Some Algorithms for Weather Prediction Using Thin Clouds

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Abstract: Clouds are important for climatic changes in the atmosphere. Cloud images are taken by visible and infrared satellites. Both visible and infrared satellites, the clouds that are not very white are called Thin Clouds. So, the identification of a thin cloud is hard to find out. In this paper, some algorithms for spotting thin clouds are proposed. They are HSL (Hue Saturation Light), ROI (Region of Interest), Watershed, Demirel and Color Segmentation. HSL (Hue Saturation Light) is used for finding the ratio of color in the cloud image, ROI (Region of Interest) is used for removing the cloud and the sky elements of the cloud image, Watershed and Demirel algorithm are used to segment the Thin Clouds. The extract values from the cloud image are measured using Gaussian Filter. The weather forecasting is carried out by comparing the images in the database after performing color segmentation by k-means clustering.

***Keyword*-Thin cloud, HSL, Demirel, Watershed, Color segmentation, k-means clustering, Gaussian Filter**

I. INTRODUCTION

Clouds are composed of liquid water and they are crucial for predicting changes in earth's energy balance, weather, and climate. A climate change depends upon Low, Middle and High Clouds. These clouds indicate various climatic conditions. Manual observation of weather by viewing the cloud by the normal eyes was difficult in olden days. Later the weather was predicted based on animals. Animals can easily sense the climatic changes. Depending on the behavior of animals, humans had predicted the climatic changes. Nowadays, satellites are used to capture cloud images and to forecast the weather. Thin cloud detection is an approach for differentiating the cloud and the thin cloud elements. Existing thin cloud detection techniques are based on spectral analysis, labeling, radiative transfer model techniques, statistical techniques and thresholding techniques. Masking in spectral analysis is very difficult to detect thin clouds. Labeling problem is unsuitable for different climatic changes in the sky. Radiative transfer model suits only for the clear sky images. A statistical technique represents only the different cloud types and cloud surfaces. Two types of thresholding techniques namely are fixed thresholding and adaptive thresholding are used for thin cloud detection.

A non-linear discriminative method using MAP-ML (Maximum-a-Posteriori and Maximum Likelihood) and ICM (Iterative Conditional Model) can be used for efficient detection of thin clouds. Applications of image segmentation for thin cloud detection are Hidden MRF, Gaussian Mixture Model, Normalized cut and MAP-MRF. In this paper thin clouds are identified by minimizing the posterior energy. A few algorithms are discussed for unearthing thin clouds for fore sighting the weather. First, thin clouds are identified by using the segmentation algorithms like ROI, HSL, Watershed, Demirel and Color Segmentation. The resulted thin clouds are compared with the stored images in the database. Finally the weather is reported approximately depending upon the resulted output. This paper is designed as follows. The related work is discussed in Section II. In Section III methodology is performed. In Section IV results and discussions are presented. Finally, in Section V conclusion is discussed.

II. RELATED WORK

The sky cover and cloud type are useful method in image processing techniques [1]. The pixel comparison of clear sky images is used for the determination of colors [2]. The Intensity, Hue and Saturation (IHS) are an important feature for finding cloud images [3]. The patterns of image pixels are used for the classification of images [4]. The distance between the adjacent nodes are done by using labeling problem [5]. The similarity and dissimilarity between the groups are discussed in a method called normalized cut [6]. Extractions of images are analyzed using the optical properties in the image processing [7]. An extensive survey of color segmentation and categorization was carried out [8]. The edge detection of images using a segmentation algorithm was demonstrated.

III. METHODOLOGY

In the proposed method, the loaded image is segmented for thin cloud detection using HSL (Hue Saturation Light), ROI (Region of Interest), Demirel, Watershed and Color Segmentation. The cloud and sky elements are extracted from the given image. The extracted cloud image is compared with the images in the database. Finally the weather is predicted approximately. The weather prediction process is shown in fig 1.

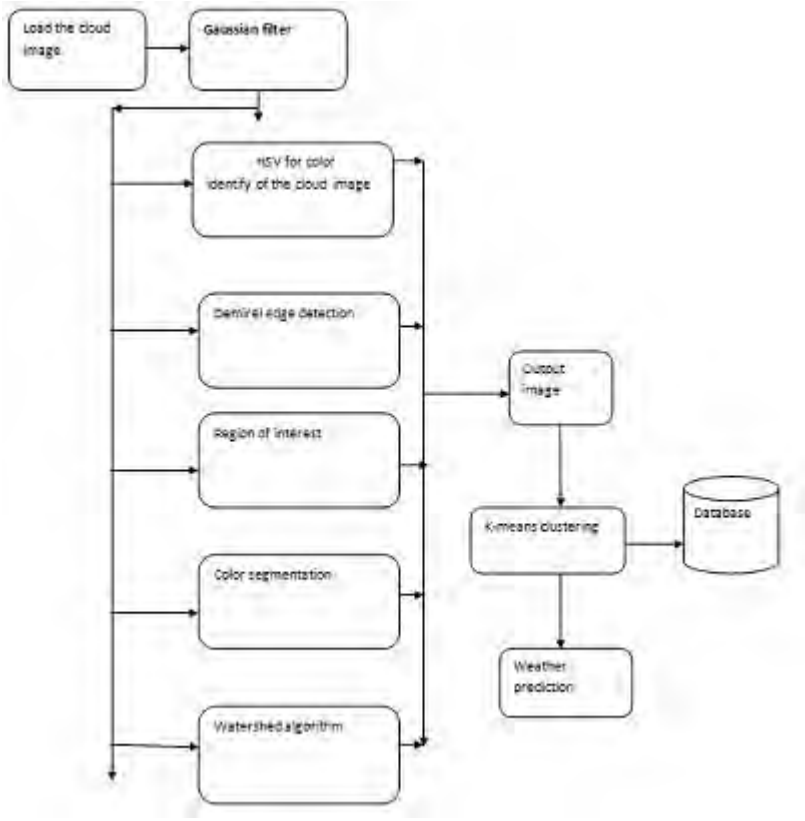


Fig 1. Flowchart for weather prediction

A. HSL Algorithm

HSL algorithm is used for finding the ratio of color in the image. Here the color ratio can be determined by two ways. They are 1) HSL using pie chart and 2) HSL uses histogram.

1) HSL Using Pie Chart and Histogram:

Step 1: The image converts it into a GRAY scale image.

Step 2: color ratio is predicted to determine the thin clouds

Step 3: Plot the exact color ratio using pie chart and histogram

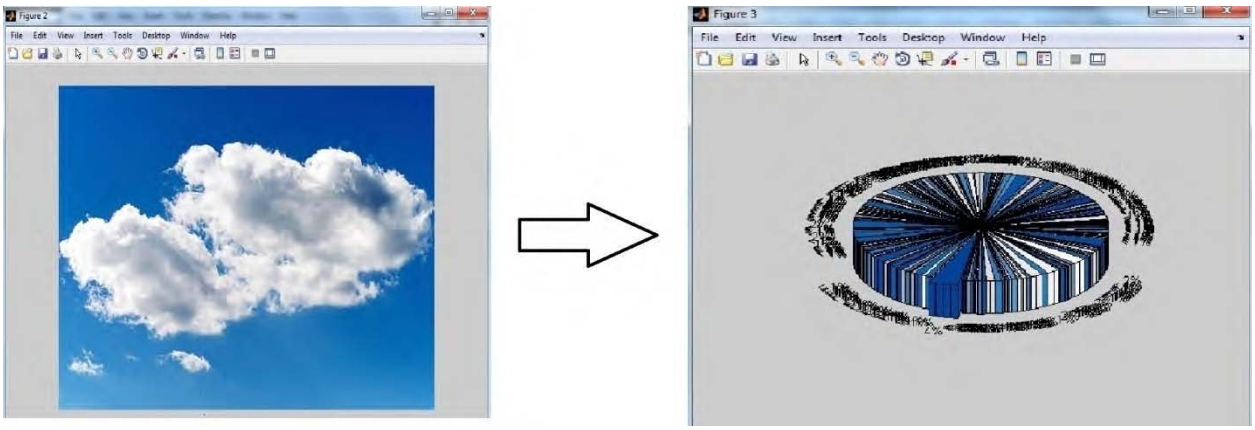


Fig 2. Pie chart representation of the color ratio of the given image

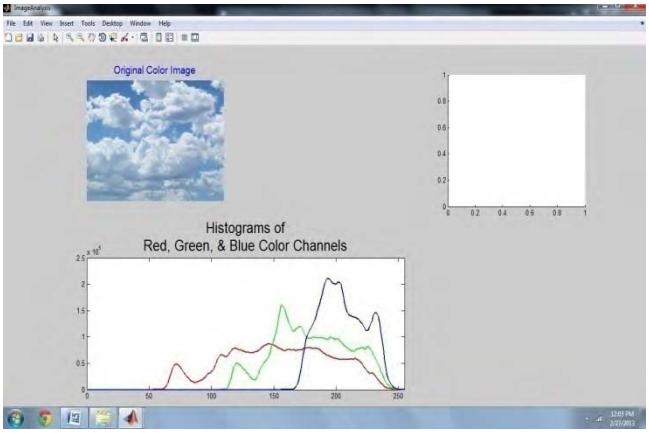


Fig. 3. A Histogram represents the percentage of color in the given image

B. ROI Algorithm

Thin clouds can be identified by checking the pixel values. It is assumed that thin cloud will have a pixel value 1.

Step: 1 Segment the thin cloud from the input image by using ROI (Region of Interest) is applied.

Step: 2Thin clouds are determined by using pixels.

Step: 3 if the pixels are set to 1 it is considered as a cloud

Step: 4 if the pixels are set to 0 they are excluded sky part

Step: 5 finally sky and cloud parts are separated.

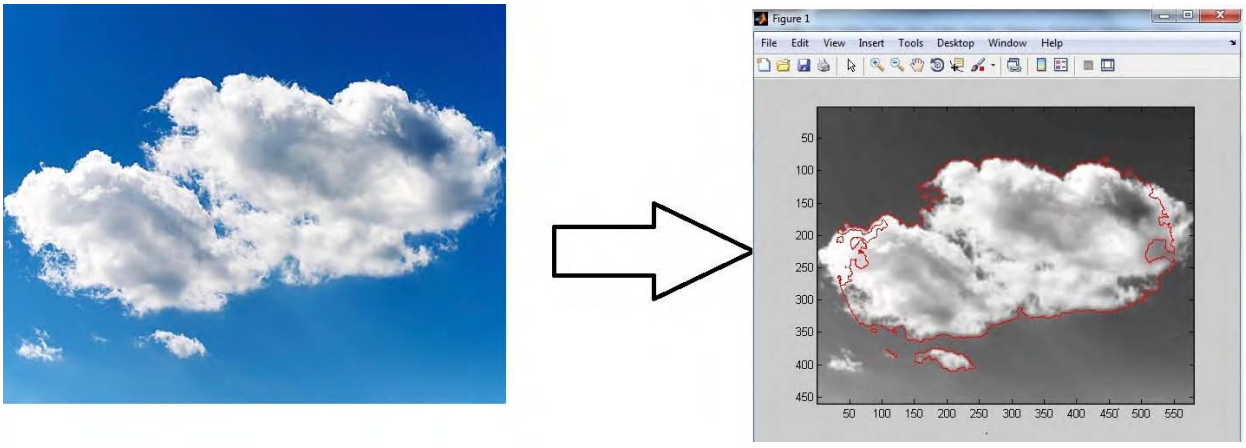


Fig 4. ROI extraction of cloud and sky part

C. Demirel Algorithm

Edge detection can be done by using Demirel algorithm. Two types of structuring are available. They are,

1. Morphological
2. Casting.

Here our discussion is fully based on morphological segmentation. The morphological operations can be given for filtering, thinning and pruning. The Morphology comes from the set theory, where the image objects can be depicted by sets.

Step: 1 convert it into a GRAY scale image

Step: 2 set the edges of the given image using morphological structuring.

Step: 3 By using this thin cloud is detected.

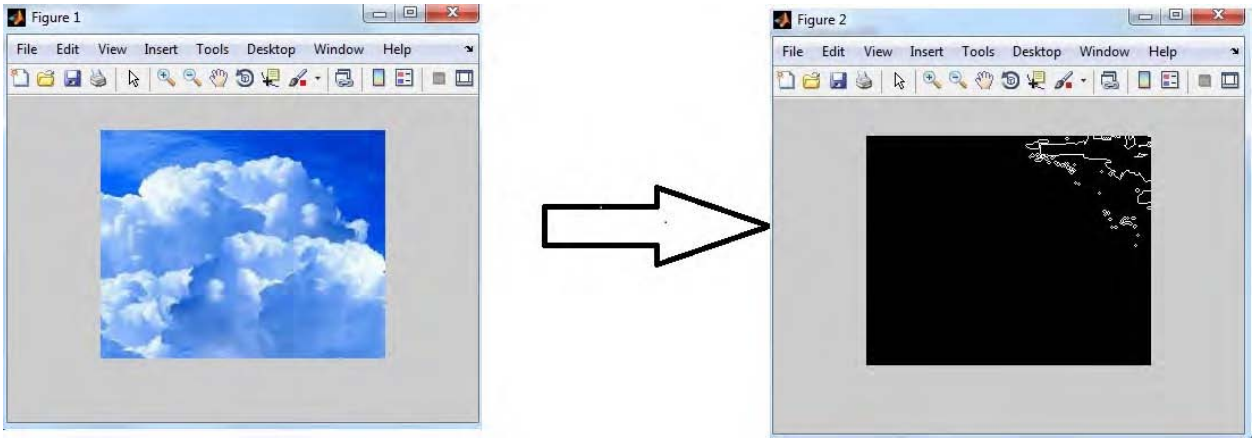


Fig 5. Demirel Detection of Thin Cloud: Thin cloud part is identified as edges in the output

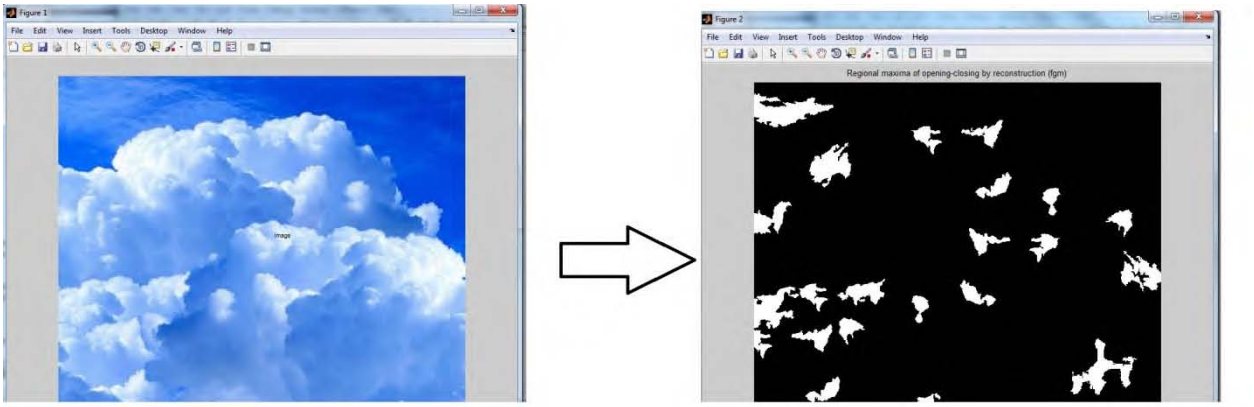
D. Watershed Algorithm

The magnitude intensities of an image are determined by watershed algorithm.

Step: 1 convert it into a GRAY scale image

Step: 2 Gradient magnitude is estimated to determine the location of edges in the cloud image.

Step: 3 Finally by using these edges thin cloud is predicted.



(a) (b)

Fig 6. Watershed Method: The input image (a) and its thin cloud part (b)

E. COLOR SEGMENTATION

Color segmentation is based on feature(s) derived from spectral components. The segmentation process can be achieved by using some extra knowledge about the objects in the scene using geometric and optical properties.

Step: 1 set the rows and column values for the given image

Step: 2 k-means clustering is used for splitting the observations into k clusters.

Step: 3 by using this thin clouds are predicted.

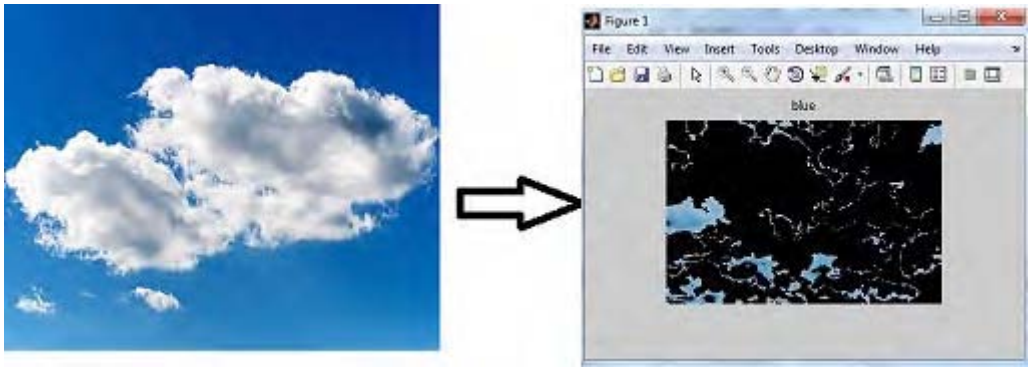


Fig 7. Color Segmentation

IV. RESULTS AND DISCUSSIONS

The predictions of thin cloud by using some algorithms are proposed. A database is created done by using the MEX compiler in Mat lab. The database stores the original image and the output image. Gaussian Filter has the minimum possible group delay and exact values are estimated. Depending upon the stored image of thin clouds and thick clouds, the weather is predicted approximately.

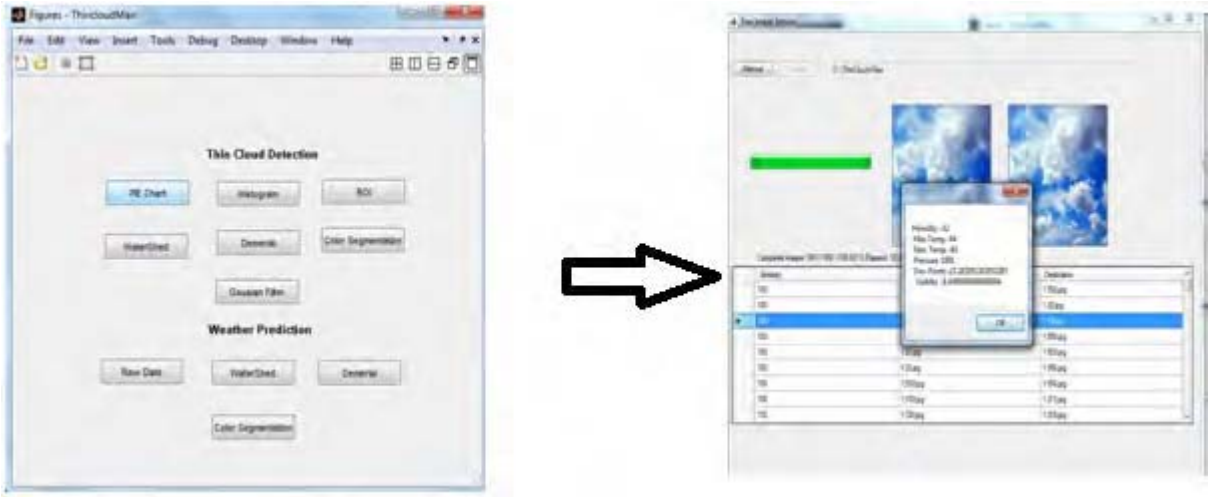


Fig 8. Output: The result of thin cloud detection and weather prediction

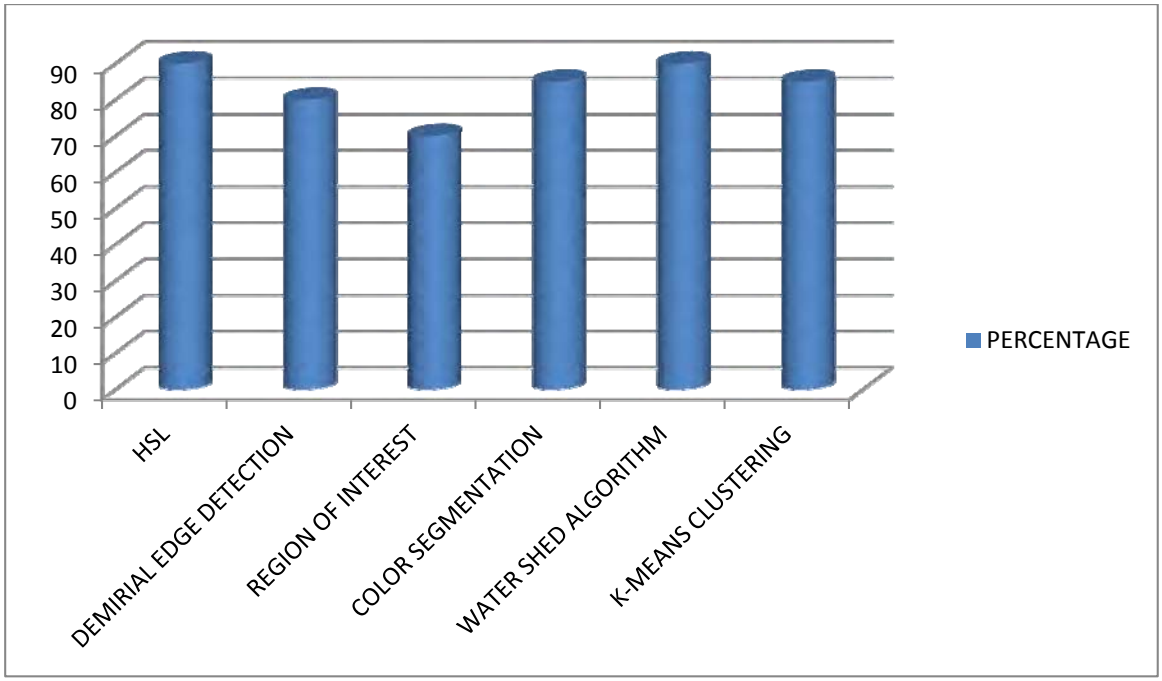


Fig 9. Percentage of Resulted output

V. CONCLUSION

The problems of detecting thin clouds by different algorithms are discussed and an efficient solution is achieved. The thin clouds are accurately predicted using a watershed algorithm and the color segmentation algorithm when compared with other algorithms. Furthermore for the purpose of better understanding, weather prediction for both thick and thin clouds are performed. Thus the results obtained show that the thin clouds are more efficient in weather prediction.

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