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Feature Extraction Using Remote Sensing Images

Nihad . A. Karam*, Ayat .F. Abed
Department of Astronomy and Space, College of Science, University of Baghdad, Baghdad, Iraq

Abstract
Feature extraction provide a quick process for extracting object from remote sensing data (images) saving time to urban planner or GIS user from digitizing hundreds of time by hand. In the present work manual, rule based, and classification methods have been applied. And using an object- based approach to classify imagery. From the result, we obtained that each method is suitable for extraction depending on the properties of the object, for example, manual method is convenient for object, which is clear, and have sufficient area, also choosing scale and merge level have significant effect on the classification process and the accuracy of object extraction. Also from the results the rule-based method is more suitable method for extracting most features, since it depends on different variable which belong to the objects.

Keywords: Feature extraction, rule-based, manual method, classification.

استخراج الميزة باستخدام صور الاستشعار عن بعد

نهاد علي كرم* ،ايات فرحان عبد
قسم الفلك و الفضاء ، كلية العلوم ، جامعة بغداد ،بغداد ،العراق

الخلاصة
استخراج الميزة توفر عملية سريعة لاستخراج الية الكائن من بيانات الاستشعار عن بعد للمخطط الحضري باقصر وقت او مستخدم نظم المعلومات الجغرافية اذا ماستخدمت الحسابات التقليدية..في العمل الحالي تم تطبيق ثلاث طرق (manual, rule based, classification) اعتمادا على(object-base approach) لتصنيف الصورة .من النتائج التي تم الحصول عليها ان كل طريقة تكون مناسبة للاستخراج اعتمادا على خصائص الكائن ،على سبيل المثال الطريقة اليدوية تكون سهلة ومريحة بالنسبة للكائن الواضح والمساحات الكافية ،وكذلك اختيار حجم و مستوى الدمج لها تأثير كبير على عملية التصنيف ودقة استخراج الكائنات ومن النتائج ايضا تبين ان طريقة (rule- based) هي انسب طريقة لاستخراج معظم الميزات كونها تعتمد على اكثر من خاصية تخص الكائن.

Introduction

Remotely sensed imagery can be used in a number of applications like feature extraction .Feature extraction is of paramount importance for an accurate classification of remote sensing images [1]. Since, the output of a remote sensing system is usually an image representing the scene being observed. Since remote sensing may not provide all the information needed for a full-fledged assessment, many other spatial attributes are needed to be integrated with remote sensing data. This integration of spatial data and their combined analysis is performed through Geographic Information System (GIS) technique [2]. Remote sensing techniques are extremely useful for change detection analysis and selection of sites for specific facilities such as hospitals, restaurants, solid waste disposal

*Email: ayat _ alkubaisi@yahoo .com

and industry. Thus, remote sensing techniques provide accurate, orderly and reliable information for planning and management of a town or a city [3].

Feature Extraction

Feature extraction is the process of defining a set of features, or image characteristics, which will most efficiently or meaningfully represent the information that is important for analysis and classification [4]

The goal of feature extraction is to improve the effectiveness and efficiency of analysis and classification. This may be done by: [5]

1) Eliminating redundancy in the image data.

2) Eliminating variability in the image data that is of little of no value in classification even discarding entire images if that is appropriate.

3) Restructuring the data (in feature space) in order to optimize the performance of the classifier.

4) Extracting spatial information (texture, size, shape, ...) which is crucial to target identification.

That is, one would like to

1) Minimize the number (and detail) of the features.

2) Maximize pattern discrimination**.**

The feature is defined as a function of one or more measurements, each of which specifies some quantifiable property of an object, and is computed such that it quantifies some significant characteristics of the object. The most classification of the various features employed as follows [5]

• **General features:** Application independent features such as color, texture, and shape. According to the abstraction level, they can be further divided into:

- Pixel-level features: Features calculated at each pixel, e.g. color, location.
- Local features: Features calculated over the results of subdivision of the image band on image Segmentation or edge detection.
- Global features: Features calculated over the entire image or just regular sub-area of an image.

• Domain-specific features Application dependent features such as human faces, fingerprints, and conceptual features. These features are often a synthesis of low-level features for a specific domain. On the other hand, all features can be coarsely classified into low-level features and high-level features. Low-level features can be extracted directed from the original images, whereas high-level feature extraction must be based on low-level features.

Study areas and data

Experimental data is representing the city of Baghdad and surrounding area has been used to extract the lake and river. The image charactertics are as follow figure 1

- Geographical location Is 42˚13'8. 47"E and 34˚*8'33.*94N.
- Dim: 7927x7557x7[BSQ].
- Size [byte]:419171.676 bytes.
- Wavelength: 0.484 to 2.5 nm.
- Pixel: 24.5
- Resolution: 26 meter.

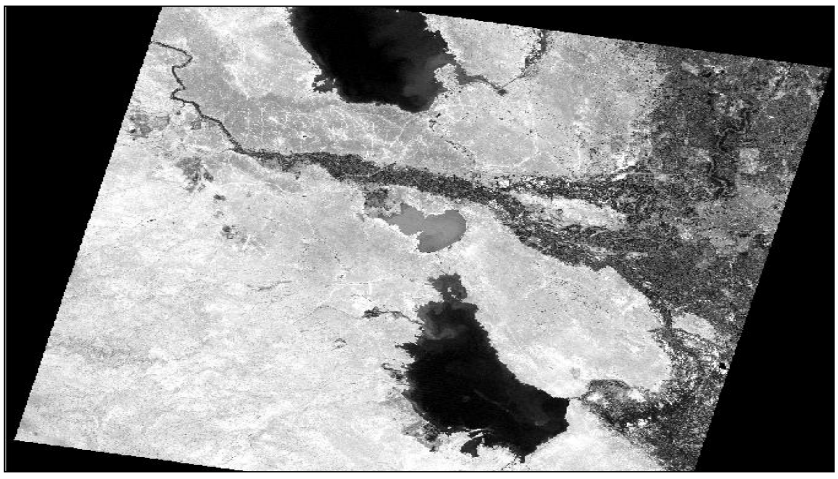


Figure 1-Represent city of Baghdad and surroundings area image

Steps of the work

Preparing the image

To use images and making it more suitable for analyzing some step should be prepared:

- Resize images using spatial subtraction.
- Applying atmospheric correction.

Extracting Process

The process of extraction involves the following steps:

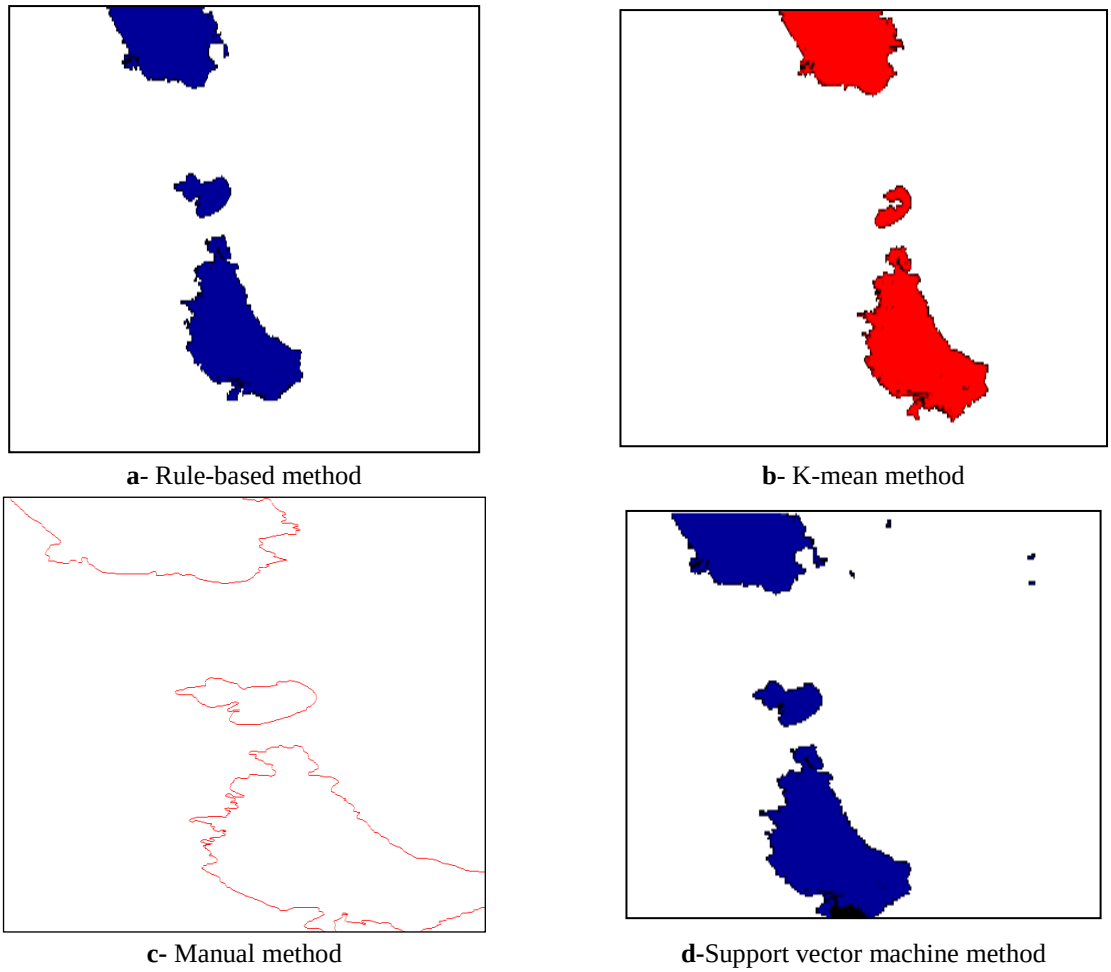
1- Dividing an image into segments
2- Computing various attributes for the segments
3- Creating several new classes
4- I assigning segments to each class
5- Classifying the entire image with a K Nearest Neighbor (KNN), Support Vector Machine (SVM) based on selected training .
6- Saving the classes to a shape file or image**.**

Lake extraction

Three methods have been applied [rule- based , classification , manual] to extract lake the figure 2 (a ,b ,c ,d) show the result of the adopted methods with procedure for each method

- Defining the rule for "lake" as the following**:**

1. Objects with an area greater than 260662 pixel.
2. Objects with a band ratio value less than -0.3991.



a- Rule-based method

b- K-mean method

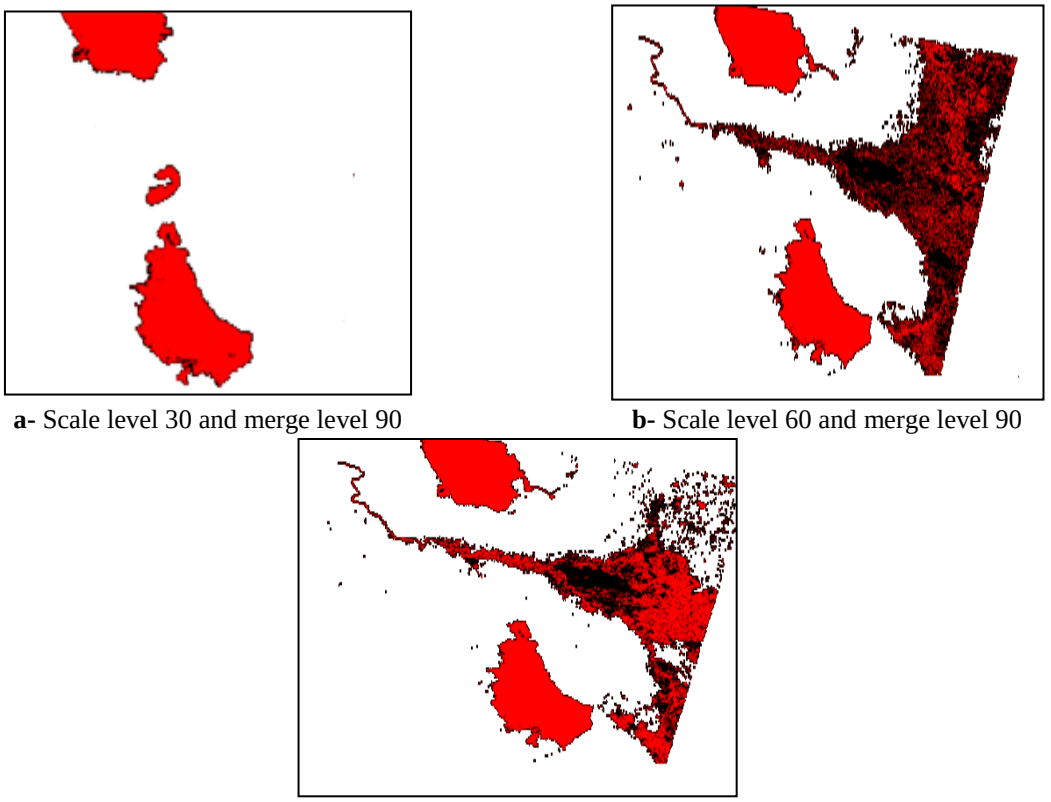
c- Manual method

d-Support vector machine method

Figure 2-Represent lake extraction

Effect of scale level on the lake extraction

To show the effect of scale level on the extracting three values have been used [, 30, 60, 90], and merge value 90 figure 3



a- Scale level 30 and merge level 90

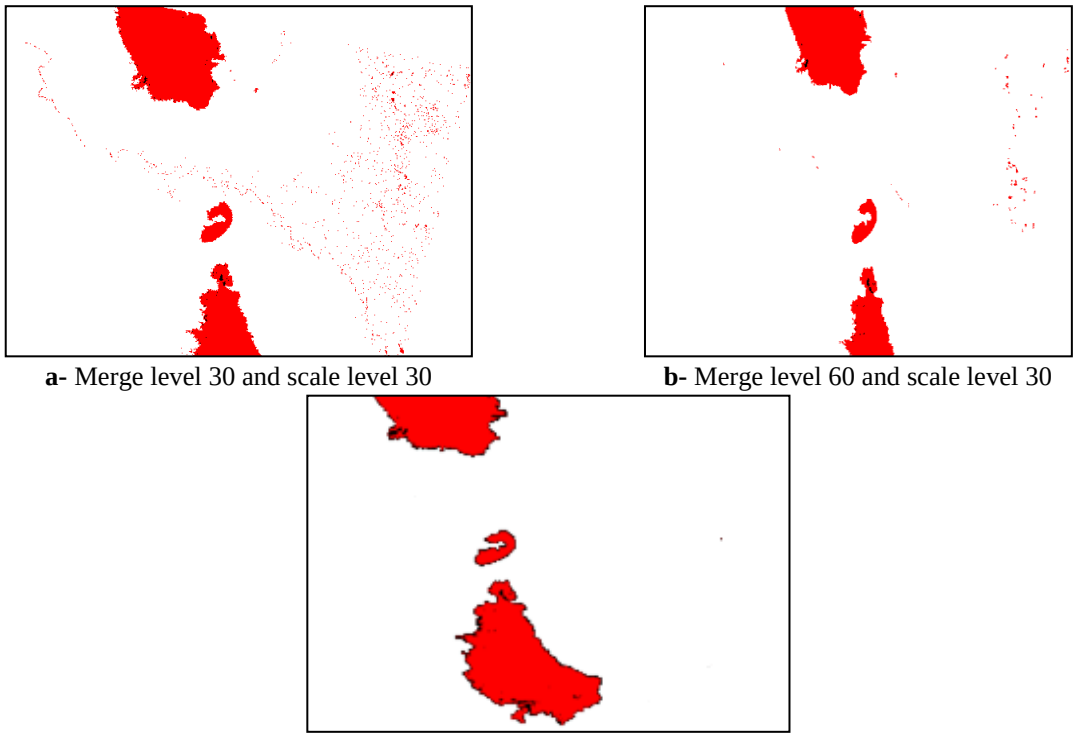
b- Scale level 60 and merge level 90

c- Scale level 90 and merge level 90

Figure 3-Represent scale level effect on lake extraction

Effect of merge level on the lake extraction

To show the effect on the lake extraction of merge level three values have been used [30, 60, 90], and merge value 30 figure 4.



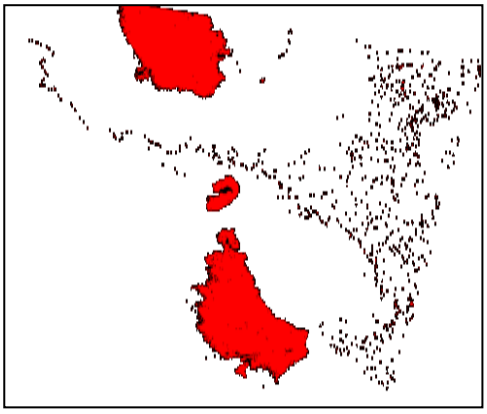
a- Merge level 30 and scale level 30

b- Merge level 60 and scale level 30

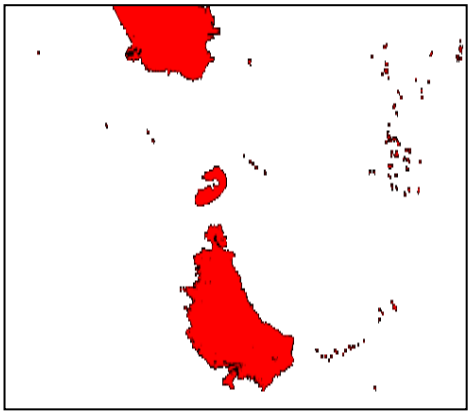
c- Merge level 90 and scale level 30

Figure 4-Represent effect of merge level on lake extraction

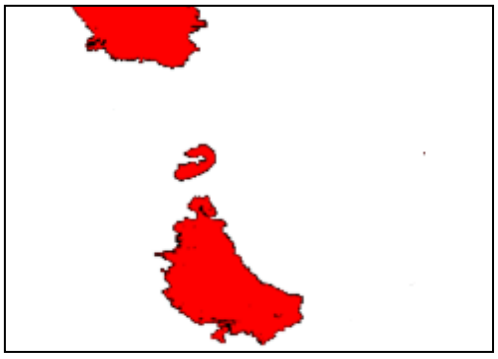
Effect of object area



a- Area with value greater than 25000



b- Area with value greater than 40000

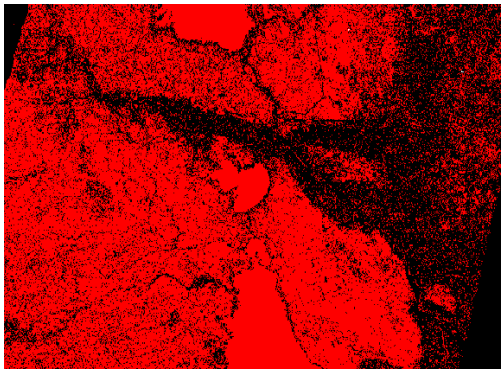


c- Area with value greater than 30349

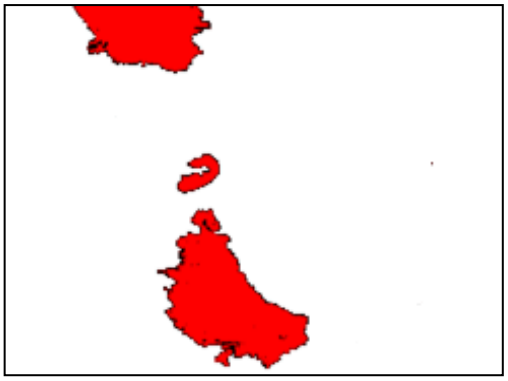
Figure 5-Represent effect of object area on lake extraction

Effect of band ratio

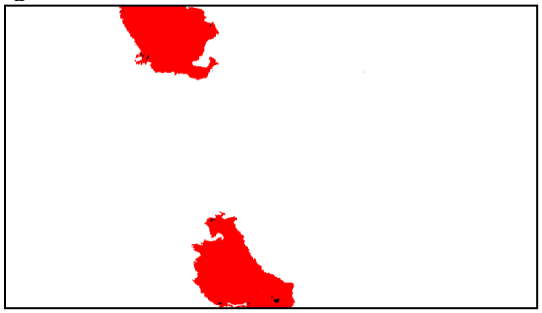
The band ratio between bands, is define as (B2-B2) / (B2+B1+eps), Where eps is a small number to avoid division by zero,B1 is red band and B near-infrared band figure 6



a- Band ratio with value greater than -0.1



b- Band ratio with value greater than -0.3



c- band ratio with value greater than -0.5

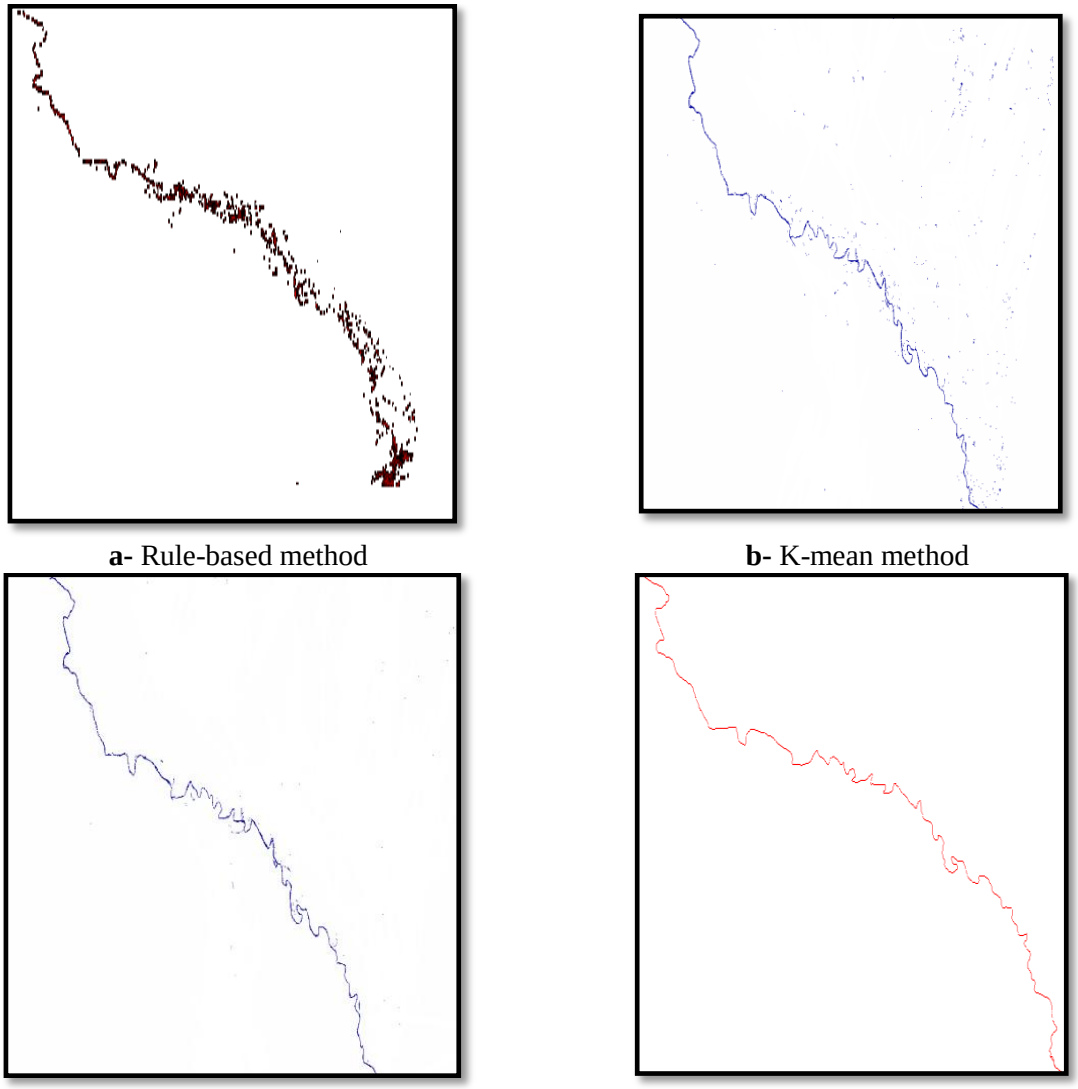
Figure 6-Represent effect of band ratio on lake extraction

River extraction

Figure.7 a,b,c,d show the results using [rule-based, classification, manual] methods with procedure for each method defined and the variable used.

- Defining the rule for "roads" as the following:

1. Objects with an area less than 20449 pixels.
2. Objects with a band ratio value less -0.4412.
3. Objects with a length greater than 273.



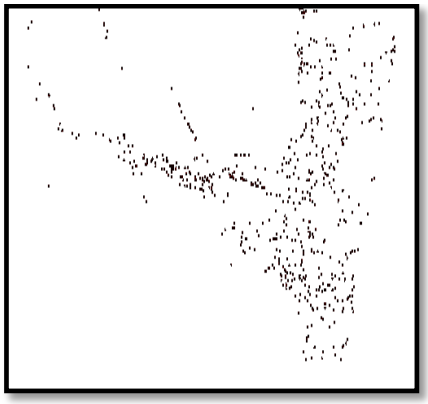
a- Rule-based method **b-** K-mean method

c- Support vector machine method **d-** Manual method

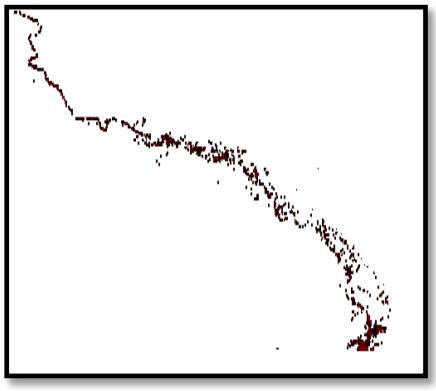
Figure 7-Represent river extraction

Effect of scale level

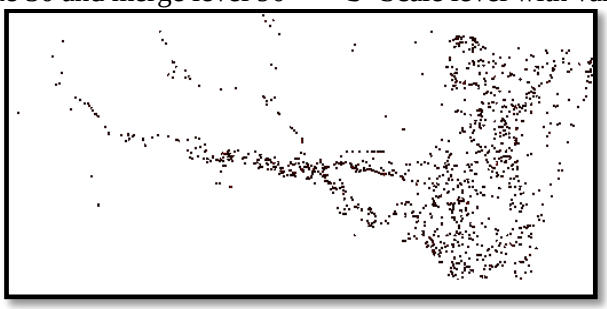
To find the effect and the result of scale level on the roads extraction are shown in figure 7 (a,b,c,d),Three value of scale level have been used [30,60 ,90] and merge level90 figure 8.



a- Scale level with value 30 and merge level 90



b- Scale level with value 60 and merge level 90



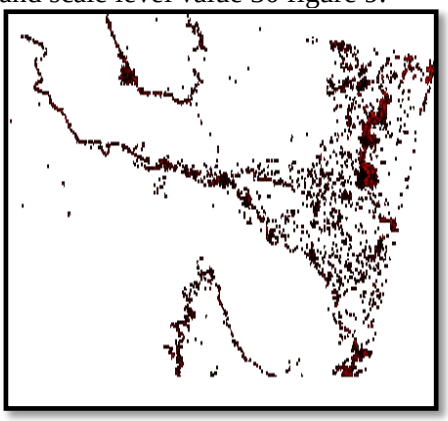
c- Scale level with value 90 and merge level 90

Figure 8-Represent effect of scale level on river extraction

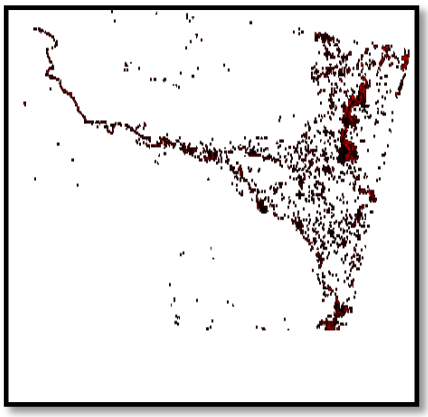
From above figures, the value 30 seems to delineate the features boundaries while preserving some detail in their shape.

Effect of merge level

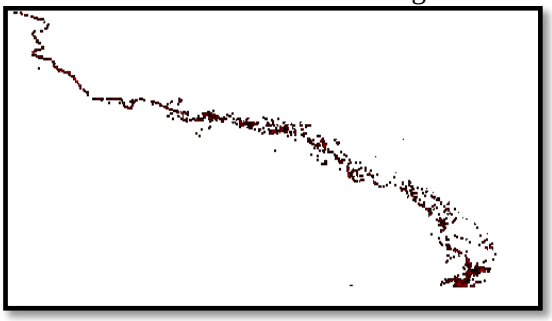
To show the effect of merge level on the extracting river three values have been used [30, 60, 90], and scale level value 30 figure 9.



a- Merge level with value 30 and scale level



b- Merge level with value 60 and scale level



c- Merge level on river extraction with value 90 and scale level 30

Figure 9-Represent effect of merge level on river extraction

From the result, the value of merge level must be high as possible and the optimum value for our study case is 90.

Discussions and conclusions

According to the results of this study, several important points can be concluded as follow:

1- Accuracy of the results depends on the experience of the analyzer and specification of the image.

2- The results are depending on, the signification resolution of the image especially for buildings and roads specifically with rule-based method.

3- The results depend on training area (location and number of training area) by increasing the number of the results when there are good agreements.

4- Manual method is suitable for extracting object with no over lab with other features, and it is not small huge number of features like buildings, roads.

5- The scale level and merge level have significant effect on the result therefore one must be careful to take these values. The value will be different for different image and feature.

6- Using remote sensing data are very convenient to obtain feature and saving time comparing with traditional method.

7- From the results, the rule-based method is more exact and saving time comparing with other methods.

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