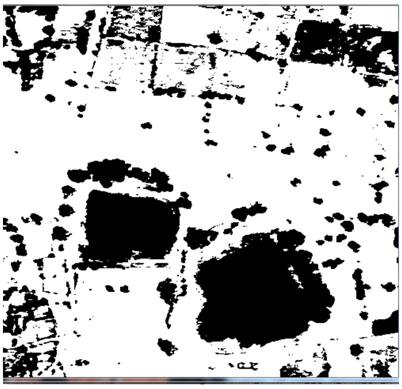
"Fig6. A Framework for Delineation of trees"



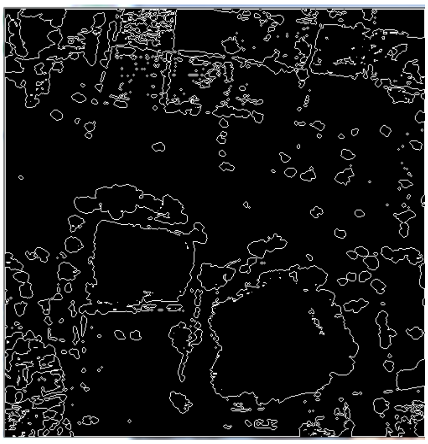
"Fig7. Input image"



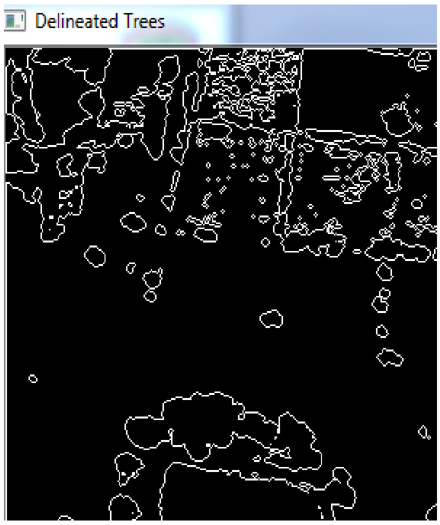
"Fig8. Enhanced Image"



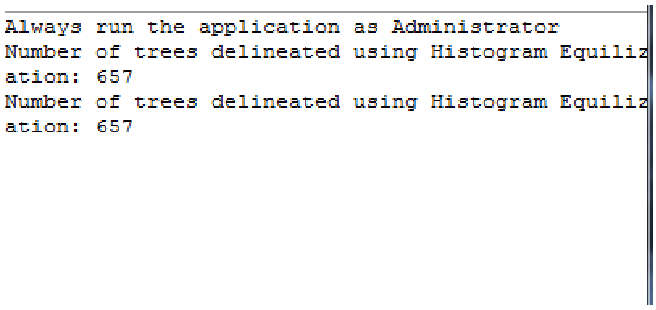
"Fig9. Detected Trees"



"Fig10. Elicitation of trees"



"Fig11(a). Delineation of trees"



"Fig11(b). Delineation of trees"

In this phase, we are considering an input image from chittore region and image processing methods are applied to an input image respectively. After completing the framework for delineation of trees, we are successfully enumerates the total number of trees of urban area respectively.

VI. CONCLUSION

In this paper, we developed a framework for delineation of trees. This framework is used to identification 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. In above [Fig 5] feature extraction table 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. In future purpose, texture features are used for classification can sort image data into more readily interpretable information, which is used in a wide range of applications such as industrial inspection, image retrieval medical imaging and remote sensing.

VII. ACKNOWLEDGMENT

This Research has been supported by Indian Space Research Organization-ISRO, NRSC- Hyderabad for providing the Cartosat2 dataset. We thank our mentor Sri Arul Raj M for his continuous support and technical deliberations who provided insight and expertise that greatly assisted in research for respond scheme.

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AUTHORS PROFILE

Sri Harsha Rompicharla, Studying Master of Technology, Department of Computer Science and Engineering, V R Siddhartha Engineering College Vijayawada.

Sree Vijayalakshmi Kothapalli, Assistant professor, Department of Computer science and Engineering, V R Siddhartha Engineering College, Vijayawada. She has 5 years teaching and 5 years research experience. And she published 3 international papers. She awarded as National Topper in MIS (B Level).

Dr. Suvarna Vani Koneru, Professor, Department of Computer science and engineering, V R Siddhartha Engineering College, Vijayawada. She has 15 years teaching experience and 7 years research experience. And she presented 10 international and 2 national conference papers**.** And 11 international papers are published.