

Soil Classification Using Region Growing Segmentation Method

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Abstract

The purpose of this system is to develop image processing system. The user must prepare the input image for the system by re-coloring the soil-containing-areas with the corresponding colors by using image-editing software. This process is essential because the system only knows 24 different colors for 24 different types of soil. The image has become an input to the system. The color contents of the image are accessed by applying the color segmentation methods. Then the system becomes to know which colors are there in the image. This means which soil types are there in that location. The system uses the region growing method for color segmentation. The system is ready to answer the user's query. If the user asks for a soil type, the system extract the corresponding color situated region from the image and display the segmented image to the user as a result.

1. Introduction

Image processing is any form of signal processing for which the input is an image, such as photographs or frames of video; the output of image processing can be either an image or a set of characteristics or parameters related to the image [1].

Image segmentation procedures partition an image into its constituent parts or objects. The image segmentation can be by color, pattern, and by other features. Segmentation refers to the process of partitioning a digital image into multiple segments of pixels. The purpose of image segmentation is to partition an image into meaningful regions with respect to a particular application. It is based on measurements taken from the image and might be grey level, colour, texture, depth or motion [1].

Each distinct coordinate in an image is called a *pixel*, which is short for picture element. In electrical engineering and computer science, image processing is any form of signal processing for which the input is an image, such as photographs or frames of video; the output of image processing can be either an image or a set of characteristics or parameters related to the image. Most image-

processing techniques involve treating the image as a two-dimensional signal and applying standard signal-processing techniques to it [1].

The system is image processing system. The system will use image segmentation which is one of the image processing methods. The system will accept an image of the map as an input. The image of the map which consists of different colors will be analyzed. The system will analyze each of the consisting colors. The system, having definition of which color represents which soil type, it can determine the different kinds of soils of the map. Then the system will show the user all the soils in that map. Then the system will ask the user input for a specific type of soil. After knowing the user-requested soil type, the system will then extract the user-requested-soil-type-equivalent-color from the image by color segmentation method of image processing. This system can be used as a helping system for the geographical analyst. This system is aimed to use for every locations in Myanmar.

2. Related work

T.Seeman et.al described digital image processing using local segmentation. Local segmentation may be applied to range of important image processing tasks. Using a traditional segmentation technique in intensity threshold and a simple model selection criterion, the new FUELS denoising algorithm is shown to be highly competitive with state-of-the-art algorithms on a range of images. This leads to further improvements in denoising performance. They are believed that image processing in general could benefit greatly from the application of the local segmentation methodology [2].

P.K Loo et.al presented the result of an adaptive region growing segmentation technique for color document images using an irregular pyramid structure. The emphasis is in the segmentation of textual components for subsequence extraction in document analysis. The method utilizes a hybrid approach where color feature based clustering followed by detailed region based segmentation is performed. Clustering is done by merging image color points surrounding a color seed selected

dynamically. Dynamic and repeating selection of the most suitable seed region, fitting changing local condition during the segmentation, is implemented. The algorithm is evaluated according to 2 factors and compared with an existing method. The result is encouraging and demonstrates the ability and efficiency of their algorithm in achieving the segmentation task [3].

Horvath describes using fuzzy C-means clustering method in image segmentation. Segmentation method is based on a basic region growing method and uses membership grades of pixels to classify pixels into appropriate segments. Images were in RGB color space, as feature space was used $L^*u^*v^*$ color space. Results were obtained on five color test images by experimental simulations in Matlab [4].

Crown et.al proposed principles, structure and a simplified key of the Canadian soil classification system. In any science a system of classification is used to organize information about similar entities within a logical and easily remembered framework. Classification also allows us to discover relationships between these entities and to apply our knowledge towards the solution of practical problems. Classification schemes arrange objects in an orderly fashion by placing them into groups or "classes" or "taxa" according to their similarity to each other. Objects to be classified are arranged in such a way that they succeed or accompany each other. Application of this principle results in a hierarchical classification scheme [5].

Thakur et.al analyzed the region based segmentation method for ultrasound images using local statistics. This method uses a look up table comprising of the local statistics of every pixel. The algorithms are implemented by using connected seeded region growing procedure where each pixel is taken as seed point. The updated merged regions produce the output in form of segmented image. This algorithm produces the results that are less sensitive to the pixel location and it also allows a segmentation of the accurate homogeneous regions [6].

3. Methodology

3.1. Image segmentation method

Several general-purpose algorithms and techniques have been developed for image segmentation. Since there is no general solution to the image segmentation problem, these techniques often have to be combined with domain knowledge in order to effectively solve an image segmentation problem for a problem domain.

Image segmentation methods are:

1. Clustering methods
2. Histogram-based methods
3. Edge detection methods
4. Region growing methods
5. Level set methods
6. Graph partitioning methods
7. Watershed transformation
8. Model based segmentation
9. Multi-scale segmentation
10. Semi-automatic segmentation
11. Neural networks segmentation

3.1.1. Region growing method

The first region growing method was the seeded region growing method. This method takes a set of seeds as input along with the image. The seeds mark each of the objects to be segmented. The regions are iteratively grown by comparing all unallocated neighboring pixels to the regions. The difference between a pixel's intensity value and the region's mean, δ , is used as a measure of similarity. The pixel with the smallest difference measured this way is allocated to the respective region. This process continues until all pixels are allocated to a region. Seeded region growing requires seeds as additional input. The segmentation results are dependent on the choice of seeds.

The approach is to start with a set of "seed" points and from these grow regions by appending to each seed those neighboring pixels that have predefined properties similar to the seed such as color or gray level.

4. Implementation

The system includes the following steps.

1. Acquire map-image from real world.
2. Recolor the image with specific color for each of the soil. The color information for the specific soil is expressed in Appendix portion of the paper. This step is essential because the system only knows and will work well with 24 different colors. There are 24 different types of soil in Myanmar. The system is aimed to be used for every location in Myanmar. The system will check the colors of the image to get the soil information of that location. Map symbols and labels must be used with black color.
3. The re-colored image becomes one of the inputs of the proposed system. The colors used for each specific soil are predefined. Thus the proposed system can distinguish the different types of soil according to the different colors.

The above step must be done as pre-processing steps before the user starts the system for a new location.

4. The result image of the previous step becomes an input to the system. The system will check every color of every pixel of the image and compare it to the color-definition of the different soil. If the match is found, the position of the pixel will be determined for further use as a seed. Region growth method of image segmentation technique will be applied to the input image, later. In this step, the proposed system will output to the user all the soil names (according to the color of the pixel) for the location. On the other hand, after this step, the system knows the input-image is having what colors. This means that the system knows which types of soils are situated in the image of that location. The system is aimed to check the different types of pixel-color for distinguishing the different types of soil. For that purpose, the soil-situated-regions are re-colored at the previous step by its corresponding color. Then the system displays the all available soil types of that location. Then the user can choose to show the specific soil.

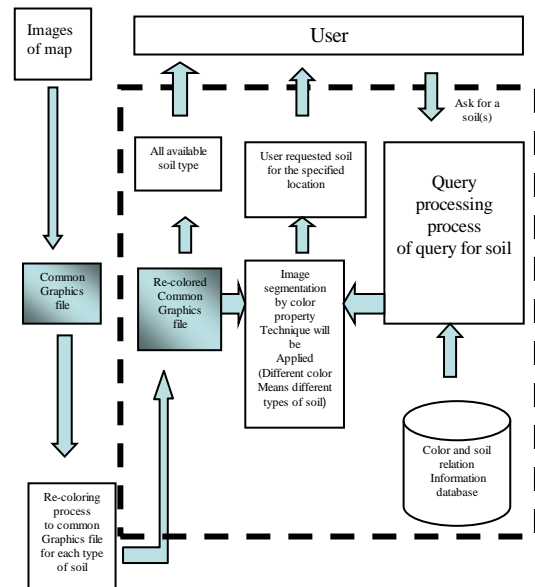
5. Then the user asks for a soil. The proposed system will be carried on to step 6.

6. The user's query will be responded by getting the soil name and the system will also find the corresponding color information of that soil in the soil-color definition. So the system will now know the query soil name and corresponding color. After that the system will find that the user-specified-soil-corresponding-color in the input-image-file. The system also knows the seed point for that color. The system responded back to the user for that part of image which is having the specified color by segmentation of image by color property.

In the system, there are two types of processing:

1. Pre-processing before the system starts and
2. Processes of the system after system start.

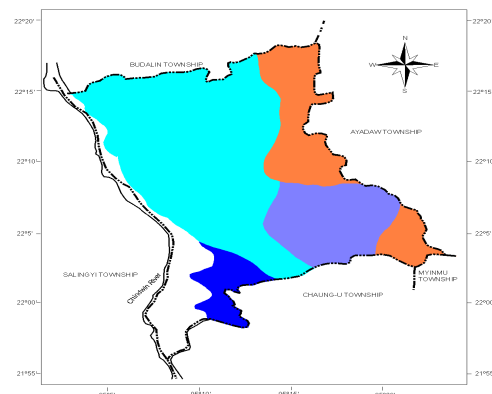
Steps 1 to 3 must be done as the pre-processing steps before the system starts. In step 4, the system will asked for the image file and soil name from the user. In step 6, the user's query is processed and responded back to the user. The overview of the system is shown in figure 1.



“Figure 1. Overview of the system”

4.1. Soil map of the Monywa

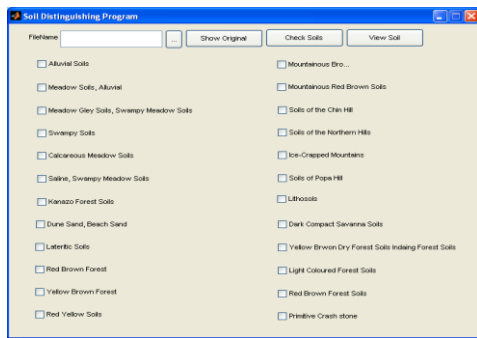
Figure 2 is input image of the system and shows as the original image with all soil type.



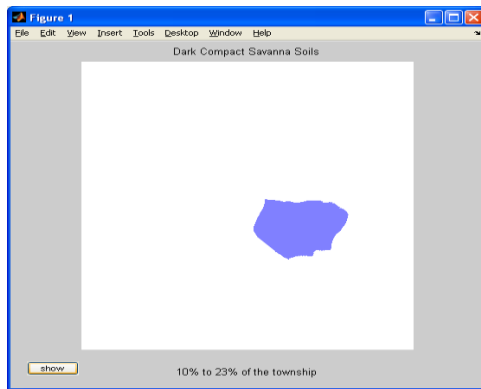
“Figure 2. Input image of the study area”

5. Result

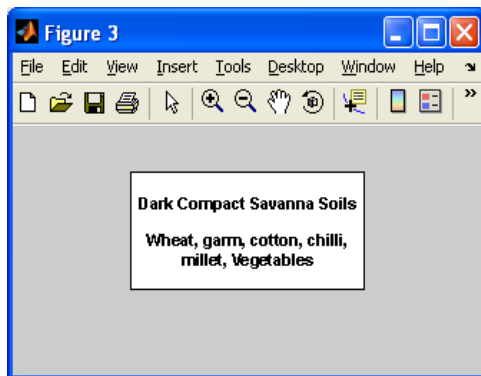
Figure 3 is shown the application main form of the system. Figure 4 and 5 show the portion of the image where the soil that the user asked is situated and the extra legend for that soil.



“Figure 3. Main frame of the system”



“Figure 4. Requested soil after segmentation”



“Figure 5. Requested soil after segmentation”

6. Conclusion

The system intends to the needs to know the different locations which is having different types of soil in Myanmar. The system only uses Monywa surrounding area as a sample region. User can add new locations. The system is suitable for every region in Myanmar. Soil classification may be of different types. This system uses the soil type, soil name, and soil classification used in Union of Myanmar.

7. Further work

























This system used the soil classification methods used by the local analyst in Myanmar. For better performance, to be used for every locations of the earth, the system should be changed its classification methods by international soil taxonomy. International soil taxonomy uses the soil properties by scientific means. Thus the system is suitable for every location of the earth. How many different types of the soils can be found should also be considered.

8. References

- [1] Image Processing and Image segmentation paper [online document]
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- [6] A. Thakur and R.S. Anand, “*A Local Statistics Based Region Growing Segmentation Method for Ultrasound Medical Images*”.

APPENDIX

After user has scanned the image for a location, the user must use the following colors to re-color the soil situated areas according to its soil type. Types of soil and its color used in the proposed system.

Color	Name of soil	Color		
		R	G	B
	Alluvial Soils	0	0	255
	Meadow Soils	255	0	0
	Meadow Gley, Swampy Meadow soil	128	0	128
	Swampy Soils	255	255	0
	Calcareous Meadow Soils	0	128	0
	Saline, Swampy Meadow Soil	0	255	0
	Kanazo Forest Soils	0	128	128
	DuneSand, Beach Sand	0	255	255
	Lateritic Soils	0	0	128
	Red Brown Forest Soil	128	0	0
	Yellow Brown forest Soils	128	128	0
	Red and Yellow Soils	255	0	255
	Mountainous Brown Forest Soils	128	128	64
	Mountainous Red Brown Soils	255	255	128
	Soils of Chin Hill	0	64	64
	Soils of the Northern Hill	0	255	128
	Ice-Crapped Mountains	0	128	255
	Soils of Popa Hill	128	255	255
	Lithosols	0	64	128
	Dark Compact Savanna Soils	128	128	255
	Yellow Brown Dry Forest Soils and Indaing Forest Soils	128	0	255
	Light Colored Forest Soils	255	0	128
	Red Brown Savanna Soils	128	64	0
	Primitive Crushed Stone Soils	255	128	64