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RESEARCH ARTICLE

RULE BASED APPROACH FOR LAND COVER CLASSIFICATION- A PART OF DEHRADUN DISTRICT

[1]Bhuvaneswaran, C., [*, 2] Ganesh, A., [1]Muruganandam, R. and [3]Muthukrishnan, A.

[1]Department of Geography, Bharathidasan University, Tiruchirappalli - 24,
[2]School of Geosciences, Department of Geography, Bharathidasan University, Tiruchirappalli
[3]Department of Civil Engineering, Ponnaiyah Ramajayam College of Engineering Technology, Anna University, Vallam, Thanjavur, Tamil Nadu

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ABSTRACT

An attempt has been carried out to develop rule-based classification through a raster GIS to improve the accuracy of land cover classification derived from ETM Data To produce rule based land cover classification for the study area (a part of Dehradun district).Rules to be produced for each land cover class in different bands namely green, red, near infrared, mid infrared 1, mid infrared 2, NDVI and PCA and to compare the rule based approach for each class in each band rule based approach for each class in each band.

INTRODUCTION

Rule based classification

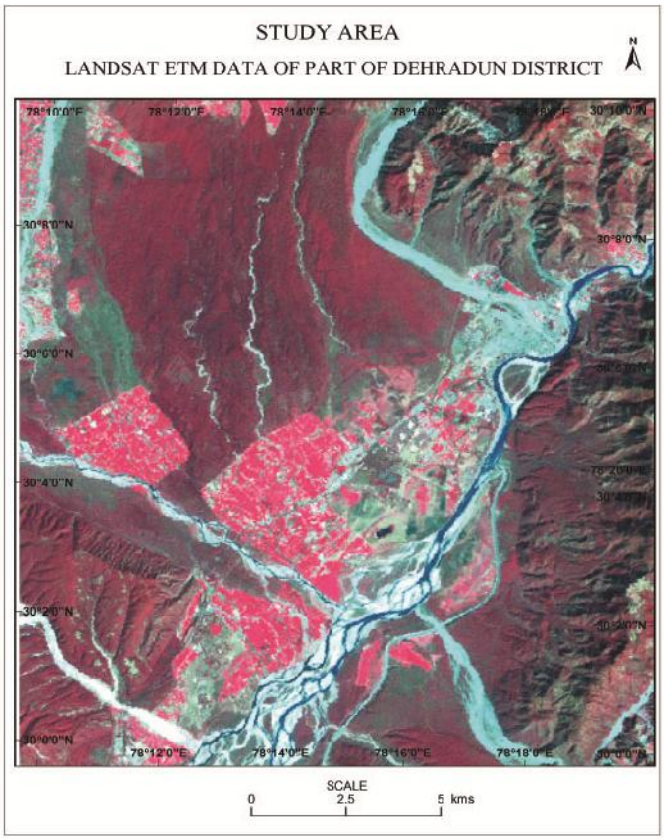
Use extensive and specific knowledge about some narrow interpretation problem area to create very specialized classification. Remotely sensed images are major sources of data and information that are used in various fields such as environmental studies, forest management, and urban change detection. One of the products of the images is a thematic map. So far many efforts have been performed to extract information from remotely sensed images and various methods have been developed in this field. One of the main approaches is quantitative analysis (digital interpretation). Among digital techniques, classification is a common and powerful information extraction method, which is used in remote sensing. There are many classification methods that have their own advantages and drawbacks. Between classification methods, maximum likelihood approach has been used more frequently. Standard classification methods usually concern pixels as main elements and try to label the pixels individually. But, their results are not perfect and always are erroneous, since many steps are introducing errors in the classification process. Initial data (pixels) have influenced by some errors. The purpose of this work is to show how some knowledge such as prior information about the expected distribution of classes in a final classification map can be used to improve classification accuracies. Rule-based image classification capitalizes on the availability of multiple spatial modeling datasets, and the recognition that other "ancillary" datasets, independent of the remotely sensed imagery provide valuable information that can be used to more effectively map land cover. The premise of a rule-based modeling approach is that distinct vegetation communities/land cover are associated with different ranges of environmental and spectral gradients, and that "rules" can be drawn from spectral and ancillary modeling layers to correctly identify the spatial distribution .A *rule* is a series of conditional statements that identify the range of values in each modeling dataset that define the target vegetation community. Rule-based mapping is conducted at the pixel level Decision trees have been used to generate modeling rules in several remote sensing-based mapping projects (Larwrence & Wright 2001, Hansen et al. 2000, Friedl & Brodley 1997, Hansen, Bubayah & Defries 1996). Decision trees, also known as CART (Classification and Regression Trees) are exploratory tools that can be used to identify complex interactions amongst numerous variables (Venables and Ripley, 1999).

Corresponding author: Ganesh, A.
School of Geosciences, Department of Geography, Bharathidasan University, Tiruchirappalli

Study area

The location of the study area (fig 2.1,2.2) lies between 30° 0’ 0’’ N and 30° 10’ 0’’ N and 78° 10’ 0’’ E and 78° 20’ 0’’ N. The study area covers a part of Dehradun district with Dense mixed forest mainly Sal which occupies most of the

mountainous area. Dehradun is one of the most important towns of the state of Uttar Pradesh, located at an altitude of 700 mt , serves as the gateway of Musoorie. The town lies in the dun valley , on the water shed of the Ganga and Yamuna rivers. Dehradun is the district head quarter of Dehradun district and also tehsli head quarters of tehsil Dehradun.



Physiography

The physoigraphy of the area is marked by undulations and has strictly governed the physical development. Physiographically, the area is an elongated longitudinal valley extending in north west-south direction more or less parallel to the strike of the Himalayan and guarded by hills of the lesser Himalayas in the north and gentle siwalik in the south.

Climatic environment

The climate of the area is sub-tropical monsoon type and shows appreciable spatial variation which is caused by the orography. The meteorological conditions of the various seasons are highly contrasting. The average annual precipitation is 2162 mm (94 years average), Of which 1892 mm occurs during the months of June to September. The maximum precipitation takes place in the months of July to September. Maximum temperature fluctuating between 30 degree and 40 degree Celsius. May and June are the hottest months while December and January records the lowest 20 degree to 40 degree Celsius.

Floral environment

Fairly heavy rainfall more than 2000 mm , favorable soil type and rock types are responsible for having luxuriant vegetation growth in the study area. Most common species seen in the forest is sal Mixed forest species are sal , bamboo, pine sisham, deodar and khair, which covers pretertiary hills. Thick sal covers mostly seen over old doon gravels and to some extent over doon fan gravels, Khair and sisso are spread over younger terraces, flood plain and especially along stream courses. Agriculture crops are practised over most of the flat terraces, elevated terraces and lower piedmont zone. Leachi , magos are the orchards , which can seen common in the area anywhere. Tea gardens are also common in this area.

Geological environment

The Doon valley forms a depression by sub Himalayan and a part of the foot hills of lesser Himalayas. It is an asymmetrical synclinal valley filled by sediments brought down by the streams from pre-tertiary and Siwalik formation. It comprise of pre-teritary and quarter nary sediments.

Geomorphological environment

Structurally, it is well known that the Dehradun city is situated in Doon valley. It is one of the larger valleys, which extends between the Ganga in the east and Yamuna in the west as it is farming a longitudinal intermontane valley .These are the major geomorphic features of this area.

MATERIALS AND METHODS

In order to fulfill the above objectives the following are performed: for land cover study, the image of the study area is the important data of which the Image acquisition involves the conversion of a scene in to digital representation that can be processed by computer. The appropriate selection of image acquisition dates is as crucial for the interpretation purpose. The problem has two dimensions, season of acquisition and temporal resolution of the data involved. As tree leaves reflect differently at the beginning and the end of the growing season due to phonological and temperature disparities their reflectance varies from season to season.

For the present study the satellite data of may 2004 (Land sat ETM) is used. The data from computer compatible tapes (CCT) of Land sat ETM were down loaded in to hard disc and sub scene of the study area was extracted using the ERDAS IMAGINE software. Image to map rectification has been done to correct distorted image data to create a more faithful representation of original scene. It typically involves the initial processing of raw image data to correct for geometric correction. The process involves relating to GCP Coordinate (row and column) with their map coordinates. This is the most precise geometric correction since each pixel can be represented not only by its row and column in a matrix after rectification is completed but it is also vigorously corrected in degree or meters in a standard map projection.

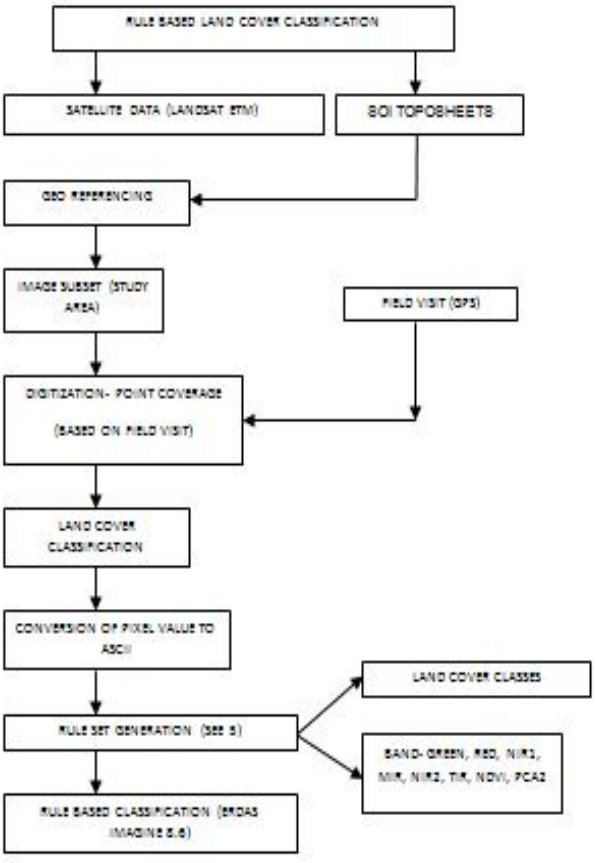
RESULTS AND DISCUSSION

Numerous studies demonstrated that simply classification algorithms like Maximum Likelihood or Threshold methods are very efficient for the classification of land-cover, both in the plane and in the hilly terrain. The classification results can be significantly improved through the inclusion of additional

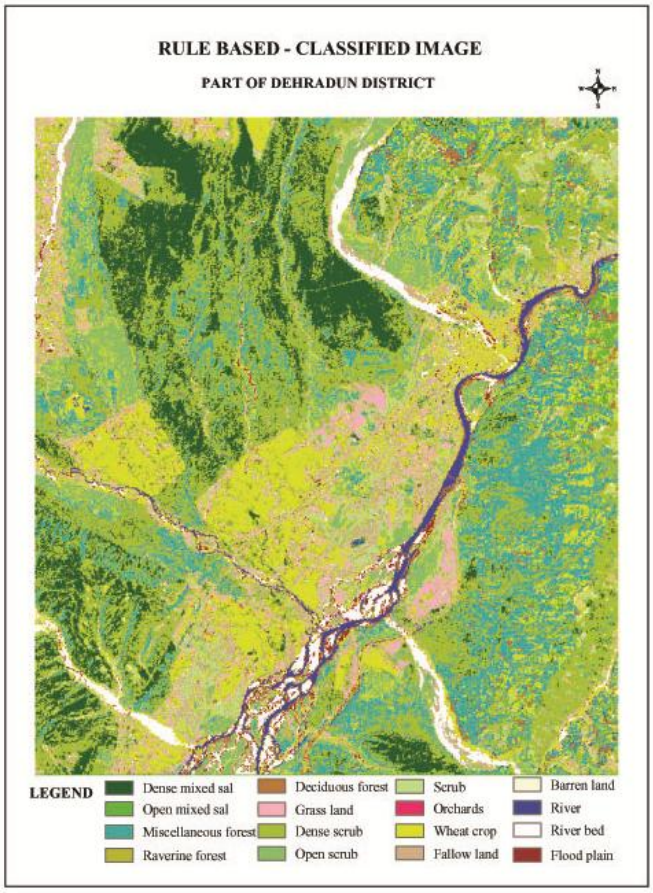
Table 1: Rule set results for land cover classifications

CLASS	G:R:NIR	G:R:NIR: MIR	G:R:NIR:MIR :TIR	G:R:NIR:MIR:T IR:NIR[1]	G:R:NIR:MIR:T IR:NIR[1]:NDVI	G:R:NIR:MIR:TIR: NIR[1]:NDVI:PC2
DENSE MIXED SAL	0.328	0.571	0.857	0.643	0.882	**0.882**
OPEN MIXED SAL	0.909	0.955	0.955	0.955	0.955	**0.889**
MISCELLANEOUS FOREST	0.800	0.938	0.938	0.938	0.905	**0.900**
RAVERINE FOREST	0.750	0.600	0.750	0.750	0.500	**0.750**
DECIDIOUS FOREST	0.833	0.800	0.833	0.750	0.875	**0.875**
GRASS LAND	0.750	0.778	0.950	0.955	0.941	**0.955**
DENSE SCRUB	0.800	0.818	0.600	0.750	0.833	**0.200**
OPEN SCRUB	0.206	0.338	0.929	0.893	0.722	**0.927**
SCRUB	0.750	0.231	0.800	0.933	0.927	**0.955**
ORCHARDS	0.500	0.800	-0.667	0.667	0.750	**0.833**
WHEAT CROP	0.923	0.8770	0.224	0.891	0.944	**0.971**
FALLOW LAND	0.733	0.800	0.889	0.750	0.917	**0.900**
BARREN LAND	0.636	0.647	0.800	0.647	0.818	**0.875**
RIVER	0.778	0.929	0.927	0.929	0.933	**0.933**
RIVER BED	0.667	0.800	0.882	0.882	0.882	**0.938**
FLOOD PLAIN	0.880	0.909	0.857	0.857	0.857	**0.909**

information. This is mainly due to the fact that the occurrence of certain land-cover Categories in the Dehradun environment is strongly dependent on the existence of favorable conditions. Here, in particular the altitude-dependence of the vegetation plays an important role in the study area. Thus, in Order to make optimum use of the satellite image data, a hierarchical, rule-based classification is carried out, the rule set results are shown below in Table 1. The classifications of the study area are as follows: Dense mixed forest mainly Sal, Open mixed forest mainly Sal, Miscellaneous forest, Raverine forest, Deciduous forests, Grass land, Dense scrub, Open scrub, Scrub, Orchards, Wheat crop, Fallow land, Barren land, River, River bed, Flood plain.



A frame work for rule based land cover classification using ERDAS.



NB: G – Green (0.525-0.605); R – Red (0.63-0.690); NIR – Near infrared (0.75-0.90); MIR-Mid infrared (1.55-1.75); NIR1 infrared (2.09-2.35) TIR-Thermal infrared (10.40-12.5); NDVI- Normalized Difference Vegetation Index ,PC- Principle component.

Rule based classifications are dependent for their accuracy on the quality of the training data as much as used for classification. For useful results to be obtained, the training data set must be representative of the whole area to be classified. The population of pixels used for training must be statistically significant. This means that there is a need to know the minimum number of observations required to characterize a particular site to an acceptable level of error. Land cover classification, training data are developed using ground truth combined with aerial and satellite interpretation to identify representative land cover types. In this work training data were acquired using ERDAS IMAGINE 8.6. This has been used to

develop rules for classification of the land cover of the study area. (Fig.1).

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