ISSN:0975-9646

Parameter Optimization using Genetic Algorithm for Classification of Multispectral Satellite Images

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Abstract: The use of multisource remote sensing data for improved land cover classification has attracted the attention of many researchers. On the other hand, such an approach increases the data volume with more exceed information and increased levels of uncertainty within datasets, which may actually reduce the classification accuracy. It is therefore an essential, though challenging task to select appropriate features and combine datasets for classification. Multispectral satellite imagery is an economical, precise and appropriate method of obtaining information since they provide data at regular intervals on land use and land cover and is economical when compared to the other traditional methods of ground survey and aerial photography. Classification of multispectral remotely sensed data and investigated with a special focus on uncertainty analysis in the produced land cover maps.

***Keywords*: Multi-spectral satellite imagery, Classification, Parameter Optimization.**

I. INTRODUCTION

Remote sensing generally refers to the user of satellite or aircraft based sensor technologies to detect and classify object on Earth, including on the surface and in the atmosphere and oceans, based on propagated signals. Remote sensing involves gathering information about the earth's surface remotely, and generally encompasses acquiring this data from aircraft or satellites. Remote sensing is very much an multidisciplinary area of scientific investigation, and relies in large part on knowledge of physics, mathematics, Computer science and geography.

Multispectral image delivers a large source of data for studying spatial and temporal changeability of the environmental factors. It can be utilized in a number of applications which consists of reconnaissance, making of mapping products for military and civil use, evaluation of environmental damage, nursing of land use, radiation level check, urban planning, growth directive, soil test and crop outcome increment. In one major area we use multispectral image for process of classification and mapping of vegetation over large spatial scales, as the remote sensing data gives away very good coverage, mapping and classification of land cover features like vegetation, water and forests. This behaves like a replacement for the normal classification techniques, which necessitates expensive and time-intensive field surveys.

Multispectral images consist of information collected over a wide range of changes on frequencies and these frequencies change over different areas which is irregular or frequency variant behavior of the signal. The overall complex nature of multispectral image data can be attributed to the spectral characteristics with correlated bands and spatial features within the same band which is also known as the spatial correlation. An efficient method capable of arranging the spectral and spatial (contextual) information existing in the multispectral data can enhance the accuracy level of the classification in a good way when matched with the traditional non-contextual information based techniques. The classification is used as a main and major product or as one of many computational methods used for deriving info from an image for further learning.

The main focus is classifying the multispectral image into multiple regions rather than just land use and land cover. We will be able to distinguish between land features in a better way and can be more useful. Support vector machine (SVM) originally presented by Vipnik (1995) has been proved as a promising pattern classification approach, and has recently been effectively used in the field of remote sensing. Support Vector Machine uses a kernel function map the low-dimensional input features into a high-dimension such as linear kernels, polynomial kernels and radial basis function kernels (RBF). However, this method usually time consuming and does not perform well, we present a Genetic Algorithm based parameter optimization method for SVM. A genetic algorithm (GA) is a search heuristic that mimics the process of natural evolution. This heuristic is usually used to generate useful solutions to optimization and search problems. Genetic algorithms belong to the larger class of evolutionary algorithms (EA), which gives us solutions to optimization problems using techniques inspired by natural evolution, such as inheritance, mutation, selection, and crossover.

II. LITERATURE SURVEY

Moje Ravindra, Patil Chandrashekhar.,[1] In this paper Support vector machine (SVM) is originally developed for linear two class classification via constructing an optimal separating hyper plane, where the margin is maximum. In case of not linearly separable training data, SVM is by means of kernel trick to map the original input space into a high dimensional feature space to increase the classifier generalization ability. Genetic Algorithm (GA) is a stochastic and heuristic searching algorithm that is inspired by natural evolution. In each process of iteration (called generation), the GA consists of three basic operation such as Selection, Crossover and Mutation. Using Genetic Algorithm along with SVM here we are trying to make classification of the objects which is closer to the original image. This is simple effort to make identification easier.

S.V.S Prasad, Dr. T. Satya Savitri, Dr. I.V. Murali Krishna.,[2] In this paper Multispectral satellite imagery is an economical, precise and appropriate method of gathering information since they provide data at regular intervals on land use and land cover and is economical when compared to the other traditional methods of ground survey and aerial photography. Classification of multispectral satellite data is investigated with a special focus on uncertainty analysis in the produced land-cover maps. This paper proposed an efficient technique for classifying the multispectral satellite images using SVM into land cover and land use sectors.

Priyanka Athawale1, A.N.Khobragade, V.A.Tehre.,[16] India is a country where agriculture is the backbone of economy. It is need of the hour to estimate agricultural production based upon its grow area, which deems to be not achievable manually every year. The underlying reason behind is the existing facilities and mechanism is inadequate to achieve the same. However, with the arrival of state of the art technologies in Remote Sensing and GIS, it is quiet easy to predict acreage of agricultural product in advance. In order to identify the land use by the crops, classification is the important task to be done. Still, it is a real challenge to get better classification accuracy. Various supervised and unsupervised classification techniques are introduced by the researchers. The survey of those techniques with their respective problems and prospects, is highlighted in the paper. The main objective is to find out the efficient classification technique that applied on multispectral satellite data for agricultural applications and to explore advanced research in this domain.

E. Saravana Kumar, A. Sumathi, K. Latha., [3] This paper describe the Content-Based Image Retrieval which is a technique that utilizes the viewed content of an image to search for similar images in large scale image databases. The viewed content of an image represents the low level features obtain from the image. These primarily constitute texture, shape and color features. The precision of image classification and image retrieval is usually based on image feature extraction. More distinguished image features will give better results in classification and retrieval process. So the feature selection and feature extraction are the important tasks to be considered in image retrieval process. The aim of this paper is to discuss about feature selection and an efficient method for feature extraction is proposed for image retrieval process.

Raj Kumar Mohanta1, Binapani Sethi.,[13] This paper describe image segmentation is an important technique of Image Processing. It is a difficult task of image processing and the next tasks containing object detection, feature extraction, object recognition and classification depend on the parameter of segmentation process. However there is no any common way to successfully segment all images. The image segmentation problem can be characterized by various factors which make the parameter selection problem difficult. The segmentation problem is define as an optimization problem and Genetic Algorithm easily locate the global maximum in a search space and solves the problem of parameter selection in image segmentation. The aim of this paper is to study Genetic Algorithm applications for image segmentation.

Xingping Wen et al., [7] This paper proposed an unsupervised classification method. Firstly, the hyper spectral remote sensing image was atmospherically corrected. Accuracy atmospheric correction is the key to the classification. Then, end member spectra were extracted using PPI algorithm, and the image was classified using SAM. Traditionally SAM algorithm used constant threshold. They improved and used adjustable threshold, and the pixel belong to class which has the smallest spectral angle. Finally, the end member spectra were clustered based on K-means algorithm and classes were combined according to the K-means algorithm result. The final classification map was projected and outputted. It is an effective classification method especially for hyper spectral remote sensing image. Users also can adjust the end member and classes number according to their applications. Gaussian mixture models (GMM) are widely used for unsupervised classification applications in remote sensing. Expectation Maximization (EM) is the standard algorithm which is used to calculate the parameters of these models. However, such iterative optimization methods can easily get trapped into local maxima. Researchers use population base stochastic search algorithms to obtain better estimates.

Shreeren D., Quirin A., Puissant A., Gancarski P. and Weber C. [8] The classification methods applied in the object oriented image analysis approach are often based on the use of domain knowledge. A key issue in this approach is the acquisition of this knowledge which is generally accurate and not formalized. In this paper, we analyze the possibilities of using genetic programming for the automatic extraction of classification rules from urban remotely sensed data. The method proposed is composed of several steps: segmentation, feature extraction, selection of training sets, acquisition of rules, classification. Features related to the spectral, spatial and contextual properties of the objects are used in the classification procedure, The quality of the results shows the effectiveness of the proposed genetic classifier in the object oriented, knowledge based approach.

S.Prabhu, Dr.D.Tensing**.,**[15] The proposed technique is used to classify the satellite image into barren land, vegetation area, building area and road area. Initially, the satellite image is preprocessed and then is segmented to have segments of barren land, vegetation area, building area and road area. The features of the segmented area are obtain and then final classification is carried out using fuzzy rule classifier. In the result section, classified output satellite images obtained are shown and proposed technique is calculated by means of accuracy parameter. The accuracy obtained is high having an average of 92.56%. Also we compare the normal graph cut and from the results, it is proved that our proposed technique using modified graph cut have obtained better results.

Ming-Hseng Tseng, Sheng-Jhe Chen, Gwo- Haur Hwang, Ming-Yu Shen.,[12] Classification of land cover information using remotely sensed imagery is a challenging topic due to the complexity of landscapes and the spatial and spectral resolution of the images being used. Early investigation of land cover classification used statistical methods such as the maximum likelihood classifier. In this paper a rule based classifier obtain from improved genetic algorithm approach is proposed to determine the knowledge rules for land cover classification done automatically from remote sensing image datasets.

III. CONCLUSION

From this survey we study the various techniques for feature extraction such as local level, global level and pixel level techniques and also study the various algorithms such as Genetic Algorithm which is use for parameter optimization. Genetic algorithms belong to the larger class of evolutionary algorithms (EA), which generate solutions to optimization problems using techniques.

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