GEOMETRIC PARAMETER EXTRACTION OF CITIES

SEMINAR REPORT

Submitted By

SANDEEP K P [EPANEIT064]

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Declaration

I, SANDEEP K P student of eighth semester BTech Information technology, Government Engineering college Sreekrishnapuram, Palakkad, hereby declare that the Seminar report entitled as **GEOMETRIC PARAMETER EXTRACTION OF CITIES** submitted to the University of Calicut during the academic year 2016-2017 is a record of an original work done by me. The work has not been submitted to any other University or Institute for the award of any degree.

SANDEEP K P

Place: Sreekrishnapuram
Date:

GOVERNMENT ENGINEERING COLLEGE

SREEKRISHNAPURAM

PALAKKAD-678 633

Certificate

This is to certify that the seminar report entitled as **GEOMETRIC PARAMETER EXTRACTION OF CITIES** *submitted by* **SANDEEP K P** [**EPANEIT064**] *to the Department Of Information Technology, Government Engineering College, Sreekrishnapuram, Palakkad, in partial fulfilment of the requirement for the award of B.Tech Degree in Information Technology is a bonafide record of the work carried out by him.*

Mr. Ranjith K

Guide

Mr.Sankar K.V

Mrs. Geethu Mary George

Co-ordinators

Prof.Anjana K.R

Head of the Department

Place :Sreekrishnapuram

Date :

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SANDEEP K P

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Abstract

The updating of road network databases is crucial to many Geographic Information System (GIS) applications such as navigation, urban planning, etc. It is noted that does not exist many rules in order to measure and compare the densities of cities and territories. This system proposes an automatic system in order to determine geometric parameters in different cities, in which the following three tasks are performed sequentially: erosion and dilation. The database was created using screenshots from OSM (Open Street Map) website. The system performs morphological operations to extract the parameters of cities from map.

Keywords: *Sustainability, Image Processing, Automatization, Cities, Geometric Parameters,Erosion, Dilation.*

Chapter 1

Introduction

Maps are date stamped evidences of a locality preserving the state of earth's surface in their production time. Mapping the earth's surface, resources and ecosystems is an invaluable source of knowledge about the past and present state of our planet. Maps are prepared based on the current state of the areas of interest; however, as far as we know, the surface of the earth does not remain intact and goes under changes over time. The rate of change in urban areas is faster than natural landscapes. In order to preserve the validity of the maps, they need to be updated in a specified time intervals and new changes should be included.

The information needed for the revision process is a vital scrap in the whole map updating procedure. Depending on the magnitude of the revision project and the extent and nature of the area covered by maps to be updated, revision process can vary extensively. In general, funding and time constraints are major concerns which make us to find more efficient and less time consuming methods to acquire essential data and accomplish revision in the least time. As a result, finding the most efficient source of information with the least cost and time involved has been always desirable for mapping communities.

Traditionally, the information required for the revision was collected through land surveying. Aerial and space imaging systems revolutionized land surface data acquisition. Aerial photography offered great help for mapping community, although became available only after the advent of airplanes. Yet it had its own difficulties; stitching many number of photographs each of which had been collected in different interior and exterior orientation of the whole imaging system were a tedious task. With parallel developments in space and imaging technologies, satellite remote sensing was evolved. Satellite systems, on the other hand, are more systematic and cover larger tracks compared to aerial photographs. Even in terms of high resolution satellite imaging systems dimensions of the images are considerably larger than any high resolution aerial imaging system. Moreover, remote sensing images, by and large, cover vast areas with a standard pixel size, making further image processing tasks even more straightforward.

In order to achieve the above, the first step is to obtain the maps, which are extracted from online tools that not need a license. Once the database is completed, the different interest zones have to be detected, such as motorways, roads or green zones, depending on the final parameter to establish in each case. In this point, is possible to obtain the parameters using different image processing techniques. These parameters will be the perimeter of metropolitan zones and the area enclose by that perimeter. The process is performed with different cities.

Chapter 2

LITERATURE SURVEY

Qiaoping Zhang et.al[2] proposed a comprehensive framework for image-based road network updating, in which three tasks are performed sequentially: road extraction from imagery, road change detection and updating, and spatio-temporal modelling. Wavelet-based road junction and centerline extraction processing is initially performed. Map conflation techniques are then applied for road change detection and updating. Finally, the change information of the road network is organized in an efficient way to facilitate spatio-temporal queries and spatio-temporal analysis.

Road maps could be updated by ground surveying, either by using a traditional method (total station, GPS) or by using a more automatic method (e.g., mobile mapping system). Usually, a survey team will be informed that some roads have been changed, go to the site and record the new positions of the roads. From a spatio-temporal point of view, this method is most suitable because only the changed roads should be taken into account and the time stamps could be easily put either at the tuple level or at the attribute level. In addition, the change is closely linked to the events which had caused the road to change. The minus of this method is that it needs many surveyors to focus on this task in order to record the change timely. Therefore, it is a costly and labour intensive way to update a road network database.

Lili Yao et.al[3] prposed a method that takes high-resolution remote sensing image as the data source and extracts the information of the urban green area according to the method of object-oriented method. The texture feature is extracted by making use of the grey co-occurance level matrix and wavelet transform.

Extract the information of the urban green area according to the method of object-oriented method . Firstly it carries on the pre-processing to the remote sensing image , Secondly the integrate criterion of the smallest heterogeneity and the scale parameter are applied to the segmentation , it divides the image into many homogeneous regions. Thirdly extracts the texture features by making use of the grey co-occurance level matrix and wavelet transform . Then target at the segmentated image, make use of the object-oriented method to combine the textures extracted from grey co-occurance matrix and wavelet transform to classify and extract green area.

Chapter 3

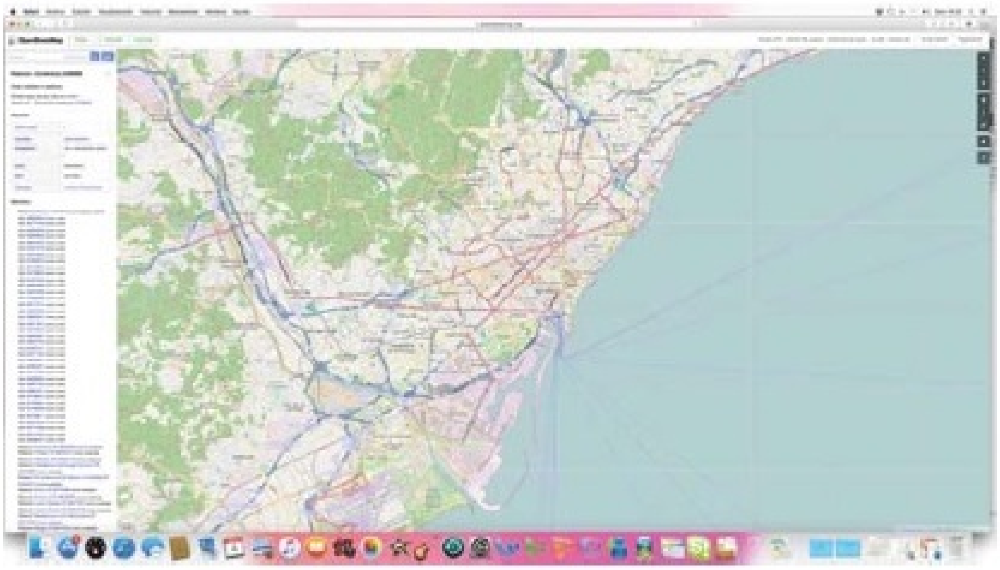
GEOMETRIC PARAMETER EXTRACTION OF CITIES

3.1 Database Creation

The database for the system was created using screenshots from OSM (Open Street Map). This is a map that creates and edits free maps. OSM shows different types of maps, including humanitarian, transport and standard map. To get the images with the best possible quality and resolution, the screen size used was 2560 x 1440 pixels. This aspect is critical and affects directly to algorithm effectiveness, due to the pixel level analysis that is implemented. The content of the database is composed of X maps, from different Spanish big cities and the scale of this images is similar for all of them. However, a system that extracts the equivalency between pixels and meters in an accurate way is necessary and implemented.

figure 3.1 shows an example of an image which is included in the database without applying any processing.

Figure 3.1: Example of images included in the database without processing



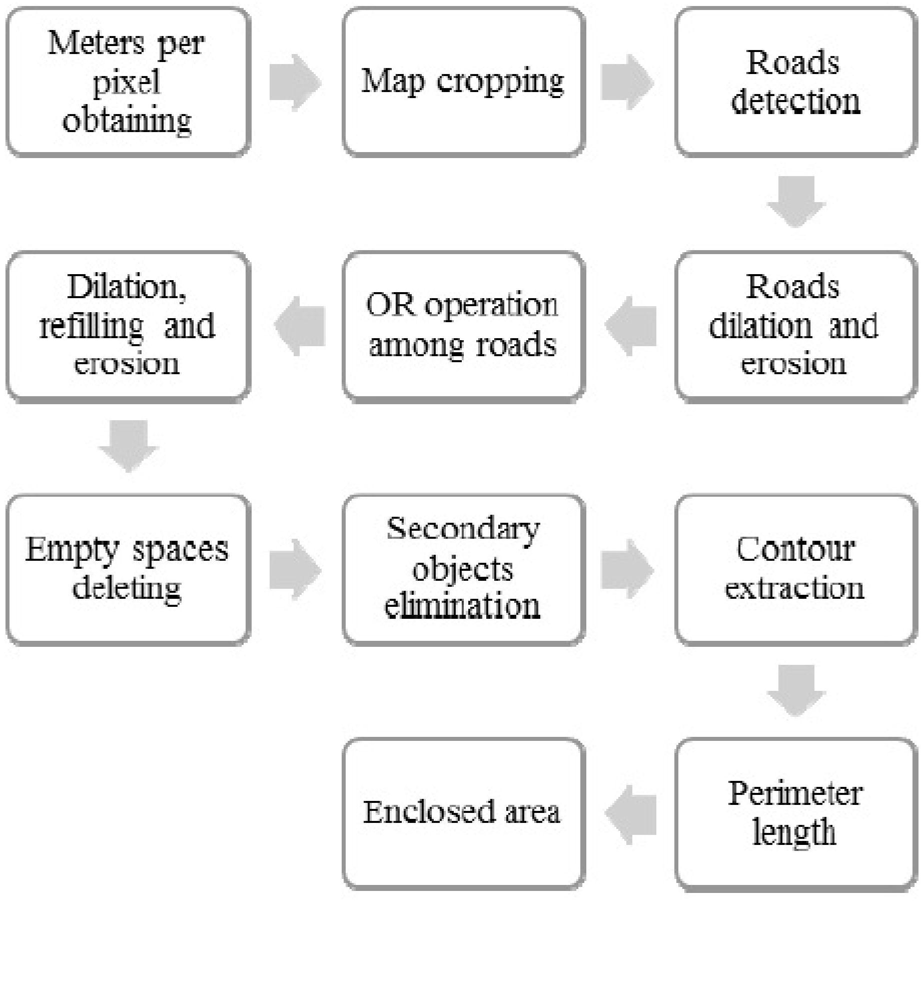
3.2 Design and Implementation

The system is divided in several parts and each one has a different function. The basic functionality is applied over all the images in the database.figure 2 mentions the various steps involved in the process.

1. Meters per pixel obtaining

   The relation between meters and pixel in each city map is determined using a scale box that appears in all the images stored in the database, whose length is always equivalent to 1000 meters. Using the RGB components of the box are extracted, and then its length in pixels. A simple conversion is required to obtain the equivalency between pixels and meters.

Figure 3.2: Basic system scheme with the different modules involved in the process



2. Map cropping

   The original screenshots in the database contains different parts that are not useful in fact, they could be a font of errors in the detection process. So they are eliminated obtaining “clean” images without explorer or operative system bars.

3. Roads detection

   This process tries to detect the different roads in the map, because they are going to be utilized to define the perimeter. The roads are distinguished in three groups, main roads, secondary roads and tertiary roads. Different groups of road are detected separately depending on its RGB components, in order to applicate different levels of dilation and erosion in function of the necessities in next steps.

4. Roads dilation and erosion

   After extracting the roads, dilation and erosion of them is carried. The level of dilation is different for each type of road. The level of erosion is always the same as in the dilation, to hold on the real shapes. These processes are taken to reconnect roads that are really connected but due to resolution and detection issues (like texts in the maps) appear disconnected.

5. OR operation among roads

   The roads now are added in a single image, obtaining a more realistic representation of the city roads than in the first detection before any image process. This image is going to be used in the rest of the process, to obtain a surface that is enclosed by the perimeter.

6. Dilation, refilling and erosion

   A dilation process is performed in the image. As a result, all roads appears more compact. But the holes among them still appearing and in order to eliminate them a refilling process is performed. Now, all must appear as a unique surface, but its dimension is not real because of the dilation process. Therefore, erosion is applied to restore the original edge shape.

7. Empty spaces deleting.

   The big spaces without construction in some cities are delimited by the roads. These holes cause mistakes, because spaces that are not metropolitan are detected like them. Consequently, a correction is needed and that correction consists of detecting that empties through the roads image and the largest 7 are stored. If the surface accumulate by them is more than the 20 % of the provisional surface obtained in F they are subtracted.

8. Secondary objects elimination

   The image is labeled in order to divide the image in the different objects that compound it. This is performed to eliminate isolated objects that could mean isolated neighborhoods that are not in the metropolitan zone, or basically they are results of detection errors. All the labels are eliminated except the largest one, which belongs to the main zone of the city.

9. Contour extraction

   The contour of the image is exactly the same as the perimeter that is been extracted. Therefore, the next step is extracting the contour. For that task, the image result of H is eroded minimally with a structural element with connectivity 1. Then, the eroded image is subtracted from the original obtaining only the outline.

10. Perimeter length

    At the first step, the relation between pixels and meters was defined and is going to be used at this point. First, the number of pixels in the contour image is determined, and with the relation mentioned above this number of pixels is directly change into the perimeter length.

11. Enclosed area

    The enclosed area has been indirectly extracted on H. The number of pixels in that image is exactly the surface enclosed by the perimeter, therefore, counting the pixels and using the scale the measurement of the surface is obtained.

Chapter 4

Conclusion

The system which extracts perimeter and area of Spanish big cities has been developed successfully. With an OSM map, due to the general processing image techniques that are used the system is useful for all the cities in the world. When the goemetric parameter extraction and calculation is done by manual it will take a long time but when this system is used the time can be saved. With this system, they are obtaining in approximately 20 seconds per city both of them, depending on the computer features and images resolution. Total length of roads, green zones areas or some indexes related to sustainability or territory division, which needs calculating that parameters. Also, a comparison between cities features is easier to create, because in each case the adopted criteria are exactly the same.

4.1 Future Scope

Perimeter and Area could be used in future works to obtain index that indicates the level of sustainability of the cities under study. And Green zones area detection can also be implemented with the system. Total length of roads can be extracted with a short time while using the system.

References

[1] N David Hernandez-Abreu, Ismael Quevedo-Medina, Carlos M. Travieso,Malay Kishore Dutta, Anushikha Singh,"Use of Maps to Extract Geometric Parameters of Cities based Image Processing",2016 3rd International Conference on Signal Processing and Integrated Networks (SPIN).

[2] Qiaoping Zhang and Isabelle Couloigner, " A framework for road change detection and map updating ", The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, Vol. 34, Part XXX.

[3] Lili Yao, Weidong Song, "Extraction of urban green area", The international Archives of the Photogrammetry ,Vol. XXXVIII, Part BB, Beijing 2008.