IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
Vol. 05, Issue 08 (August. 2015), ||V4|| PP 32-38

A Novel Technique for the better analysis of Ice Properties using Kalman Filtering

Rajwinder Sidhu[1], Gurbakash Phonsa[2]
[1]*Dept of Computer Science and Engineering, Lovely Professional University, Phagwara*
[1]*e-mail:Shilpakaur100@gmail.com*
[2]*Dept of Computer Science and Engineering, Lovely Professional University, Phagwara*
[2]*e-mail: Gurbakash.15483@lpu.co.in*

Abstract:SAR algorithm has been used to detect the sea ice to save the ship from any kind of damage. So that ship does not strike with ice. SAR algorithm applied on RADAR1 imagery data to get accurate results. Pixel based segmentation MIRGS algorithm to segment the ice has been studied. Due to this we can differentiate the ice based on its properties. PMA detector has also been studied and thus can easily detect and recognize target by knowing the signal values. There are many methods for multitemporal segmentation from the MODIS data called TempoSeg method for multiyear sea ice floes has also been studied. RADARSAT1 imagery data which is used by Synthetic Aperture Radar to detect the ice of sea at different regions of the oceans. Automated algorithm gives better result of target using R1 imagery data. In project work, we have to implement the automated SAR algorithm to detect sea ice which is already implemented. In further work we have to enhance this automated SAR algorithm to get more accurate results using RADARSAT1 imagery data and will try to use the RADARSAT2 imagery data to make it compatible to SAR algorithm.

Keywords: *Sea Ice, SAR, Floe, Rater Scan, Dual Polarization, Kalman Filtering*

I. INTRODUCTION

Processing of an image is a process of translating an image into Digital form into digital form and applied some operations so that information can be extracted from it. In this entire process input can be any image, video frame and output can be like features of images and any other things associated with it. Whenever any functions or signal processing applied on it, image is usually considered as 2D. It is one of the fast growing technologies. Most of the time this process is known as digital image process but sometimes digital and optical image processing is also considered [6]. Digital images are manipulated using Digital computers. The main necessity for image processing of images is that digitized form of image should be available of any finite length of binary. For digitization, on a discrete grid the given image is sampled and using a finite number of bits each sample or pixel of image is quantized. Digital images are processed by computers and are converted to Analog signals for displaying. It is then followed by scanning over some display. Processing is of two types Graphical and Computer vision based. The Computer Graphics involves the Physical models of lightning, objects and environment. It is a manual process. It is similar like seemed in a animated movies. But computer vision is often considered as high-level of Image processing. From this high-level image software tries to extract useful physical information.

1.1Image Segmentation*:*

Image segmentation can be defined as the mechanism of subdividing a digital image into multiple pixels or regions. Regions should greatly reveal to interpret objects. A region is collection of similar pixels. The aim of segmentation is to represent the image into some meaningful form. There are many different ways to perform segmentation like thresholding, color based segmentation, watershed segmentation, and texture methods etc. The Segmentation process involves the partitioning of Digital images into parts. This number could be N. Segmentation is done based on the pixel sets or the pixels present in a given region. The pixels present are similar and are based upon the homogeneity of Texture, Colour, and Intensity. This information helps in locating objects and boundaries in the given image [2]. Segmentation is partitioning a digital image f(a, ab) into distinct, continuous, and nonempty subsets. After that from these subsets we extract the information of high level. Practical applications of image segmentation include object identification and recognition, criminal investigation, medical image processing, facial recognition, satellite images, quality assurance in factories, etc The two Image Segmentation areas of consideration are:

1.1.1 Region based segmentation:

Region segmentation can be defined as partitioning the image into regions. Region is an important concept to depict the image because regions may correspond to objects in the scene. In this, formations of pixels around some objects are located creating a region of those pixels and separating the region from the rest of the image [7].

1.1.2 Edge based segmentation:

Edge segmentation can be defined as that in which each object is surrounded by a border. Edge detection is used to identify the edges and edge pixels. The border of the object is closed, visible and can be detected in the intensity values of the image. It analyzes the distribution according to gray level value scale [7].

1.2Dual Polarization

RADARSAT 2 is a multichannel receiver. The HH channel of it provides same data as of R1. HV channel of R2 is a new addition and is anticipated to enhance the bias of ice and water. Unusually, water is wind roughens and it looks similar to ice at several incidence angles in the channel. Therefore, its required for it to enhance the sea ice image segmentation results using automated algorithms of SAR. RADARSAT 2 provides all the features of RADAR1 and offers some additional features to distinguish different ice types [3]. Dual polarization is the advanced feature which is Radar2 based and is use for mapping of ice. It incorporates 500 km Swath width as that of Radar1 in single polarization. Dual polarization provides Scanning mode of SAR with additive data [10]. The ENVIST Advance SAR (ASAR) also provides the features of dual polarization bit it is having different swath width of 100 km from R1 and R2. ASAR has five modes and five different preferences of polarization levels which can take different images of earth's surface. We are having a full SAR scene which contains pixel resolution of 1000*1000 m. Now, we will target on SAR Scan wide mode to understand the use of R2 dual polarization and will use this model for sea ice monitoring.

1.3 PMA Detector:

In SAR, reflected rays come from target to make it visualize. Point of target will not get if the intensity or amplitude of reflected rays will not large, usually, because of Lower cluttering signal ratio. Fundamentally, SCR affects the detection in the presence of amplitude or intensity data. Thus, a good detector should be designed in such a way that SCR should be improved naturally. Due to this, target can be enhanced and disorder constrained. We know that, the processor which is mostly used in SPAN detector and this makes only use of image intensities because the sum of all polar metric channels is incoherent [12]. SPAN detector is having the synthetic power of all the channels. Therefore, according to some analysis, it has been noticed that this detector can retrieve a higher SCR and lower noise level than HH, HV, or VV independently. So, we can conclude that SCR can be improved with the way of synthetic power. Due to this, by using single channel willfull information; we can single out the targets from the disorder or clutter. For the moment, it is very hard to give the appropriate detection with the SPAN detector because of the lack of knowledge of related data. Considering these facts, a PMA detector has constructed as another synthetic power [13].

1.4 Related Work

X.Yang and Clausi(2012)[1] introduces an approach for ice segmentation in Synthetic Aperture Radar (SAR) generated images. This is done by the combination of Edge Preserving region (EPR) and the MRF Models. Construction of EPR representation requires the measurement of Edge strength. Measuring of the Edge strength is done using the Instantaneous Coefficient of Variation (ICOV). The basis of ICOV is the Watershed Algorithm which is applied on the image to get the regions. Evaluation of the proposed method has been done using SAR image which gets corrupted first by varying levels of Speckle Noise. The proposed method gives accuracy with the combination of above mentioned models and also improves accuracy by 29% reduction in Computational time.

Mari-Ann N. Meon, et.al, (2009) [2] list the brief study and exploration of SAR. In this paper [2] researchers explored an automatic segmentation of syntheticaperture radar satellite images (SAR) satellite images of sea ice. The investigation is based on a comparison of an automaticallysegmented SAR image and manual classifications by iceservice analysts. Statistical ice properties are considered for segmenting SAR images into classes. The number of classes is determined from available ground truth.Sea ice experts, aided by various in-situ data, were able tolabel most of the segments from the automatic algorithm.They utilized the physical data of the Polar metricfeatures which are used for classifying the algorithm, in order tofurther explore the class labeling.

Phonsa G et al, (2014) [10] proposed a technique to resolve the object extraction problem. This technique helps in object extraction on basis of area assessment size, pixel, enhancement and mining.

GuiGao, et.al, (2013) in their research paper [8] a CFAR method for the detection of ship in presence of high resolution of SAR amplitude of dual polarization. In order to get better form of clutter ratio, a PMA detector has been designed, thereby preventing any form of biasness for the ship due to SCR as it's quite sensitive to clutter ratio and the procedure thus helps to reduce the discrimination to a huge extent. Statistical model of PMA detector has also been described using G0 distribution. This distribution is suitable for coping with the complex backgrounds of sea.

B. Ramsay et al [4] proposed a design of a method of temporal segmentation for Multi Temporal segmentation of sea ice to detecting the melting rate of multilayered sea ice. MODIS images has been generated for the experimentation purposes, position of ice floes has been detected using microwave radiometer to determine the position of ice floes with time and changing atmosphere. The procedure involves dividing the image into Floe and the background. Feature extraction is done at the first place to extract the useful features followed by marking of floes and shape constrained region growing is applied to detect to best shape. Region maps are generated by post filtering and area of interest or ice floes is thus obtained using morphological operators on piece of MODIS images. The advantage of this newly proposed approach is the availability of the area of the image under study for the region of interest over the period of time. In this paper a study about [5] the study of various feature extraction methods and is marked as an important research area in order to implement the intelligent processing in more précised and effective manner. The best texture extraction method has been determined based on the geostatistic principles and entropy concept. These are the two evaluating factors. The proposed method is marked superior over the other pre existing approaches. Experiments has been performed on medical data which is complex in nature due to the presence of discontinuities when it comes to X-rays or magnetic resonance imaging and the piece of data is hard to segment and analyze.

ChristofRidder et.al [15] discusses the foreground and background estimations for image processing. For the background estimations are done considering illuminations but does not present it as background, the author proposed an approach using the CCD cameras of fixed length for making estimations. Back ground estimations have been parallel, independent of pixel positions. Background estimation on smaller image resolution can also be performed easily.

Simon J Julier and Jeffrey K. Uhlmann[16] describes the method of linear estimator that has been proposed using the principle of sampled points which can parameterize mean and covariance and can easily work on the nonlinear systems, Performance comparisons of the new approach has been done with the present Extended Kalman Filter.

2 Proposed Methodology

SAR generated data is employed for mapping the ice. Among the various segmentation methods for interpretation of such data, unsupervised approach is used. The data in the form of images is obtained from RADARSAT 1 at the first place. But it does not provide accurate results. Thus development of various automated algorithms reduced this hurdle to some extent but further enhancement in such techniques is further required together with the source and RADARSAT 2 provided better outcomes in terms of considering factors such as density and position. The given work is focused on analyzing the pixel data and the related algorithms.[9] Study of region based algorithms and use will also lead to achieve the desired output and results. Need to enhance SAR for RADAR1 imagery data. Now, RADARSAT 1 provides better results using the concept of polarization in SAR and we can get more accurate results by enhancing it.

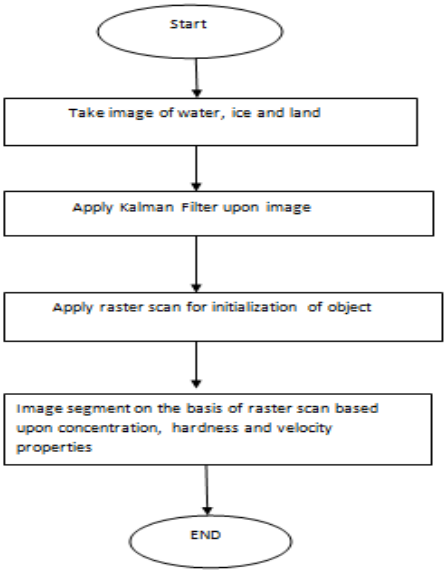


Fig. 2.1 Chart to show the context of proposed methodology

2.1 Algorithm:

INPUT: - INPUT IMAGE FOR SEA ICE DETECTION
OUTPUT: - VALUE OF IT,IC AND IV
Start ();
1. Input image and store in variable a;
2. [b c]=size(a);
3. Define initialize starting pixel and increment value of the pixels
4. If property of p(i,j)!=p(i+1,j+1)
5. Image will be segmented
6. Store value of IT, IV and IC

STOP ()

The existing algorithms SAR is compatible to RADARSAT1 and give accurate results to detect the ice and for more accurate and efficient results of ice images we need to enhance the SAR algorithm. So, we need to enhance the automated algorithms to capture better results. In proposed work we have used raster scan and kalman filtering to get better and accurate results.

2.2 Experimental Results

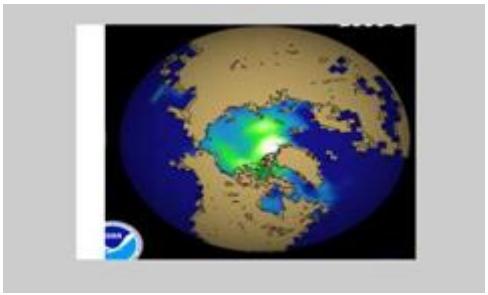
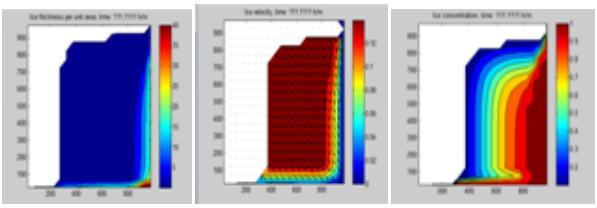


Fig. 2.2.1 Input Image

As shown in Figure 2.2.1, the image is input which contains ice and water. In this image technique of morphological segmentation is applied to extract the image properties like Ice Thickness, Velocity and Concentration.



(a) (b) (c)

Fig. 2.2.2a) Thickness b) Velocity c) Concentration

In fig 2.2.2 the image is input which contains ice, water. In this image technique of morphological segmentation is applied to extract the image properties like ice thickness, ice velocity and ice concentration.

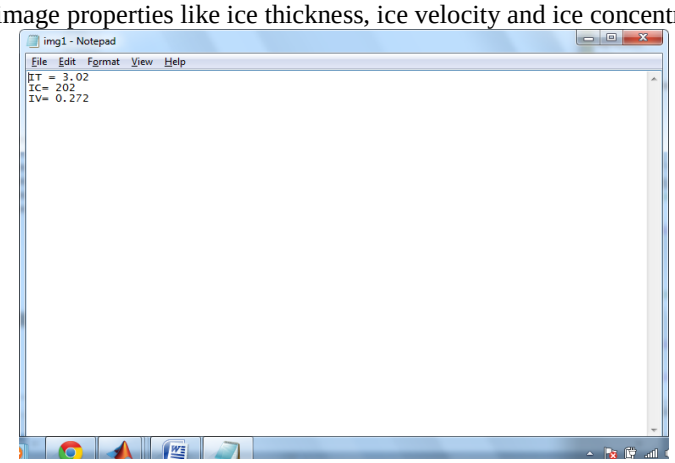


Fig. 2.2.3 Values in Text File

As shown in figure 2.2.3, the image is input which contains ice, water. In this image technique of morphological segmentation is applied to extract the image properties like thickness, velocity and concentration. Final values of Thickness, Velocity,and Concentration are defined and analyzed value is shown in text file.

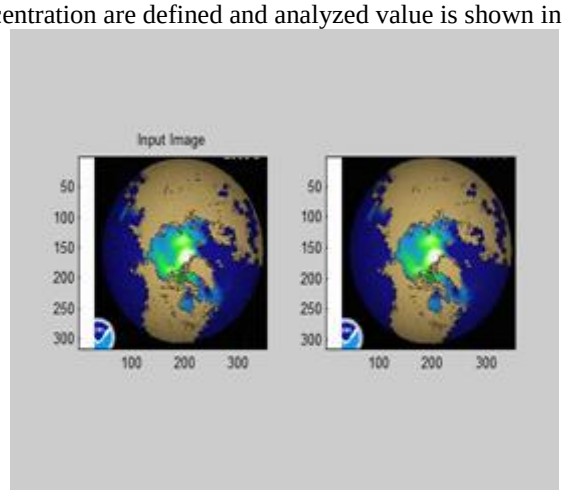
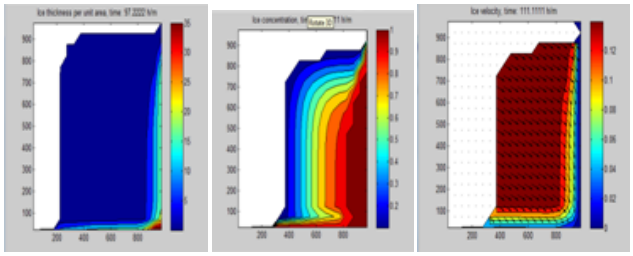


Fig. 2.2.4 Input Images



(a) (b) (c)

Fig. 2.2.5a) Ice Thickness b) Ice Concentration c) Ice Velocity

In this Figure 2.2.5, the image is input which contains ice, water. In this image technique of morphological segmentation is applied to extract the image properties like ice thickness, ice velocity and ice concentration.

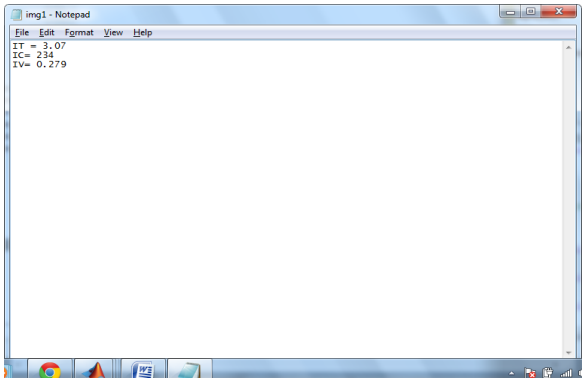


Fig. 2.2.6 Final Values

As shown in Figure 2.2.6, the image is input which contains ice, water. In this image technique of morphological segmentation is applied to extract the image properties like Ice Thickness, Velocity and Concentration. The final values of ice concentration, ice velocity and ice thickness is defined and analyzed value is shown in text file.

Table 2.2.1 Results for observations

Images	IT	IC	IV
Figure 2.3.2 (a),(b),(c)	old=3.02 new=3.07	old=202 new=234	old=0.272 new=0.279
Figure 2.3.5 (a),(b),(c)	old=2.54 new=2.59	old=147 new=153	old=0.226 new=0.236

IT: ICE THICKNESS
IC: ICE CONCENTRATION
IV: ICE VELOCITY
Table 2.2.1 represents the values generated for a set of five images namely, Image1 to Image 5. There is increase in values for ice thickness, concentration and velocity after applying the proposed method.

II. CONCLUSION

The image segmentation is the technique in which the images are segmented for better analysis of the given piece of data. In proposed work involves the segmentation of images of ice present in sea we are working on ice sea segmentation. SAR is the algorithm being used for analyzing the properties of the ice sea images. Main focus is on getting the ice properties in order to do the further analysis ad segmentation in an enhanced way. Ice thickness, ice concentration and ice velocity are the important parameters being focused on to segment various ice types as well. In this paper, an enhancement is being proposed in the SAR algorithm to do better analysis of ice images and the ice types.

REFERENCES

[1] Xuezhi Yang; Clausi, D.A., "Evaluating SAR Sea Ice Image Segmentation Using Edge-Preserving Region-Based MRFs," Selected Topics in AppliedEarth Observations and Remote Sensing, IEEE Journal of , vol.5, no.5, pp.1383,1393, Oct. 2012
[2] Mari-Ann N. Moen Pnthony P. Doulgeris, Stian N. Anfinsen, Nick Hughes, Angelika H.H. Renner, " Comparison of feature based segmentation of SAR Satellite Sea Ice Images with manually drawn ice charts", 2009
[3] Bernd Scheuchl et.al, "Potential of RADARSAT-2 data for operational sea ice monitoring", CJRS, 2004
[4] B. Ramsay, D. Flett, H. S. Andersen, R. Gill, S. Nghiem, and C. Bertoia. Preparation for the operational use of RADARSAT-2 for ice monitoring. Canadian Journal of Remote Sensing, June 2004.
[5] B. Scheuchl, R. Caves, D. Flett, R. Abreu, M. Arkett, and I. Cumming "ENVISAT ASAR AP data for operational sea ice monitoring" In Proc. IEEE,International Geoscience and Remote Sensing Symposium, volume 3, Sept. 2004
[6] Costa, AlceuFerraz, Gabriel Humpire-Mamani, and AgmaJuci Machado Traina. "An Efficient Algorithm for Fractal Analysis of Textures." In Graphics, Patterns and Images (SIBGRAPI), 2012 25th SIBGRAPI Conference on, pp. 39-46. IEEE, 2012.
[7] Ehmann, J. "Structural Texture Similarity Metrics for Image Analysis and Retrieval", IEEE 2013

[8] GuiGao, Gongtao Shi and Shilin Zhou, "Ship Detection in High-Resolution Dual-Polarization SAR Amplitude Images" IJAP, volume 3 issue 5, pp- 213-2-15, 2013
[9] Kanchan S. Deshmukh, "Texture Image Segmentation using FCM" 012 IACSIT Hong Kong Conferences IPCSIT vol. 25 2012, IACSIT Press, Singapore
[10] Phonsa, G & Sandhar, R. K. (2014, May). Distinctive feature mining based on varying threshold based image extraction for single and multiple objects. In*Advanced Communication Control and Computing Technologies (ICACCCT), 2014 International Conference on* (pp. 1537-1541). IEEE.
[11] Marta, Antonio, " Models For Synthetic Aperture Radar Texture Analysis" IEEE, 2009
[12] Pham, Tuan D. "Image texture analysis using geostatistical information entropy" IEEE 2012
[13] Waller, Ben M., Mark S. Nixon, and J. N. Carter. "Analysing Micro-and Macro-Structures in Textures." In Signal Image Technology and Internet Based Systems (SITIS), 2012 Eighth International Conference on, pp. 246-253. IEEE, 2012.
[14] YuliyaTarabalka et.al "Shape-Constrained Segmentation Approach For Arctic Multiyear Sea Ice Floe Analysis", IEEE, 2012
[15] ChristofRidder et.al "Adaptive Background Estimation and Foreground Detection using Kalman-Filtering" Bavarian Research Center for Knowledge-Based SystemsOrleansstr. 34, D–81667 Munchen, Germany.
[16] Simon J Julier and Jeffrey K. Uhlmann "A New Extension of the Kalman Filter to Nonlinear Systems" The Robotics Research Group, Department of Engineering Science, The University of Oxford.