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Mathematical Modelling Based Extraction of Colour Band from Segmentation of Water Bodies in Remote Sensing Images Using Knot Theory Based Clustering Algorithms

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Abstract: *Remote sensing images are the images that are captured by satellites and used to retrieve information about the particular area or the object. Noise is the intrusion that occurs in the image due to which the quality of image is fouled. Noise can occur in an image due to various conditions .Salt & pepper noise is a type of noise, which appears like a mixture of black and white dots. Filters are mainly used in the editing of the noises present in the image. Median Filter is used to elimination of the noise in the image. Fuzzy C-Means algorithm is used to get a better quality image by clustering. In fuzzy c means clustering every point belongs to all clusters .In this paper Fuzzy C-Means algorithm based Knot theory is used in the colour segmentation of images for separating the water area. And the colour band is derived to get a better view of the water segmented area.*

Key words*: Remote Sensing Image, Traditional Median filter, Knot Theory, Water bodies, Clustering Algorithms*

I. INTRODUCTION

When the remote sensing images are in digital format the digital image processing techniques are be used to improve the feature of the image. Remote sensing images are used in various applications for disaster monitoring and mitigation, mineral exploration. Remote sensing images can be efficiently used when the data is extracted .Noise is the disturbance that occurs in an image due to which the clarity of the image is being affected. There are various types of noises which affect the image .Noise is generally caused due to dust particles present in air. Hiss is a type of noise which s mainly caused due to random movement of electrons. Filtering techniques are used to reduce these noises from the image .Salt and pepper noise is a type of noise which is diverse from the colour intensity of the nearby pixels, it appears like irregularly distributed black and white pixels. By using median filter the noise is reduced in the image. Median filters are very effective in reducing the salt and pepper noise. Median filter preserves the edges in the image when noise is isolated from the image.

In Fuzzy clustering the data set belongs to more clusters, which indicates the relationship between the data set and cluster. Fuzzy partition is mainly carried out in a iterative method, it is mostly applied to get the Fuzzy models .When the dataset is larger the closer is the degree of membership in the data set. Different types of images are acquired from the clustering. Clustered images are then used to derive to blue band separately. Colour band consist of RGB colours. The name comes from the initials red, green, and blue. These colours are mixed together to get various other colours. Extracting a particular colour from the image is called colour band extraction. Blue band is extracted separately which represents the water body in the images.

II. KNOT THEORY

Knot theory is a subset of a larger branch of mathematics called Topology. Topology is an area of mathematics which involves studying the properties of geometric figures which are unaltered by elastic deformation such a stretching or twisting. To a topologist, a sphere is the same as a cube, and a doughnut is the same as a coffee cup. Knot theory is an area of topology that deals with knots and links. A knot is a closed curve in space with no self intersections (i.e. a knot is a simple closed curve). In layman's terms, a knot is a piece of string and tangled, whose ends are connected.

A topology on a set X is a collection τ of subsets of X having the following properties:

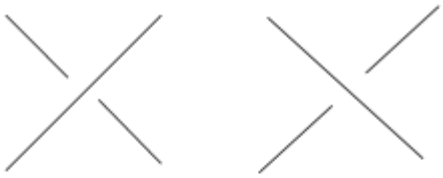
- ϕ and X are in τ.
- The union of the elements of any sub-collection of τ is in τ.
- The intersection of the elements of any finite sub-collection of τ is in τ.

A set X for which a topology τ has been specified is called a topological space.

A homeomorphism $f : X \rightarrow Y$ gives us a bijective correspondence not only between X and Y but between the collections of open sets of X and of Y. As a result, any property of X that is entirely expressed in terms of the topology of X (that is, in terms of the open sets of X) yields, via the correspondence f, the corresponding property for the space Y. Such a property of X is called a topological invariant of X.

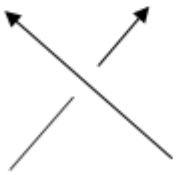
A knot projection is a projection of a knot $K \subset S^3$ into a 2-dimensional plane where under and over strands are not specified. In this projection, no three points in K correspond to one point on the plane and strands cross transversely.

A knot diagram is a projection where under and over strands are specified at each crossing as in Figure (a). A knot diagram is minimal if it has the minimum number of crossings needed to draw the knot. If a diagram is oriented, we can assign $+1$ or -1 at each crossing as in Figure(b).



(a) A crossing of a knot diagram

(b) +1 crossing



(c) -1 crossing

Two knots / links K , K' in X are ambient isotopic if there is an ambient isotopy $F_t: X \times [0,1] \rightarrow X$ such that $F_1(K) = K'$. Two knots / links are equivalent (ambient isotopic) in S^3 if and only if two knot diagrams are equivalent in a 2-dimensional plane.

III. METHODOLOGY

Image processing is a technique of using algorithms to process an image to get a better feature of image. There are various methods used in the processing of the image. This figure shows the process of Proposed Approach. Images are sources which gives much information. Images are processed to get information which can be used as a resource. In this paper remote sensing images are being used to segment the water bodies.

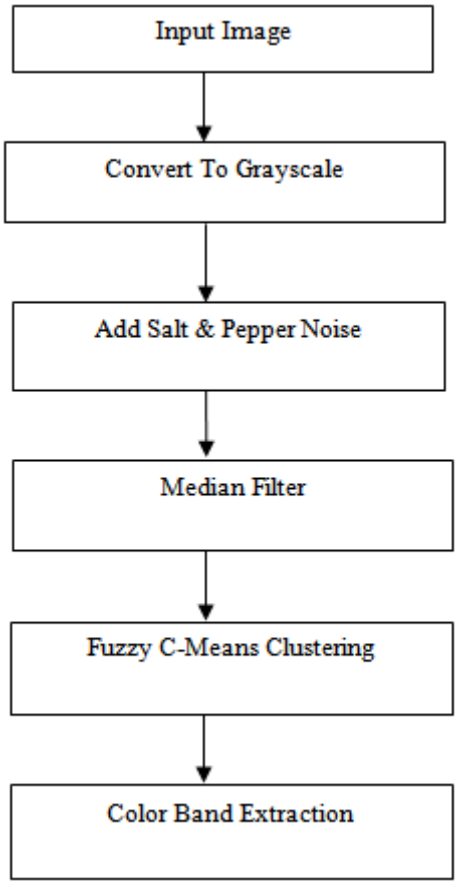


Fig. 1 System Design Architecture

2.1 Salt and pepper

Salt and pepper noise is the unnecessary random pixels that are captured with the image. These noises can be due to model defects in the CCD or in the transmission of the image. Before the noise could be added the image is converted to gray scale. This type of noise can be eliminated by reducing the unwanted isolated pixels in the image. This is sometimes called fat tailed-distribution. Salt and pepper noise corrupts the image by maximizing the grey pixels. This can be expressed by

$$q(x) = \begin{cases} Q1 & x=A \\ Q2 & x=B \\ 0 & \text{otherwise} \end{cases}$$

Where Q1, Q2 are the Probabilities Density Function q(x) is distribution of salt and pepper noise in the image and A, B is the array size of image.

2.2 Median Filtering:

This filtering technique is widely used enhancement technique for the removal of the noise in the image. Median filter is very effective in the removal of the salt and pepper noise. By using this median filter the sharpness in the image is significantly reduced. Median filter is used to smooth the image which is a nonlinear digital filtering technique.

2.3 Fuzzy C-Means algorithm:

Segmentation is process of fragmenting the image into smaller parts. The colour image segmentation is performed by Fuzzy C-Means algorithm. Fuzzy C-Means clustering method is a method in which the data belong s to more than one cluster, when the data is more the closer is the relationship the data .this method is mainly used in the field of pattern recognition. The clusters centres are updated using the formula

$$\mu_{ij} = 1 / \sum_{k=1}^{c} (d_{ij}/d_{ik})^{(2/m-1)}$$

$$v_j = (\sum_{i=1}^{n} (\mu_{ij})^m x_i) / (\sum_{i=1}^{n} (\mu_{ij})^m),$$

$$\forall_j = 1,2,\ldots..c$$

Where 'n' is the number of data points
'vj' is the j^{th} cluster centre.
'm' is the fuzziness index m € [1,∞],
'c' is the number of cluster center.
'μij' is the membership of i^{th} data to j^{th} cluster centre.
'dj' represents the Euclidean distance

Algorithm

Let $X = \{x_1, x_2, \ldots\ldots, x_n\}$ is the data set points

$V = \{v_1, v_2 \ldots\ldots\ldots\ldots v_c\}$ is the set of centres.

Step 1: Cluster c is selected at random.

Step 2: Fuzzy membership is calculated using

$$\mu_{ij} = 1/\sum_{k=1}^{c} (d_{ij} / d_{ik})^{(2/m-1)}$$

Step 3: calculate fuzzy center

$$v_j = (\sum_{i=1}^{n} (\mu_{ij})^m x_i / \sum_{i=1}^{n} (\mu_{ij})^m),$$

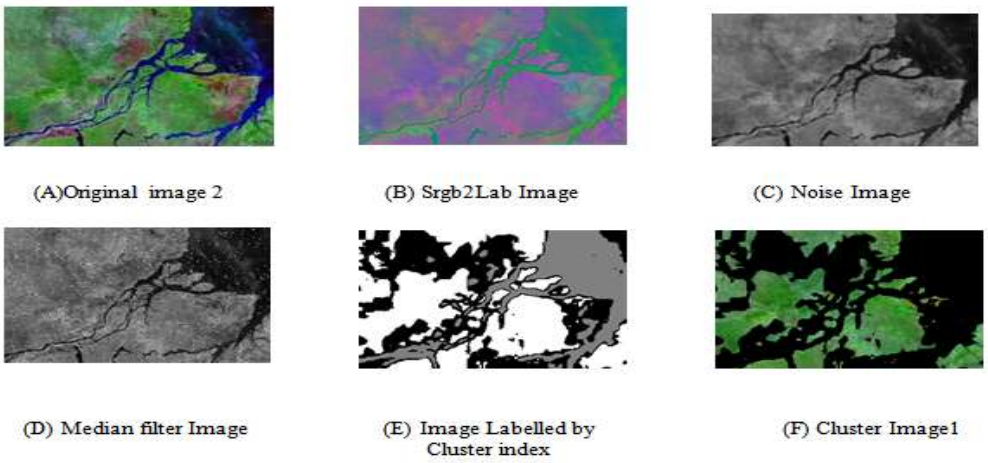
$$\forall j = 1,2,\ldots..c$$

Step 4: 2 and 3 steps are repeated till minimum value of j is acquired.

Fuzzy algorithm segments the images into various clusters these clusters are used in colour band extraction. Colour band extraction has Red band, Green band and Blue band which represents the RGB colours. The clustered image is being used to extract only the blue band in an image. Fuzzy algorithm helps us to recognize data in a more supple manner using Knot parameter.
The experimental results shown in the diagram 2 for extraction of water bodies based on Knot with the help of Fuzzy C-Means clustering algorithm.

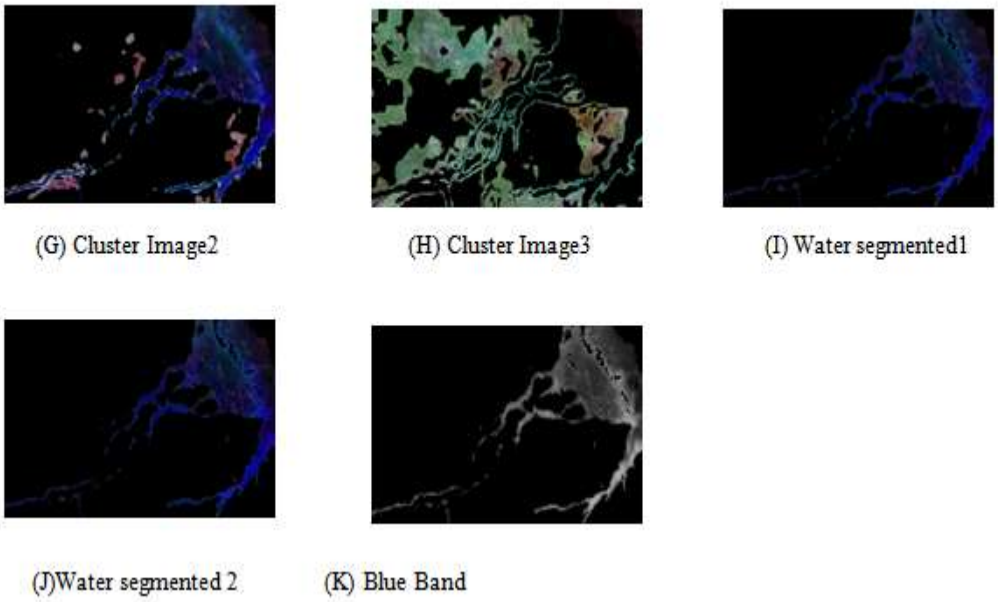
IV. CONCLUSION

In this paper the Fuzzy c- means clustering algorithm is being used in remote sensing images for water body segmentation. Salt and pepper noise is removed effectively using the Median filter without reducing the sharpness of the image. Colour segmentation is mainly performed here to separate the water bodies from the other region. Colour band extraction is processed with the clustered image which is acquired from Fuzzy clustering based on Knot parameter. Since blue represents the colour of the water, only the blue colour is being extracted from the image using the colour band extraction



(A)Original image 2 (B) Srgb2Lab Image (C) Noise Image

(D) Median filter Image (E) Image Labelled by Cluster index (F) Cluster Image1



(G) Cluster Image2 (H) Cluster Image3 (I) Water segmented1

(J)Water segmented 2 (K) Blue Band

Fig-2 Experimental Results

REFERENCES

[1]. Mr. Salem Saleh Al-amir, Dr. N.V. Kalyankar and Dr. S.D. Khamitkar, "A Comparitive Study of Removal Noise from Remote Sensing Image", IJCSI, Vol.7, Issue.1,No.1,Jan 2010.

[2]. Liu, Jian Guo & Mason, Philippa J. (2009), "EssentialImage Processing for GIS and Remote Sensing", Wiley-Blackwell. p. 4. ISBN 978-0-470-51032-2.

[3]. Schowengerdt, Robert A. (2007). "Remote sensing: models and methods for image processing (3rd ed.)", Academic Press. p. 2. ISBN 978-0-12-369407-2.

[4]. Hamerly, G. and Elkan, C. (2002). ""Alternatives to the k-means algorithm that find better clusterings" Proceedings of the eleventh international conference on Information and knowledge management (CIKM).

[5]. FaberV., Mark O. Mundt, Jeffrey S. Saltzman, and James M. White (1994), Clustering and the Continuo k-Means Algorithm,Paradigm Concepts, Inc., Santa Fe, NM. Los AlamosScienceNumber 22, 138-149

[6]. HAN Jin-yu, WANG Shou-zhi. Color image denoising algorithm based on noise character and vector median filter . Computer Application. 2009, 29(9).

[7]. R. Lukac, B. Smolka, K. Martin, K.N. Plataniotis, and A.N. Venetsanopoulos,"Vector filtering for color imaging,'' IEEE Signal Processing Mag., vol. 22, no. 1,pp. 74–86, Jan. 2005.

[8]. Y. Lim, S. Lee, On the color image segmentation algorithm based on the thresholding and fuzzy c-means techniques, Pattern Recognition Journal 23 (9) (1990) 935–952

[9]. Darren MacDonald,et al; Evaluation of Colour image segmentation hierarchies, Proceeding of the 3rd anadian Conference on computer and robot vision, IEEE 2006.

[10]. N. Pal, S. Pal., " A review on image segmentation techniques, Pattern Recognition", Vol. 26. No. 9, 1993, pp 1277-1294.

[11]. Raja, A.,Meister, A., Martverk., P.: Fuzzy Classification Algorithms with Some Applications.

[12]. M Rama Bai , Dr V Venkata Krishna and J SreeDevi, "A new Morphological Approach for Noise Removal cum Edge Detection",IJCSI International Journal of Computer Science Issues, Vol. 7,Issue 6, November 2010.

[13]. M Rama Bai , Dr V Venkata Krishna and J SreeDevi, "A new Morphological Approach for Noise Removal cum Edge Detection",IJCSI International Journal of Computer Science Issues, Vol. 7, Issue 6, November 2010.