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Color Based Urban and Agricultural Land Classification by GLCM Texture Features

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Abstract: *This paper presents colour based classification of Urban and Agricultural Land using GLCM Texture Features in Satellite images. Now a day due to the progresses in spatial resolution of satellite imagery, the methods of Classification based image analysis for generating and updating geographical information are becoming more important. In this work, First cluster is formed using La*b* colour space and classified, then Glcm Texture features (Homogeneity, Contrast, Angular Second Moment (ASM), Energy, Entropy) applied and statistical value calculated . Experiments are conducted on a satellite images.*

1. Introduction

The satellite image processing is becoming increasingly available for vegetation mapping and to decision makers for future growth and development. The multi-date satellite spectral data is examined for crop yield modelling crops. Colour image segmentation is useful in many applications. From the segmentation results, it is possible to identify regions of interest and objects in the scene, which is very beneficial to the subsequent image analysis or annotation. The problem of segmentation is difficult because of image texture. If an image contains only homogeneous colour regions, clustering methods in colour space are sufficient to handle the problem. To identify image regions containing colour-texture patterns are difficult, to resolve this some approaches are followed. They are each region in the image contains a uniformly distributed Colour-texture pattern.

The colour information in each image region can be represented by a few quantized colours, which is true for most colour images of natural scenes. The colours between two neighbouring regions are distinguishable a basic assumption of any colour image segmentation algorithm[1]. Colour of an image can carry much more information than Gray level. There probably is no "one true" segmentation acceptable to all different people and under different psychophysical conditions. Researchers have extensively worked over this fundamental problem and proposed various methods for image segmentation. Some of the methods are clustering, Region growing, region splitting and merging, and Edge-Based approaches[2].

Unsupervised classification algorithms, also known as clustering, can be used, if no training data exists. These kinds of classifiers were used before class information was available and before the manual selection of prototypes has taken place. These algorithms aggregate similar objects to clusters according to the feature information. Clustering was used here to group plants with similar shapes. Classes can be set for these automatically derived clusters and prototypes can be selected. The advantage of the approach is that classes with similar features can be identified. The training for classes which are difficult to separate can be optimized this way [3].

Clustering is useful in several exploratory pattern-analysis, grouping, decision-making, and machine-learning situations, including data mining, document retrieval, image segmentation, and pattern classification. In image segmentation coding techniques, image is segmented to different regions separated with contours, and coded with different coding techniques.

Clustering approach can integrate any number of training images of an object into a single model. Training images from similar viewpoints are clustered into single model views [4].Clustering problems arise in many different applications, such as data mining and knowledge discovery, data compression and vector quantization and pattern recognition and pattern classification. Among clustering formulations that are based on minimizing a formal objective function, perhaps the most widely used and studied is k-means clustering. Clustering based on k-means is closely related to a number of other clustering

and location problems. One of the most popular heuristics for solving the k-means problem is based on a simple iterative scheme for finding a locally minimal solution. This algorithm is often called the k-means algorithm [5]. The proposed scheme is to classify the land into agricultural and urban area by clusters were formed with k-means clustering algorithm. Then Glcm texture features were used to calculate statistical values of the classified clusters.

2. Colour Based Segmentation

2.1 Euclidean Distance Metric

Learning distance metrics is very important for various vision applications such as object classification, image retrieval. This task is much easier when the target values associated to the data samples are available. In metric learning can bridge the semantic gaps between the low-level image feature representations and high level semantic concepts in many visual applications, which enables us to select our preferred characteristics for distinction. In most of these cases, typical distance functions employed in vision community such as Euclidean distance or Gaussian kernels do not give satisfactory results. learning distance metrics from side information has been actively studied in machine learning[6]. Euclidean distance is widely used in clustering problems.

2.2 Clustering

Clustering is one of methods widely applied in image segmentation and statistic. The main concept of data clustering is to use the centroid to represent each cluster and base on the similarity with the centroid of cluster to classify. According to the characteristics of clustering algorithm, we can roughly divide into "hierarchical" and "partitional" clustering.

The concept of hierarchical clustering is to construct a dendrogram representing the nested grouping of patterns (for image, known as pixels) and the similarity levels at which groupings change. The hierarchical clustering can be divided into two kinds of algorithm: the hierarchical agglomerative algorithm and the hierarchical divisive algorithm. The partitional clustering algorithm obtains a single partition of the data. It is useful to implement in large data sets, but for hierarchical clustering, the construction of dendrogram needs lots of computation time. The problem of partitional clustering is that we have to select the number of desired output clusters before we start to classify data [7]. Clustering is a process for classifying objects or patterns in such a way that samples of the same group are more similar to one another than samples belonging to different groups. Many clustering strategies have been used, such as the hard clustering scheme and the fuzzy clustering scheme, each of which has its own special characteristics [8]. Although hierarchical methods can be more accurate, partitional methods are used in applications involving large data sets, like the ones related with images, due to the fact the construction of a dendrogram is computationally prohibitive. a partitional clustering algorithm usually produces clusters by optimizing a criterion function, the combinatorial search over the set of possible results would solve the inherent problems that it presents. Clustering algorithms assume that pixels belonging to the same cluster have a similar behaviour, which is explained by uniform features like grey levels, texture or colour[9]. The clustering process is performed by using a classical algorithm, such as K-means, but including one important restriction: pixels with a high gradient are not classified.

2.3 Colour Based Segmentation

Colour image segmentation attracts more and more attention because colour images can provide more information than gray level images. A colour image is a combination of some basic colours. In MATLAB breaks each individual pixel of a colour image (termed 'true colour') down into Red, Green and Blue values[12]. Histogram thresholding is one of the widely used techniques for image segmentation but for colour images, the situation is different due to the multi features. Since the colour information is represented by tristimulus and/or some linear/nonlinear transformation of RGB, representing the histogram of a colour image in a three dimensional array and selecting threshold in the histogram is not a trivial job [2].

2.4 Texture Features

Haralick et al. (1973) defined 14 texture features that were derived from the GLCM. Among them 5 will be Angular Second Moment (ASM), Contrast, Homogeneity, Energy and Entropy are considered to be the most relevant for remote sensing imagery analysis. Their information content depends on the type of image analysed with regards to the spectral domain, the spatial resolution and the characteristics of the sensed objects (dimension, shape and spatial distribution). The Homogeneity and contrast features were applied to the images for land cover classification. The extraction process of texture feature is performed by computing the Gray Level Co-Occurrence Matrix (GLCM).

3. Texture Based Classification

Many of the land classification methods were implemented based on color alone and texture alone. In the proposed technique, the K-Means algorithm was applied to the satellite image which covers agricultural land, urban

area and not vegetated area to form Clusters. According to the nearest neighbor pixel values Cluster index have created the cluster1, cluster2, cluster3 images had created. In cluter1 all three areas were grouped. In cluster2 urban area was grouped. In cluster3 vegetated area was gropued. Texture Features such as Homogeneity, contrast, Angular Second Moment (ASM), Energy, Entropy were applied to the clusters to produce Feature value of the cluster images. Land cover map was assessed by evaluating the classification of cluster feature values.

4. Experiment Results

In this paper, various satellite images have taken to classify vegetation plants. These images are taken from GeoEye which are of parts of India(south region). It implemented on Matlab7.12.0 (The Mathworks Inc.). In First experiment Figure a was the original image of the satellite image. Figure b was the cluster index of the vegetated and urban area. Figure c was the vegetated area. Figure d was the urban area. Figure e was the cluster values of urban and vegetated area. From Table1, Homogeneity value observed as high for cluster2 images which classify the urban area. From Table 2, Contrast value observed as high for cluster 3 images which classify agricultural area.

Table 1: Glcm values for each cluster images (H: Homogeneity, A : ASM, E: Energy)

	H	A	E
Cluster1	0.4557	0.0664	0.2577
Cluster2	0.9267	0.8168	0.9038
Cluster3	0.3951	0.0493	0.2220

Table 2 : Glcm values for each cluster images (C: Contrast, E: Entropy)

	C	E
Cluster1	72.7769	5.5323 + 0.0006i
Cluster2	27.9402	1.3457 + 0.2574i
Cluster3	101.0028	5.8674 + 0.0014i

In the second Experiment Figure e was the original image of the satellite image. Figure f was the cluster index of the vegetated and urban area. Figure g was the vegetated area. Figure h was the urban area. Figure i was the cluster values of urban and vegetated area. From Table3, Homogeneity value observed as high for cluster3 images which classify not vegetated area. From Table 4, Contrast value observed as high for cluster 2 images which classify the urban area.

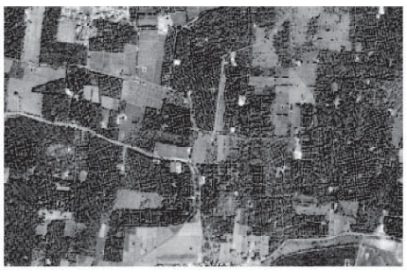


Fig. a Original Image

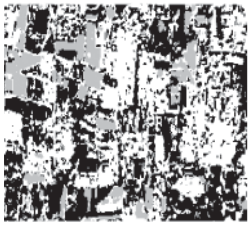








Fig. d. Cluster 2 Objects

Fig. e. Cluster 3 objects



Fig. e Original Image

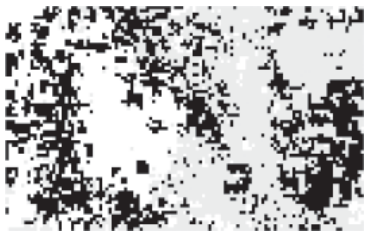


Fig. f Cluster Index

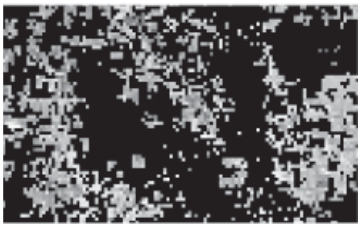


Fig. g Cluster 1 Object

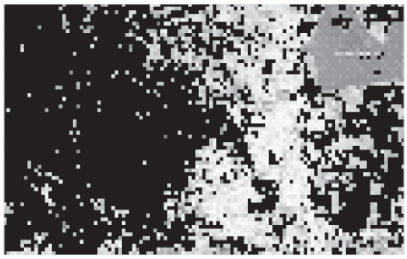


Fig. h Cluster 2 Object

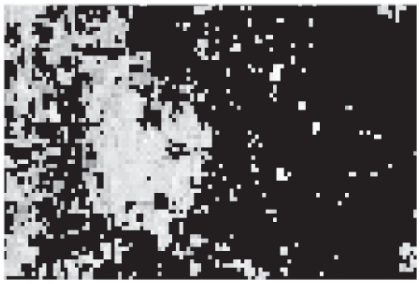


Fig. i Cluster 3 object

Table 3: Glcm values for each cluster images (H: Homogeneity, A : ASM, E: Energy)			
	H	A	E
Cluster1	0.6807	0.3513	0.5927
Cluster2	0.6648	0.2946	0.5427
Cluster3	0.7749	0.4981	0.7057

Table 4: Glcm values for each cluster images (C: Contrast, E: Entropy)		
	C	E
Cluster1	39.3909	4.0715 + 0.3143i
Cluster2	46.9056	4.4803 + 0.2919i
Cluster3	37.7599	3.3152 + 0.3920i

5. Conclusion

Colour based image Classification by Glcm Texture Features calculation was applied for every pixel in the image. Although this approach provides good result when classifying the image but still we found that there is a scope of improvement in it. In future more texture property may be taken to classify and segment the land perfectly.

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