CLOUD REMOVAL FROM SATELLITE IMAGES

Submitted by

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ABSTRACT

This paper demonstrates the studies on cloud masking algorithm. more than one strategies had been advanced to cope with the trouble of cloud detection in satellite imagery and a number of cloud protecting algorithms have been advanced for optical sensors. The primary idea of MCM algorithm is to calculate the distinction among reflectance values between clear pixels and cloud shadow infected pixels. several bands of satellite image which have large distinction values are decided on for developing Multi - temporal Cloud protecting (MCM). that is applied on snap shots from Landsat 8. The qualitative and quantitative assessment show that MCM algorithm can as it should be distinguish between cloud and cloud shadows the usage of confusion matrix. some other technique is the use of pix2pix Generative adversial networks that during assessment to different algorithms gives greater accurate outcomes through distinguishing among cloud, haze, fog which can be dealt with as noise. It makes use of log loss errors function to teach the GANS model. This paper further shows a comparative study that specifies our objective of selecting the GANS version.

***Key Words:** cloudy image , dataset, pix2pix, GAN algorithm , quality image.*

1. INTRODUCTION

Cloud elimination from satellite tv for pc snap shots has been a essential studies mission since the 1960s. advanced satellite tv for pc era has made expertise and studying clouds more particular, supporting scientists to determine the exceptional strategies and protocols to allow us to capture images specific and correct images from satellites. The potential to stumble on clouds from satellite tv for pc pix can help us better understand and fee the world round us. whether or not you are attempting to understand climate and climate styles or benefit an insight into how our environment is converting and how it may be controlled sustainably, accumulating correct and unique satellite tv for pc statistics is vital. this article will talk the manner of cloud elimination, unique techniques used and the importance of know-how clouds from satellite tv for pc pics.

The process of cloud elimination involves identifying clouds in an picture and both covering them, to hold them from being visible, or getting rid of them from the photo completely. Many techniques are used to appropriately become aware of clouds and put off them from the image, and understanding those strategies is essential to getting the most unique facts to be had. The most not unusual approach used to come across clouds is referred to as cloud covering. This method makes use of the visible traits of clouds to isolate them from the picture and covers them up with a layer that essentially hides them, making them appear as part of the historical past. at the same time as this technique is pretty correct, it does not account for versions inside the styles of clouds present within the picture, making it much less unique than other methods.

Any other approach used for cloud removal is called cloud thinning. With this approach, the clouds are identified and eliminated from the picture by means of adjusting the brightness, assessment and backbone of the image. This method debts for diverse varieties of clouds inside the pix, making it extra correct than cloud overlaying however also more computationally intensive.

Eventually, a 3rd approach used for cloud removal is called cloud modelling. With this method, computational fashions of clouds are created and used to perceive and cast off clouds from the photo. This technique yields particularly correct consequences due to the fact the version considers the traits of various types of clouds and the environmental situations wherein they may be fashioned.
The importance of expertise cloud elimination from satellite snap shots lies in the reality that the information accumulated from these pix allows us to better recognize and cost our surroundings.

1.1AIMS & OBJECTIVES

The main objective behind the development and upgradation of existing projects are the following.

- To study different approaches used for cloud removal from satellite images.
- To compare these methods choose an approach for implementation.
- To compare the accuracy of studied approaches and perform research.
- To implement the selected approach.

1.2MOTIVATION

Satellite images now provide the necessary details about the Earth's surface. Numerous research, including those looking at disaster management and prevention, may require this information. These visual scenes may be difficult to see in clouds. This makes it necessary to locate the clouds and swap them out for precise pixels in order to make the photos useful for more general or machine learning (ML)-based studies.
A trained classifier can be used for monitoring land surfaces and detect changes in land use or land cover. These land cover changes can be used for various studies and for future farming and agricultural purposes.

2.SYSTEM ARCHITECTURE OF MCM (Existing System)

MCM requires pre-processing of images. It uses multiple images with different atmospheric conditions, solar illumination and angles. Image pre-processing helps to get rid of these radiometric distortions. For this particular experiment bands 1 to 7 of Landsat 8 are converted to Top of Atmosphere (TOA) reflectance. TOA reflectance for Landsat-8 image is (USGS, pp. 61):
It uses the difference of reflectance values between clear pixels and cloud contaminated pixels, and clear pixels and cloud shadow contaminated pixels to select bands. The band with highest difference of reflectance indicates that the band can be used to distinguish between cloud and clear, and cloud shadow and clear appropriately.

TOA reflectance for Landsat-8 image is (USGS, pp. 61):

$$\rho_{\lambda} = \frac{\rho_{\lambda'}}{\sin(\theta)} \quad (1)$$

where ρ_{λ} = top of atmosphere planetary reflectance (unitless)
θ = solar elevation angle (from the metadata, or calculated)

TOA planetary reflectance can be calculated by:

$$\rho_{\lambda'} = M_{\rho} * Q_{cal} + A_{\rho} \quad (2)$$

where $\rho_{\lambda'}$ = top of atmosphere planetary reflectance, without correction for solar angle (unitless)
M_{ρ} = reflectance multiplicative scaling factor for the band
A_{ρ} = reflectance additive scaling factor for the band
Q_{cal} = level 1 pixel value in digital number (DN)

2.1 CURRENT SCENARIO

The exploitation of Earth statement satellite photos obtained by way of the usage of optical gadgets calls for an automatic and correct cloud detection. dependable and accurate cloud detection is a obligatory first step in the direction of developing far flung sensing merchandise based totally on optical satellite images. Undetected clouds inside the obtained satellite pictures hampers their operational exploitation at a worldwide scale for the purpose that cloud contamination impacts maximum Earth announcement package deal. Cloud covering of time series is for that reason a concern to acquire a better monitoring of the land cover dynamics and to generate more elaborated products. Cloud detection procedures are normally based on the notion that clouds gift some useful features for his or her identification and discrimination from the underlying floor. on the handiest hand, a clean technique to cloud detection is composed then in making use of thresholds over a hard and fast of decided on capabilities, such as reflectance or temperature of the processed

2.2 PROPOSED SYSTEM

The proposed system is divided into two parts i.e discriminator and generator. Here we use tensor flow which is an end to end machine learning platform. Advanced machine learning-based techniques, such as deep Convolutional Neural Networks (CNNs) and Generative Adversarial Networks (GANS), have demonstrated their effectiveness

Generator: Image input is given to generator. One with cloud and other without cloud. This is to train the generator for generating a clear cloud free image. Data is loaded as a jpeg images and then converted to set of pixels with RGB. The generator will output an image by adjusting each and every pixel color by taking an average of its surrounding pixels. This

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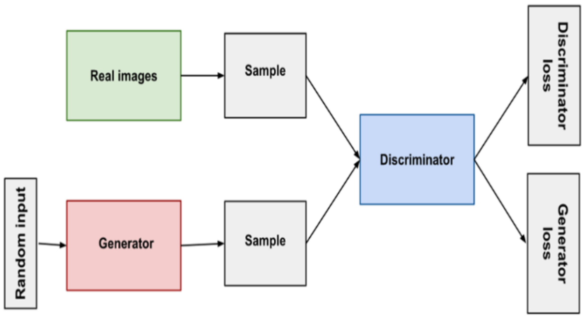
will result in translation and shifting of pixels and ultimately it will output a cloud free image.



Discriminator: The discriminator is built to discriminate between the real and generated image .Data from discriminator will be used to check and improve the accuracy of generator. This will train the generator to generate more accurate image.

In order to identify and replace the clouds in satellite photos, researchers have conducted a variety of studies. Both traditional techniques and cutting-edge ML-based methodologies can be used to categorize these investigations.

Three major categories can be used to categorize conventional methods: multi-spectral, multi-temporal, and inpainting. Images with some cloud coverage can be processed using multi-spectral methods.

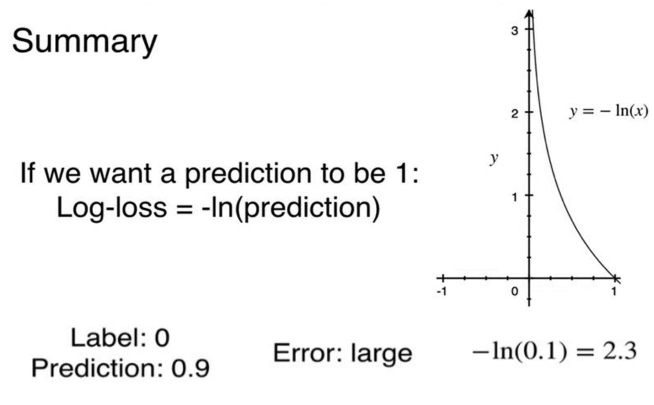
Inpainting methods can use cloud-detection algorithms to locate the cloudy area of a picture so that it can be recreated using the other non-cloudy areas .Advanced machine learning-based techniques, such as deep Convolutional Neural Networks (CNNs) and Generative Adversarial Networks (GANS), have demonstrated their effectiveness to recover the missing information alongside.

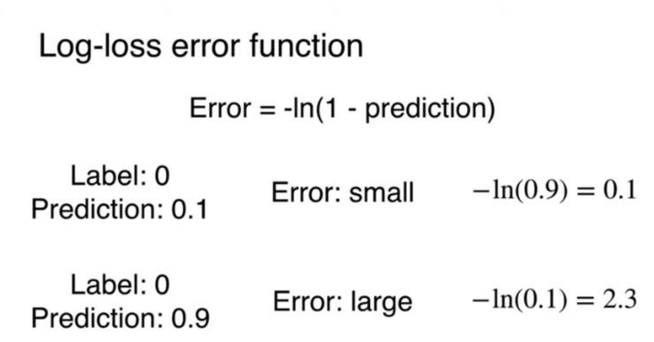
GANs perform unsupervised learning tasks in machine learning.They compete with each other to scrutinize, capture, and replicate the variations within a dataset.

GANs are a clever way of training a generative model by framing the problem as a supervised learning problem with two sub-models:

The generator model that we train to generate new examples, and the discriminator model that tries to classify examples as either real (from the domain) or fake (generated).

3. Training





It uses log loss error function for the purpose. More the graph of log loss is close to zero more accurate will be the output. At initial level the discriminator will be able to discriminate between real and generated image due to the errors after certain graph will be close to zero and it will not be able to discriminate between large number of iterations discriminator's log loss real and generated images.

4.CONCLUSION

Our study presents a novel method for generating cloud-free images from cloudy ones using deep productive models, which results in improved structural similarity with the target optical images. Our results demonstrate the practical value of these generated images for downstream tasks. We believe that our approach provides a strong foundation for further research and development in this area, and we look forward to seeing how our findings can be extended in future studies.

4.1 SUMMARY

Satellite imagery benefits multiple industries flaunting a wide range of applications. Yet, it would not be entirely possible without cloud masking techniques. Haze or clouds have an impact on the bulk of optical measurements made by spaceborne satellites. Therefore, prolonged cloud cover inhibits the ability of the remote sensing practitioner to continuously and seamlessly monitor our world. The goal of this project is to aid in optical satellite image reconstruction research and development, and transform cloud-covered data from global satellite observations.

Generative modelling has shown to be a more efficient way for recovering missing information based on a learned distribution than earlier techniques. In the task of translating one image into another, generative models have lately produced state-of-the-art results and can be successfully used to convert cloudy photographs into cloud-free images. They can be trained with a lot fewer photos than image composite approaches, and the machine learning approach makes use of learnt instead of manually created feature generators.

4.2FUTURE SCOPE

This project can be further enhanced to provide greater flexibility and performance with certain modification whenever necessary.

By combining more neural network algorithms, the model's performance can be further enhanced.

- Our project can further be developed into an application that takes all real time satellite images and generates a clear, uncloudy data.
- Further it could be trained to differentiate between cloud, snow, fog and haze for more accurate results.
- Many important observations captured by satellite could be found and analyzed.

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