Classification of Objects from High Resolution Remote Sensing Images using eCognition

Nikita Aggarwal¹, Mohit srivastava², Maitreyee Dutta³.

¹ME scholar (ECE), NITTTR, India-160019
²Professor (ECE), Chandigarh Engineering College (Landra), India-140307
³Head of department (ECE), NITTTR, India-160019

Abstract: High resolution satellite images offer rich abundance information of the earth surface including spatial, spectral and contextual information. In order to extract the information from these high resolution images, we need to utilize the spatial and contextual information of an object and its surroundings. If pixel based approaches are applied to extract information from such remotely sensed data, only spectral information is used. Thereby, Pixel based approaches can’t satisfy high resolution satellite image’s classification and the information extraction is based exclusively on the gray level thresholding methods so this produced the large data redundancy. To overcome this situation an object-oriented approach is implemented. This paper demonstrated the concept of object oriented information by using eCognition software, allows the classification of remotely-sensed data based on different object features, such as spatial, spectral, and contextual information. Thus, with the object based approach, information is extracted on the basis of meaningful image objects rather than individual gray values of pixels. The test area has different discrimination, assigned to different classes by this approach: Vegetation, Shadow, Artificial patches, Soil patches, Roads and Buildings. The Multiresolution segmentation and the nearest neighbor (NN) classification approaches are used and overall accuracy is assessed.

Keywords: Segmentation, Classification, High Resolution, Features, eCognition.

I. INTRODUCTION

High Resolution (HR) Remote Sensing images have many applications that is very useful in explaining land use/ land cover (LULC) mapping. Many applications where the need of remote sensing data is required like in detection of meteorology, forestry, agriculture geology and landscape. However, to explore the full value of these data, the useful information has to be extracted and represented in standard format so that to import it into geo-information systems (GIS) [2]. The Pixel-based approaches work on each individual pixel and also extract information from remote sensed data based on spectral information only [4]. The increased variability implicit within high spatial resolution imagery confuses traditional pixel based classifiers resulting in lower accuracies. The problems faced by pixel based approaches are overcome by the Object Based image classification. Object-Based information interprets an image not only by single pixel but also in meaningful image objects and their mutual relationships. Object-based information extraction not only depends upon spectrum character, but also on geometry and structure information. This approach provides the truly revolutionary data and can easily accessible [3]. With the help of object based feature extraction, automatic recognition and segmentation of the common objects like buildings, roads, houses and vegetation from high resolution images have been carried out with a certain degree of success.

In this paper, object based information extraction is realized by classifying the image into six major classes Vegetation, Shadow, Artificial patches, Soil patches, Roads and Buildings. The classification procedure is carried out by the various tools provided by eCognition software. The classification procedure has been implemented using panchromatic and multi band Quickbird image of the interested area. The object oriented information extraction consists of two main steps: Segmentation and the Classification. Segmentation is carried out by several tests to match with the successful segmentation step; after that classification is carried out by setting different parameters to the used software and also classification results depends upon the selection of the best features parameters.

II. DATA DESCRIPTION AND EXTRACTION PROCESSION

The available QUICKBIRD image was acquired in August of 2002. The spatial resolution is high upto 2.4m and in pan band have 0.65m. in this paper we select the subset of 1784x1365 of Chandigarh image 8192x8192 as shown in Figure 1 & 2. And we use eCognition software with object-oriented information extraction method to classify cultures accurately.
We proposed the methodology of the work as in the form of flow chart in figure 3.

The multi-scale segmentation is the base of object oriented classification. We can segment the image to produce polygon objects with any scale by adjusting the scale, shape and compactness parameters. These objects have the similar attribute information. The image segmentation parameter’s setting is based on the basic rules and can debug again & again. Finally in this test, each layer weight is 1 with standard deviation of 1.9, the spectral and shape heterogeneity weights are 0.9 & 0.1 respectively. The smoothness and compactness are set both to 0.5. The scale parameter is 25. The results of segmentation achieve good effects as shown in figure 4. Here, we can see that layer object’s characters include not only pixels values, but also grain, size and shape information. This area mainly includes Vegetation, Shadow, Artificial patches, Soil patches, Roads and Buildings. The layer object hierarchy is based on these six cultures. And it provides the base for classification. Each culture is put difference color. Assign samples to determine which class an object belongs to. Select samples from one (at least one) to several for each culture and create the training areas.

After the segmentation process, we create the class hierarchy to assign the classes as shown in figure 5.

After the creation of classes, we select the samples of individual category as shown in figure 6.
Then let us choose classification method: Nearest neighbor classifier is an automatic generation based on sample objects. It is a supervised classification method with fuzzy rules. It classifies image objects with a given feature space and given sample for the concern classes. Its principle is: after sample objects have been selected for each class, the algorithm searches for the closet sample object in the feature space for each image object. If an image object is the closest sample object belongs to class A, the object will be assigned to class A.

Finally, classify the image objects and display the class results. The classification of objects has been done by selecting the NN features for each class. Perhaps the classification effect is not satisfied. We can reedit the samples and classify again and again until receive the best classifier effect as shown in figure 7.

![Figure 7. Classified Image](image)

**FIGURE 7. CLASSIFIED IMAGE**

### III. VERIFICATION OF RESULTS

The eCognition software provides membership function of every class. The mean of each class reaches 0.55. All of maximum is one. The standard deviation is less than 0.16 as shown in table 1.

#### TABLE 1. ACCURACY ASSESSMENT

<table>
<thead>
<tr>
<th>Class</th>
<th>Objects</th>
<th>Mean</th>
<th>StdDev</th>
<th>Minimum</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>shadow</td>
<td>391</td>
<td>0.572368</td>
<td>0.158</td>
<td>0.108484</td>
<td>1</td>
</tr>
<tr>
<td>vegetation</td>
<td>593</td>
<td>0.957</td>
<td>0.012</td>
<td>0.115403</td>
<td>1</td>
</tr>
<tr>
<td>roads</td>
<td>122</td>
<td>0.546376</td>
<td>0.010700</td>
<td>0.132369</td>
<td>1</td>
</tr>
<tr>
<td>buildings</td>
<td>200</td>
<td>0.588</td>
<td>0.161189</td>
<td>0.107258</td>
<td>1</td>
</tr>
<tr>
<td>artificial</td>
<td>156</td>
<td>0.321367</td>
<td>0.101521</td>
<td>0.101494</td>
<td>1</td>
</tr>
<tr>
<td>soil patches</td>
<td>417</td>
<td>0.951742</td>
<td>0.0174</td>
<td>0.110952</td>
<td>1</td>
</tr>
<tr>
<td>barren land</td>
<td>26</td>
<td>0.637723</td>
<td>0.214</td>
<td>0.2506734</td>
<td>1</td>
</tr>
</tbody>
</table>

### IV. CONCLUSION

From the experiment, it can be seen that the classification accuracy has been improved greatly by the newly arisen object-oriented approach. Besides, the whole procedure proves efficient and feasible because of the following reasons: Firstly, Use of object’s multi-feature including spectrum, shape, texture, shadow, context, spatial location. Secondly, the object oriented approach of information extraction guarantee the classification accuracy by making full use of high resolution images information. Thirdly, with manually adjustment of different parameters, multiscale makes image object resolution adaptive for specific requirements, data and tasks. High resolution satellite images are widely used in various commercial and civil areas in recent years like meteorology, forestry, agriculture geology and landscape. In conclusion, it is proven that the object-oriented information extraction approach will be the trend for the high resolution remotely sensed data. The object based approach provided by eCognition software is a big step forward in interpretations of remote sensing images.

**REFERENCES**


