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AUTOMATIC ESTIMATIONS OF OIL SEEP LOCATIONS USING SYNTHETIC APERTURE RADAR IMAGES(SAR)

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***Abstract*— Color image segmentation has been the hotspot for the researchers in the image processing field. Color image segmentation using the k-means clustering algorithm has yielded fruitful results. An advantage resulting from the choice of color space representation could be taken to enhance the performance of segmentation processes. The amount of information contained in the segmented objects is adopted as a measure to determine the segmentation rule. In this project the segmented object is an oil seeped area in sea surface. Here we segment all regions in a naturally captured image of sea surface and the segmented image can be used for further analysis like amount of affected area, counting affected area in large surface. Our proposed system is simulated and implemented using Matlab R2013a and Xilinx ISE softwares.**

KEYWORDS—Xilinx ISE, Clustering, MATLAB, k-means, Segmentation

I. INTRODUCTION

First, colours in the image are completely quantized without considerably decreasing the colour quality of the natural scene. The objective is to extract a few colours denoting the different regions in the image that will be used to distinguish surrounding regions in the image. Typically, 8-15 colours are required to separate regions of natural scenes. A good colour quantization is important to the segmentation process. K-means clustering algorithm is used in our implementation.From the results, it is possible to identify regions of interest, foreground extraction, background elimination and objects in the scene, which is very useful to the further image analysis. Coloured images are attracted to many researches for analysis of colour image. Coloured images are major component to represent the colour data of each pixel in the image.

Image segmentation is the process of interpretation of properties lies in image, may be that can be noise reduction, image enhancement, tracking, object detection and image registration, all these applications are very important techniques in future world of image processing. Image segmentation has been the most important thing for image processing based applications and has a vast impact on the overall performance of the developed image processing applications. Image segmentation contains dividing the image into several regions having similar pixel properties within that region. The aim of segmentation is to simplify or refining the image representation into something that is

more meaningful and easier to analyse foreground and background components. Segmentation is mainly used to form a set of segments that collectively cover the entire image. Researchers are only interested in certain segments of the image.

Image segmentation techniques can be broadly divided into two categories dealing with the properties of intensity values, they are, namely: discontinuity and similarity. Using the discontinuity property we segment an image into regions having sufficient difference in terms of intensity values of each pixel from each other and from the background to allow boundary detection based on local discontinuities in intensity.

Using the similarity properties of an image we can segment numbers of regions having same properties defined corresponding to a set of predefined criteria. Based on these two properties various image segmentation techniques have been developed such as edge based segmentation, region based segmentation and special theory based segmentation. The image segmentation techniques can be used in large number of applications such as medical face recognition, diagnosis of cancer, surveillance and traffic control systems. Among these developing of segmentation techniques and their application in a variety of areas, it seems that a unified approach to the specific problem of colour image segmentation. In our proposed work, an attempt is made to study the effect of k-means clustering algorithm on colour image segmentation. Several general purpose algorithms have been developed for image segmentation. Since there is no general solution to the image segmentation problem, these techniques have often been combined with domain knowledge in order to effectively solve an image segmentation problem for a problem domain.

II. PROPOSED SYSTEM

In this paper k-means clustering technique has been proposed that has been applied to solve low-level image segmentation tasks. K-means is one of the simplest unsupervised learning algorithms that solve the well known clustering problem. This clustering is convergent and its aim is to optimize the partitioning decisions based on a user-defined initial set of clustering that is updated after each iteration. This procedure is computationally efficient and can be applied to multidimensional data. K -means is an iterative technique that is used to partition an image into k-clusters. The basic procedure is as follows:

- Pick k cluster centres, either randomly or based on some heuristic.
- Assign each pixel in the image to the cluster that minimizes the distance between the pixel and the cluster centre.
- Re-compute the cluster centre by averaging all of the pixels in the cluster.
- Repeat steps 2 and 3 until convergence is attained.

The proposed system will first load the image. As there are, only colored images are required for the proposed system. The researcher collected the colored images from the data set of Berkeley University of California (USA). The researcher tested 100 images and then collected the result which is applicable for some specialized tasks, i.e. detection of any object and machine vision, and scene recognition in the images of natural scenes. Image Standardization is followed through image size standardization and enhancement.

Images are different in size. Some images are large, others are small, and some other images are in middle size so the proposed algorithm will normalize the image into the standard size i.e. 800×1200. A [800×1200] ← A [x, y, c] The proposed system will create the temporary and individual clusters in order to find the optimal threshold value. K-means clustering algorithm is used to find the optimal cluster value calculation and feature has been extracted i.e. color space, pixel intensity level and regions. After the feature extraction, three histograms will be created with one each for Red, Blue and Green in RGB domain and then peaks are identified for each histogram. Individual peak values for Red, Blue and Green are calculated. The relative distance of each value on

the specified three channels with respect to the peak value is calculated. When relative distance is calculated then mean value is calculated for each cluster. Finally, the image is segmented by using the mean cluster value.

A. Clustering

Clustering refers to the process of grouping samples so that the samples are similar within each group. The groups are called clusters. Clustering is a data mining technique used in statistical data analysis, data mining, pattern recognition, image analysis etc. Different clustering methods include hierarchical clustering which builds a hierarchy of clusters from individual elements. Because of its simplicity and efficiency, clustering approaches were one of the first techniques used for the segmentation of (textured) natural images. In partitioned clustering; the goal is to create one set of clusters that partitions the data in to similar groups. Other methods of clustering are distance based according to which if two or more objects belonging to the same cluster are close according to a given distance, then it is called distance based clustering. In our work we have used K-means clustering approach for performing image segmentation using Mat lab software. A good clustering method will produce high quality clusters with high intra-class similarity and low inter-class similarity. The quality of clustering result depends on both the similarity measure used by the method and its implementation. The quality of a clustering method is also measured by its ability to discover some or all of the hidden patterns. Image Segmentation is the basis of image analysis and understanding and a crucial part and an oldest and hardest problem of image processing. Clustering means classifying and distinguishing things that are provided with similar properties[17].Clustering techniques classifies the pixels with same characteristics into one cluster, thus forming different clusters according to coherence between pixels in a cluster. It is a method of unsupervised learning and a common technique for statistical data analysis used in many fields such as pattern recognition, image analysis and bioinformatics.

B. K-Means Clustering Algorithm

K-Means algorithm is an unsupervised clustering algorithm that classifies the input data points into multiple classes based on their inherent distance from each other. The algorithm assumes that the data features form a vector space and tries to find natural clustering anthem. The points are clustered around centroids $\mu_i \forall i = 1 \ldots k$ which are obtained by minimizing the objective

$$V = \sum_{i=1}^{k} \sum_{x_j \in S_i} (x_j - \mu_i)^2 \quad (1)$$

where there are k clusters Si, i = 1; 2; : : : ; k and _i is the centroid or mean point of all the points xj 2 Si As a part of this project, an iterative version of the algorithm was implemented. The algorithm takes a 2 dimensional image as input. Various steps in the algorithm are as follows:

1. Compute the intensity distribution(also called the histogram) of the intensities.
2. Initialize the centroids with k random intensities.
3. Repeat the following steps until the cluster labels of the image do not change any more.
4. Cluster the points based on distance of their intensities from the centroid intensities.

$$c^{(i)} := \arg\min_j ||x^{(i)} - \mu_j||^2 \quad (2)$$

5. Compute the new centroid for each of the clusters.

$$\mu_i := \frac{\sum_{i=1}^{m} 1\{c_{(i)} = j\} x^{(i)}}{\sum_{i=1}^{m} 1\{c_{(i)} = j\}} \quad (3)$$

where k is a parameter of the algorithm (the number of clusters to be found), i iterates over the all the intensities, iterates over all the centroids and μi are the centroid intensities.

C. Field Programmable Gate Arrays

Field Programmable Gate Arrays (FPGAs) are arrays of logic units that can be programmed by the user to operate as special purpose functional units. They can evaluate certain types of tasks at far

higher speeds than those achievable on general-purpose processors. Tasks with limited data dependencies and tasks with significant scope for parallel execution are those on which the most significant performance advantage can be extracted.

D. VHDL based K-means algorithm design

The basic principle of the image clustering process is to take an original image and to represent the same image using only a smaller number of pixel values. The k-means clustering algorithm performs this task by attempting to minimise a squared error cost function over a set of NB_CLASS cluster center. The k-means algorithm works as follows.

- Assign pixels to NB_CLASS classes and compute centers
- Loop(**N**)
  - For each pixels
    - **C**=class of the pixels
    - Determine the class number K whose center have the smallest distance from the pixel
    - If(**C!=K**)
      - Move pixel to class **K**
      - Recompute the centers of the class K and C

The number of iterations (**N**) can be either fixed in advance or undetermined. In that case, the process stops when no more pixels, or less than a threshold value, move.

Actually, the k-means clustering includes several variants ranging from a continuously class center updating (as mentioned above) to a general updating (once after a complete loop iteration). But more often the class centers updated, faster the convergence.

III. RESULTS

Proposed work is useful in segmentation of image where regions of interest are important for region classification. In this proposed work, surface area of the ocean is the input image as represented in figure 1(a), since the system has to segment oil seeped area and unaffected regions in the sea surface. K-means algorithm is applied on the sea surface image and resulting segmented regions as shown in the figure 1(2) which distinguish the oil affected regions.

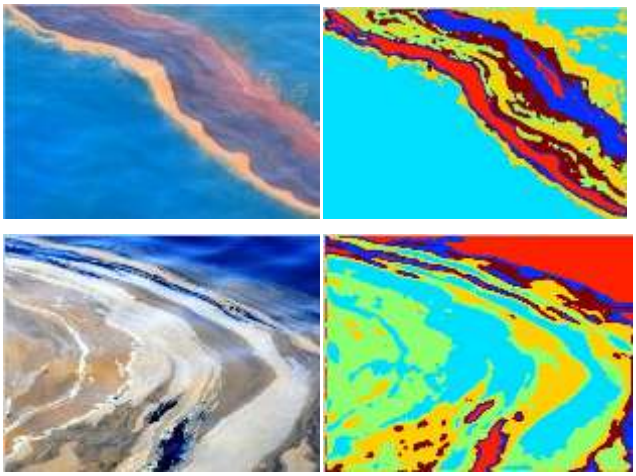

Figure 1: shows (a) Oil seeped sea surface image, (b) Segmented Image

This system works on the intensity values of each pixel in the image. It is easier to show oil seeped regions because of the colour components of the affected area had considerable intensity changes.

Conventional hardware development is normally performed in languages such as VHDL or Very log. Our proposed work has been simulated using Mat lab R2013aand implemented this algorithm using Spartan 3E FPGA hardware. Figure 2 shows the output of our segmentation algorithm, in that orange squared box indicates the output variable which holds the segmented regions in terms of decimal values as in the simulated images in figure1.

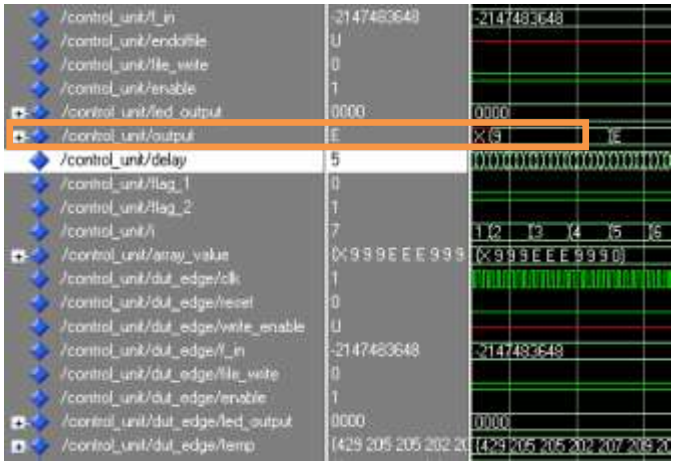

Figure 2: Shows FPGA implementation of k-means clustering based segmentation

Figure 3 show all logic utilizations while FPGA implementation, for our proposed work we have utilized 102 slices out of 4,656 slices in Spartan 3E hardware which is 2% of the original area in FPGA slices.

Device Utilization Summary			
Logic Utilization	**Used**	**Available**	**Utilization**
Number of Slice Flip Flops	122	9,312	1%
Number of 4 input LUTs	107	9,312	1%
Number of occupied Slices	102	4,656	2%
Number of Slices containing only related logic	102	102	100%
Number of Slices containing unrelated logic	0	102	0%
Total Number of 4 input LUTs	134	9,312	1%
Number used as logic	103		
Number used as a route-thru	27		
Number used as 16x1 RAMs	4		
Number of bonded IOBs	6	232	2%
Number of BUFGMUXs	1	24	4%
Average Fanout of Non-Clock Nets	3.15		

Figure 3: List of logic utilization in implementing k-means segmentation

IV. CONCLUSIONS

This report proposes a colour image segmentation using k-means classification on RGB histogram. The research work used the k-means clustering technique. The k-means is an efficient and fast algorithm by using the k-means function. The k-means used to partitioned n data points into k clusters. At first, the algorithm loaded the image. Then the size of the image has been standardized according to the proposed method. Then image represented in temporary clusters. In the proposed method, the clusters are combined and then calculated the means of the peaks in the image. At last, the image has been represented in segmented form. Image segmentation is the analysis technique of image processing, which gives the in depth knowledge about the information of the object identification.

V. FUTURE WORK

The process in which a data set or say pixels are replaced by cluster, pixels may belong together because of the same color, texture etc is known as Clustering based method. The survey has shown that of the existing techniques, main focus is on complex regions. Therefore not much work has been done for the images with mixed regions. The effect of the regions on the segmentation has been neglected by many researchers. The effect that color have on segmentation results has also been neglected.

So in near future we will propose a new integrated Edge preserving smoothing, region growing based image segmentation algorithm to improve the accuracy of the segmentation procedure further. The motivation behind the proposed approach is simple and effective. First of all edge preserving smoothing will filter the objects available in digital image so that the complex objects can also be easily detected. However, the use of HSV has the ability to segment the color images in efficient manner. The actual segmentation is done by using the integrated region growing based image segmentation algorithm.

REFERENCES

[1] T. Zouagui, H. Benoit-Cattin, and C. Odet, “Image segmentation functional model,” Pattern Recognition, vol. 37, no. 9, pp. 1785–1795, Sep. 2004.

[2] Arbel, P., Berkeley, B., Rd, W., & Park, M (n.d.), "Semantic Segmentation using Regions and Parts"Berkeley University Journal 2010.

[3] Arbeláez, P., Maire, M., Fowlkes, C., & Malik, J. , "Contour detection and hierarchical image segmentation", IEEE Transactions on Pattern Analysis and Machine Intelligence, 33(5), 898–916, 2011.

[4] A.Y. Yang, J. Wright, Y. Ma, S. Sastry, “Unsupervised segmentation of natural images

via lossy data compression", Computer Vision and Image Under- standing 110 (2) 212–225, 2008.

[5] E. H. S. Lo, M. R. Pickering, M. R. Frater, and J. F. Arnold, "Image segmentation from scale and rotation invariant texture features from the double dyadic dual-tree complex wavelet transform," Image Vis. Computer, vol. 29, no. 1, pp. 15–28, Jan. 2011.

[6] National Academy of Sciences (NAS), "Oilin the sea 111: Inputs fates and effects," Washington, DC, USA, 2003.

[7] "Natural oil seeps," Woods Hole Oceanographic Institution, Woods Hole, MA, USA, 2014. [Online]. Available http://www.whoi.edu/main/ topic/natural-oil-seeps, [Accessed: 14-May-2014].

[8] O. Garcia-Pineda *et al.*, "Using SAR images to delineate ocean oil slicks with a texture-classifying neural network algorithm (TCNNA)," *Can. J.Remote Sens.*, vol. 35, no. 5, pp. 411–421, Oct. 2009.

[9] O. Garcia-Pineda, I. MacDonald, B. Zimmer, B. Shedd, and H Roberts, "Remote-sensing evaluation of geophysical anomaly sites in the outer continental slope, northern Gulf of Mexico," *Deep Sea Res. Part II,Topical Studies Oceanograp.*, vol. 57, no. 21–23, pp. 1859–1869, Nov. 2010.

[10] L. Chang, Z. S. Tang, S. H. Chang, and Y.-L. Chang, "A region-basedGLRT detection of oil spills in SAR images," Pattern Recognit. Lett.,vol. 29, no. 14, pp. 1915–1923, Oct. 2008.