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Preparing A Land Cover Map with Emphasis on Green Space (Grass, Tree, Agriculture): by using Image Texture Filters in Panchromatic Band, Iran

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Abstract: *Satellite data are currently considered as one of the most important sources in producing usemap and land coverage. Several digital classification methods have been proposed for such maps which are now being used. Accordingly, evaluating and comparing different methods for determining the appropriate and principled method is of utmost importance in different situations in the country. High-resolution images available for sensors, such as Ikonos and QuickBird are more efficient than digital operating systems that provide opportunities for details of large-scale land cover maps. In this article panchromatic band of QuickBird images is used in Northeast of Isfahan in 2006. Image texture is used for processing panchromatic band. To extract the texture of six soil cover (explained in this research), the author used the filters in the software Envi. 4. 8. About 80% resolution for greenspace cover implies the acceptability of this method.*

Keywords: *land cover, high resolution, texture, Greenspace image, Isfahan*

1. INTRODUCTION

In order to reach the land cover graph on a global and regional scale, accessing updated field data are usually difficult and limited, since such data are collected from accessible places at a generally small level and at different intervals which vary from one another in terms of type and credit. Using conventional and traditional methods of harvesting and measuring earth requires a lot of time and money, and still, is impossible to perform in some difficult-to-pass areas.

The use of satellite imagery is of particular importance due to special features such as wide vision, low cost, use of different parts of the electromagnetic spectrum to record the properties of phenomena, aperiod of a short return, the possibility of automatic analysis, faster investigation and the possibility of monitoring the region. Remote sensing data with features such as frequent imaging at low intervals, vastness of land cover surface detected by sensors, proper spectral and spatial separation; provide a suitable tool for the landcover graph. Today's advances provide significant opportunities and achievements for observing and managing the rapid growth of cities in remote sensing and geographic information systems. One of the characteristics of remote sensing sensors is as patial resolution. Each sensor with different spatial resolution is used in a different application. In recent years images from high-resolution sensors have been considered as one of the newly used achievements in remote-

sensing. The spatial resolution of these sensors is often between 0.4 and 6 meters. Due to satellite imagery's high spatial resolution, spatial changes are increased so as a result, the variance of each class rises; this spreads probability density functions of classes and results in a high degree of overlap between the two which itself raises the classification error. To reduce error in such imagesone needs to use spatial information (textural)as well as spectral information. Managers and urban planners need a tool to provide them the correct, fast and updated information. There are the most common classification methods used in remote sensing as non-regulatory classification like Isodata and regularly methods as maximum likelihood methods in which each spectral class is described by a multivariate normal distribution. (Salami, 2009, 258-266) Matin-Far, H et al. (2007) examined determining the type of land use and land coverage by Landsat7 ETM+ and by using object-oriented methods in Kashan's dry areas. The accuracy of the object-oriented method is 95, and, therefore, it can be concluded that object-oriented method is suitable for the study of dry areas. (Saroasta et al. 2012) used some remote sensing techniques to check land cover variations such as SVM, Artificial Neural Networks, and the most probable classification. The images used in this research study are of Landsat's. Results showed that SVM technique is more suitable than other two techniques. Alimohammadi et al. (2009) compared pixel-based methods, base object and decision tree in preparing forest types maps by using forest data and remote sensing data.The overall accuracy of 54% and Kappa coefficient of 39% is achieved for the based-pixel method. In theobject-oriented method, the overall accuracy is 63 and Kappa coefficient is 54%. By using auxiliary data such as height in decision tree method the overall accuracy and the Kappa coefficient reach 76 and 0.7 respectively.Results show that the object-oriented method is more efficient than pixel-based method and decision tree method (which uses auxiliary data) for separating tree species in mixed forests. Lotfi, Sad et al. (2010) examined applications of Spot satellite imagery for preparing a land use map of Marand County with anobject-oriented approach. To classify land cover and land use in Terminus Lagoon in the southeastern of Mexico, MAS (2003)utilized multilayer perceptron (MLP) neural network algorithm. Neural network inputs for band 2.3, 4, 5, 7 were ETM sensor of Landsat satellite and six class of land cover were prepared as output. The accuracy of the classification was reported: 82%. (MAS.2003:3498-3500). Using Landsat images, Membini et al. (2013) compared the maximum likelihood method to the fuzzy method in thepreparation of land cover/ land use map in thesouth of Khuzestan. Results show that the fuzzy method with Kappa coefficient of 99% is more accurate than maximum likelihood method with Kappa coefficient of 98%. Using fuzzy Artmap method and multilayer perceptron neural network, Zaeri, Amirani, Safianian examined Isfahan for preparing theland cover map. Results on the image LISS-III showed that multilayered perceptron neural network method with anaccuracy of 93.3 is more precise than thefuzzy method with anaccuracy of 88%. Kate et al. (2012) in a study based on image texture identified underprivileged urban areas in Hyderabad, India. Closely-packed housing is the key feature of theslum. The method used for preparing maps of slum areas in populated cities is reliable and could be used for examining multi-dimensional data in developing cities.

2. METHODS AND MATERIALS

Isfahan is located 435km from south of Tehran. The City of Isfahan has a longitude of 51 degrees, 39 minutes and 40 seconds east and latitude of 32 degrees, 38 minutes and 30 seconds north. Its urban area is divided into 14 regions. Outside of the urban area, Khomeini Shahr and Najafabad are in the west, Mount Sofeh and Sepahan Shahr in the south, Shahin Shahr in the north and Segzi plain is located in the east of the city. According to Figure (1), the area under study is north of the city.

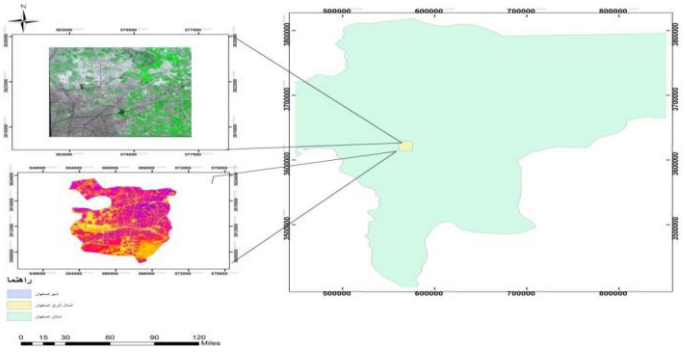


Fig1. *Geographical location of the area*

Classification Accuracy in Quick Bird Color Image

To compare colored band to panchromatic band, at first, Quick Bird color image of northeast of Isfahan is classified into six classes of land cover using maximum likelihood classification. As seen in Fig (2), the overall accuracy is 86.27% and the Kappa coefficient is 81%.

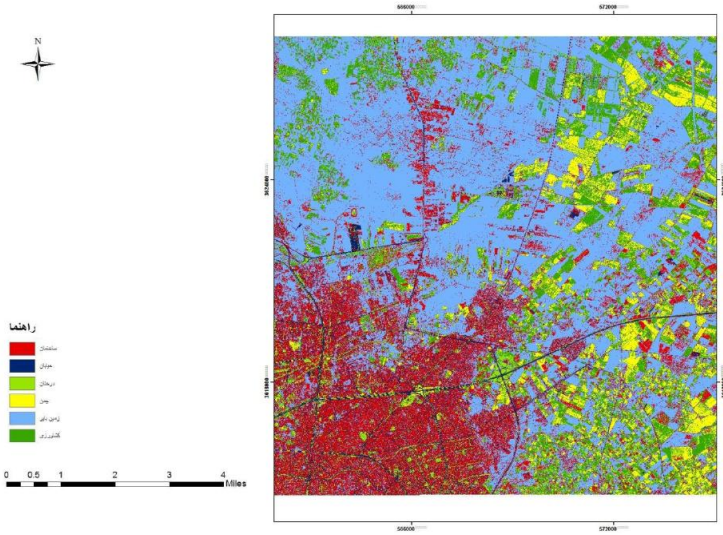


Fig2. *Maximum likelihood classification in Quick Bird color image of Isfahan Panchromatic band classification*

In this panchromatic band research study, in order to obtain higher precision, Quick Bird image is used rather than acolor image. To detect texture in images, the texture filter tool in the software ENVI4.8 is used. After performing the pre-processing step on all images, they are ready to be processed. In the first step, texture filtering is applied.

Data Range Filter

As it is reflected in Fig (3), the filter has a dark color in the green grass band. Barren land also has a dark color, but due to the fact that the barren land does not have a smooth surface, the pixels are not uniformly distributed in terms of darkness as opposed to theshadow of the building which has a completely dark color which can almost be distinguished from all other phenomena in this filter. What separates the phenomena in this filter is the boundary of the phenomena.

Since the color of all phenomena except shadows and cars are dark in the filter, the boundaries of phenomena are sharp and bright. Roads inside the city are also dark gray and in terms of color, they are similar to grass. The greenspace of the buildings in this filter does not have the same texture and the texture is irregular. The degree of greynessof the phenomena is constantly changing in greenspace and buildings, it could be said that there is no regular continuity. Buildings have sharp and white edges. Shadow of the trees darkened the road, therefore, the existence of trees can be proven.

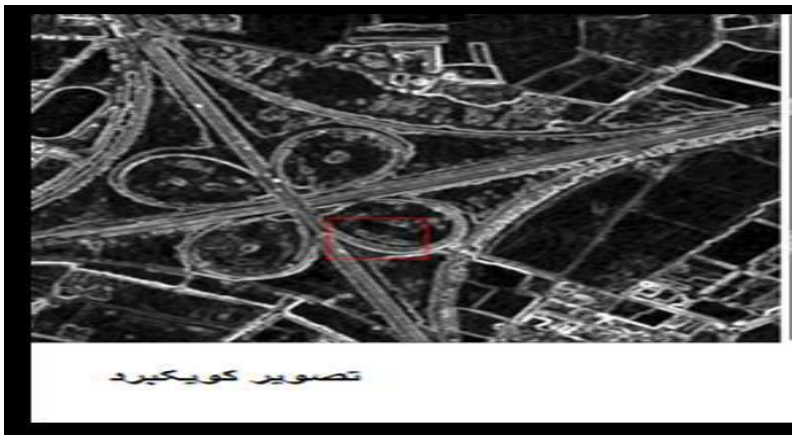


Fig3. *Data Range Filter*

Mean Filter

In this filter, phenomena retain their shape on the image. Fig (4) shows that based on the shape, our visual interpretation, experiences and mental image are distinguishable from the phenomena.

Fig4. *Mean Filter*

Variance Filter

In the variance filter, figure (5), the more amount of variance is the better, because variance shows the differences and makes abetter distinction betweenthe phenomena. In this filter, all of the phenomena are almost black and dark. On the border of phenomena, edges are sharp, white and recognizable.

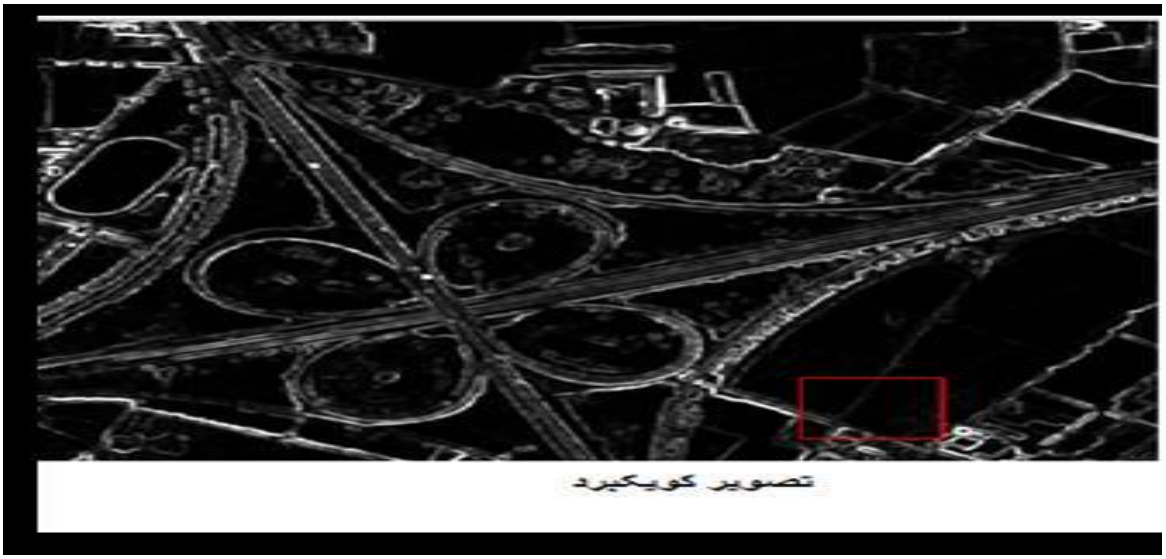


Fig5. *Variance Filter*

Entropy Filter

In this filter, figure (6), all of the phenomena are almost white as opposed to shadows and the roofs of the houses which are uniformly black colored.

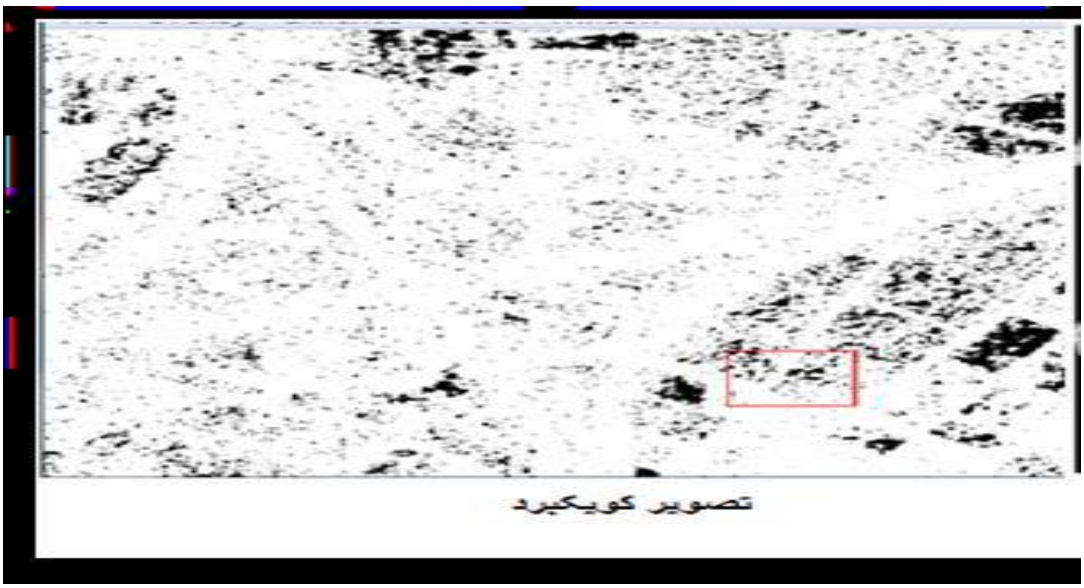


Fig6. *Entropy Filter*

Training Sample

To perform classification operations, a training sample was prepared for all the applications. Sampling is done using the software ENVI 4.8. Six classes were defined for sampling. Maximum likelihood classification is one of the most popular methods among pixel-based methods. After performing texture filtering on panchromatic band and images and doing sampling, classification based on maximum likelihood classification was performed. Figure (7). To verify the accuracy of classification, Confusion Matrix tool was used and the resultsare as follows:

Table1. *Overall accuracy and Kappa coefficient of classified images using maximum likelihood method*

Satellite Imagery	Overall Accuracy		Kappa Coefficient	
	Land Coverage	Greenspace	Land Coverage	Greenspace
QuickBird	0.63	0.71	0.54	0.44

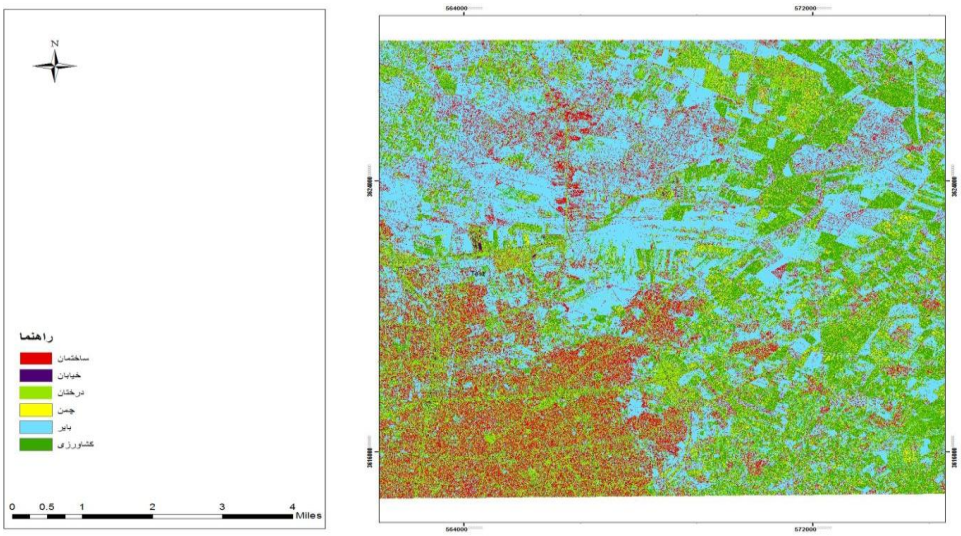
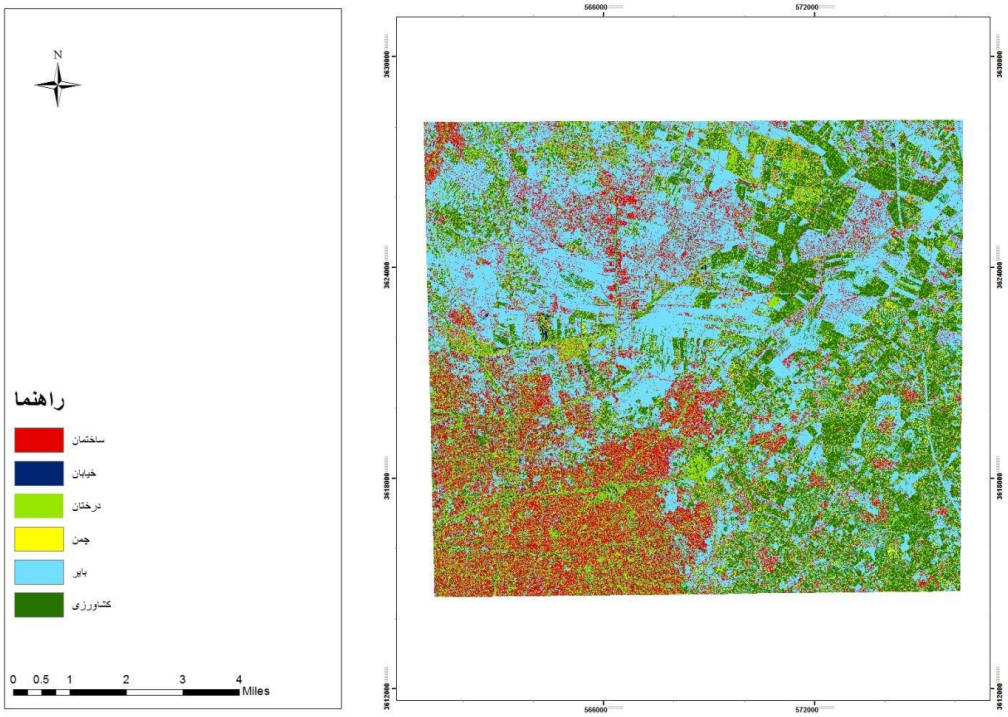


Fig7. *Maximum likelihood classification in QuickBird image of Isfahan*

Median Filter with A Window size of 3*3:

To improve theaccuracy of image classification, amedian filter with awindow size of 3*3 is used. Figure (8). Overall accuracy for land coverage and Kappa coefficient reached 69.62 and 0.61 respectively. In the use of greenspace overall accuracy was increased to 78.0034 and Kappa

coefficient to 0.66. These results show that the median filter has been effective enough and according to figure (9), the classification accuracy is increased to some extent.



Fi8. *Maximum likelihood classification in QuickBird image of Isfahan, with median filter with window size of 3*3*

Median Filter with a Window Size of 5*5

Considering the result of previous step and improvement of land cover classification, median filter with window size of 5*5 was performed on the image, Figure (9), and results are as follows:

The overall accuracy for the land cover of Quick Bird image is 69.62 and for green space is 79.08. The Kappa coefficient also reached 0.61 in land cover and 56 in green space. These results showed that median filter with the window size of 5*5 has a significant effect on the accuracy.

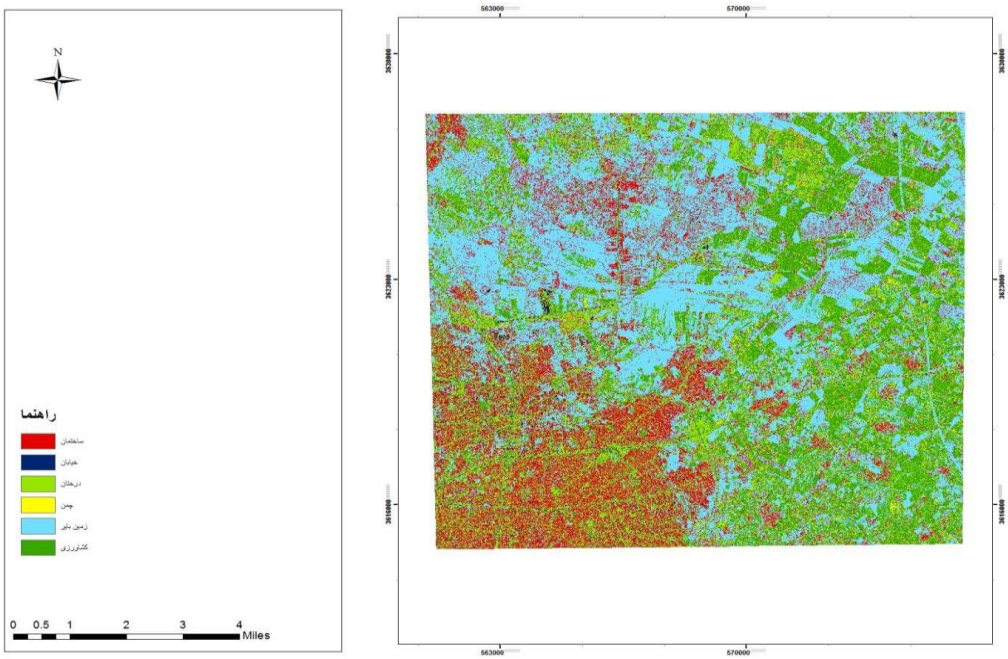


Fig9. *Maximum likelihood classification in QuickBird image of Isfahan by performing median filter with window size of 5*5*

Maximum Likelihood Classification Without Median Filter

To show the effect of median filter, classification is once done without using it in QuickBird image of Isfahan, according to fig (10), the overall accuracy for maximum likelihood classification is 32.5 and for land coverage and Kappa coefficient is 18%. This classification for urban greenspace is 41 and for Kappa coefficient is 0.07%, therefore, results show the considerable effect of median filter on the accuracy of the classification of land cover.

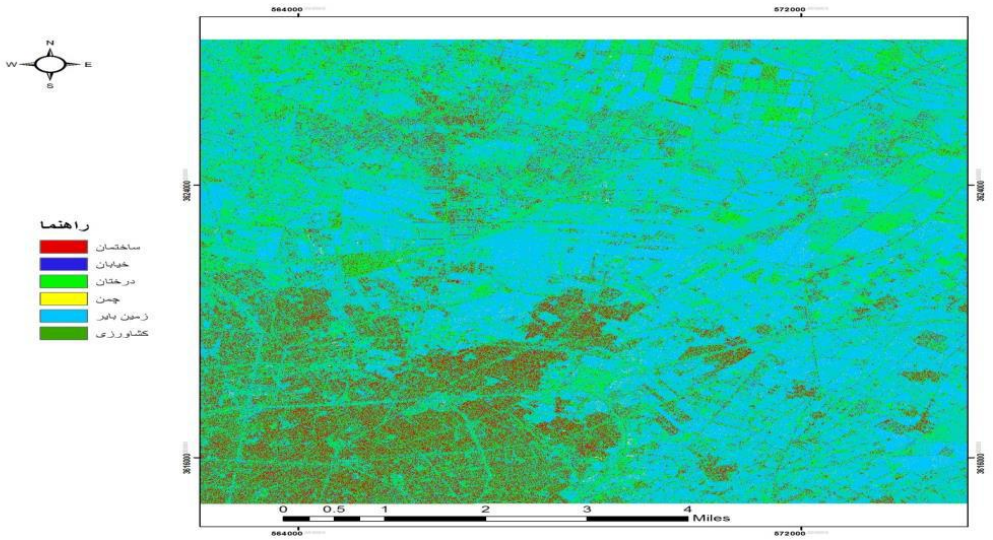


Fig10. *Maximum likelihood classification map without median filter*

3. CONCLUSION

Detailed information on land coverage from urban areas is necessary for many purposes, such as urban land management, urban planning and urban landscape pattern. In order to achieve sustainable development, it is essential to have detailed planning, controlling and managing the changes in the cover function of land, which are a result of natural or artificial phenomena including the manipulation of man. The present study employs Quick Bird panchromatic image band which is more accurate compared to color bands and is often ignored when it comes to categorizing and designing function/land-cover maps. Its accuracy has been compared to the color image and, as it can be seen, the categorizing accuracy in color images equals 86%. In panchromatic band, the accuracy for the six cover/function equals 62.69% and for the three function of greenspace it equals 79%, which is acceptable accuracy considering the application of filters with a window-size of 5*5 for agricultural lawn cover and tree cover.

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