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Water Bodies Extraction Using Remote sensing for Extraction of Coastline Information

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Abstract

Tasselled cap Transformation (TCT) is derived from satellite images are commonly and successfully utilized in surface water body detection and mapping. In this study, the water body detection of generated using Landset-8 OLI multispectral images was analysed for Krishna River, Guntur Dist., in Andhra Pradesh. This study focused on two important open research questions: (i) Which TCT model produces the most superior results? And (ii) How much does accuracy change in the use of spatial resolution. In the view of fact that most traditional water body extraction methods are affected by shadows and buildings, it is difficult to extract the water body. Try to use the tasselled cap transformation method to deal with the in which can distinguish and extract the information of water and non-water bodies. The result of this method can eliminate the influence of shadows and buildings and extracted water with high consistency, this extraction method better than existed methods for the research area.

Keywords- *Remote sensing image, lanset-8 OLI, Tasselled cap transformation, Water body detection, accuracy evaluation.*

I. INTRODUCTION

Water is the most important resource for sustaining life since it keeps the whole ecosystem alive and shapes human survival and development. In recent years, water pollution and frequent floods have become. The main environmental factor, as a resource, or as a source of flood disaster, monitoring and investigation of water bodies have great significant to utilization of natural resources. Water irrigation and environment, flood protection.

The main resource for the human civilization [1]. Water resource management will be the most important issue in the future as it is today. Due to the increasing Population and consequent increase in food requirements, global warming and climate change, precision water resource management is of much greater importance-especially in the organization of agricultural irrigation activities. However, effective water resource management is only possible with continuous monitoring. Satellite remote sensing is functional technology for monitoring natural resources such as water bodies and enables a time and cost-effective monitoring of water resources with reliable data.

The operation of extraction of water bodies in remote sensing images is the water boundary the threshold method of NDWI, MNDWI method and automatic water and non-water bodies. The process of automatically extraction of water bodies_setting via a very simple process, but it is unable to extract the small water bodies, so the precision is not high. The NDWI method is based on the threshold method of single-band. The precision of this method is greatly improved by the operation of multiple bands, and it can also reduce the influence of the building shadows and extract the small water body. But there are other features and mountain shadows mixed in the results via this method, and it is impossible to extract the water with high suspended sediment concentration, and MNDWI (Modified Normalized Difference Water Index) method is a spectral index used to analyze water bodies such as rivers, lakes and dams especially in built-up areas since it can reduce or even remove built-up land. The aim of this study is to investigate the ranges of three spectral indices from the aspect of land cover types. We compared the spectral ratios by land cover types and evaluated their efficiency in discriminating land cover classes.

In the view of several satellite remote sensing methods such as image classification, linear mixing, single-band thresholding and water index are mixing and image classification depend on huma expertise and comprise high computation and single-band thresholding based on limited information, water indices that can produce more accurate, faster and easier information than others are better at detecting water bodies.

Suggest that approximate thresholds NDWI band ratios and visuals interpretation based multi resolution segmentation technics provides inaccurate results for extraction of the areas. Hence, an efficient technic is based on the histogram analysis is proposed to extracts the lakes areas using landset-8 imagery.

II. The Tasselled Cap Transformation

An Orthogonal Transformation is a fixed feature space transformation designed specifically for agricultural monitoring, stable from scene to scene. Linear transformation of original image data to new axes: Brightness, greenness, wetness. An image is an array, or a matrix, of square pixels (picture elements) arranged in columns and rows. Images are arranged in the form of image processing.

Tasselled cap transformation is an empirical linear transformation of multispectral image (In multidimensional spectral space, soil, vegation and other information are regularly distributed, just like tasses, and this orthogonal transformation is called tasselled cap transformation.

ENVI can calculate the Tasselled Cap Transformation of Landsat MSS, TM, and ETM sensor data. The transforms for each sensor produce a different number of bands. The MSS transform produces a four-band output file with bands identified as: Soil Brightness Index, Green Veg Index, Yellow Stuff Index, and Non-such Index. The TM transform produces a three-band output file with bands identified as: Brightness, Greenness, and Third. The ETM transform produces a six-band output file with bands identified as: Brightness, Greenness, Wetness, Fourth, Fifth, and Sixth. The user is encouraged to consult the literature for assistance interpreting these data.

Tasselled cap transformation is a special principal component analysis method, which is different from principal component analysis method in that is conversion coefficient is fixed and determined by the number of bands and the range of the sensors, therefore, it is independent of single images, the soil, brightness and greenness of different images can be compared with each other.

III Existed Method

The NDWI introduced by Mcfeeters is one of the is one of the most widely commonly used water indexes to detect water bodies. The NDWI is derived from satellite images are commonly and successfully utilized in surface water body detection and mapping. It can be detected by using of three models: NDWI (Green, NIR), NDWI (Green, SWIR1) and NDWI (Green, SWIR2) generated using 28 multitemporal satellite image.

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NDWI (Normalized Difference Water Index) is developed by McFeeters (1996) to enhance the water related features of the landscapes. This index uses the near infrared (NIR) and the short-wave infrared (SWIR) bands, in case of Landsat-7 it was band#4 and band#5, respectively.

$$NDWI = \frac{NIR - SWIR}{NIR + SWIR}$$

The Modified Normalized Difference Water Index (MNDWI) uses green and SWIR bands for the enhancement of open water features. It also diminishes built-up area features that are often correlated with open water in other indices.

$$MNDWI = \frac{(Green - SWIR)}{(Green + SWIR)}$$

Green=Pixel values from the green band

SWIR= Pixel values from the short-wave infrared band.

Method MNDWI (Modification of Normalized Difference Water Index) is also a water-index and is developed by Xu (2005). It uses the green (GREEN) and the short-wave infrared (SWIR) bands, in case of Landsat-7 it was band#2 and band#5.

Fig 2: NIR band of the input image

Fig3: NDWI fig4: MNDWI

IV Landsat imaginery-8

The sensors aboard each of the Landsat satellites were designed to acquire data in different ranges of frequencies along the electromagnetic spectrum (View Bandpass Wavelengths for all Landsat Sensors). The Multispectral Scanner (MSS) carried on Landsat 1,2,3,4 and 5 collected data in four ranges (bands); the Thematic Mapper (TM) sensor on Landsat 4 and Landsat 5 included those found on earlier satellites and also introduced a thermal and a shortwave infrared band. A panchromatic band was added to Landsat 7's Enhanced Thematic Mapper Plus (ETM+) sensor.

While the earlier satellites carried just one sensor, Landsat 8 acquires data in 11 bands from two separate sensors: the Operational Land Imager (OLI) and the Thermal Infrared Sensor (TIRS). The instruments on Landsat 9 were designed as improved copies of the Landsat 8 sensors. Landsat 8 Operational Land Imager (OLI) and Thermal Infrared Sensor (TIRS) images consist of nine spectral bands with a spatial resolution of 30 meters for Bands 1 to 7 and 9. New band 1 (ultra-blue) is useful for coastal and aerosol studies. New band 9 is useful for cirrus cloud detection. The resolution for Band 8 (panchromatic) is 15 meters. Thermal bands 10 and 11 are useful in providing more accurate surface temperatures and are collected at 100 meters. Approximate scene size is 170 km north-south by 183 km east-west (106 mi by 114 mi). The instruments on Landsat 9 are improved copies of those on Landsat 8.

V Methodology

The initial steps of the tasselled cap transformation for extraction of water bodies using remote sensing images. Images should be available from the using of satellite those images are available in the Earthexplorer.usgs.gov website to we can view of the particular images using path, row coordinates.

We can get them multiple bands to extract the water bodies with efficient way using TCT method. The original remote sensing image data are pre-processed with radiometric and atmospheric correction to eliminate the deviation caused by radiation and atmosphere on remote sensing images. Examine the spectrum information of the corrected image.

Next step to transform the correlated images information into new spectral space using tasselled cap transformation. In this method four component images are obtained: Brightness index(B), greenness index(G), Wetness(W), Yellowness(Y). Then observe the last band of image containing the information about the water bodies. In this study area contains the water body including paddy field, vegation including dry fields, mountain areas with shadows, including road, construction lands & building area. Sampling of the corresponding area to taken different types of indexes to use the tasselled cap transform bands. On the basis of this, the new histogram image to threshold values to comparison with intensity values. The greenness index of water image different compared with other bands.

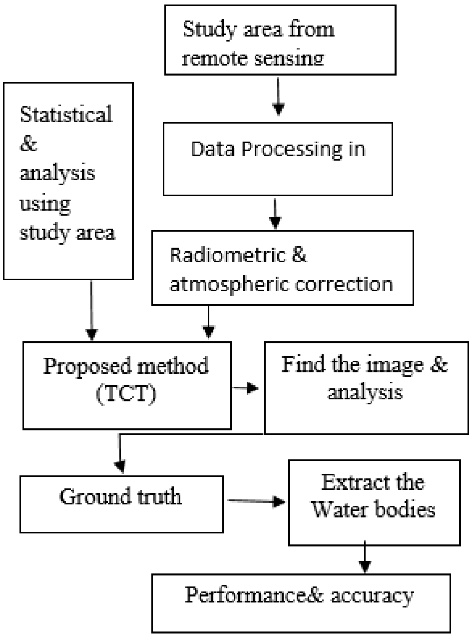

Fig 5: illustate detailed procedure

A.study Area

The reasearch are is a part of the Landset-8 OLI multispectral images was analysed for Krishna River, Guntur Dist., in Andhra Pradesh. This area should be available in the earthexplorer.usgs.gov website to selcted the particular area using of rows and colum to search the area in the earth.The study area[6] is availble to enhance the input image for the extraction of water bodies with effective waye to detected by the proposed method.

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Fig 6: Input image

The reaserch are covers different areas such as mountain areas and cities, lakes, rivers.

B) Data processing:

Remote sensing is a type of geospatial technology that samples emitted and reflected electro magnetic radiation from the earth terrestrial, atmospheric and aquatics ecosystem in order to detect & monitor the physical characteristics of an area without making physical contact this can be form of data in the collection to involves air-craft & satellite-based sensors. It can be sensing the image or information stored in the satellite in that stage observation by sensors about satellite recording & transmission of observation data. The threshold method is one of the most widely used algorithm for the extraction of water bodies from satellite image. In this work, an adaptive thresholding technique based on histogram analysis, is proposed to extract the water bodies from the area. Therefore, an adaptive threshold for extraction of water bodies in the region of lake areas form water bodies areas are occurred. Histogram analysis of images are analysis, which is mainly focused on the estimation of the probability density values. Intensity values are compared with the threshold value less than the threshold value get the efficient output image

Fig 7: Brightness image

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Brightness and Greenness: Correlations between two visible and two infrared channels z Brightness: variations in soil background reflectance z Greenness: variations in the vigor of green vegetation. Yellowness and Nonesuch: Yellowness: related to variations in the yellowing of senescent vegetation z Nonesuch: atmospheric conditions z Not widely used; transformation has been used to reduce four-band MSS data to two functions. Wetness: Crist and Crist and Cicone 4 to 6 reflective bands of Landsat TM data sets z Contained significant information in the third dimension.

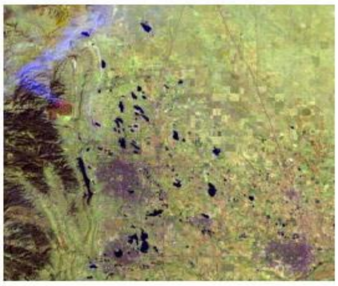

fig 8: Yellowness

fig9: Wetness

The combination of high temporal resolution is achieved, it has played an important role in land and resources investigation and dynamic monitoring, environmental monitoring, climate change monitoring, precision agricultural and urban planning. Data processing is processing the operation with form of radiometric correction and atmospheric corrections are applied to acquired remote sensing image.

C) RESULTS:

Using different were extraction methods (NDWI method and Spectrum- photometric method, MNDWI) to extract the water body from the same image using the tasselled cap transformation, establish a different water body extraction model by observing the difference of index between different features in tasselled cap transformation. It is suitable for water body extraction from a wide range of remote sensing images which contains plains and mountains areas. That certain reference value for the study of water body extraction method. For high resolution remotely sensed image acquired in visible band, visual interpretation is usually able to provide the strongest reliability and the highest precision in general under the condition of a state-of-the-art automatic image recognition. TCT method to delineation is often exploited to obtain the results of visual interpretation[10,11,12].

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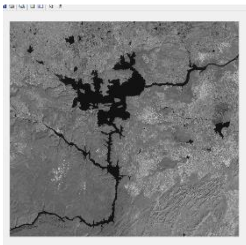

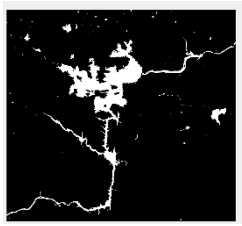

Fig 10: Intensity input image   Fig11: water bodies extraction

Intensity values of the histogram images are [13.14,15] obtained.

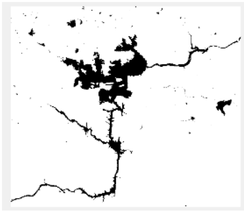

fig11: NDWI detected

d) Accuracy and evaluation

Even though the purpose of the indices is to produce fast and accurate water maps, an accuracy assessment must be conducted for evaluation purposes. A confusion matrix-based approach, as shown in Table3, is used in this study. On comparing the extracted water and non-water map with reference data, the outcomes are four types of pixels:

i. True positive (TP): The number of correctly extracted water pixels;
ii. False negative (FN): The number of undetected water pixels;
iii. False positive (FP): The number of incorrectly extracted water pixels; and
iv. True negative (TN): The number of correctly rejected non-water pixels

Table 5.1: A confusion matrix.

		Reference Data	
		Water	**Non-Water**
Classified data	**Water**	TP	FP
	Non-water	FN	TN

Based on above four outcomes, the overall accuracy (OA) and kappa coefficient (kappa) were used to assess the accuracy of the produced maps with different water indices. In this section, the performance of the various water indices for the surface water extraction for the entire scene is assessed. First, an evaluation of each index will be conducted for the standard 0 and optimum thresholds, then a combination of indices and segmentation with elevation will be explored for possible water extraction. A detailed comparison and discussion of the different water types will be conducted to evaluate the performance by each method.

Kappa coefficient = T[TP+TN] −∑T2−∑

Producer's accuracy= TP+TNT

TPTP+FP

User's accuracy = TP+TNT

TPTP+FN

Overall accuracy = TP+TNT

T

From the accuracy evaluation the overall accuracy, the kappa coefficient, and the user accuracy of the method proposed in this project are higher than the other methods. Histogram Equalization is a computer image processing technique used to improve contrast in images. It accomplishes this by effectively spreading out the most frequent intensity values, i.e., stretching out the intensity range of the image. Histogram Equalization Histogram equalization is a method in image processing which is used for adjusting the contrast of an image using image's histogram. This method usually increases the overall contrast of many images, especially when the usable data of the image is represented by close contrast values.

Conclusion:

In this research, we propose a novel water body extraction method for color remotely sensed image. The proposed method does not required infrared components or any other additional information, and only exploits the properties of water bodies in input image to build a classifier. This Experiment takes satellite as the data source, compared the results of several mainstream methods (the single-band threshold method, the NDWI method and the spectrum-photometric method) of water body extraction from a wide range of remote sensing images. On the basis of summarizing the advantages and disadvantages of the above water body extraction methods, the previous research methods for extracting whole water body from high resolution satellite extracting the whole water-body from high resolution satellite remote sensing images. On the basics of tasselled cap Transformation, establish a water body extraction model by observing the difference of index between different features in tasselled cap transform bands. This method of tasselled cap transforms from the remote sensing images in the study area, the water body pixel corresponds to this characteristic: The wetness index is larger than the greenness index, and the greenness index is less than specified value.

This method can distinguish buildings and shadows from water body extraction from a wide range of remote sensing images which contains Plains and mountain areas. This method also has high precision and simple operation. That certain reference value for the study of water body extraction method.

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