

KNOWLEDGE EXTRACTION METHOD USING STOCHASTIC APPROACHES IN GOOGLE MAPS

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ABSTRACT

Develop a system to extract knowledge from real images are challenging research work. To extract knowledge from the Google map first authors apply the image analysis technique to the Google maps. Authors develop a system to extract knowledge from Google map image, by using this system any user can locate the place and can identify number of objects in an image. By applying image segmentation technique, partitioning or subdividing an image into multiple meaningful regions or sets of pixels with respect to a particular application. In image analysis system, Image segmentation is an important component. There are many image segmentation techniques; one of the most important techniques is marking techniques. This method transform original image into mark segmented image. After marking the object find centroids points for the each identified object then in the result apply into the spatial data mining technique to extract knowledge. In this paper, define a stochastic approach for image analysis to object identification from Google map using Matlab.

Keywords: *Image Analysis, Image Segmentation and Marking*

1. INTRODUCTION

The world-wide web has containing information of a geographical or spatial nature, particularly location information such as addresses, postal codes, telephone numbers and so forth. Commercial web pages typically contain address and contact telephone numbers as well as descriptions of the products and services offered. It is natural to assume that associations exist between the general contents of a web page and the specific location information it may contain.

Spatial data mining or knowledge discovery in spatial database is the process of extracting of implicit knowledge, i.e., spatial relations, and finding interesting characteristics and patterns that are not explicitly represented in the database. This technique plays an important role in understanding spatial data and in capturing intrinsic relationships between spatial and non-spatial data. The main aim of this paper is to analyze the Google map images and identify the building object from the Google map images. Hence the authors develop a new system to identify the objects from the image and stored into the database.

Later we can get results for the spatial queries from the database by applying spatial data mining techniques. This system will provide knowledge to

the entrepreneur to extract details for a particular location.shed.

2. THE RESEARCH METHOD

An Image is an array or a matrix of square pixels arranged in columns and rows. Each pixel represents the color at a single point in the image. A digital image is a numeric representation of a two-dimensional image. Any image from a scanner, or from a digital camera, or in a computer capture from a Google map, is a digital image.

The task of partitioning an image into regions with homogeneous texture, commonly referred to as image segmentation, is widely accepted as a crucial function for high-level image understanding, significantly reducing the complexity of content analysis of images. Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images[12].

It is one of the most difficult tasks in image processing because it determines the quality of the final result of analysis.

Image segmentation is useful in many applications. It can identify the regions of interest in a scene or annotate the data. The existing important segmentation algorithms are region-

based segmentation, data clustering, and edge-base segmentation[4].

Region-based methods mainly rely on the assumption that the neighboring pixels within one region have similar value. The common procedure is to compare one pixel with its neighbors. If a similarity criterion is satisfied, the pixel can be set belong to the cluster as one or more of its neighbors. The selection of the similarity criterion is significant and the results are influenced by noise in all instances[3].

Edge-base segmentation generally indicates the segmentation method based on the edge in an image. The simple methods apply some edge detection methods before segmentation. Some edge detection methods are gradient operators and Hilbert transform. Then the other methods only based on the concept of edge instead of using edge detection methods, for instance, watershed segmentation algorithm.

Watershed transform is a powerful tool that is based on the object's boundary and finds local changes for image segmentation. The simplest description of watershed transform comes from geography as it is the ridge that divides areas drained by different river systems and catchment basins are areas draining into rivers or reservoirs. The image processing uses this concept for gray-scale image in a way to overcome a variety of the segmentation image problems. Knowledge of the watershed transform requires to take into account a gray-scale image as a topological surface, where the values of $f(x, y)$ are interpreted as heights. It finds the catchment basins and ridge lines, where catchment basins are the objects or regions which we want to identify[10].

The distance transform is the appropriate and common tool that is associated with watershed transform for processing on a binary (white & black) image. To apply watershed transform with distance transform, it is necessary to convert the gray-scale image to binary image with calculating global image threshold by using Otsu's algorithm. Euclidean distance is implemented as mathematical method based on the distance from each pixel to the nearest nonzero-valued pixel. Below, there is a 4×4 matrix of zeros and ones that is first described as the binary image and then follows its distance transform:

0 0 0 0	1.41 1.00 1.00 1.41
0 1 1 0	1.00 0.00 0.00 1.00
0 1 1 0	1.00 0.00 0.00 1.00

0 0 0 0	1.41 1.00 1.00 1.41
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(a) Binary image (b) It's distance transform

After calculation distance transform of complement binary image, the negative of distance transform is used in watershed transform to produce the label matrix. In the label matrix, the zero values correspond to watershed ridge pixels and the positive integer values imply catchment basins [3].

The gradient magnitude is another method for computing watershed transform [4]. It is used often to pre process a gray-scale image prior to using the watershed transform for segmentation. The gradient magnitude image has high pixel values along object edges, and low pixel values everywhere else [3]. Gradient magnitude is used as edge indicator in order to identify region boundaries [5]. The gradient magnitude and its direction of gray-scale image are computed in both of directions (x, y) of image. If F is known as a gray scale image then its gradient is defined by the vector [3] as follows:

The gradient of an image is given by the formula :

$$\nabla f = \frac{\partial f}{\partial x} \hat{x} + \frac{\partial f}{\partial y} \hat{y}, \text{ where :}$$

$\frac{\partial f}{\partial x}$ is the gradient in the x direction
 $\frac{\partial f}{\partial y}$ is the gradient in the y direction.

The **gradient direction** can be calculated by the formula :

$$\theta = \text{atan2} \left(\frac{\partial f}{\partial y}, \frac{\partial f}{\partial x} \right)$$

The gradient magnitude is computed by linear filter methods [2]. Sobel is one of edge filters that emphasizes edge of image in both vertical and horizontal directions [3]. After computing gradient magnitude of image, watershed is used as a line separation which belongs to different minima of object. It means catchment basin moves to minima and edges of them become watershed segmentation. This method of segmentation describes that image contours are equal to ridge lines of the gradient magnitude image which can be identify via watershed [6]. If before watershed transform, directly the gradient magnitude of the original image is computed without pre-processing like smoothing, etc., it can cause the over segmentation [7].

The separation of overlapping objects in the image is an important topic in the image



processing. Overlapping is a major problem in image segmentation and its applications in engineering, object identification etc. The results of segmentation for overlapping objects are usually not satisfactory and the main problem is caused by the situation when two objects segment as one.

In this paper, the marking segmentation algorithm is applied to identify the objects, the improved method described below:

This method extracts the edge of an object in binary image by basic operation in mathematical morphology that is dilation. Dilation aims to expand objects in a binary image. Magnitude of enlargement of objects is controlled by different shapes and values as structuring elements.

The dilation of A by B is defined by (2):

$$A \oplus B = \bigcup_{b \in B} A_b$$

The dilation is commutative, also given by:

$$A \oplus B = B \oplus A = \bigcup_{a \in A} B_a$$

If B has a center on the origin, then the dilation of A by B can be understood as the locus of the points covered by B when the center of B moves inside A. The dilation of a square of side 10, centered at the origin, by a disk of radius 2, also centered at the origin, is a square of side 14, with rounded corners, centered at the origin. The radius of the rounded corners is 2.

The dilation can also be obtained by:

$$A \oplus B = \{z \in E | (B^s)_z \cap A \neq \emptyset\},$$

where \emptyset is empty set and B_z is the translation of B by the vector z and B_s indicate to the symmetric of B. B_s denotes the symmetric of B, that is, $B^s = \{x \in E | -x \in B\}$.

The second step of this method is to identify the foreground object of the image. In binary image, the foreground pixels are labeled as one and background pixels are labeled as zero so that in the boundary tracing the pixels of foreground are detected. Now we get the images with background is black and the foreground objects are white color.

In binary morphology, an image is viewed as a subset of an Euclidean space \mathbb{R}^d or the integer grid \mathbb{Z}^d , for some dimension d.

The basic idea in binary morphology is to probe an image with a simple, pre-defined shape, drawing conclusions on how this shape fits or misses the

shapes in the image. This simple "probe" is called structuring element, and is itself a binary image.

- Let $E = \mathbb{R}^2$, B is an open disk of radius r, centered at the origin.

The basic operations are shift-invariant operators strongly related to Minkowski addition:

- Let E be a Euclidean space or an integer grid, and A a binary image in E.

The erosion of the binary image A by the structuring element B is defined by:

$$A \ominus B = \{z \in E | B_z \subseteq A\},$$

where B_z is the translation of B by the vector z, i.e., $B_z = \{b + z | b \in B\}, \forall z \in E$.

When the structuring element B has a center, and this center is located on the origin of E, then the erosion of A by B can be understood as the locus of points reached by the center of B when B moves inside A.

The erosion of A by B is also given by :

$$A \ominus B = \bigcap_{b \in B} A_{-b}$$

The opening of A by B is obtained by the erosion of A by B, followed by dilation of the resulting image by B: $A \circ B = (A \ominus B) \oplus B$.

The opening is also given by

$$A \circ B = \bigcup_{B_x \subseteq A} B_x$$

, which means that it is the locus of translations of the structuring element B inside the image A.

The closing of A by B is obtained by the dilation of A by B, followed by erosion of the resulting structure by B: $A \bullet B = (A \oplus B) \ominus B$

The closing can also be obtained by $A \bullet B = (A^c \circ B^s)^c$,

where X^c denotes the complement of X relative to E (that is, $X^c = \{x \in E | x \notin X\}$). The above means that the closing is the complement of the locus of translations of the symmetric of the structuring element outside the image A.

In the Euclidean plane, if $p = (p_1, p_2)$

and $q = (q_1, q_2)$ then the distance is given by

$$d(p, q) = \sqrt{(p_1 - q_1)^2 + (p_2 - q_2)^2}.$$

To calculate the Euclidean distance, take complement of the image. From the complement

image, eliminate the background of the image and display only the foreground objects.

Now again complement of the binary image, in that binary image we can identify all foreground objects. From that objects, we can remove the unwanted objects based on the size of the pixel. The remaining objects are the expected objects from the original image.

Next step is labeling for the extracted objects by find the center point of each object. The centroid of a plane figure X can be computed by dividing it into a finite number of simpler figures X_1, X_2, \dots, X_n computing the centroid C_i and area A_i of each part, and then computing

$$C_x = \frac{\sum C_{ix} A_i}{\sum A_i}, C_y = \frac{\sum C_{iy} A_i}{\sum A_i}$$

Holes in the figure X , overlaps between the parts, or parts that extend outside the figure can all be handled using negative areas A_i . Namely, the measures A_i should be taken with positive and negative signs in such a way that the sum of the signs of A_i for all parts that enclose a given point P is 1 if P belongs to x , and 0 otherwise. Then draw the boundary of all objects. After boundary detection, give a structure to the finally extracted objects. Finally count the total number of objects based on the centroids points of the objects.

3. METHODOLOGY

The statement of the problem is to select the best location for starting a new business. The seeking result from this study is a map showing potential areas for a new business from the object identification. Break down the taken problem into a series of objectives to be solved. Once the problem is stated, break it down into smaller and smaller pieces, until we know what data and steps are required to solve it. The problem of finding the best location for an entrepreneur can be break down into the following objectives: Which location the entrepreneur wants to choose? How many objects are there? How many buildings are there? To create a map of good location, we need to define some characteristics of best location. Based on the survey data and a data set of locations and attributes, we can select the best location. To determine if there are enough buildings, we need to create a map of the number of objects within the selected object area. Find suitable areas, the identified objects we find the centroids and overlays it to get the latitude and longitude values

then the user can extract the knowledge by applying the spatial data mining technique.

To select the optimum location for starting a new business the following diagram explains about our new system.

3.1. Dataflow Diagram:

The dataflow diagram Fig-1 is describing the overall process of this system. The total activities of this system are controlled by the administrator. Any visitor can visit this system, if the visitor register then he will become an user. This system can able to search and retrieve the location information from Google map and results are stored into a database. The user only can use the knowledge extraction functionality.

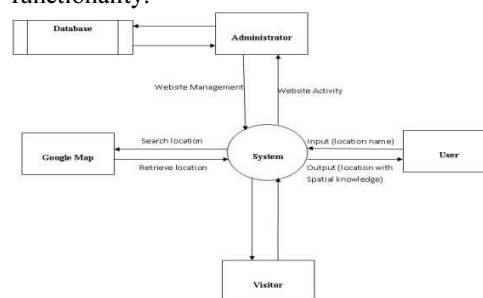


Fig – 1 Overall System

Google Image extraction through Web page:

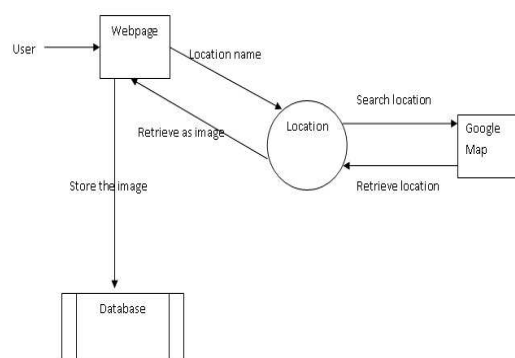


Fig – 2 Image Extraction From Google Map

The System is developed by PHP, MySQL and MatLab. The diagram-2 explains the Google map image extraction through web page and store it into the MySQL database. Through the web page, the user can able to search the location. The search will take into the Google map and also store as an image

into MySQL database. In MySQL we have created a table and store spatial information about the image.

Database design in MySQL:

No	Field Name	Data Type	Description
1	no	Int(5), Auto Increment	Serial number
2	lo_name	Varchar(20)	Location name
3	image	Longblob	Image of location
4	Cen_lat	Float	Centerpoint's Latitude of image
5	Cen_lon	Float	Centerpoint's Longitude of image
6	Ri_top_lat	Float	Right side top point's latitude of image
7	Ri_top_lon	Float	Right side top point's longitude of image
8	Ri_bot_lat	Float	Right side bottom point's latitude
9	Ri_bot_lon	Float	Right side bottom point's longitude
10	Le_top_lat	Float	Left side top point's latitude of image
11	Le_top_lon	Float	Left side top point's longitude of image
12	Le_bot_lat	Float	Left side bottom point's latitude
13	Le_bot_lon	Float	Left side bottom point's longitude
14	Cen_image	longblob	Image with centroid points

Fig – 3 Database

In MySQL we have created the database with the above said fields the data can be stored from PHP website. In MatLab we extract data from the database and process it and the results are updated into that database. This table has totally fourteen fields like no, lo_name, image, cen_lat, cen_lon, ri_top_lat, ri_top_lon, ri_bot_lat, ri_bot_lon, le_top_lat, le_top_lon, le_bot_lat, le_bot_lon and cen_image.

Connection between Database and MatLab:

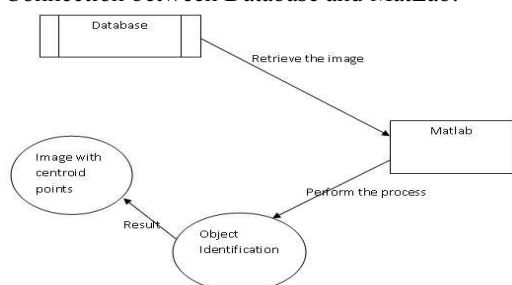


Fig – 4 Database And Matlab Connection

The above diagram explains about the connection between Matlab with MySQL database. The Matlab retrieve the location image from the database. The various objects like buildings, roads, trees and empty lands are identified and labeled all objects by the Matlab and also the labeled images are stored into the database.

New method to identify Building object:

In MatLab, get image from the database, to identify the objects like buildings, labeled and

stored into the database. The users can extract the spatial knowledge of the given location through the labeled image by using the queries. The extraction process will be explained in the following algorithm.

Proposed Algorithm

Algorithm to identify the object and centroids points

1. BEGIN
2. Read location name as input from user and retrieve a specific location from Google map.
3. Marking the Object area
 - 3.1 Convert RGB image into Grayscale image
 - 3.2 Identify the foreground objects
 - 3.3 Convert into Binary image
 - 3.4 Find the Euclidean distance Transform
4. Object Identification
 - 4.1 Remove unwanted objects from the marked objects
 - 4.2 Labeling to the identified objects
5. Find Centroid points of the identified objects
6. Counting the Objects
 - 6.1 Draw the boundaries of each identified objects
 - 6.2 Counting the objects based on the centroid points
 - 6.3 Display the chart for the identified objects
7. END.

4. ANALYSIS OF PROPOSED WORK

Let us consider a color image, which is retrieve from the Google map and convert it into grayscale: the gray level of a pixel exhibit the buildings, roads, rivers, lands and mountain areas. An objective of the location identification is to determine the position of any feature or more generally any point in terms of both a horizontal coordinate system such as latitude and longitude. Identifying (naming) features and recognizing typical landform patterns are also part of the field. In this paper, we propose an original approach to identify location using the stochastic approach and image analysis in the real images like Google images.

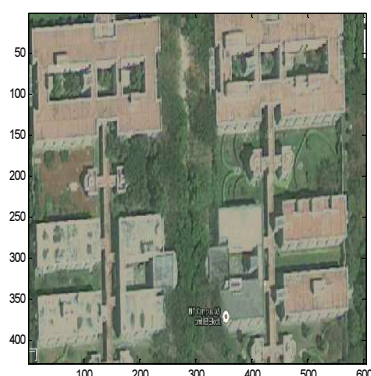


Fig – 5. Original Input From The Google Map

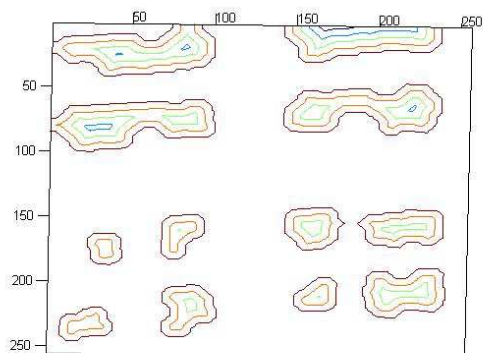


Fig – 8 Output Of The Proposed Algorithm

Sobel

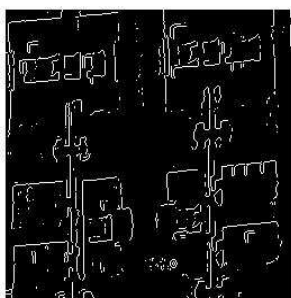


Fig – 6. After Applying Sobel Operator

Prewitt

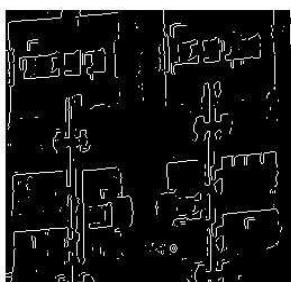


Fig-7 After Applying Prewitt Operator

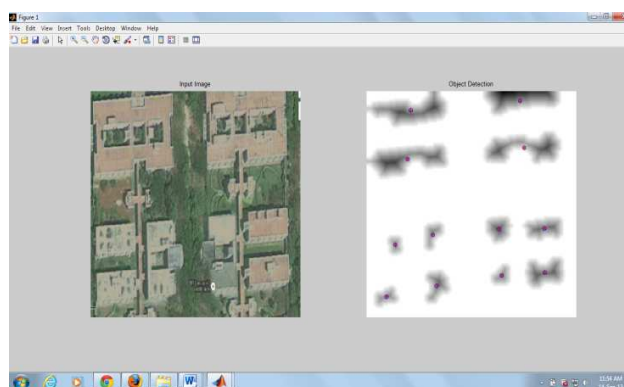


Fig – 9 Matlab Output Screen

7. CONCLUSION

Object Identification is a major issue in real world images. Image segmentation is one of the most important steps leading to the analysis of processed image data. There are many applications of image segmentation like Medical imaging, Treatment planning, Face recognition, Iris recognition, Fingerprint recognition, Building object recognition etc.

This paper describes the analysis of different segmentation methods applied on the Google image. Segmentation by watershed distance transform in both the non-overlapping and overlapping objects in the image is complex and the problem arises when the region is composed by multiple parts and separation area of two overlapping objects has to be considered because most of them have a line for separation, however determination of this line is critical for the whole process. Gradient segmentation with pre-processing methods in some areas of objects result in over-segmentation and the separation of two overlapping objects is not successful. The mark segmentation

method associated by technique separation of overlapping objects applied on the objects of image provides better results compared to the other previous methods. Finally authors created a system; using the system any one can extract knowledge to identify objects in the real world image for selecting best place.

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