Object & bridge detection of GIS images using pattern recognition and knowledge base

Survashe Supriya
Department of Computer Engineering
SVERI's College of Engineering, Gopalpur,
Pandharpur, Solapur, Maharashtra, India

Korke Ashok
Department of Computer Engineering
SVERI's College of Engineering, Gopalpur,
Pandharpur, Solapur, Maharashtra, India

Abstract- Pattern Recognition is becoming an area of fast growing area of Image processing. Remote Sensing is one of the branches of it. Sometimes it is difficult to visit & analyze the geographical areas like forestry or island etc. also it is difficult to visit the areas in case of natural calamities. For this purpose some technique needs to be developed to recognize the areas like building, greenery, land, water, bridge. Study is done previously on these topics but it was limited to one or two objects of remote sensors.

In this paper the method for detection of the objects like building, greenery, water, roads, land are introduced. Also technique for detecting the bridge over water is also defined. The Knowledge base used for this recognition is based on analysis, so it is unbound to different areas also. The technique is helpful to find the area under civilization and to find percentage area of specific pattern. The technique is helpful in natural calamities situations also where it is not possible to reach.

Keywords – Pattern recognition, Remote Sensing, Knowledge base, Object detection.

I. INTRODUCTION

Pattern recognition is used to find most likely features from the input image. The study for pattern recognition is done in many areas in which study of GIS images is also one of the interesting areas. As the resolutions of the remotely sensed images are changing, new and advanced algorithm and techniques are developed for automated analysis. This new data include man made areas of construction, agriculture studies with natural and human-induced disasters, effect of climate change and all. So the technique needs to be developed to recognize image objects taken from remote sensors.

The study done till now is based on some specific areas only [1]. So it is necessary to develop a technique in which many areas can be covered under one application. Bridge detection over water is also one of the challenging task needs to be covered [4].

II. NEED OF PATTERN RECOGNITION OF GIS IMAGES

For GIS images one of the most important challenges is the increasing resolution of the data. This leads to an increase in the data volume and a raise in the complexity of the analysis algorithms. Higher resolution also gives additional patterns that are visible in large scenes so more detailed and faster techniques need to be developed to detect and recognize them.

In this paper, the main aim decided to develop the method for detecting the objects in the remotely sensed images like building, vegetation, water, land etc. Also formulate the method for detecting bridge over the water. This leads to calculation of the region under civilization in a given remotely sensed image. Furthermore, finding the percentage area of identified regions in a given remotely sensed images is also covered in this.

III. LITERATURE REVIEW

Forestier et. al., [1] has proposed steps to build an urban knowledge-based High Spatial Resolution (HSR) image analysis. In this domain-dependent knowledge-base is created by domain experts and used for semantics to regions of segmented images. The process of KB is carried out in 3 steps: identification of the concept, formalization of the

concept, and implementation of the knowledge base. The experimental results highlighted the effectiveness of the method. Different segmentation approaches were applied on the results obtained using this technique, together with commercial softwares. The five different segmentation approaches are used for segmentation are Watershed algorithm, A supervised segmentation algorithm, A supervised segmentation algorithm with manual corrections an expert made by cracking or merging regions, The eCognition 5.0 software, and The ENVI EX 4.8 software

Gosselin et. al., [2] has investigated an approach to identification of buildings in aerial images with the combination of a classical segmentation algorithm. With the base of support-vector machines, a user guided training approach and a supervised learning solution based is used for the detection. In this paper the original combination of shape features with an automated double seeded region-growing approach, and a binary support vector machine is used for the detection of buildings in aerial images. The results of experiments shows the objects of interest to be identified using shape descriptors encode an appropriate set of features in spite of different shapes and sizes of roofs.

Mantrawadi et. al.,[3] has studied today's growing dependence on the satellite technology for imaging needs. This study tells that the satellites with higher resolution image acquisition capabilities are being developed. The satellite data available both in terms of difference in spatial and spectral resolutions and companies facilitating these data there is a urgent need for the development of a system based on the principles of data mining which harnesses he combined effectiveness of both the Model based and appearance based approaches. Development of such a system would in turn help in the knowledge building and development of an intelligent system capable of distinguishing and identifying objects under consideration.

Zhang et.al., [4] have proposed a method to recognize a bridge over water in remote sensing image by using binary coding specific to combination feature extraction and Discrete Hopfield Neural Network. This binary coding makes the whole proposed techniques suitable for recognizing various targets, not only the bridge over water. Chen et.al., [5]have proposed method for detecting vehicles on road using features like histogram of oriented gradient, local binary pattern, scale-invariant feature transform. The proposed HDNN i.e. Hybrid Deep convolutional Neural Networks method divides all maps of the highest convolutional and max-pooling layer of DNN into multiple blocks of variable receptive field sizes or max-pooling field sizes. So it proves the HDNN is capable of extracting multi-scale features. Experiments on vehicle database of the City of San Francisco show that HDNN outperforms DNN.

Zeng et.al., [6] have proposed a novel segmentation and recognition algorithm based on Improved Iterative Threshold Selection with the use of Skeleton Extraction. This method first makes the between-class distance and scatters as part of an iterative process that is meant for better segmenting the aircraft images, and then uses the skeleton Zernike moment to match templates for recognition. The experiments carried in this technique results in new method can effectively achieve the target segmentation under complex backgrounds. These are used to provide a satisfactory result both in recognition rate and recognition speed.

IV. TECHNIQUE USED

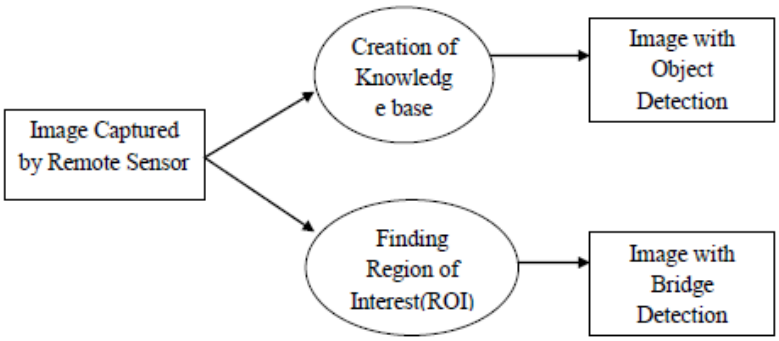

Figure 1: Working strategy

For construction on Knowledge base, first concept identification is done. This is then formalized to implement the knowledge base. At the same time the input image is sent for noise removal and after classification the segmented image is formed by applying segmentation algorithms. These results of segmented images are used for identification of the objects like building, greenery, water, land etc.

For detection of bridge, mathematical morphology [4] method is applied. To select the ROIs, where the target, bridge over water, is probably located, we have to first analyze the connectivity of the filtered binary image so that all black regions can be selected. And then, square measure of all black regions are calculated and sorted.

Several largest black regions are considered to be water areas because in remote sensing image, water areas are often larger than any other low gray level areas. After that, each two selected black regions are put together, and all the edge points from the two regions are detected to find out the nearest pair of points from their respective black regions. Finally, the middle points of the pair of edge points are selected to be the center of a ROI. This method is reasonable because a bridge over water is always at the location next to two water areas. After calculating all the black regions, we can find out all the ROIs. However, many of the ROIs don't embrace a bridge, and from them some noise and irrelevant regions should be discarded. So the techniques of feature extraction and decision-theoretic methods must be used.

IV. Experiment and Result

The work is done using MATLAB. Input image is taken from remote sensors like Google Earth. After giving input as a remotely sensed image, the image is edge segmented using canny edge detection algorithm and Gaussian filter algorithm is used for noise removal.

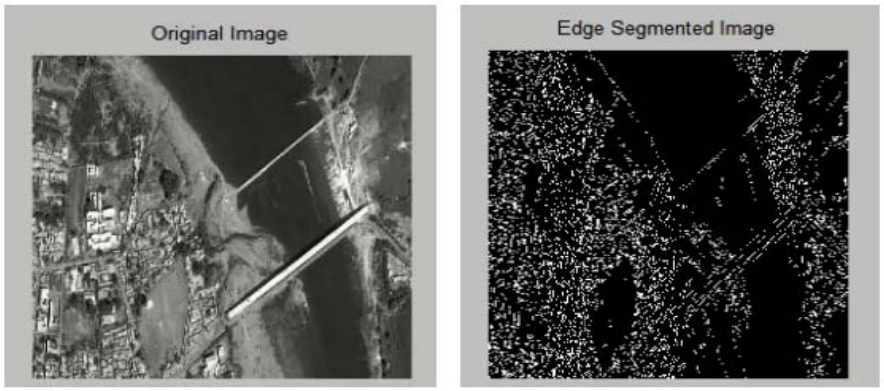

Figure 2. (i) Original Image (ii) Edge segmented image

After applying classification algorithm, the KFCM segmented image is generated which is shown below. In this the detected regions coming under one category are shown with one color. Accordingly different patterns are shown by using this image.

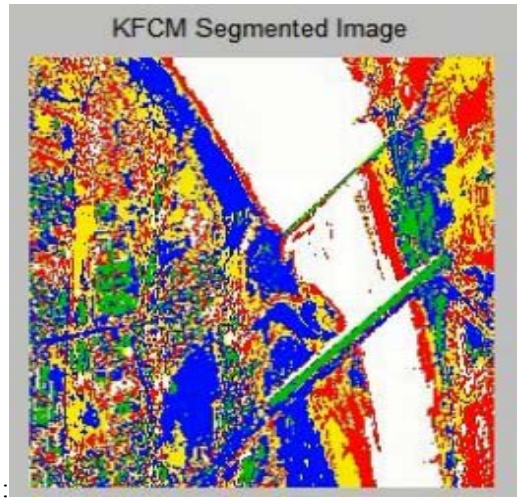

Figure 3: KFCM Segmented image

For bridge detection, the input image is converted into binary image. This leads to separation of water body from bridge part. The binary image is shown in Figure 4.

Figure 4: Binary image

After that the position of bridge is located and shown with 'Red' line. The result is shown in figure 5.

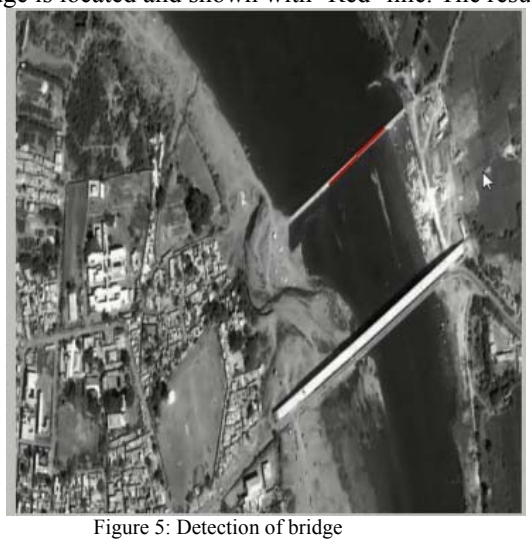

Figure 5: Detection of bridge

After studying all the images the analysis for detection of building, water, land, greenery and road is calculated in percentage & given in the table below.

Table 1: analysis of object detection

Image	Building		Water		Land		Greenary		Road	
	Actual (%)	Detected (%)	Actual (%)	Detected (%)	Actual (%)	Detected (%)	Actual (%)	Detected (%)	Actual (%)	Detected (%)
Pandharpur	40	36	35	37	15	17	5	7	5	3
Karad	10	7	40	46	18	15	22	20	10	12
Krishna-1 (Sangli)	15	17	35	30	9	10	31	32	10	11
Krishna-2 Irwin bridge	33	33	19	21	9	10	28	26	11	10
Kolhapur	37	40	28	34	7	10	20	10	8	6

So the objects detected are more than 90% correct.
Around 25 images are taken for study purpose. In analysis using the proposed technique of bridge detection, result show that about 84% of the images (21 images) are showing bridge location correctly. However some of the locations are not very precise.

V.CONCLUSION

Remote sensing is becoming an area of pattern recognition. In this thesis lot of work is going in research area for pattern recognition is remote sensing. So, it is necessary to develop this area for getting more knowledge in area of remote sensing. A modified algorithm for object detection is studied in this thesis which can be concluded as.

1. Creation of knowledge base gives more deep knowledge in detecting different types of objects gives more than 90% accuracy in the results.
2. Bridge detection module is giving about 84% accuracy as out of 25 images, 21 images shown correct results.
3. This technique can be used to find area under civilization or forestation as result is giving percentage with respect to particular area.
4. The percentage of particular area like building, greenery, land, water can also be calculated using this technique.

In future, algorithms for detecting different objects in the real world can be applied as per different patterns. Work can be carried out in the area of size, shape, texture, intensity of the object. As of now bridge, aircraft like objects are identified; likewise other objects can also be identified.

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