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Paper Authors
Dr. SatyaBrata.Dash[1], Mounika Kanikanthi [2], Kolla Aravind [3] , Musunuri Yamini [4] ,Pasumarthy Gayatri Parvathaneni Navyasri [5]

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HYPERSPECTRAL IMAGE CLASSIFICATION USING MACHINE LEARNING

Dr. SatyaBrata.Dash[1], Mounika Kanikanthi [2], Kolla Aravind [3] , Musunuri Yamini [4] ,Pasumarthy Gayatri Parvathaneni Navyasri [5]
[1]Associate Professor, Dept. of CSE, [2]17ME1A0599, [3]17ME1A0589, [4]17ME1A05A2, [5]17ME1A05A5
Ramachandra College of Engineering, A.P., India

ABSTRACT:

Hyperspectral image (HSI) classification is a phenomenal mechanism to analyzediversified land cover in remotely sensed hyperspectral images. Remote sensing technology is improving day by day which has also increased the uses of hyperspectral imaging tremendously. Exact classification of ground features from hyperspectral images is an important and a popular research area and also has attracted widespread attention. In our research, a brief description among different classification models i.e., SVM, with PCA, has been described. The study has been carried upon one common hyperspectral datasets i.e., Indian Pines which comprise various landscape fields like dense vegetation, barren land, grasslands, etc. For noisy band reduction, PCA has been used.

1. INTRODUCTION

Imaging is a good way to work with materials,identifythem and to definetheir properties is to study how light interacts with them.Spectroscopy is a study that examines how light behaves in the target & recognizes materials based on their diferent spectral Signatures. A human eye can see electromagnetic waves with wavelengths between 380 and 780 nanometers.Wavelengths beyond this range such as Infrared are invisible to humans and also human has 3 color receptors red,blue and green but Hyperspectral Imaging is a new analytical technique based on spectroscopy that measures thecontinuous spectrum of the light for each pixel of the scene with finewavelength resolution,not only in the visible but also in the near infrared.Hyperspectral imaging (HSI) is a method for capturing images thatcontain information from a broader portion of the electromagneticspectrum. This portion can start with UV light, extend through thevisible spectrum, and end in the near or short-wave infrared. Thisextended wavelength range can reveal properties of material compositionthat are not otherwise apparent. Hyperspectral Image(HSI) classification is a phenomenalmechanism to analyse diversified land cover in remotely sensed hyperspectral images.Remotesensing technology is improving day by day which has also increased the uses of hyperspectral imaging tremendously.Exact classification of ground features from hyperspectral images is an important and a popular research area and also have attracted a widespread of attention.A good classification results areachieved by many methods for the classification of hyperspectral

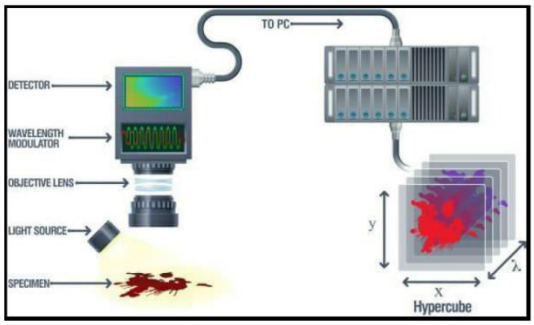
Imaging. Purpose Hyperspectral imaging, like other spectral imaging, collects and processes information from across the electromagnetic spectrum. The goal of hyperspectral imaging is to obtain the spectrum for each pixel in the image of a scene, with the purpose of finding objects, identifying materials, or detecting processes. Hyperspectral imaging (HSI) integrates conventional imaging and spectroscopy, to obtain both spatial and spectral information from a specimen. This

technique enables investigators to analyze the chemical composition of traces and simultaneously visualize their spatial distribution. HSI offers significant potential for the detection, visualization, identification and age estimation of forensic traces. The rapid, non-destructive and non-contact features of HSI mark its suitability as an analytical tool for forensic science.

The availability of hyperspectral remote sensing images with high spatialand spectral resolution have begun to be available in recent years. As these hyperspectral images have strong angular resolution for a spectra, these images have a wide range of applications such as in the environment, mining, military and medical fields. Imaging spectrometers are the mainsources for the acquisition of hyperspectral images which are installed at particular places. The imaging spectrometer acquires images in many continuous and narrow bands due to which each pixel of the image gets a spectrum of reflected wavelength range which was used during acquiring of image. Hencehyperspectral images have high spectral resolution with many bands and plentiful data.

2. RELATED WORK

Hyperspectral images provide rich spectral and spatially continuousinformation that can be used for soil mineralogy discrimination. This paper proposes a method to evaluate the feasibility of Hyperion image in the rapid prediction of soil mineralogy. Four areas in Egypt were chosen for the current study. Preprocessing of the Hyperion data was done before applying the atmospheric correction. The minimum noise fraction transformation was usedto segregate noise in the data. Various techniques were applied to the studied areas in which mixture tuned matched filtering gave good results in a prediction of the end-members. Then, it is employed to predict soil minerals in each cell using a spectral unmixing method. Illite, chlorite, calcite, dolomite,As an emerging imaging modality for medical applications, HSI offers great potential for noninvasive disease diagnosis and surgical guidance. Light delivered to biological tissue undergoes multiple scattering from inhomogeneity of biological structures and absorption primarily in hemoglobin , melanin, and
water as it propagates through the tissue.Itis assumed that the absorption, fluorescence, and scattering characteristics of tissue change during the progression of disease.Therefore, the reflected, fluorescent, and transmitted



light from tissue captured by HSI carries quantitative diagnostic information about tissue pathology.Hyperspectral imaging (HSI) integrates conventional imaging and spectroscopy, to obtain both spatial and spectral information from a specimen. This technique enables investigators to analyze the chemical composition of traces and simultaneously visualize their spatial distribution. HSI offers significant potential for the detection, visualization, identification and age estimation of forensic traces. The rapid, non-destructive and non-contact features of HIS mark its suitability as an analytical tool for forensic science. The preliminary investigation

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examines project feasibility, the likelihood the application will be useful to the user. The main objective of the feasibility study is to test the Technical, Operational, and Economical feasibility for adding new modules and debugging traditional desktop-centric applications, and porting them to mobile devices. All systems are feasible if they are given unlimited resources and infinite time.

3. METHODOLOGY:

System design is the process or art of defining the architecture,components, modules, interfaces, and data for a system to satisfy specified requirements. One could see it as the application of systems theory to product development. There is some overlap and synergy with
the disciplines of systems analysis, systems architecture, and systems engineering.This is the architecture that describes the Hyperspectral image classification process with a step by step representation.

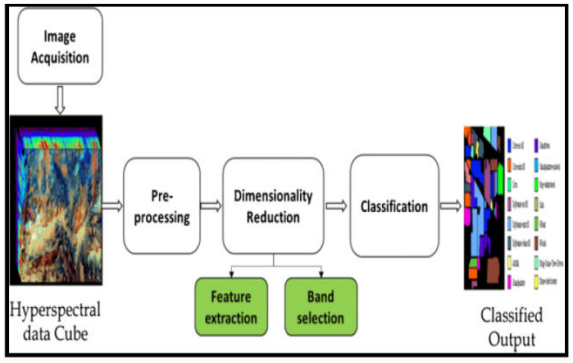

Figure 1:Architecure

Data flow diagram

This explains the way of representing the flow of data through a process or a system. It provides information about the outputs and inputs of each entity and process itself.

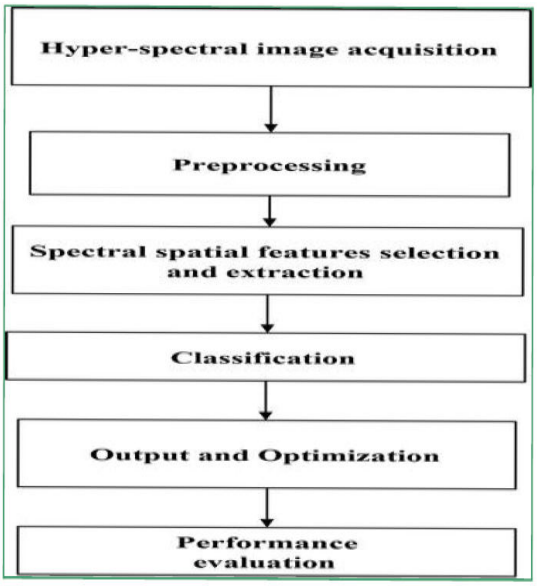

Figure 2: Data flow diagram

Support vector Machine is a set of supervised learning methods used for classification, regression and outliersdetection.The advantages of support vector machines are: Effective in high dimensional spaces. Still effective in cases where the number of dimensions is greater
than the number of samples. Uses a subset of training points in the decision function (called
support vectors), so it is also memory efficient. Versatile: different Kernel functions can be specified for the decision function. Common kemelsare provided, but it is also possible to specify custom kernels. The disadvantages of support vector machines include:If the number of features is much greater than the number of samples, avoiding over-fitting in choosing Kernel functions and regularization terms is crucial. SVMS do not directly provide probability estimates, these are calculated using an expensive five-fold cross-validation (see Scores and probabilities, below).
The support vector machines in scikit-learn support both dense (numpy.ndarray

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and convertible to that by numpy.asarray)and sparse (any scipy.sparse) sample vectors as input. However , to use an SVM to make predictions for sparse data, it must have beenfit on such data. For optimal performance, use C-ordered numpy.ndarray (dense)orscipy.sparse.csr_matrix (sparse) with dtype=float64.

4. STUDY OF RESULTS:

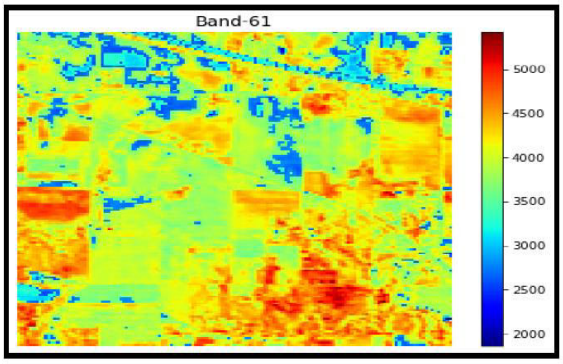

Figure 3:Visualizing the bands of the Hyperspectral image

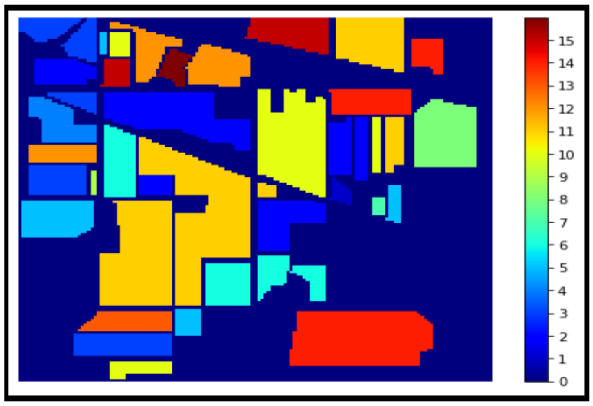

Figure 4:Visualizing ground truth of the image.

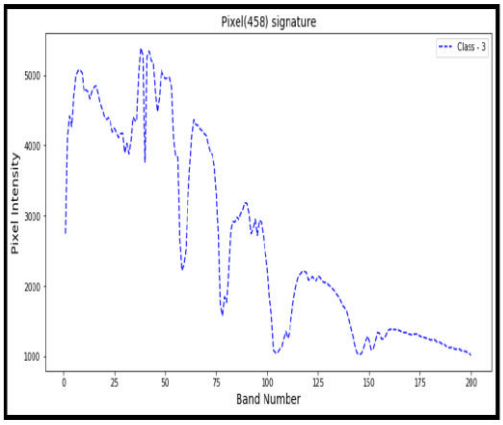

Figure 5:Visualizing spectral signatures

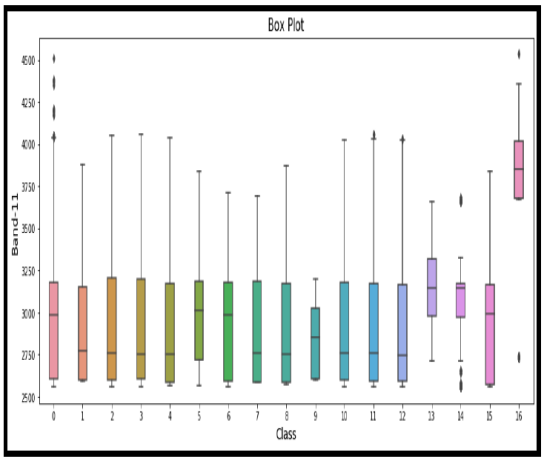

Figure 6:Box plot w.r.t bands of the HSI

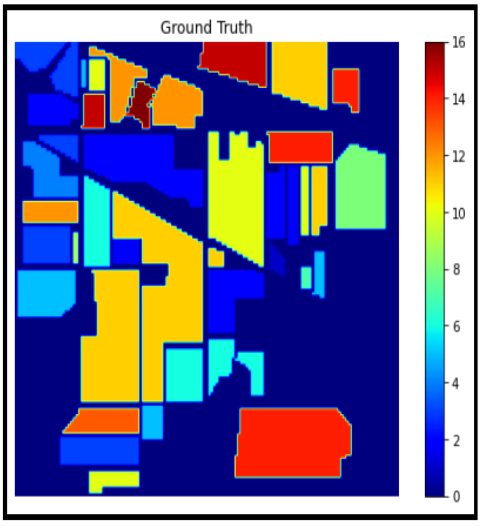

Figure 7:Classification map

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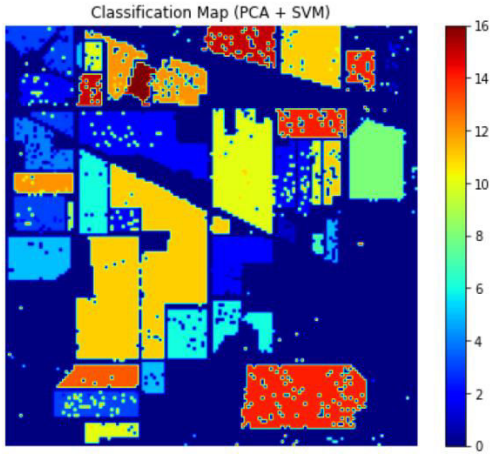

Figure 8:Classification map (PCA+SVM)

5.CONCLUSION :

A spectral and spatial classification method was developed for thehyperspectral image classification. The proposed approach uses the SVM classifier with kernels for the classification. The results show that the RBF kernel will have the highest overall accuracy. Hyperspectral image contains many numbers of bands so more computational time is required to compute the kernel parameters and classification maps.In order to minimize the computational time, spectral features are reduced using PCA and only a few principal components are used for the classification. Furthermore, the classification accuracy of the SVM is increasedby using the guided image filter with the first principal component having a guided image. From the experimental resultsit can be inferred that overall accuracy is improved from 81.15% of SVM to 94.22% for RBF kernels with the same training samples. In the future scope, computational time of the classification can be further reduced by employing supervised dimensionality reduction algorithms.

6.REFERENCES :

[1] Li, Shutao, et al. "Deep learning for hyperspectral image classification: Anoverview." IEEE Transactions on Geoscience and Remote Sensing 57.9 (2019): 6690-6709.

[2] Yang, Xiaofei, et al. "Hyperspectral image classification with deep learning models." IEEE Transactions on Geoscience and Remote Sensing 56.9 (2018): 5408-5423.

[3] Bioucas-Dias, José M., et al. "Hyperspectral remote sensing data analysis and future challenges." IEEE Geoscience and remote sensing magazine 1.2 (2013): 6-36.

[4] Brown, Adrian J., Brad Sutter, and Stephen Dunagan. "The MARTE VNIR imaging spectrometer experiment: Design and analysis." Astrobiology 8.5(2008): 1001-1011.

[5] Melgani, Farid, and Lorenzo Bruzzone. "Classification of hyperspectral remote sensing images with support vector machines." IEEE Transactions ongeoscience and remote sensing 42.8 (2004): 1778-1790.

[6] Li, Jun, José M. Bioucas-Dias, and Antonio Plaza. "Spectral–spatial hyperspectral image segmentation using subspace multinomial logistic regression and Markov random fields." IEEE Transactions on Geoscience andRemote Sensing 50.3 (2011): 809-823.

[7] Ji, Rongrong, et al. "Spectral-spatial constraint hyperspectral image classification." IEEE Transactions on Geoscience and Remote Sensing 52.3 (2013): 1811-1824.