IJARSCT

ISSN (Online) 2581-9429

International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)

Volume 2, Issue 8, June 2022

Impact Factor: 6.252

Cloud Detection and Tracking System using Machine Learning

Hameer Mahajani[1], Ganadhish Mardikar[2]

UG Student, Department of Electronics and Telecommunication Engineering, NBN SSOE, Pune, India[1,2]

Abstract: *Cloud detection is an important task in remote sensing (RS) image processing. Numerous cloud detection algorithms have been developed. However, most existing methods suffer from the weakness of omitting small and thin clouds, and from an inability to discriminate clouds from photometrically similar regions, such as buildings and snow.Here, we derive a novel cloud detection algorithm for optical RS images, whereby test images are separated into three classes: thick clouds, thin clouds, and noncloudy. First, a simple linear iterative clustering algorithm is adopted that is able to segment potential clouds, including small clouds. Then, a natural scene statistics model is applied to the super pixels to distinguish between clouds and surface buildings. Finally, Gabor features are computed within each super pixel and a support vector machine is used to distinguish clouds from snow regions. The experimental results indicate that the proposed model outperforms state-of-the-art methods for cloud detection.*

Keywords: Sigmoid Function, Image, Object Detection, Object Tracking, Cloud Mask, Convolution Neural Networks, Optical Flow, Deep Learning, U-Net, Augmentation, etc.

I. INTRODUCTION

Cloud is an apparent mass of dense water fume in the air. Cloud-instigated inconstancy in sun-based radiation has gotten probably the best worry in the force matrix, as the portion of the overall industry of sun powered energy, that is, sunlight- based energy entrance, has consistently expanded lately. Clouds are significant as they bring precipitation, yet then again, mists become a deterrent when earth surface investigation is the target of satellite pictures. Satellite pictures are quite possibly the most impressive and significant apparatuses utilized by the researcher for the investigation of earth and space science. Lately, scientists have utilized satellite picture information accessible from various hotspots for the investigation of mists. Cloud detection is an essential and important process in satellite remote sensing.

Researchers proposed variousmethods for cloud detection. Literature reported different strategies to identify the cloud utilizing distant detecting satellite symbolism. Scientists investigated different types of Cloud identification like Cloud/No cloud, Snow/Cloud, andThin Cloud/Thick Cloud utilizing different methodologies of AI and old-style calculations. gain from preparing information and old-style calculation approaches is carried out utilizing an edge of various picture boundaries. Limit based strategies have helpless all-inclusiveness as the qualities change according to the area. Methods for detecting and tracking clouds are widely applied to estimate their motion n satellite images at the global scale.

Proceeding with a low- level image feature to high-level event understanding approach. Here we have taken example of the cold clouds to be detected from thermal infrared images taken from Indian Satellite INSAT 3D. We have proposed a method for cloud detection using U-Net and its tracking with Optical Flow Lukas Kanade method. This analogy can be stretched out to different applications including movement-based acknowledgment, access control, video ordering, human-PC communication, and vehicle traffic checking is used to classify the ambiguous super pixels into possible thick clouds, thin clouds, and non-clouds. Finally, Gabor features are fed to an SVM which learns to separate clouds from snowy areas. As we will show in the experiments, our model performs much better than the existing methods.

II. LITERATURE SURVEY

Ma N et al. author [1] Data set used is 8 images of soil, desert, water, vegetation was used the method utilizes a Convolutional Neural Network to classify training samples for cloud and non-cloud. The calculation exploits picture data and doesn't depend on warm infrared data, which has a viable application as an incentive for improving picture use and resulting recovery of distant detecting boundaries. The data set used is not more than 8 Landsat image so accuracy may increased.so more no of image may give more accuracy.

J. O. Zhou Ao, S. Teo Xuer, S. V. Salinas and L. Soo Chin [2], The data set used is of 20 images and taken from Nikon D60 camera was used. Bruhn method and contrast its presentation and models dependent on more traditional optical stream techniques. It is faster than the traditional optical flow methods, and performs almost 39.48% faster than the cross- correlation method Images used are camera clicked images from earth. Accuracy may be increased with satellite images.

M. Le Goff, J. Tourneret, H. Wendt, M. Ortner and M. Spigai[3] , A database of more than 10000 SPOT 6 album images were used. The capability of deep learning to cloud detect to accomplish the performance is used. Comparison between deep learning strategy utilized with handmade features and classical CNN is performed for cloud detection. The primary benefit of this sort of approach is to assemble insights for comparative pixels to settle on a dependable choice. Future work includes the study of convolutional networks exploiting semantic segmentation of images.

S. Mohajerani and P. Saeedi, "Cloud-Net: An End-To-End Cloud Detection Algorithm for Landsat 8 Imagery [4], A cloud detection algorithm for satellite imager y based on deep learning (2019) Remote Sensing Network (RS-Net), a deep learning model based on the U-net architecture for cloud classification is used. RS net model had been biased towards the SPARCS database leading to low precision and high value.

S. Mohajerani and P. Saeedi, "Cloud-Net: An End-To-End Cloud Detection Algorithm for Landsat 8 Imagery,[5] This will allow us to have a better idea of how well this method performs for longer forecasting horizons (1 hour <t <1 day) associated with using satellite images for cloud tracking purposes. Another area is the possible incorporation of statistical tools such as Cohen's kappa coefficient to improve our tracking purposes. Another area is the possible incorporation of statistical tools such as Cohen's kappa coefficient to improve our tracking accuracy calculations.

III. PROPOSED METHODOLOGY

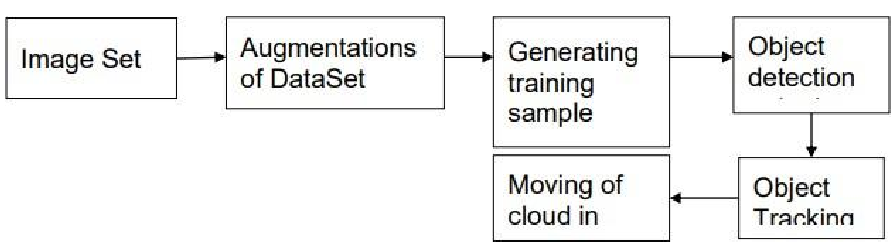


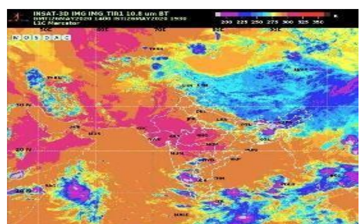
Figure 1: High level Architecture of the proposed system

Block schematic is as shown in fig.1.It has 6 blocks which have the whole process of where in the first block as we see that there is image data set and then in the next block, we add augmentation of the data set. After that we generate training data set in the project, we did object detection and object tracking. 1)Image set: During training of the model, we performed annotations on the data from INSAT 3D satellite images, the annotations were performed on the clouds which had temperatures below 225K [3].

For cloud detection we have taken RGB images of size 256x256 and pass those images through U- net model. 2)Augmentation of Dataset: It is method of making something larger here for example if we have 300 images then say we make 1000 images. We perform augmentation and segmentation simultaneously, here we perform semantic segmentation because object is irregular in shape. We have used label Me tool for semantic segmentation. U net model in turn gives us the segmentation mask of the provided images these segmentation masks are binary images, which consequently gives us the mask of clouds and hence we are able to detect the clouds. 3)Generatingtraining sample: Generally, we must get cloud mask at CNN's output same as that of input image same size, encoder is about the covenant layers follows pooling operation.

It is used in extraction of factors in the image. The second part decoder uses transposed convolution to allow localization. It is a fully connected layers network. During training of the model, we performed annotations on the data from kalpana satellite images, the annotations were performed on the clouds which had temperatures below 225□ cloud detection we take images from dataset 256x256 RGB (red, green, blue) images and pass those images through u net model. U net model intern gives us the segmentation mask of the provided images these segmentation masks are binary images, which consequently gives us the mask of clouds and hence we are able to detect the cloud. Following shows original images and its augmentation performed on kalpana satellite data set toget more data to train.

Generally, we must get cloud mask at CNN's output same as that of input image same size, contracting arm is responsible for feature extracting and other one extending arm to utilize those features [4]. Cloud mask is essential following images shows output of mask which is performed on augmented data. After u net model performs segmentation mask, we get binary images as the results then we apply lucas kanade algorithm to track the motion of multiple resulting images from the unet model the tracking of clouds is done using lucas kanade optical flow.



(Figure a) Original Image

(Figure b) Masked Image

(Figure c) Tracked Image

Lucas kanade depends on local information surrounding to area of interest, lucas kanade falls into category of sparse optical flow, only find need to calculate optical flow vector of image feature has excellent real time performance, low complexity in tracking process [7]. Following figureshows output of cloud tracking. Lukas and Kanade [3] expected as an extra constraint that the optical flow is varying slickly long the neighbouring object points that possessed the same speed The least squares assessor has been adjusted in (3) to min the squared mistake, communicated as: The pictures of optical flow are calculated using partial derivatives between pixels in the x, y and t directions calculation.

IV. CONCLUSION

We have described an improved cloud detection system for optical satellite images. The image is first segmented into super pixels using a suitably modified algorithm, which successfully captures clouds, including small clouds. Then, a bright subset of the super pixels is analysed using a model, in order to remove bright but unsmooth regions such as buildings. Finally, the average responses filters applied on the super pixels are classified by an SVM model to distinguishbetween diffuse clouds and snowy regions.

The experimental results show that our model more accurately and robustly detects clouds than the compared methods. Prediction of extra humid specific conditions of adding humidity information along with cloud appearance. More specific climatic conditions can be analysed by considering other environmental parameters. Furthermore, in our cloud tracking system, all four proposed irradiance models considerably reduced the prediction errors for forecasts of up to fifteen minutes ahead. Compared with the persistent model, both linear and non- linear models based on the extracted sky-image features significantly offered significantly improved accuracy.

ACKNOWLEDGEMENT

We, Mr. Hameer Mahajani & Mr. Ganadhish Mardikar are greatly thankful to Prof. Mr. K. B. Kharat for the overall guidance. We also thank HOD Mr. M. M. Jadhav for the overall support & backing us with exceptional guidance. We also thank college authorities for providing us the required infrastructure support.

REFERENCES

[1] Ma N, Wang C, Lin S, Wang Q (2019) “Cloud Detection Based on Convolutional Neural Network using Different Bands Information for Landsat 8 OLI. J Remote Sens GIS 8: 259”. doi:10.4172/2469-4134.1000259

[2] J. O. Zhou Ao, S. Teo Xuer, S. V. Salinas and L. Soo Chin, "A Short-Term Cloud Tracking Model Based on the BruhnOptical Flow Method," IGARSS 2019 - 2019 IEEE International Geoscience and Remote Sensing Symposium, 2019, pp.7598-7601, doi: 10.1109/IGARSS.2019.8899104.

[3] M. Le Goff, J. -. Tourneret, H. Wendt, M. Ortner and M. Spigai, "Deep learning for cloud detection,"8th International Conference of Pattern Recognition Systems (ICPRS 2017), 2017, pp. 1-6, doi: 10.1049/cp.2017.0139.

[4] S. Mohajerani and P. Saeedi, "Cloud-Net: An End-To-End Cloud Detection Algorithm for Landsat 8 Imagery," IGARSS 2019 - 2019 IEEE International Geoscience and Remote Sensing Symposium, 2019, pp. 1029-1032, doi: 10.1109/IGARSS.2019.8898776

[5] B. Rusyn, R. Kosarevych, O. Lutsyk and V. Korniy, "Segmentation of atmospheric clouds images obtained by remote sensing," 2018 14th International Conference on Advanced Trends in Radio electronics, Telecommunications and Computer Engineering (TCSET), 2018, pp. 213-216, doi: 10.1109/TCSET.2018.8336189.