
Band Analysis for Land Use in Multi Spectral Images

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ABSTRACT

Hyper spectral and multi spectral image analysis is the commonly used technique for land use and land cover classification. Effective use of the land cover can play a vital role in the development of country. Multi spectral satellites use passive sensor, hence the only source of energy involved in the acquisition of satellite imagery is the reflection of the sun. In order to investigate the role of individual bands of the Visible and near-infrared region in the recognition of land covers such as vegetation, non-vegetation, settlements and barren land an extensive research has been carried out.

This paper is focused in the dissection and contribution of individual component (band) of SPOT-5 imagery for land cover analysis as well. In this article extensive experimentation has been carried out which reveals the effect of individual and combine bands in the recognition of land cover. Classification of various bands were done using supervised machine learning classification, random forest classifier has been used for classification purpose.

Keywords

Land cover classification, SPOT-5, multi-spectral imagery, random forest, NIR, SWIR.

1. INTRODUCTION

In remote sensing analysis, the primary source of obtaining the imagery is satellite. The sensors in the satellite are responsible for the conversion of sunlight energy into pixels. Based on the sensor features sensors are either multi spectral or hyper spectral. Multi spectral sensors has multiple bands while hyper spectral has more than hundred bands and are thus hyper spectral sensors are more powerful from multidimensional with the capability of storing more information regarding the geography of a surface. To make use of the satellite image commonly machine learning techniques are used. Common approaches followed are pixel and object based classification of the imagery. In object based classification approach the given image is divided into small object called patches, based on patches training set is created for classifier learning while in pixel based approach the underlying pixels of the image is considered as feature, these features are processed for the detection of area of interest. Various methods has been adopted for the classification of land covers, in literature the state of art classifier used for land cover analysis, change detection and land use analysis are SVM, ANN, MLE and Random forest. Maximum likelihood classifier is from the parametric set of classifiers which use the prior information about the event. Based on these prior probabilities the probability of an event for all the classes are calculated and the most probable class for the event is the one having the maximum probability. The performance of maximum likelihood compared with the distance based classifier such as Minimum distance and Mahalanobis distance, which showed that maximum likelihood has the high recognition compared to the other classifiers, the comparison was carried out on raw LandSAT thematic Mapper imagery having resolution of 30m [1]. For pixel based classification such as change analysis, land cover classification is mostly used [2-9]. The strengths of MLE has also been investigated in the use of thematic data [2]. MLE uses the probability distribution based on which the incoming pixel is classified and hence this technique fails to discriminate between pixels having the same spectral signature compared to non-parametric classifier such as ANN [7]. A neural network consists of input, output and hidden layer. The input layer of the neural network consist of raw data which is presented in the form of vectors, the hidden layer contains the kernels or activation function which maps the input to the output layer. The strength of ANN has influenced the process of classification of both hyper spectral and multi-spectral satellite imagery compared to other parametric approaches [8-12]. Besides ANN and MLE SVM is also used for land cover classification. On low resolution satellite imagery SVM has outperformed MLE and ANN [13]. SVM creates an optimal decision boundary for the classes, originally the SVM were used for binary classification. Today SVM has various nonlinear kernels such as Basis function (RBF), Polynomial and sigmoid [14]. For pixel based classifications of satellite imagery parametric and non-parametric classifier has been used [15]. Based SVM and ANN. Random forest is also used for land cover analysis in the recent studies [18]. A random forest is a tree based classifier or more specifically random forest is an ensemble classifier which combines more than one tree using bootstrapping and bagging approaches to make a random forest. More detail about random forest can be found in [17]. The comparisons between parametric, random forest and non-parametric: MLE shows that random forest has the high accuracy on high resolution imagery [18]. The random forest based approach has also been applied to the high resolution Landsat imagery and has shown better results [19]. For agricultural change detection the use of Normalized Difference Vegetation Index (NDVI) has been advocated. NDVI uses vegetation indices which are helpful in determining the change in the agriculture. In [14], the authors have demonstrated the role of vegetation indexes to locate the land use and land cover changes over a period of time.

In this paper, we have illustrated the role of individual band of the multi-spectral satellite imagery on land use classification detection and classification. The experimentation setup was carried out on SPOT-5 satellite imagery which consist of four bands namely Green, Red, Near infra-red and Short Wave Infra-red. The high resolution dataset were classifier using 10
INTRODUCTION

Most social media applications offer photo-uploading services to users. The users can tag their photos public or private. It has been observed that most of the photos related to points of interest are kept public and hence could easily be accessed through the Application Programmer Interfaces (APIs). These photos can be analyzed to extract useful information. This paper presents a framework for extracting the POI connectivity through mining these publicly available social media photos. Such a framework could be utilized in various ways for tourism improvement such as (i) building an intelligent recommender system for tourists by combining the proposed work with some Artificial Intelligence planning techniques (Sirin, et al. 2004; Saleem, et al. 2013) and (ii) helping the tourism management authorities to predict the tourism statistics of the nearby POI once they have collected statistics of a particular POI. This information can be utilized in efficient resource management for sustainable tourism.

The rest of the paper is organized as follows: Section 2 states the related work from literature; Section 3 gives an overview of Flickr (an image tagging website) APIs; Section 4 explains the structure of the database for storing different parameters of the photos. Section 5 details the connectivity measurement algorithm; Section 6 presents a case study and Section 7 concludes the paper with future directions.

RELATED WORK

Towards an Efficient Urdu Keyboard Layout

ON THE PERFORMANCE OF SUPERVISED CLASSIFIERS FOR CROP IDENTIFICATION AND ESTIMATION USING MULTI-SPECTRAL IMAGERY

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ABSTRACT

The objective of this research is to investigate crop estimation using SPOT-5 satellite imagery. We specifically considered tobacco as our pilot crop and compared the obtained results with manually delineated calculations. For this research, SPOT-5 imagery of 2.5m spatial resolution, was provided by Space and Upper Atmosphere Research Commission (SUPARCO), space agency of Pakistan. After preprocessing, which is a preparatory step in analyzing and classifying satellite imagery to improve classification results and reduce the efforts and processing time, different supervised classifiers namely Maximum Likelihood approach, Neural Network and Minimum Distance Classifier have been used to classify the imagery. Training data for classifiers has been collected through multiple field surveys using GPS receivers. The results obtained clearly show that the performance of maximum likelihood classifier is better than the other considered counterparts. Also it is indicated that the newly developed system offer an efficient, reliable and faster approach for estimation of tobacco crop.

KEY WORDS: Crop Estimation, SPOT-5 imagery, Maximum Likelihood classifier, Neural Network, Region of Interest (ROI), Minimum Distance Classifier

INTRODUCTION

Pakistan is the 7th largest tobacco growing country in the world. Pakistan Tobacco Board (PTB), a government organization is regulating tobacco crop growing in Pakistan. The PTB play an important role to measure and estimate the total yield of tobacco. This yield measurement and estimation of tobacco crop is very important for government agencies and tobacco regulatory authorities to strictly monitor the tobacco production and to keep its production within allowed limits. Furthermore it also helps in tracking proper tax collection on the basis of tobacco crop yield.

Conventional strategies based on manual measurements are currently used within Pakistan to estimate the overall tobacco yield which is not only time consuming but also prone to human errors. Furthermore, controlled monitoring of tobacco crop within remote villages of Pakistan is only possible through remote sensing because uncooperative attitude of the rural community to limit tobacco production and to deposit Tax returns on Tobacco yield is a major limitation in precise yield data collection using manual measurements.

In this paper, we investigate the application of remote sensing for crop identification and estimation using different approaches such as Maximum Likelihood classification, Neural Network and Minimum Distance Classifier.

Since the development of remote sensing systems, its use is highly considered by both the research and development community for agricultural purposes. Data derived from these systems has been used for crop mapping, crop type identification and crop area estimation. Crop productivity i.e. its type and spatial area coverage is the most important factor for accurate crop yield estimation.

General classification and image processing techniques are used for mapping and identification of crop areas from multi-temporal satellite imagery. Different segmentation algorithms are applied on the imagery for object based classification. Several classification techniques such as maximum likelihood approach, Support Vector Machine (SVM), minimum distance and nearest neighbor classifiers etc. are used for identifying different objects.

Satellite imagery has been used for different purposes in agriculture. The urban vegetation has been calculated using different satellite images. The objective of the research was to investigate and calculate the natural resources and vegetation in settled areas using different satellite images. Johnson et al13, used Spot-5 imagery to map banana plantation using object-oriented approach. Harris used Landsat imagery for identifying agricultural

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