Orbital Snapshots: Digestible Satellite Image Insights

[1]Mr.V.Naga Srinivas [2] V.Uresh [3], Mr. K. Praveen Kumar

[1]Assistant Professor, Department of CA, vnsrinivasu@giet.ac.in
[2]Student, Master of Computer Application, ureshveligutla@gmail.com
[3]Assistant Professor, Department of CA, pravikanapala@gmail.com

Godavari Institute of Engineering and Technology, Rajahmundry, East Godavari, Andhra Pradesh, India

ABSTRACT

Image segmentation is a core challenge within computer vision, involving the partitioning of images into meaningful segments for easier analysis. Techniques for segmentation abound, including edge detection, region-based approaches, clustering methods, partial differential equations, watershed algorithms, and neural networks. In this research, we concentrate on the segmentation of satellite images using machine learning. The K-Means clustering algorithm is applied to remotely sensed data, offering superior results compared to conventional methods. Implementation will utilize MATLAB, with machine learning significantly streamlining the creation of accurate maps. Finally, K-Nearest Neighbors (KNN) and Support Vector Machines (SVM) will be employed for classification, with performance compared in terms of accuracy.

KEY WORDS: KNN, SVM, MATLAB, K MEANS CLUSTERING

1. INTRODUCTION

Without requiring human participation, predictions are aided by digital representations of the Earth's surface provided by remote sensing photographs. Pixels in an image are classified according to predetermined standards, like vegetation and urban areas; nevertheless, mixed class coverings and intricate patterns provide difficulties. In order to study vegetation indices and land use patterns, feature extraction is a necessary step in the processing of remote sensing photographs, such as those from LANDSAT. After that, classification algorithms like KNN and SVM are used, and accuracy is measured using evaluation metrics.

Large-scale archives are provided by satellite projects like Landsat for researching changes in land cover. However, due to the restricted availability of training data, interpreting these images might be difficult. This problem is addressed by signature extension techniques, which use signatures from one domain to categorize images from another, albeit accuracy problems arising from distance across regions may arise.

2. LITERATURE SURVEY

Profound Independent Remaining Organization for Multispectral Pictures Arrangement In view of Component Level Combination Jiaqi Zhang ; Dan Zhang ; Wenping Mama ; Licheng Jiao IEEE 2021.

The grouping strategies in light of combination procedures of multisource multispectral (MS) pictures have been read up for quite a while. Nonetheless, it very well might be challenging to group these informatation in view of an element level while staying away from the irregularity of information brought about by multisource and various locales or urban communities. In this letter, we propose a profound learning structure called 2-branch SPL-ResNet which joins the independent learning with profound leftover organization to characterize multisource MS information in view of the element level combination. Initial, a 2-D discrete wavelet is utilized to get the multiscale highlights and meager portrayal of MS information. Then, a 2-branch SPL-ResNet is laid out to separate the individual qualities of the two satellites. At last, we carry out the element level combination by flowing the two component vectors and afterward arrange the incorporated element vector. We lead the examinations on Landsat_8 and Sentinel_2 MS pictures. Contrasted and the generally utilized grouping techniques, for example, support vector machine and convolutional brain organizations, our proposed 2-branch SPL-ResNet system has higher precision and more strength.

Directed and Versatile Element Weighting for Item Put together Grouping with respect to Satellite Pictures Ya'nan Zhou ; Yuehong Chen ; Li Feng ; Xin Zhang ; Zhanfeng Shen ; Xiaocheng Zhou IEEE 2021.

In this paper, we introduce a multiscale profound component learning strategy for high goal satellite picture scene order. In particular, we initial twist the first satellite picture into various scales. The pictures in each scale are utilized to prepare a profound convolutional brain organization (DCNN). In any case, all the while preparing various DCNNs is tedious. To resolve this issue, we investigate DCNN with spatial pyramid pooling (SPP-net). Since various SPP-nets have similar number of boundaries, what share the indistinguishable beginning qualities, and just tweaking the boundaries in completely associated layers guarantees the adequacy of each organization, in this manner enormously speeding up the preparation cycle. Then, the multiscale satellite pictures are taken care of into their relating SPP-nets, separately, to remove multiscale profound highlights. At last, a numerous bit learning technique is created to become familiar with the ideal mix of such highlights consequently. Probes two troublesome informational indexes show that the 7 proposed strategy accomplishes positive execution contrasted and other cutting edge technique.

3.EXISTING SYSTEM

K-Nearest Neighbour (KNN): The K-Nearest Neighbor (KNN) algorithm plays a significant role in remote sensing image classification, where accurate feature extraction depends on precise classification. Researchers have focused on refining KNN for this purpose. Enhancements to KNN include combining locality with maximum margin classification, integrating artificial immune B-cell networks for data reduction, and using the maximal margin principle. Genetic algorithms have also been used in conjunction with KNN for improved decision boundaries in hyperspectral images. Overall, these studies demonstrate the effectiveness of KNN when combined with optimization techniques. Further KNN applications include feature reduction, metric distance functions for higher efficiency, and moving from pixel-based to object-based representation. KNN has even been integrated with semi-supervised one-class support vector machines for applications like crop and cloud monitoring.

Drawbacks of Existing System:

- Just edges are been identified.
- Time utilization.
- Less proficiency.
- Greater intricacy.

4

4. PROPOSED SYSTEM

Support Vector Machine (SVM): Support Vector Machine is another way to deal with managed design order which has been effectively applied to many example acknowledgment issues and it is likewise a preparation calculation for gaining grouping and relapse rules from information. SVM is generally reasonable for working precisely and effectively with high dimensionality include spaces notwithstanding that SVM depends areas of strength for on establishments and results in straightforward and exceptionally strong calculations.

Advantages of Proposed System:

- All areas which we needed are been detected.
- Time consumption is less.
- Less complexity.
- User friendly model.

4.1 SYSTEM ARCHITECTURE

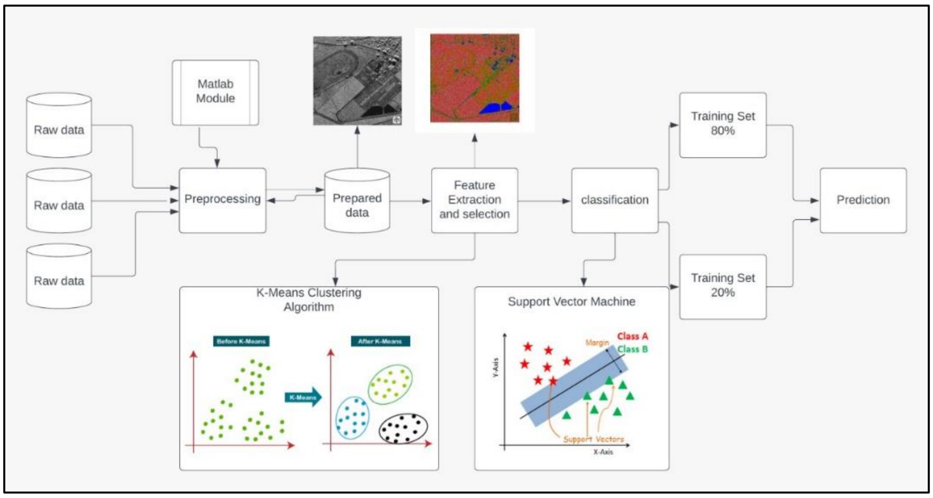

Fig.4.1.1 work flow of data processing

This workflow involves data preprocessing, feature extraction, classification, and the use of specific algorithms like K-Means and SVM. It's a comprehensive process for handling data in a structured manner.

4.2 MODULES

Picture Obtaining: Obtaining is the course of assortment of pictures. These pictures are downloaded from the online dataset supplier calledKaggle.com.

Picture Pre-handling: Picture pre-handling incorporates changing over RBG pictures into Grayscale pictures. A RGB picture implies the pictures present with its unique tones. Grayscale pictures have the blend of high contrast. Transformation Of RGB to grayscale is finished for improving the dataset accessible. Switching the pictures over completely to grayscale helps in working on the precision of the outcome.

Image Segmentation: Image segmentation separates the picture into significant areas. It divides digital image into multiple segments.

Feature selection and Extraction: In this module the features such as amplitude, contract, brightness, entropy, mean, median etc are extracted and analyzed.

Classification: The final module focuses on classification, utilizing TensorFlow and other machine learning algorithms. TensorFlow, an open-source library compatible with MATLAB, facilitates efficient machine learning processes.

5. RESULTS AND DISCUSSIONS

Grayscale images were created as a pre-processing step for the obtained RGB images. Grayscale photographs use shades of gray to represent pixel intensities, making the analysis that follows easier. By converting RGB to grayscale, the dataset's dimensionality can be decreased while maintaining crucial details about the composition and content of the images. The quality of the dataset is improved by this preprocessing stage, which also increases the precision of later image processing operations like feature extraction and division. Picture division is the process of breaking up a digital image into different areas or segments according to specific standards like texture, color, or pixel intensity. Further analysis and interpretation are made easier by the segmented sections, which represent significant portions of the image.

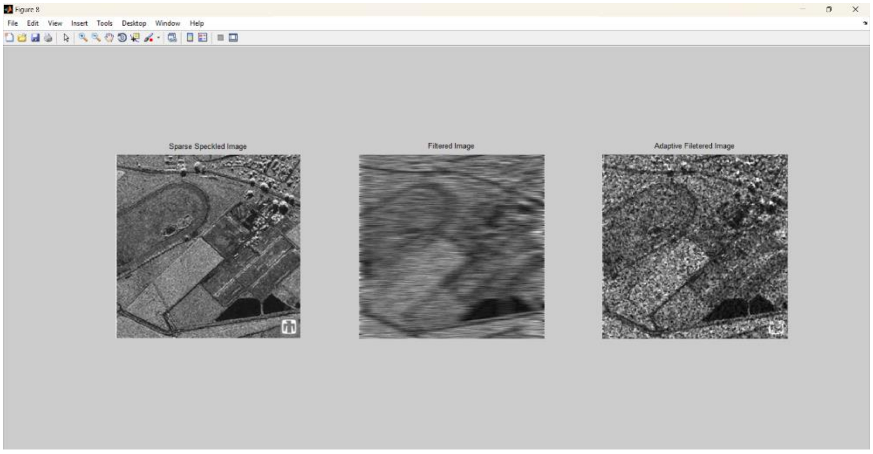

Fig.5.1.Segmentation of a satellite image

This figure shows the different segmentation of a satellite image in gray scale as:

- The first image is Sparse Speckled Image.
- The second image is Filtered Image.
- The third image is Adaptive Filetered Image.

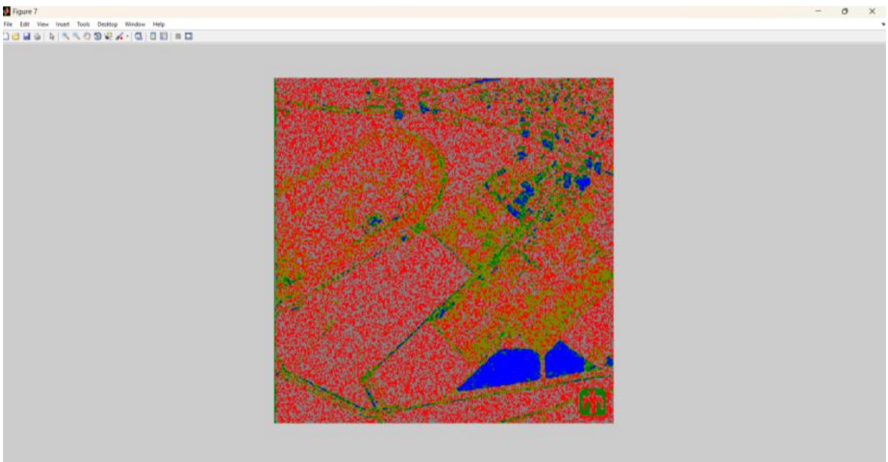

Fig.5.2.Output of satellite image with representing labels

- This image describes graphical representation of map.
- The content within this window is highly pixelated, with red as the dominant color, along with specks of green and areas of blue. Although there are discernible shapes within the pixelated content.

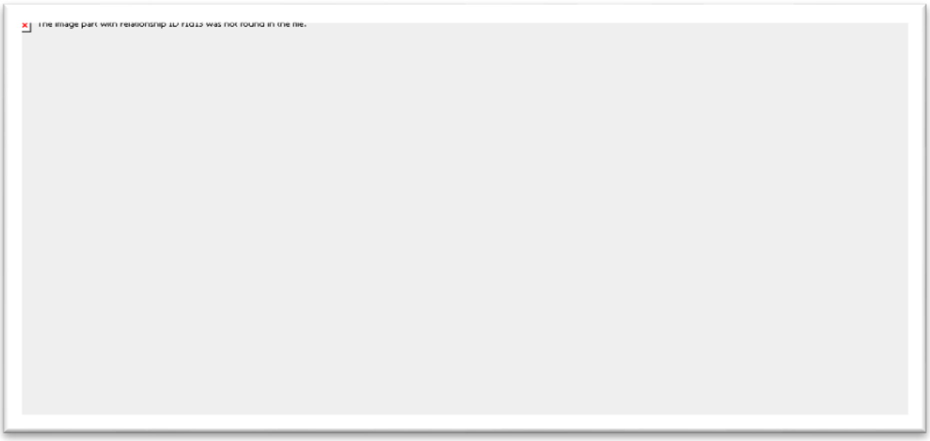

Fig.5.3. The screenshot from a MATLAB programming environment

The image displays code output related to color analysis. It shows the percentages of different colors labeled as follows:

- Gray (Label1, Crops) : 37.67%
- Blue (Label2, Water) : 4.11%
- Red (Label3, Other) : 35.50%
- Green (Label4, Trees) : 6.38%
- Yellow (Label5, Plants) : 16.35%

6. CONCLUSION AND FUTURE SCOPE

This system explores automated satellite image classification methods, including supervised and unsupervised techniques. Building on existing research, this work summarizes reviews of satellite image classification methodologies, aiding researchers in selecting the most suitable approach based on their specific needs.

The results obtained through this proposed classification method have the potential to revolutionize flood prediction and analysis. Rescue teams could use this information to prioritize high-risk areas, ultimately minimizing loss of life. Additionally, this method could be adapted for tasks such as coastline detection, urbanization monitoring, deforestation tracking, and earthquake analysis.

7.REFERENCES

[1] Boshir Ahmed, Md. Abdullah Al Noman (2015) “Land Cover Classification for Satellite Images based on Normalization Technique and Artificial Neural Network” in 1st International Conference on Computer & Information Engineering.

[2] S.Chitra, N.Kumaratharan, S.Ramesh, “A novel subspace method for precise carrier frequency offset estimation in multicarrier modulation scheme under multiuser environment,” International Journal of Communication Systems, vol. 33, no. 17, pp. e4608, 1-16, 2020.

[3] V. Satheesh Kumar, S. Ramesh, “Implementation of High-Q Embedded Band Pass Filter in Wireless Communication,” Intelligent Automation & Soft Computing, vol. 36, no. 2, pp. 2191-2200, 2023.

[4] K. Schindler, "An Overview and Comparison of Smooth Labeling Methods for Land-Cover Classification," in IEEE Transactions on Geoscience and Remote Sensing, vol. 50, no. 11, pp. 4534-4545, Nov. 2012, doi: 10.1109/TGRS.2012.2192741.

[5] Ramesh, S., Rama Rao, T., “Indoor channel characterization studies for V-band gigabit wireless communications using dielectric-loaded exponentially tapered slot antenna,” International Journal of Microwave and Wireless Technologies, vol. 8, no. 8, pp. 1243-1251, 2016.

[6] Ramesh, S., Rama Rao, T., “Millimeter wave dielectric loaded exponentially tapered slot antenna array using substrate integrated waveguide for gigabit wireless communications,” Journal of Infrared and Millimeter Waves, vol. 34, no. 5, pp. 513-519, 2015.

[7] G. Cheng, Z. Li, L. Guo, and Z. Wei, X. Yao(2018) “Remote sensing image scene classification using a bag of convolutional features,” IEEE Geosci. Remote Sens.

[8] Dingsheng Wan, HaoWu, Jial Zhu, Shijin Li(2016) “ An effective feature selection method for hypoerspectural image classification based on genetic algorithm and support vector machine”, Science Direct Book and Journals, Knowledge Based System, Volume 24, Issue 1

[9] V. Satheesh Kumar, S. Ramesh, “LCP Based Planar High Q Embedded Band Pass Filter for Wireless Applications,” Journal of Mobile Multimedia, vol. 14, no. 3, pp. 307-318, 2018.

[10] K. Kayalvizhi, S. Ramesh, “Design and Analysis of Reactive Load Dipole Antenna using Genetic Algorithm Optimization,” Applied Computational Electromagnetics Society Journal, vol. 35, no. 3, pp. 279-287, 2020.

[11] J. Jayalakshmi, S. Ramesh, “Compact Fractal wearable Antenna for Wireless Body Area Communications,” International Journal of Telecommunications and Radio Engineering, vol. 79, no. 1, pp. 71-80, 2020.

[12] S. Ramesh, T. Rama Rao, “High Gain Dielectric loaded Exponentially Tapered Slot Antenna Based on Substrate Integrated Waveguide for V-Band Wireless Communications,” Applied Computational Electromagnetics Society Journal, vol. 29, no. 11, pp. 870-880, 2014.

[13] M. Vanitha, S. Ramesh, S. Chitra, “Wearable Antennas for Remote Health Care Monitoring System Using 5G Wireless Technologies,” International Journal of Telecommunications and Radio Engineering, vol. 78, no. 14, pp. 1275-1285, 2019.

[14] Chitra S, Kumaratharan N, Ramesh S, “Enhanced brain image retrieval using carrier frequency offset compensated orthogonal frequency division multiplexing for Telemedicine applications,” International Journal of Imaging Systems and Technology, vol.28, no.3, pp. 186-195, 2018.

[15] A. Mitra and S. Shukla, "An Empirical Study on Availability of Rural Health Care Services in Zarol Village as per the Indian Public Health Standards," Independent Journal of Management & Production (IJM&P), vol. 10, no. 1, pp. 216, Jan.-Feb. 2019.

[16] J. Krishna Das, A. Das and J. Rosak-Szyrocka, "A Hybrid Deep Learning Technique for Sentiment Analysis in E Learning Platform with Natural Language Processing," 2022 International Conference on Software, Telecommunications and Computer Networks (SoftCOM), Split, Croatia, 2022, pp. 1-7.

[17] Das, A., Choudhury, B., Sarma, S.K. (2023). POS Tagging for the Primitive Languages of the World and Introducing a New Set of Universal POS Tagging for Sanskrit. In: Fong, S., Dey, N., Joshi, A. (eds) ICT Analysis and Applications. Lecture Notes in Networks and Systems, vol 517. Springer, Singapore.

[18] C. Goswami, A. Das, K. I. Ogaili, V. K. Verma, V. Singh and D. K. Sharma, "Device to Device Communication in 5G Network using Device-Centric Resource Allocation Algorithm," 2022 4th International Conference on Inventive Research in Computing Applications (ICIRCA), Coimbatore, India, 2022, pp. 467-472.

[19] Das, A. (2022). Designing green IoT communication by adaptive spotted hyena tunicate swarm optimization-based cluster head selection. Transactions on Emerging Telecommunications Technologies, 33.

[20] Das, A. Adaptive UNet-based Lung Segmentation and Ensemble Learning with CNN-based Deep Features for Automated COVID-19 Diagnosis. Multimed Tools Appl 81, 5407–5441 (2022).

[21] Choudhury, B., Das, A. (2020). Incepting on Language Structures with Phonological and Corpus Analysis Using Multilingual Computing. In: Saha, A., Kar, N., Deb, S. (eds) Advances in Computational Intelligence, Security and Internet of Things. ICCISIoT 2019. Communications in Computer and Information Science, vol 1192. Springer, Singapore.

[22] A. Das and M. A. Akour, "Intelligent Recommendation System for E-Learning using Membership Optimized Fuzzy Logic Classifier," 2020 IEEE Pune Section International Conference (PuneCon), Pune, India, 2020, pp. 1-10, doi: 10.1109/PuneCon50868.2020.9362416.

[23] Das, A., Ali Akour, M., Bahatab, A., Zin, Q. (2022). Energy-Efficient Wireless Communications Using EEA and EEAS with Energy Harvesting Schemes. In: Patgiri, R., Bandyopadhyay, S., Borah, M.D., Emilia Balas, V. (eds) Edge Analytics. Lecture Notes in Electrical Engineering, vol 869. Springer, Singapore.

[24] Das, A., Sarma, S.K., Deka, S. (2021). Data Security with DNA Cryptography. In: Ao, SI., Gelman, L., Kim, H.K. (eds) Transactions on Engineering Technologies. Springer, Singapore.

[25] Suklabaidya, M., Das, A., & Das, B. (2018). A cryptography model using hybrid encryption and decryption techniques. International Journal of Computational Intelligence & IoT, 2(4).

[26] M. A. Akour and A. Das, "Developing a Virtual Smart Total Learning Environment for Future Teaching-Learning System," 2020 IEEE International Conference on Teaching, Assessment, and Learning for Engineering (TALE), Takamatsu, Japan, 2020, pp. 576-579.

[27] A. Das and S. K. Sarma. Article: A Study on Energy Consumption in WLAN and Improving its Efficiency through an NBE-Algorithm. International Journal of Computer Applications 73(2):1-4, July 2013.

[28] Das, A., & Sarma, S.K. (2014). Energy Efficiency in IEEE 802.11 standard WLAN through MWTPP. IOSR Journal of Computer Engineering, 16, 42-46. 2

[29] Das. A. Das. S. A. U. Islam. (2018). Load Balancing and Congestion Control using Congestion Aware Multipath Routing Protocol (CAMRP) in Wireless Networks. International Journal on Future Revolution in Computer Science &Amp; Communication Engineering, 4(2), 193–198.

[30] Akhilesh Kumar Sharma , Shamik Tiwari, Gaurav Aggarwal, Nitika Goenka, Anil Kumar, Prasun Chakrabarti, Tulika Chakrabarti, Radomir Gono, Zbigniew Leonowicz, Michal Jasiński , “Dermatologist-Level Classification of Skin Cancer Using Cascaded Ensembling of

Convolutional Neural Network and Handcrafted Features Based Deep Neural Network", IEEE Access , 10 : 17920-17932, 2022.

[31] Gaurav Kumawat, Santosh Kumar Viswakarma, Prasun Chakrabarti , Pankaj Chittora, Tulika Chakrabarti , Jerry Chun-Wei Lin, "Prognosis of Cervical Cancer Disease by Applying Machine Learning Techniques", Journal of Circuits, Systems, and Computers, 2022.

[32] Abrar Ahmed Chhipa, Prasun Chakrabarti, Vadim Bolshev , Tulika Chakrabarti , Gennady Samarin, Alexey N. Vasiyev, Sandeep Ghosh, Alexander Kudryavtsev, "Modeling and Control Strategy of Wind Energy Conversion System with Grid-Connected Doubly Fed Induction Genenator", Energies , 15, 6694, 2022.

[33] Tulika Chakrabarti, Sibabrata Mukhopadhyay, Prasun Chakrabarti, Gholamreza Hatam, Mohammad Nami, "Phenyl Ethanoid Glycoside from the Bark of Oroxylum indicum Vent: a Potential Inhibitor of DNA Topoisomerase IB of Leishmania donovani", Journal of Advanced Medical Sciences and Applied Technologies, 2022.