A Review on Boundary Detection and Area Calculation of Lake using Image Processing

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Abstract: It is very important to monitor the increase or decrease in water level and occupied area of lakes or rivers during summer and rainy seasons to overcome the problems in future. The boundary and area of lake is calculated of satellite images using Image Processing Technique. This paper gives review on different techniques to obtain the area and detect boundary of lake. Analyzing the satellite images of the lakes would help to determine the edges of the lake and it's declining rate. The analysis process can be done using various algorithms and software.
Index Terms - **Image segmentation, Region Growing, Thresholding.**

I. INTRODUCTION

The purpose is to estimate changes in water level of lakes using satellite images. The high resolution satellite images are collected and passed through an image processing stage for calculating the area of lake and its boundary. To detect the changes in water level, the image is divided into two classes, land and water so that the lake surface and surrounding ground surface are precisely separated and then the area and boundary of the lake can be calculated. Area is computed by enumerating black colored pixels and boundary by enumerating edges of the lake. The boundary or area of lake may shrink or rise due to changes in water level .Image segmentation is the prior step for image analysis process. A seeded region growing and merging algorithm is created to segment grey scale and colour images.

II. LITERATURE REVIEW

JIAQI CHEN, et al [1] proposed an edge active contour model (ACM) which was based on the mixed log-normal distribution for SAR image edge extraction and evaluated the parameters by using the classic expectation maximization (EM) algorithm.

Erwin, et al [2] explained various methods of image segmentation-region growing, Watershed and Adaptive Thresholding; and a comparision of these methods was discussed depending upon the results obtained.

Mustafa Hayri Kesikoglu, et al [3] proposed the changes in coastline boundary by using artificial neural network method. The results of seasonal changes in the coastline information was obtained by using post classification.
Suman Das, et al [4] described the proposed strategy to detect & extract brain tumour from patient's MRI scan images of the brain. This method incorporated with some noise removal functions, segmentation and morphological operations which consisted of basic concepts of image processing. Detection and extraction of tumour from MRI scan images of the brain was done using MATLAB.

Dr. Taleb Obaid,et al [5] explained Monte Carlo algorithm that relies on repeated random sampling to compute the result. This method was used to calculate area of a lake by surrounding the irregular region of lake by geometric shapes, as area of geometric shapes is easy to obtain.

Ting Liu, et al [6] presented an iterative training and testing algorithm that generated various tree structures and combined them to emphasize accurate boundaries by segmentation accumulation.

Baoan Han [7] proposed a watershed segmentation algorithm which was based on morphological gradient, to improve and reconstruct the gradient image, by considering more number of gradient pixels with low value were removed and some gradient pixels with high value were preserved.

Prof. S. S. Kattire, et al [8] proposed boundary detection algorithm, which detected the boundary both magnitude and directions were considered for calculation of vector information. This method was used to detect accurate boundary of an object.

Joyjit Patra, et al [9] described various segmentation techniques used in the field of ultrasound and SAR Image Processing. This paper investigated various technologies used in image segmentation. And then presented a survey of current segmentation techniques.

A. M. Khan, et al [10] illustrated various methods of Image segmentation. The various methods illustrated by Author were Intensity based method, Discontinuity based method, Similarity based method, Clustering method , Graph based method, Pixon based method and Hybrid method.

Mua'ad M. Abu-Faraj, et al [11] analysed the declining rate of water using matlab image processing functions-Threshold, Edge and watershed segmentation. The Authors also did a case study which predicted, calculated and forecasted the declining rate of the Dead Sea.

N. Senthilkumaran, et al [12] explained three different soft computing approaches for edge detection in image segmentation, which were Fuzzy based Approach, Genetic Algorithm based approach and Neural Network based Approach.

James McLurkin, et al [13] described distributed boundary detection algorithm which was suitable for use of multi-robot system with dynamic network topologies. The cyclic-shape local boundary algorithm uses local network geometry, and was more accurate in rapidly changing network topologies than algorithms that used global communication floods.
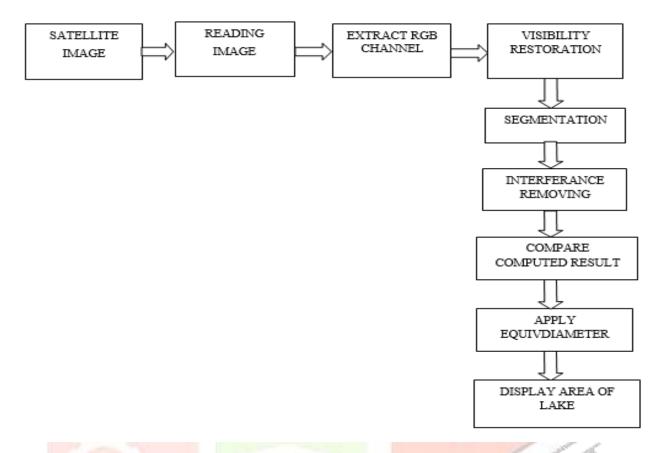
Jiang Li, et al [14] explained the procedure for efficiently representing shapes of interesting features in remotely sensed image using supervised classification, object recognition, parametric contour tracing, and proposed piecewise linear polygonal approximation techniques.

Literature Review Table

Sr.no	Author	Journal	Year of Publication	Method Used
1	JIAQI CHEN,et al	IEEE Access SPECIAL SECTION ON ADVANCED SENSOR TECHNOLOGIES ON WATER MONITORING AND MODELING	Vol 7,2019	Active contour model
2	Erwin,et al	International MultiConference of Engineers and Computer Scientists, ISSN: 2078-0966	Vol 1, March 14-16, 2018	Regiongrowing, Watershed and Adaptive Thresholding
3	Mustafa Hayri Kesikoglu,et al	International Conference on Information Technology, 978-1-5090-6332-1	2017	Artificial Neural Network
4	Suman Das,et al	International Journal of Computer Engineering In Research Trends, ISSN: 2349-7084	Vol 4, Issue 1, January 2017	Morphological operation
5	Dr. Taleb Obaid,et al	International Journal of Computer Science and Mobile Computing, ISSN 2320–088X	Vol.5 Issue.1, January- 2016	Monte Carlo algorithm
6	Ting Liu,et al	IEEE Transaction on Image Processing	Vol. 25, NO. 10, OCTOBER 2016	Iterative training and testing algorithm
7	Baoan Han	International Conference on Information Science and Control Engineering, 978-1-4673-6850-6	2015	Watershed segmentation algorithm
8	Prof. S. S. Kattire,et al	International Journal of Engineering Research & Technology, ISSN: 2278-0181	Vol. 3 Issue 12, December-2014	Boundary detection algorithm
9	Joyjit Patra,et al	Journal of Computer Engineering, ISSN: 2278-8727	Vol 16, Issue 2,Mar-Apr. 2014	Segmentation techniques used in the field of ultrasound and SAR Image Processing
10	A. M. Khan,et al	International Journal of Soft Computing and Engineering, ISSN: 2231-2307	Vol-3, Issue-4, September 2013	Image Segmentation Methods
11	Mua'ad M. Abu-Faraj,et al	International Journal of Computer Science Issues, ISSN : 1694-0814	Vol. 10, Issue 6, No 2, November 2013	Threshold, Edge and watershed segmentation.
12	N. Senthilkumaran,et al	International Journal of Recent Trends in Engineering	Vol. 1, No. 2, May 2009	Soft computing approaches for edge detection in image segmentation, which were based on Fuzzy, Genetic and Neural Network Approach
13	James McLurkin,et al	International Conference on Intelligent Robots and Systems, 978-1-4244-3804-4	October 11-15, 2009	Boundary detection algorithm
14	Jiang Li,et al	IEEE TRANSACTION ON GEOSCIENCE AND REMOTE SENSING	VOL. 41, NO. 11,	Parametric contour tracing, and Linear polygonal

			NOVEMBER 2003	approximation techniques

III. BLOCK DIAGRAM

IV. CONCLUSION

Analysis of various segmentation technique is done to estimate the lake area and perimeter, as the water level of lake shrink or rise every season. By implementing Image Processing Algorithms the changes in water accessibility for various parameter of lake could be obtained. In recent years many techniques have been invented based on image processing which offers satisfactory results and can be implemented to obtain the parameters of lake by using various algorithms.

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