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SATELLITE IMAGE SEGMENTATION USING HSV COLOUR SPACE WITH EPITOMIZED KERNEL BASED FUZZY C MEANS (EKFCM)

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ABSTRACT - Segmentation of Image is one of the promising and dynamic researches lately. Partitioned our segmentation task into three critical advances First, a basic segmentation is cultivated using dynamic local thresholding, making a lot of regions. Satellite images are by and by used as a useful device for farming administration and observing. In this paper we proposed HSV colour space with Epitomized Kernel based Fuzzy C Means (EKFCM) algorithm for satellite image segmentation. It is also maybe the most troublesome image segmentation problem on account of factors like ecological conditions, poor resolution and poor brightening. Pixel clustering is a well known strategy for concluding the homogeneous image regions, contrasting with the unmistakable land cover types, considering their spectral properties and Introduced as HSV colour space with EKFCM based segmentation technique for agriculture satellite images.

Keywords: Satellite Image Processing, Image segmentation, HSV, RGB, Colour Space;

1. INTRODUCTION

The Improvement in the resolution of satellite imagery and the increment in the quantity of satellites that are utilized for remote detecting and observing of the climate have prompted an emotional expansion in the volume of the data accessible to researchers. Full double-dealing of these data necessitates that examination approaches be pretty much as completely computerized as could be expected, while taking into consideration basic, however restricted, client association. The satellite imagery of natural scenes presents various novel problems, and it contrasts from the assessment and segmentation of urban, commercial, or agrarian regions. At long last, the presence of natural objects can fluctuate incredibly dependent on the geographic region, the season, the momentum climate conditions, or the previous climate conditions. For instance, the backscatter of synthetic aperture radar (SAR) sea ice images.

Image segmentation implies relegating a label to every pixel in the image to such an extent that pixels with same labels share normal visual characteristics. It makes an image simpler to investigate in the image processing undertakings. There are a wide range of techniques accessible to perform image segmentation. Our thought process is to execute practically similar idea as we people attempt to carry out, while understanding the image which we visualize. In human vision, the intricate image is promptly segmented into the straightforward objects based on color, texture, patterns, shapes, and so forth This equivalent thing is developed with the assistance of the image segmentation techniques in the computer vision framework. We could section the digital image based on these elements, with the goal that the undertaking of comprehension of image should be possible in a straightforward and humanly way.

2. EXISTING METHODOLOGY

1. Biplab Banerjee, Surender Varma G, Krishna Mohan Buddhiraju et.al Satellite Image Segmentation: A Novel Adaptive Mean-Shift Clustering Based Approach. Segmentation of satellite images using a smart adaptive non parametric mean-shift clustering algorithm is proposed in this paper. Image segmentation refers to the most common way of splitting up an image into its constituent objects. In this paper, an original clustering based satellite image segmentation technique is proposed. The clustering depends on the idea of mean-shift method and is non parametric ordinarily. The segmentation is object based. First watershed is applied to the crude image data to create an over segmented image. The proposed clustering is performed now on object switch. The main downside of the method is its higher time intricacy because of the mean-shift paradigm. This can be diminished by switching to the parallel execution of the algorithm.

2. Kerem Sahin, Ilkay Ulusoy et.al Automatic Multi-Scale Segmentation of High Spatial Resolution Satellite Images Using Watersheds. A segmentation method is proposed for high spatial resolution satellite images. This segmentation approach is a decent contender for an object-based classifier's segmentation step. A programmed segmentation algorithm that depends on watersheds and region merging sort multi-scale segmentation (MSS) is proposed, which can be utilized as the initial advance of an object-based classifier. By thusly, rather than manually labeling numerous pixels, labeling just a limited quantity of segments could speed up a classification.

3. Nailussa Ada, Tri Harsono, Achmad Basuki et.al proposed Satellite image segmentation contains a most critical job to carry out inside the field of remote detecting imaging, for detection of the outer layer of the planet adequately. One of the satellite images that accessible in Indonesia is Homeward 8 IR enhanced gave by Indonesian Agency to Meteorology, Climatology and Geophysics, refreshed each hour. Meng hee heng k-means and DBSCAN proposed as the algorithm. Both of algorithms give a steady cluster numbers on each datum with data range esteem between 0.45 - 0.47. The examination result demonstrates that DBSCAN can acquire more specific result of the cloud structure division displayed by the number of cluster obtained.

3. PROPOSED METHODOLOGY

In this research work proposed HSV colour space with Epitomized Kernel based Fuzzy C Means (EKFCM) algorithm. This colour based method is based with respect to HSV colour space and histogram edge. In the proposed approach, the satellite image in RGB colour space is transformed into HSV colour space and afterward the transformed satellite image is parted into three distinct components (stations or images) in light of intensity and colour. This HSV colour space is intended to surmise the human vision. In the subsequent stage, the histogram for every one of the three components (shade, saturation and worth) is processed and plotted. Then, at that point, the edge esteem is independently applied to every one of the three components.

3.1 HSV Colour Space

The HSV colour space is a mathematical representation of colours in three dimensional Cartesian coordinates like tint, saturation and worth. The tone addresses the colour type or shade of the colour by which we can without much of a stretch recognize one colour from another. The tint is a point from 0 to 2π (360 degrees), normally 0 or 360 degree addresses red colour, 60 degree addresses yellow colour, 120 degree addresses green colour, 180 degree addresses cyan colour, 240 degree addresses blue colour, and 300 degree addresses magenta colour. The transformation from RGB colour space to HSV colour space is given in the following equations

$$H = arccos\frac{\frac{1}{2}(2R - G - B)}{\sqrt{(R-G)^2 - (R-B)(G-B)}}$$

$$S = \frac{max(R, G, B) - min(R, G, B)}{max(R, G, B)}$$

$$V = max\,(R, G, B)$$

The purposes behind utilizing HSV colour space in image segmentation is recorded as follows:

1. The HSV colour space approximate the human vision i.e., depict the colours in a way like how the human eye will in general perceive colour.
2. In RGB colour space, the colour is addressed as a blend of three essential colours Red, Green and Blue. HSV depicts colour utilizing three unique components as shade (colour), saturation (vibrancy) and value (brightness).
3. In HSV colour space, the intensity information can undoubtedly be isolated from the color information. This is exceptionally helpful in numerous applications like robustness to lighting changes, or removing shadows.
4. More information can be retrieve from HSV colour space
5. The RGB colour space is device dependent while HSV colour space might be device dependent or independent relying upon applications.

The extraction of the ideal region of interest in the satellite images is proposed. This colour based method is carried out utilizing HSV colour space and histogram limit. Despite the fact that number of images are tried utilizing the proposed method, the result of just one image is delineated and clarified in this article. Despite the fact that the robustness and efficiency of the proposed method the HSV colour space isn't actually perceptually uniform and device dependent.

3.2 Morphological Operations for Edge Preservation

Morphology is the investigation of the shape and type of objects. Morphological operations apply an organizing element to an input image, making an output image of a similar size. In a morphological operation, the value of every pixel in the output image depends on an examination of the relating pixel in the input image with its neighbours. Morphological image analysis can be utilized to perform following:

- Object extraction
- Image filtering operations, such as removal of small objects or noise from an image
- Image segmentation operations, such as separating connected objects
- Measurement operations, such as texture analysis and shape description

In this proposed work, dilation and erosion morphological operations are thought of and are HSV colour space process utilized for edge protecting techniques. Dilation adds pixels to the limits of objects in an image, while erosion eliminates pixels on object limits. In a binary image, assuming any of the pixels is set to the value 1, the output pixel is set to 1. Erosion operation will find local minima in binary or intensity images. Here the value of the output pixel is the base value of the relative multitude of pixels in the input pixel's neighbourhood. In a binary image, in the event that any of the pixels is set to 0, the output pixel is set to 0.

3.4 Clustering

Clustering is a cycle that endeavours to discover structures or certain patterns in a data set, where the objects inside each cluster show a specific level of comparability. For image section based classification, the images that should be classified are segmented into numerous homogeneous regions with comparable spectrum information. The colour homogeneity relies upon the standard deviation of the spectral colours, while the shape homogeneity relies upon the compactness and smoothness of shape.

3.5 Epitomized Fuzzy C-Means Clustering Algorithm

The epitomized fuzzy c-means clustering (EFCM) algorithm with further developed fuzzy segment incredibly works on the exhibition of kernel fuzzy c-means clustering algorithm (KFCM). EFCM under suitable parameters can meet more quickly than FCM. To make EFCM strong to noise in gray images, EFCM was consolidated with the local information got from the image. To additionally work on the insensitivity or EFCM to noise in gray images, a kernel adaptation of' EFCM with spatial information is proposed. By presenting the spatial constraint term, it acts heartier than EFCM in the noisy gray image segmentation.

However the conventional FCM algorithm functions admirably on most noise-free images and KFCM algorithms have great execution in the applications by given fitting kernel work and reasonable parameters. In any case, the KFCM algorithm portrayed in past area actually has one downside: it is exceptionally sensitive to noise and other imaging relics, since it doesn't consider any information about neighbourhood term. Utilizing the KFCM algorithm on image segmentation, the computation of J just consider the pixels of X,, indeed, the neighbor around of the X, have the suggested relationship to the X,

As a result the KFCM algorithm is unacceptable for images undermined by motivation noise. To beat this problem, propose an epitomized kernel based fuzzy c means (EKFCM) algorithm which incorporates local information into its objective capacity, defined in terms of J_EKFCM as follows:

A local spatial constraint term where x means the spatial information of the pixel z,, into the objective capacity of FCM to make FCM hearty to noise in the image EFCM was consolidated with this spatial constraint term and the objective capacity of EFCM S with spatial information was introduced as follows

$$J_{\mathrm{EFCM}_S} = \sum_{i=1}^{c}\sum_{j=1}^{n} u_{ij}^{m}\|x_j - \vartheta_I\|^2 + \sum_{j=1}^{n} a_j \sum_{i=1}^{c} u_{ij}(1 - u_{ij}^{m-1}) + \beta \sum_{i=1}^{c}\sum_{j=1}^{n} u_{ij}^{m}\|\bar{x}_j - \vartheta_I\|^2$$

The third term is the spatial constraint term, in which the parameter β, I controls the punishment el'lect of the spatial constraint. In this work, the mean (median) of' the neighbors inside a predetermined window around the pixel $x_j$is used to address x_j,, and signify EFCM with the mean (median) spatial information as EFCM_S. Through kernel substitution, the objective function of kernel epitomized fuzzy c-means clustering with spatial information (KEFCM_S) is given as follows

$$J_{\mathrm{KEFCM}_S} = 2\sum_{i=1}^{c}\sum_{j=1}^{n} u_{ij}^{m}(1 - K(x_j, \vartheta_I)) + \sum_{j=1}^{n} a_j \sum_{i=1}^{c} u_{ij}(1 - u_{ij}^{m-1}) + \beta \sum_{i=1}^{c}\sum_{j=1}^{n} u_{ij}^{m}\|\bar{x}_j - \vartheta_I\|^2$$

The equation can be validated by determining the described intensity ϑ_i. To determine the ϑ_i value, the J_{KEFCM_S}, is converted into unconstrained form L. By taking partial derivative of L as for to v_i and setting it to zero,

$$\frac{\partial L}{\partial \vartheta_I} = 0 \leftrightarrow \sum_{j=1}^{n} u_{ij}^{m} K(x_j, \vartheta_I)(x_j - \vartheta_I) + \beta \sum_{j=1}^{n} u_{ij}^{m} K(x_j, \vartheta_I)(x_j - \vartheta_I) = 0$$

$$v_I = \frac{\sum_{j=1}^{n} u_{ij}^{m} K(x_j, \vartheta_I)x_j + \beta K(x_j, \vartheta_I)\pi_j}{\sum_{i=1}^{n} u_{ij}^{m} K(x_j, \vartheta_I) + \beta K(x_j, \vartheta_I)}$$

It is clearly shown that the comparing enrolment values o1"the noisy, just as of the no-noisy pixels bit by bit keep an eye on a comparative value later iteration by cycle, disregarding the noisy pixels. Subsequently, all pixels inside the window have a place with one cluster. In this manner, the mix o1" the spatial and the gray level constraints joined in the variable K stifle the impact of the noisy pixels. Besides, the component K is naturally determined as opposed to artificially setting, even in the absence of any prior noise knowledge.

Algorithm for the proposed extraction of wanted region as follows.

Step 1: The input image is ordinarily in RGB colour space. This colour space isn't favoured in light of the fact that this space isn't perceptually uniform and all components ought to be quantized with a similar precision. So it is important to change over into other colour space.

Step 2: The Image in RGB colour space is transformed into HSV colour space. The HSV image is parted into three distinctive sub images as tone, saturation and value. The tone addresses the colour type or shade of the colour by which we can undoubtedly recognize one colour from another. The saturation characterizes the virtue of the colour or tint i.e., what measure of white colour is blended in with shade. The value addresses the brightness of the colour.

Step 3: Histogram for each of the three components (tint, saturation and value) is registered and plotted.

Step 4: Choose low and high edge value for every component.

Step 5: The morphological operations like masking, filtering and smoothing is performed. In this operation, the pixel value in the output image depends on an examination of the relating pixel in the input image with its neighbours. In image processing, the morphological reproduction processes one image dependent on the characteristics of one more image is called as veil.

Step 6: Filtering is performed to eliminate the objects having more modest pixel value. For instance, the objects having fewer than 200 pixels are removed.

Step 7: For the natural search for the extricated output image, the output image is smoothened by eroding the image twice with any of the structuring element.

Step 8: The epitomized fuzzy c-means clustering (EFCM) algorithm with further developed fuzzy segment clustering, the non-Euclidean structures in data are incorporated.

Step 9: Fill the image regions and holes in the ceased object or region.

Step 10: The result is the extraction of the ideal region of interest in the satellite image.

2.4 Experimental Result

The experiment has been conducted for a number of satellite images samples of an original satellite image taken for this experimental consideration.

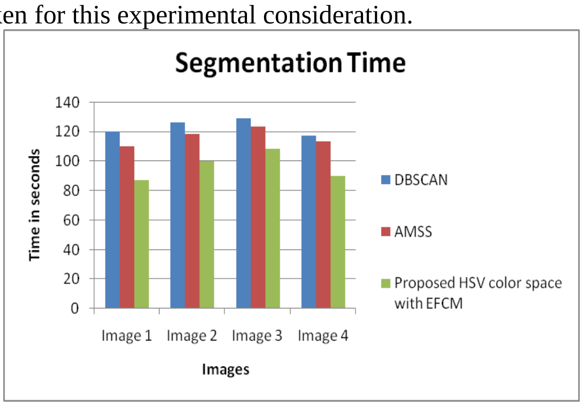

Figure 2.4 Comparison chart of Segmentation Time

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Figure 2.4 shows the Comparison table of segmentation times (in seconds) Values explains the different values of existing algorithms (DBSCAN, AMSS) and the proposed HSV colour space with EFCM method. X axis denote the Times in seconds and y axis denotes the Images. The proposed HSV colour space with epitomized kernel based fuzzy c means (EKFCM) algorithm values is better than the existing algorithm. The existing algorithm DBSCAN, AMSS values start from 120 to 117, 110 to 113 and proposed HSV colour space with EFCM method values start from 87 to 90. The proposed method provides the great results.

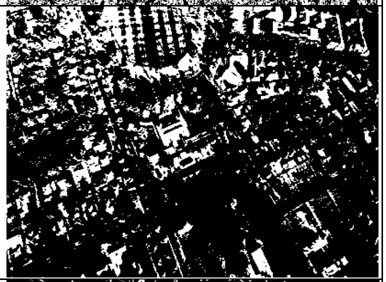
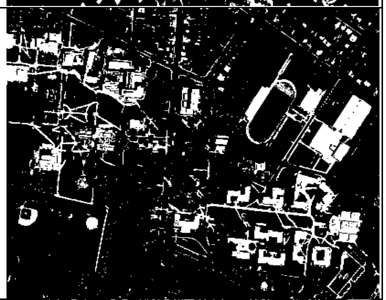
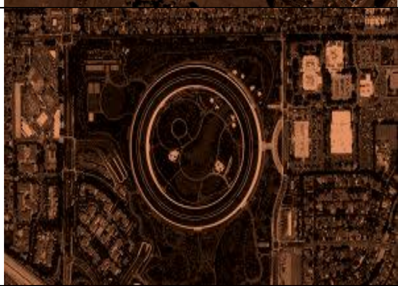
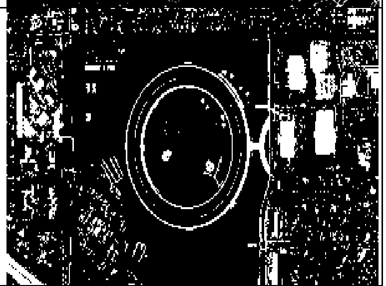
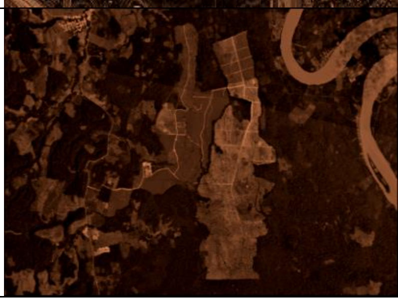
Input Image	HSV colour space segmented image	epitomized fuzzy c-means clustering (EFCM)
		
		
		
		
		

Table 1.HSV colour space image segmented with EFCM transformed image

The above Table 1 shows the HSV colour space image segmented with EFCM transformed image. Dilation operation will find the local maxima in binary or intensity images. Here the value of the output pixel is the maximum value of all the pixels in the input pixel's neighbourhood. HSV segmentation done on input image then EFCM clustering was done to produce the final image.

CONCLUSION

In the satellite image processing, segmentation is the most significant yet troublesome interaction to accumulate tremendous measure of information. In this phase, another method for the extraction of the ideal region of interest in the satellite images is proposed HSV colour space with Epitomized Kernel based Fuzzy C Means (EKFCM) algorithm. This colour based method is carried out utilizing HSV colour space with EKFCM and histogram limit. Remove the region of interest in other colour like green, yellow, blue by making the slight adjustment in the algorithm. At last the segmentation result is assessed by utilizing different image quality parameters to look at the result of the RGB and HSV images. The result obviously shows that the HSV colour space with EKFCM is more efficient and viable for satellite image segmentation.

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