Classification of Spatial Data from Satellite images distinguish Regions of Land Used

P. Penchala Swamy,
PG Scholor,
Department of Information Technology,
SRKR Engineering College, Bhimavaram, Andhra Pradesh.

Ch. Dileep Chakravarthy,
Assistant professor,
Department of Information Technology,
SRKR Engineering College, Bhimavaram, Andhra Pradesh.

Abstract

Multi-spectral satellite imagery is a practical, precise and proper strategy for getting data ashore utilize and arrive cover since they give information at consistent interims and is sparing when contrasted with the other customary techniques for ground study and aeronautical photography. Classification of multi spectral remotely detected information is examined with an uncommon spotlight on vulnerability examination in the created land cover maps. Here, we have proposed a proficient strategy for ordering the multi spectral satellite pictures utilizing SVM into arrive cover and land utilize segments. In the proposed classification system at first pre-processing is done where the information picture is subjected to an arrangement of pre-processing steps which incorporates Gaussian filtering and RGB to Lab shading space picture change. In this manner, division utilizing fluffy fused progressive clustering method is done. At that point preparing of the SVM is done in the preparation information determination methodology lastly the classification step, where the cluster centroids are subjected to the prepared SVM to get the land utilize and land cover parts. The experimentation is completed utilizing the multi spectral satellite pictures and the investigation guarantees that the execution of the proposed system is enhanced contrasted and conventional clustering algorithm.

Keywords: Multispectral satellite image, Clustering, Classification, Support vector machine.

Introduction

Multi spectral image conveys an awesome wellspring of information for concentrate spatial and worldly variability of the ecological components. It can be used in various applications which comprises of surveillance, making of mapping items for military and common use, evaluation of natural harm, nursing of land use, radiation level check, urban arranging, development mandate, soil test and product result increase [8]. One noteworthy region where we use multi spectral image is currently classification and mapping of vegetation over expansive spatial scales, as the remote detecting information conveys great coverage, mapping and classification of land cover highlights like vegetation, soil, water and woods. This acts like a substitution for the typical classification strategies, which requires costly and time-serious field overviews [10].

Investigates and concentrates on image classification have for some time been interested the grouping of established researchers, from the time when numerous natural and financial presentations depend on the classification outcomes [9]. As a rule, a classification framework influences a classification to guide of the identifiable or important highlights or classes of land cover segments in a section [11]. Notwithstanding every one of the focal points, classification of land cover utilizing multi spectral imagery is a troublesome subject because of the multifaceted nature of landscapes and the spatial and spectral determination of the images being locked in.

Multi spectral images comprise of data gathered over an extensive variety of changes on frequencies and these frequencies change over various territories (sporadic or recurrence variation conduct of the flag) [15]. The general complex nature of multi spectral image information can be ascribed to the spectral qualities with associated groups and spatial highlights related inside a similar band which is otherwise called the spatial relationship. A productive strategy equipped for masterminding the spectral and spatial (logical) data existing in the multi spectral information can build the precision level of the classification positively when coordinated with the conventional non-relevant data based strategies. Looks into and ponders on multi spectral image classification have since quite a while ago procured the consideration of established researchers, since most natural and financial applications depend on the classification comes about [9].

Multi spectral image classification can be considered as a consolidated undertaking of both image processing and classification strategies. For the most part, image classification, during the time spent remote detecting is the strategy for alluding pixels or the fundamental units of an image to the classes. It is generally liable to make gatherings of comparable pixels found in image information into classes that match the instructive classifications of user enthusiasm by coordinating the pixels to each other and to those of the said character [12].

Numerous methods of image classification have been presented and various regions like image examination and example acknowledgment use the crucial term, classification. Much of the time, the classification itself may turn into the element of the investigation and fill in as a definitive issue. In different situations, the classification means to be the center advance in more confounded calculations, for example, land-debasement thinks about, process considers, landscape demonstrating, beach front zone administration, asset administration and other condition observing applications. Because of this, image classification has developed and built up as a noteworthy apparatus for learning advanced images. Besides, the decision of the perfect classification strategy to be used can considerably affect its results. The classification is used as a noteworthy item or as one of numerous computational techniques used for getting data from an image for additionally learning [12].

The accessible writing has a decent number of administered systems that have been made to defeat the multispectral information classification dangerous scene. The factual method used for the before investigations of land-cover classification is the most extreme probability classifier. As of late, different examinations have connected computerized reasoning strategies as seconds to the remotely-detected image classification applications [13]. Moreover, unique group classification procedure has been presented to expand the classification precision [14]. Researchers have made awesome walks in making proficient classification frameworks and techniques for expanding the classification exactness.

The fundamental focal point of this exploration is to order into land use and the land cover. Land cover means to trademark highlights of land surface. These can be characteristic, semi-regular, oversaw or absolutely man-made and are specifically detectable. The real rationale in influencing land to cover maps is to give us an unmistakable photo of the stock and condition of our characteristic and assembled assets. A land cover classification is crucial fixing in making a mindful disposition to ecological administration. Land cover is not the same as land use despite the fact that the two terms are usually being used conversely. Land use is an announcement of how individuals use the land and financial activity– urban and farming land uses are two of the successive ordinarily used abnormal state classes of use. Sooner or later or put, there can be in excess of one substitute land uses, the portrayal of which may have a political measurement. Land cover

classifications are real contributions to ecological and land use arranging at nearby, territorial, and national levels [5].

Classification of multi spectral remotely detected information is registered with an uncommon consideration on vulnerability calculation in the land-cover maps. Here, we have proposed an effective strategy for grouping the multi spectral satellite images into land cover and land use areas utilizing SVM. The proposed classification procedure contains four stages which incorporates pre-processing, division utilizing clustering system, preparing information determination for SVM and classification utilizing prepared SVM. Multi spectral images can't be sustained specifically into the SVM for preparing and testing. The info image is subjected to an arrangement of pre-processing with the goal that the image gets changed appropriately for division. At that point, we use fluffy joined various leveled clustering algorithm for division of the image into clusters. At that point, the cluster centroids are then subjected to prepared SVM and the last classification of the multi spectral satellite images into land use and land cover is gotten.

Related work

A lot of research works have been completed in the writing for remotely detected multispectral image classification and some of them have propelled us to take up this exploration. Brief surveys of a portion of those ongoing critical examines are presented underneath:

K Perumal and R Bhaskaran [1] proposed a capable land use image classification framework with the assistance of image processing strategies and Support Vector Machines. The proposed strategy comprised of SVM Training and after that, SVM Testing. In the preparation part, the multispectral image information was done unsharp sifting and nonlinear isotropic dispersion division. The divided image pixels coordinating the land use districts were then given as preparing contribution to the SVM. Furthermore, to have the testing in a programmed way, the districts divided by nonlinear isotropic dissemination division were then mined out with the use of the dynamic form display. At that point, the prepared SVM precisely arranged the land cover locales in view of the pixel estimations of the mined out zone. The exploratory outcomes demonstrated the viability of the proposed classification method in ordering land cover districts.

Jan Knorn et al. [2] presented a method for the Landsat image classification. Their objective was to evacuate the disadvantages of a typical framework and to inspect the chain classifications, which is to the group Landsat images in light of the information in the covering locales of close-by sights. The SVMs ordered 8 locate scenes with a precision in the scope of 92.1% and 98.9%. Xiaochen Zou and Daoliang Li [3] proposed a blueprint of various diverse procedures to image surface investigation. Every one of the results of the classifications were coordinated and processed. In their work, they used dark level co-event network (GLCM) and the component mark images, which aided the classification of remote detecting.

Reda A. El-Khoribi [4] proposed a technique to perform classification of multispectral images in which, a discriminative preparing strategy for discrete concealed Markov tree (HMT) gainful structures were given to the multi-determination ranklet changes. furthermore, it was performed and assessed on an arrangement of Landsat 7-band images and used the adequate measurements of the HMT generative model. B Sowmya and B Sheelarani [5] elucidated the mission of land cover classification making use of the restored fluffy C implies. Keeping in mind the end goal to evaluate the image on the greater part of its hues, the possible hues were gathered together by the reestablished fluffy C implies algorithm. The sectioned images were coordinated utilizing image quality assessment measurements which used pinnacle flag to commotion

proportion (PSNR), mistake image and compression proportion. The time required for image division was likewise used as an appraisal factor.

V.K.Panchal et al. [6] presented a method in which focused on the classification of the satellite image of a particular land cover making use of the idea of Bio-geology based Optimization. Modifications were connected to the first BBO algorithm to join clustering and the adjusted changed algorithm was utilized to arrange the satellite image of the given territory. Exceptionally precise land cover highlights were mined effectively when the proposed strategy was made use of. Huang B et al. [7] presented a SVM displaying structure to talk about and survey the land-use change in connection to various factors, for example, populace, separation to streets and offices, and encompassing land use. An unequal SVM was actualized by enhancing the standard typical SVMs to unravel the issues looked by ordinary SVM, for example, having a precarious land use information.

Support Vector Machine

SVM [16] is a factual learning based classification framework. The SVM segments the classes regarding a choice surface that boosts the edge between the classes. The surface is ordinarily known as the ideal hyper plane and the information guides nearest toward the ideal hyper plane are known as the help vectors. These help vectors are the most critical components of the preparation set. A few deviations of SVM are: 1) the SVM can be altered to make it a nonlinear classifier by the work of nonlinear portions and 2) a multiclass classifier can be made by clubbing an expansive number of twofold SVM classifiers (making a parallel classifier for each conceivable match of classes). For multiclass classification, the match savvy classification technique is consistently made use of. The aftereffect of the SVM classification is the choice estimations of every pixel for every one of the class. This is utilized for likelihood gauges [17].

In the two-class situation, a help vector classifier delivers an attempt to accomplish a hyper plane that limits the separation from the individuals from each class to the discretionary hyper plane. A two-class classification issue can be characterized in the accompanying path: Suppose there are M preparing tests that can be given by the set sets {(xi,yi), i=1, 2, 3… ..,M} with xi being the class name of estimation of + or - 1 and yiϵ M where highlight vector with n parts. The classifier is given by the capacity f(y;α)□x with α , the parameter components of the classifier.

Hierarchical Clustering Algorithm

Hierarchical algorithms are of two sorts, one is the agglomerative and the other, troublesome. Hierarchical clustering [18] conveys a characteristic decision to graphically typify the dataset. In any case, it has detriments of being very intricate and furthermore the way that, a minor variety in the dataset may incredibly change the hierarchical dendrogram structure. Here we make use of agglomerative approach in our proposed technique for disease classification. At the point when an arrangement of N things is given as the information that must be clustered and it delivers a N*N separate grid and the fundamental strategy of hierarchical clustering created by S.C Johnson [18] have the means given beneath,

1. Start the procedure by submitting everything to a cluster, so that if there are N things, there will be N clusters, each cluster having one thing each. Here the separations (likenesses) between the clusters will be the same as the separations (similitudes) between the things they incorporate.

2. Find the closest (most comparative) match of clusters and join them into a solitary cluster, with the goal that it will bring about one cluster less.

3. Calculate separations (similitudes) between the recently framed cluster and every one of the old clusters.

4. Repeat stages 2 and 3 until the point that all things are clustered into a last single cluster of size N.

The primary disadvantage of agglomerative clustering strategy is the way that they don't scale well as the time multifaceted nature is at any rate O (n2), where n is the quantity of aggregate things. That is the time acquired is high particularly when an expansive arrangement of information is considered.

Implementation Technique Clustering with SVM Classifier

Here presents the proposed procedure of classification of multispectral satellite images utilizing clustering with SVM classifier. At first in our proposed classification system, pre-processing is done where the info image is subjected to an arrangement of pre-processing steps, for example, Gaussian sifting and change of RGB to Lab shading space image with the goal that the image gets changed reasonably for division. The pre-prepared image is divided utilizing the fluffy joined hierarchical clustering algorithm. Preparing information choice is done for SVM lastly, classification of the multispectral satellite images utilizing SVM is done in view of the prepared information and the centroid pixel esteems. The square graph of the proposed procedure is given in the figure beneath.

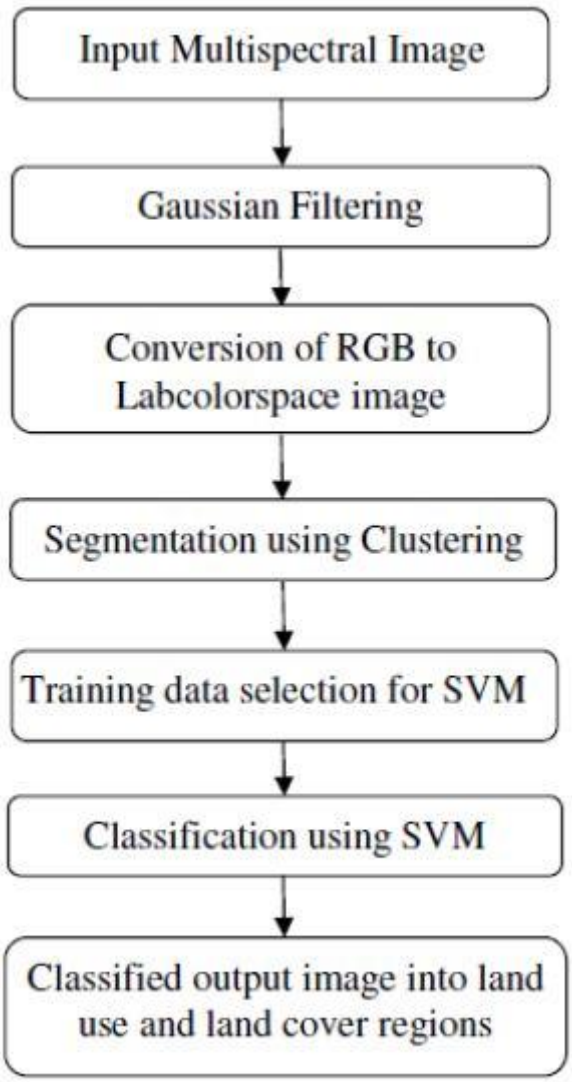

Figure: Block diagram of the proposed technique

Pre-processing

Multi spectral images can't be encouraged specifically into the SVM for preparing and testing. The info multi spectral satellite image is subjected to an arrangement of pre-processing steps with the goal that the image gets changed reasonably for the further processing. Here we utilize two stage preprocessing technique in which first the info image is gone through a Gaussian channel to lessen the commotion and show signs of improvement image fit for division. Going the image through the Gaussian channel likewise improves the image quality. In the second step in the preprocessing, we change over the image from the RGB model to Lab shading space Image which makes the more fit to be portioned by the use of clustering method.

Gaussian Filter: A Gaussian channel [20] is a channel whose motivation reaction is a Gaussian capacity. Gaussian channels are produced stay away from overshoot of step work input while diminishing the ascent and fall time. This character is especially connected to the way that the Gaussian channel has the base conceivable gathering delay. In scientific terms, a Gaussian channel changes the information motion by convolution with a Gaussian capacity.

Here in the preprocessing step, the information image is gone through a Gaussian channel which brings about diminishment of the clamor in the info image and furthermore brings about getting an image fit for additionally processing. Going the image through the Gaussian channel likewise improves the image quality.

Transformation of RGB to Lab shading space Image: A Lab shading space [21] is a shading rival space with measurement L for gentility and „a‟ and „b‟ for the shading rival measurements, in view of nonlinearly compressed CIE XYZ shading space arranges. Unique in relation to the RGB and CMYK shading models, Lab shading is produced to estimated the human vision. It goes for perceptual consistency, and its L segment moderately relates to human view of softness. It is consequently used to influence exact shading to adjust amendments by changing the yield bends in the „a‟ and „b‟ parts, or to direct the softness differentiate utilizing the L segment. In RGB or CMYK spaces, which demonstrate the yield of physical gadgets rather than the human visual discernment, these progressions are finished with the guide of the comparing mix modes in the altering application.

Initial Segmentation Using proposed clustering algorithm

After applying the preprocessing ventures to the info multi spectral satellite image, we get an image fit to be divided. This image is made of thousands of pixels and to group this image in view of every one of this individual pixel is a boisterous errand and is tedious. Processing this gigantic measure of information likewise brings about increment of mistake rate and the debased execution of the classifier framework. Subsequently, we cluster the pre-prepared image into clusters and after that select the centroid of every one of these clusters shaped for the classification procedure. This is because of the reality, that every part in a cluster will have relatively comparative pixel esteems and vary from the centroid estimation of the cluster by just a little sum. Thus, this centroid esteem will represent every one of the pixels in the clusters.

Subsequently, the classification of a centroid of a cluster will act basically as classification of the considerable number of pixels in the cluster. This bring about lessening the quantity of the contributions to the classifier framework which decrease the classifier multifaceted nature and furthermore the time acquired. It additionally brings about making the framework more productive and precise. Here for the

clustering, we are utilizing a fluffy joined hierarchical clustering, which is an augmentation of fundamental hierarchical clustering.

We have used hierarchical clustering here; too multiple outcomes from the dendrogram structure of the hierarchical clustering process. We get the diverse number of classifications for various levels as each level will have a one of a kind number of clusters. Here around 20-30 number of clusters after the clustering procedure is alluring and yields better outcomes. In any case, the use of the typical hierarchical algorithm doesn't yield that a decent outcome and is blunder inclined. These reasons provoked us to expand the fundamental hierarchical algorithm. In our expansion, we have consolidated Fuzzy C Means algorithm used.

Training Data Selection for SVM

In this segment, we talk about the preparation information choice given to the SVM for the classification reason. Our proposed system plans to order the image into land use and land cover. This is viably done making use of the colour features in the satellite image. Every one of the components in earth has a shading by which it is recognized. Consequently so as to order the image utilizing the SVM, we make use of the shade of these natural components. Certain hues in the multispectral image remain for „land use" and sure for the land cover. We have recognized those hues and these color points of interest are given to the SVM classifier for classification reason.

Distinctive hues and what they represent in the multispectral image. It likewise demonstrates what all go under the land use and land cover classification. A portion of the components that go under the land use are solid structures, rooftops and those in land cover incorporate that of vegetation, soil, mud, crops. These shading subtle elements are given to the SVM and in view of this information classification is done in the last advance.

Final Classification Using SVM

The pre-prepared multispectral satellite image is then clustered utilizing the fluffy fused clustering to acquire clusters. Here it can be seen that every part in a cluster will have relatively comparable pixel esteems and vary from the centroid estimation of the cluster by just a little sum. Thus the centroid esteem can represent every one of the pixels in the clusters. Thus, by performing single step of arranging the centroid of a cluster will act like as multiple means of grouping every one of the pixels in the cluster. This brings about diminishing the quantity of the contributions to the classifier framework which lessen the classifier intricacy and furthermore the time acquired.

Results and Discussion

In this area, we examine the aftereffects of the proposed method. We have used multispectral satellite image as the info image which is to be named land use and land cover. In our proposed classification procedure, at first pre-processing is done where the info image is subjected to an arrangement of pre-processing steps is completed with the goal that the image gets changed reasonably for division. It comprises of Gaussian sifting and change of RGB to Lab shading space image. The pre-handled image is portioned utilizing the fluffy fused hierarchical clustering algorithm. Preparing information choice is done for SVM lastly, classification of the multispectral satellite images utilizing SVM is done in light of the prepared information and the centroid pixel esteems.

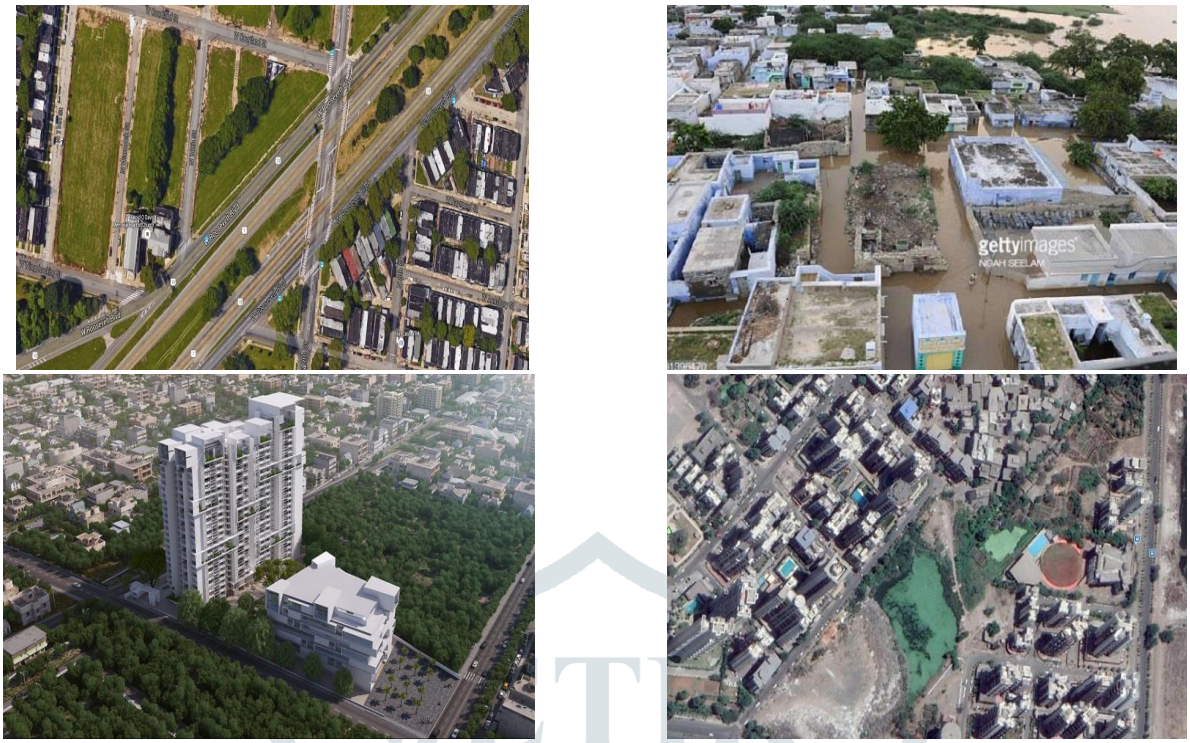

Figure: Input satellite images

The above figures demonstrate the information multispectral image of a territory taken from the satellite and we would we be able to plainly observe the land and water highlights. Our point is to characterize the image into land use and land cover utilizing the proposed strategy.

Performance Evaluation

In this segment, we present the execution assessment consequences of the proposed method. Here we have assessed and contrasted the outcomes and different clustering algorithms and furthermore with different classifiers. The initial segment in this area, manages the examination with different clustering algorithms. In the later part, assessment and examination is made by contrasting different classifiers. A detailed examination, trailed by the assessment diagram is made in each part. This made and comes about got obviously exhibit the productivity of the proposed approach in arranging the multispectral image into land use and land cover locales.

Assessment Utilizing Distinctive Clustering Algorithm

For execution assessment, the proposed method (proposed clustering + SVM) is assessed with the customary clustering algorithm like, FCM clustering + SVM and Hierarchical clustering + SVM. Moreover, as opposed to the SVM classifier, neural system arranges based classifier is likewise used to widely break down the outcomes. The precision esteem is registered by partitioning the aggregate number of comparative pixels recognized as land use to the quantity of pixels in the land use locale. The accompanying diagrams and tables mean the execution of the procedure contrasted and the conventional techniques.

Table 1: Accuracy of the different methods in land use classification

Techniques	Number of similar pixels		
No. of clusters	Cluster 1	Cluster 2	Cluster 3
Proposed clustering + SVM	1560	84	8
FCM+SVM	5	20	106
Hierarchical + SVM	10	5	8

Here, table 1 demonstrates the exactness of the distinctive strategies in land use and land cover classification. Here we contrast our proposed clustering method and that of FCM and hierarchical strategies. Here the outcomes got are utilizing the particular clustering procedure with the use of the SVM classifier. The quantity of comparative pixels is ascertained and given in the above tables. We can see from the above tables that our proposed procedure accomplishes the best outcomes both in land use and land cover classification.

Conclusion

In this paper, we have proposed a productive image classification procedure for multispectral remote detected satellite images with the guide of clustering and Support Vector Machines (SVM). Here in our proposed classification method is made of four stages in particular pre-processing, division, preparing of SVM and last classification utilizing SVM. In the pre-processing step, the information image is subjected an arrangement of pre-processing steps which incorporates Gaussian sifting and change of RGB to Lab shading space image. The pre-processing brings about changing the info image into an image fit for division. After the preprocessing, the image is divided for which we have used the fluffy joined hierarchical clustering algorithm. This outcome in the image being portioned into clusters. SVM is prepared by the information given.

At last the image is given as contribution to the prepared SVM, which characterizes the multispectral satellite images into land use and land cover locales as per the prepared information and pixel esteems. Subsequently we get an ordered image. The exploratory outcomes have shown the viability of the proposed classification system in characterizing into land cover and land use areas. The experimentation is done utilizing the multi-spectral satellite images and the investigation guarantees that the execution of the proposed system is enhanced contrasted and customary clustering algorithm. In future, we expect to degree our approach into arranging the multispectral image into multiple locales instead of simply land use and land cover. All things considered, we will have the capacity to recognize land includes betterly and can be more useful.

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