International Journal of Innovation and Applied Studies
ISSN 2028-9324 Vol. 3 No. 1 May 2013, pp. 112-115

http://www.issr-journals.org/ijias/

Accuracy Assessment of Cloud Reconstruction Approaches using Segmentation

***E. Menaka*[1]*, Dr. S. Suresh Kumar*[2]*, and M. Bharathi*[3]**

[1]Assistant Professor
Department of Information Technology,
Vivekanandha College of Engineering for Women,
Namakkal, TamilNadu, India

[2]Principal,
Vivekanandha College of Technology for Women,
Namakkal, TamilNadu, India

[3]Department of Information Technology,
Vivekanandha College of Engineering for Women,
Namakkal, TamilNadu, India

ABSTRACT: Cloud is the major obstacle to analyze data in the satellite images. The various approaches are used to remove the cloud from the satellite image for further processing. The approaches are in-painting and multi-temporal. But, the algorithm working for these approaches cannot produce the accurate results. So, that the accuracy assessment helps to motivate the increased accuracy result. The main aim of this paper is to analyze the accuracy of in-paint and multi-temporal approach and produce the pros and cons of those approaches. Accuracy assessment helps to obtain degree of truthfulness of the results. There are 'n' numbers of metrics are available to find the accuracy of the result such as analyzing variance, spatial error, probabilistic error etc. In this paper, two approaches are implemented and the results are applied to the segmentation algorithm. Then, the segmentation results are analyzed by using the error matrix. The error matrix have constructed based on the difference between the clusters of the image result. For segmentation the K-Means algorithm is used and for simplicity only two clusters are segmented. Segmentation result will clearly show that the accuracy of the in-paint and multi-temporal approaches. From the result it is evident that the multi-temporal approach produces a better result when compared to the in-painting. Especially, in that multi-temporal the Averaging method produces better accuracy result.

KEYWORDS: Accuracy Assessment, Cloud Reconstruction, Satellite images, Segmentation, K-Means.

1 INTRODUCTION

Satellite images are useful to monitor various changes on earth such as development of urban regions, deforestation, forest fire, and climate changes and so on. But, the major problem with these images is frequent availability of clouds. The extraction of cloud region information is a serious problem but essential step. It is difficult to remove due to various reasons such as illumination, different atmospheric and sensor conditions.

There are three different types of satellite images are available. They are invisible, infrared and water vapor. In that visible satellite images are easy to identify the clouds. In this satellite, the measure of light uses the same wavelengths as human eye. These images can be only viewed during the day time. The clouds are always reflected by the sun light. Thus, the cloud looks brighter when compared to infrared and water vapor images. Thus, in visible satellite images, clouds are brighter in nature, but snow present in it is very difficult to distinguish from clouds. Objects with higher reflective ability to sunlight appear brighter. Object with lower reflective ability to sunlight is darker on satellite images. The infrared satellite images measured temperatures. So, the clouds can infer based on different temperature being measured, whereas in water vapor it is measured based on the humidity of the atmosphere. Some radar satellites are available that do not affected by the cloud problems because they operate in the microwave range of the electromagnetic spectrum. These types of images are not suitable to replace on the cloudy region. The radiation emitted in microwave range is very low while in visible range the maximum energy emitted.

The paper is organized as follows. In the next section, the brief explanation of literature review required for developing the proposed scheme. In Section 3, the construction of the proposed cloud masking approaches are discussed. The applications of the proposed family as well as the experimental results are given in Section 4, followed by our main conclusions in Section 5.

2 LITERATURE REVIEW

Chao-Hung Lin, Po-Hung Tsai, Kang-Hua Lai, and Jyun-Yuan Chen [4] discussed about the information cloning. They used multi-temporal satellite images to clone the information for the cloudy region. A threshold based method is used to define the boundaries of the cloud. The geometrically corrected images are used as a reference image in order to clone the information. The major drawback of this method is the lack of accuracy of the information for the replaced cloudy region. Asmala Ahmad and Shaun Quegan [3] proposed two methods for cloud masking. They proposed spectral and Principle Component Assessment (PCA) method for the Moderate Resolution Imaging Spectroradiometer (MODIS) data. In spectral approach, threshold is applied in order to detect clouds. They used two methods to detect clouds such as reflective and thermal bands. In the PCA approach, threshold is applied to the seven principal component is derived from spectral analysis. Based upon the positive and negative value the clouds are detected. The difference between the cloud and land was biggest in PC1 and very small in other PCs. From their Study of cloud detection spectral analysis is relaiable.

Ana Carolina Siravenha, Danilo Sousa, Aline Bispo, and Evaldo Pelaes [1] present the evaluation of two approaches widely in-painting literature, applied for noise removal. One is the nearest neighbor interpolation for the information disseminated by a DCT-based smoothing method. The other method is second order partial differential equations methods. The interpolation process depends on the neighborhood of the pixels labeled as 0 and 3. Michael. J. Wilson and Lazarous Oreopoulos [5] proposed a cloud masking algorithm using Landsat Data Continuity Mission (LDCM). The threshold and "Split–Window" technique will use. Nicolas Champion [7] developed a new algorithm for cloud detection using multi-temporal images by using seed extraction and region growing method. The major drawback of this approach is that false positive cloud detection and this leads to the lack of accuracy in the result.

3 PROPOSED SYSTEM

3.1 IN-PAINTING APPROACH

In-paint approach is the information reconstruction approach in which the same image pixel values are to replace the clouded area. There are various methods are available to in-painting approach by using similar pixel replacement, replacing by using any distance formulae etc,. But, here consider, the image is I1 and the clouded area is C1, then C1 have replaced by summation of I1 except the pixels in C1.

The main advantage of this method is the cloud value cannot be restored again. In distance calculation method, suppose the size of the cloud is large then the cloud pixel value will replace. The major advantage of this proposed method is applicable for the large cloud region.

3.2 MULTI-TEMPORAL APPROACHES

3.2.1 TEMPORAL AVERAGING ALGORITHM

The Temporal averaging algorithm is the type of Multi-temporal approach. The two or three reference images have taken and finding the average of the pixel value. The average pixel values have used to fill the gap. It produces the best result when compared with in-paint method. The result have verified by using the simulated cloud. The clouds have simulated manually to prove that the produced result is working efficiently. In above mentioned algorithms help to fill the data instead of cloud but not accurately.

3.2.2 TEMPORAL CLONING

Temporal Cloning is another Multi-Temporal approach. In this algorithm, the same information which is present in the reference year is used to fill in the gap of cloudy region. This method has very less accuracy when compared to the Multi-temporal averaging method.

3.2.3 SEGMENTATION ALGORITHM

The k-means algorithm is used to segment the cloud free images. The cloud free images are usually used for various process and applications such as segmentation, classification and so on. The K-means algorithm is the type of segmentation algorithm which helps to segment different application. Here two clusters are fixed to obtain the segmentation and the two clusters are referred as k=1 and k=2. Then the mean value of the cluster k=1 and k=2 are obtained to find the differences.

4 RESULTS AND DISCUSSIONS

The main aim is to assess the accuracy of the cloud replaced images by using the Segmentation algorithm. Here the mean value of the cluster is used to analyze the accuracy assessment with the simulated cloud. The Table 1 Shows the error matrix for the multi-temporal information cloning images approaches. The Table 2 Shows the error matrix for the multi-temporal information cloning images approaches. The result shows difference clearly shows the accuracy of the information Cloning is worse when compared to the Multi-temporal Averaging method.

Table 1. Error matrix for the Multi-temporal cloning method using k-means segmentation algorithm

Error matrix	Simulated cloud image		Original image		Difference	
	K=1	K=2	K=1	K=2	K=1	K=2
	52.0940	62.2362	52.1973	62.845	0.1033	0.6088
	58.0486	53.3864	58.9661	52.4649	0.9175	0.9215

Table 2. Error matrix for the Multi-temporal Averaging method using k-means segmentation algorithm

Error matrix	Simulated cloud image		Original image		Difference	
	K=1	K=2	K=1	K=2	K=1	K=2
	52.9532	63.2511	53.1973	62.945	0.2441	0.3061
	58.9921	52.4915	58.9661	52.4649	0.026	0.0266

5 Conclusion and Future Work

The Multi-temporal approaches are the very famous approach for cloud masking. The major advantages of these approaches are gain accuracy when compared to the in-paint method. In the in-paint method the ground truth information are not presented. Because the information's are collected from the same image itself. So it cannot produce the accurate information. In the averaging method the approximate value are to be replaced in place of the cloudy region. So the approximate values are to be only able to replace. In the cloning method the exact reference image pixel values are replaced. In all the three methods accuracy will not be appropriate in level because there is no analyze of the data. The previous year images are not analyzed whether the information's are increased or decreased. When analyzing the reference image only the quality of the accuracy result will improve.

The Future work will be analyzing the degree of variance between the reference images. With more reference images also the quality of accuracy will improve. So the Efficient Cloud Detection and Removal algorithm will develop for analyzing the percentage of difference between the cloudy images. So that the accuracy level of the cloudy region will improve.

References

[1] Ana Carolina Siravenha, Danilo Sousa, Aline Bispo, and Evaldo Pelaes, "Evaluating Inpainting Methods to the Satellite Images Clouds and Shadows Removing", Communications in Computer and Information Science Volume 260, 2011, pp. 56-65.

[2] Anil Z Chitade and Dr. S.K. Katiyar, "Colour Based Image Segmentation Using K-Means clustering*", International Journal of Engineering Science and Technology*, Vol. 2(10), 2010, 5319-5325.

[3] Asmala Ahmad, Shaun Quegan, "Cloud Masking for Remotely Sensed Data using Spectral and Principal Components Analysis", *Engineering, Technology & Applied Science Research*, Vol. 2, No. 3, 2012, 221-225.

[4] Chao-Hung Lin, Po-Hung Tsai, Kang-Hua Lai, and Jyun-Yuan Chen, "Cloud Removal from Multi-temporal Satellite Images Using Information Cloning", IEEE *Transactions on Geoscience and Remote Sensing*, Vol. 51, No. 1, January 2013.

[5] Michael J. Wilson and Lazaros Oreopoulos, "Enhancing a Simple MODIS Cloud Mask Algorithm for the Landsat Data Continuity Mission", *IEEE Transaction On Geoscience And Remote Sensing*. Vol. 51, No. 2, 2013, 0196-2892.

[6] Qingmin Meng, Bruce E. Borders, Chris J. Cieszewski, and Marguerite Madden, "Closest Spectral Fit for Removing Clouds and Cloud Shadows", *Photogrammetric Engineering & Remote Sensing*, Vol. 75, No. 5, pp. 569–576.

[7] Nicolas Champion, "Automatic cloud detection from multi-temporal satellite images: towards the use of pléiades time series", *International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, Volume XXXIX-B3, 2012 XXII ISPRS Congress, Melbourne, Australia.