A Novel Technique for the Estimation of Accurate Thickness of the Sea Ice

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Abstract- : ***Abstract: An ice has different types of properties and types. Remote sensing is safe navigation for ships where ice caps are form and it is essential to understand the climate conditions of the oceans. The main function of ice mapping is to generate the maps of sea ice according to their geographical location. Existing algorithms are not able to give accurate results of the thickness of the ice and size of the ice. In this proposed work, we will be work on pixel segmentation. It helps to calculate the exact thickness value of the ice.***

Keywords: Sea ice, Radar 1, Radar 2, SAR

1. Introduction

Image processing is referred to processing of a 2D picture by a computer. It is a form of signal privilege in which image is input similar to video frame or photograph and is image or characteristics associated with that image may be output. Image processing system treat images as two dimensional signals and set of signals processing methods are applied to them. Image segmentation is the process of partitioning the images into different types of regions [6]. A region is collection of pixels of similar properties. The properties of the images include its gray level, texture, motion etc. There are two regions of image segmentation are as follow:

a) Region Segmentation
b) Edge Segmentation

a) **Region Segmentation:** In region segmentation, the pixels of the same objects are grouped and marked to indicate the formation of the region. The pixels may be assigned to the same regions if they have same intensity values and close to one another. Edge canary operators are used in it [7].

b) **Edge Segmentation:** In edge segmentation, it analyzes the gray value level of distribution and gives value them according to the level of gray scales. Sea ice mapping is one of the important applications of remote sensing technology. An ice has different types of properties and types. Remote sensing is safe navigation for ships where ice caps are form and it is essential to understand the climate conditions of the oceans. The main function of ice mapping is to generate the maps of sea ice according to their geographical location. It also mentioned its different development stages and its properties. For image data RADARSTAT 1 is the main source and later on RADARSTAT 2 (R2) is main source for sea ice mapping. R2 is the enhancement in R1 offered by Canadian SAR (synthetic aperture radar). R2 has better spatial resolution and ahs some additional feature like imaging mode which discriminate water from ice better than R1[8].

R2 is a relatively new satellite and tiny work has been done on evaluating the actual value of these expected enhancements. Moreover, current operational sea ice maps are formed by human analysts with visual inspection of the image data [9]. This process is rather subjective as different ice analysts can produce different results given the same data set. It is also extremely difficult for humans to produce a highly detailed, pixel-level accurate ice map in an operational setting due to the workload involved. In this section we described introduction of image processing. In section 2nd we will do literature survey. In section 3rd we will discuss about SAR. In section 4th and 5th we focused on proposed methodology and experimental results respectively.

2. Literature Survey

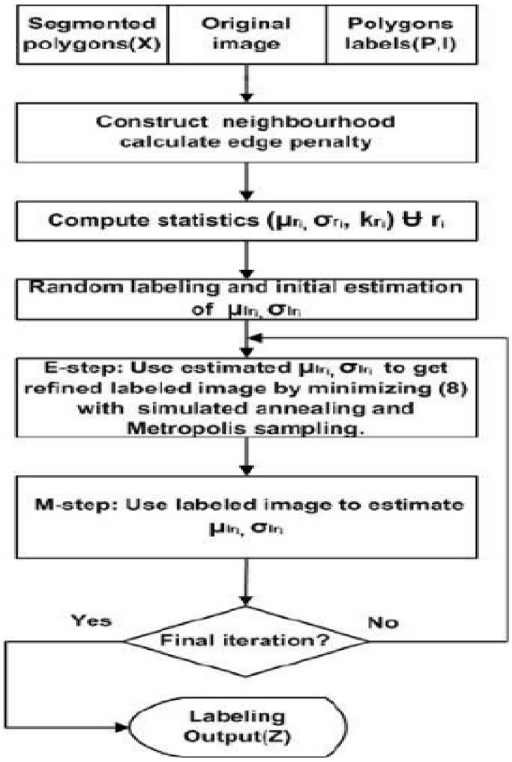
Gui Gao, Gongtao Shi and Shilin Zhou (2013)they introduced [1] a CFAR detecting method which aiming adaptive detection of a ship only when high resolution dual polarization SAR amplitude is available. First of all they design a novel PMA detector, which can improve the signal-to-clutter ratio and make the discrimination of a ship from clutter more easily. Meanwhile, the PMA detector's statistical model has been described by the well-known G0 distribution when facing complex sea background. The experiments performed on measured dual-polarization Terra SAR-X images demonstrate the good performance of the proposed CFAR detecting method. Our goal is to present a powerful detector for ship detection in high-resolution dual-polarization SAR amplitude images. On one hand, this detector can improve the signal-to-clutter ratio (SCR) to enhance the moving targets or restrain the clutter. Meanwhile, wish that a flexible and adaptive constant false alarm rate (CFAR) threshold could be derived from this detector. Under this consideration, this paper proposed a novel detector similarly with the span detector, simply called the product of multilook amplitudes (PMAs) detector. **Yuliya Tarabalka (2012)** they designed [2] a new TempoSeg method for multi temporal segmentation of multiyear sea ice floes from the MODIS data. The proposed technique is based on shape-constrained best merge region growing, and it segments each image from a time series into Floe and Background regions. They have applied this method to a set of MODIS images acquired in August-October 2008 and successfully estimated both an area and a perimeter of the floe of interest over the given time period. **Pham, Tuan D (2012)** paper author studied [3] and proved that the extraction of effective features of objects is an important area of research in the intelligent processing of image data. A well-known feature in images is texture which can be used for image description, segmentation and classification. A novel texture extraction method using the principles of geostatistics and the concept of entropy in information theory. Experimental results on medical image data have shown the superior performance of the proposed approach over some popular texture extraction methods. **Ehmann, J. A**uthor developed [4] new metrics for texture similarity that account for human visual perception and the stochastic nature of textures. The metrics rely entirely on local image statistics and allow substantial point-by-point deviations between textures that according to human judgment are essentially identical. The proposed metrics extend the ideas of structural similarity (SSIM) and are guided by research in texture analysis-synthesis. We conducted systematic tests to investigate metric performance in the context of known-item search, the retrieval of textures that are identical to the query texture. This eliminates the need for cumbersome subjective tests, thus enabling comparisons with human performance on a large database. **Bernd Scheuchl** they introduced [5] Synthetic aperture radar (SAR) data from RADARSAT-1 are an important operational data source for several ice centres around the world. Whereas RADARSAT-1 is only capable of acquiring data at a single polarization, RADARSAT-2 will be capable of acquiring dual-polarization data in many wide-swath modes and fully polarimetric SAR data in a narrow 25-km swath mode. In this paper, we consider the ice information requirements for operational sea ice monitoring at the Canadian Ice Service and the potential for RADARSAT-2 to meet those requirements. Primary parameters are ice-edge location, ice concentration, and stage of development; secondary parameters include leads, ice thickness, ice topography and roughness, ice decay, and snow properties. Iceberg detection is included as an additional ice information requirement. The dual and fully polarimetric modes of RADARSAT-2 are expected to enhance ability to measure these parameters. For ice operations, the dual-polarization data are expected to be most useful, as they will provide the required wide coverage in a number of modes. Although ScanSAR is the recommended mode of operation, the properties of other modes are also discussed. To illustrate the expected improvements from polarimetry conclusions of past work and add some new results using ENVISAT ASAR and simulated RADARSAT-2 data.

3. Synthetic Aperture Radar (SAR)

SAR is capable of day-night and all weather atmospheric penetration in practically all conditions using active microwave sensing [10]. SAR aerial and satellite platforms are able for regularly capturing information at satisfactorily sufficient resolutions for the purposes of sea ice discrimination resolution. SAR sea ice images are interpreted using unsupervised segmentation.SAR imaging is the one of the most important source of the sea ice mapping. TO understand the concept of SAR knowledge of R2 is necessary. The system consists of a spacecraft with the SAR apparatus moving along an orbital track, which traces out the orbital ground track along the Earth's surface. The SAR system emits microwave pulses at the Earth's surface. The antenna lengths required to build high resolution images that are too large to begin into orbit for traditional RADAR. SAR solves this problem by using signal processing techniques and the activity of the spacecraft to generate the effect of a larger antenna, giving rise to the synthetic aperture. The motion of the spacecraft also allows the field of view to be advanced in the direction of motion so that two dimensional SAR images of the surface can be generated. SAR systems can transmit and receive EM energy in different polarizations. Polarization refers to the orientation of the electric field component of the electromagnetic wave. Different ice types have unusual backscatter characteristics that can be measured by SAR, since each ice type differs in factors such as surface roughness, volumetric structure and salinity[11]. The HH channel provides the same data as R1, while the addition of the HV channel is expected to improve the discrimination of ice and water, particularly water that has been wind roughened, which looks very similar to some types of ice in the HH channel at small incidence angles. A SAR dual-polarization data confirmed that the HV channel improves the discrimination of ice and water under these circumstances. R2's dual-polarization mode should be similar [12].

4. Proposed Methodology

SAR imaging is used for mapping of the ices. SAR sea ice images are interpreted using unsupervised segmentation. For image source RADARSTAT 1 is the main source. But it has some disadvantages that its results were not accurate. So for accuracy automated algorithms were developed for radar 1 for better results. These updations were not satisfied so enhancement in RADARSTAT 1 was required known as RADARSTAT2. Now RADARSTAT 2 provided better results than RADAR 1 in the form of image position, its density etc. The existing algorithms of RADARSTAT1 are not as much compatible with RADARSTAT 2 as expected for better, accurate and efficient results of ice images. In this proposed work, we are working on pixels based algorithms which will gives précised results for analysis. Our work is based upon region based segmentation which will give better than exiting algorithms in the form of property of ice, color density and geographically position type of the sea ice. In proposed technique for sea ice classification they used region based interpretation in which ice concentrations are inaccurate because if a region may have 30 multi-year ice, but the user can not pin point the multi-year ice location. Such information would be useful for mathematical climate models, route planning and for ship navigation. Hence, automated interpretation of SAR sea-ice images would be invaluable for organizations performing sea-ice interpretation operationally.



Flowchart of methodology

The overall complexity of just the labeling algorithm is $O(\theta n_r n_p + MN)$. Table V summarizes the computational time required to achieve labeling results for every test image after the segmentation. The segmentation of all polygons is 10 minutes on average. Labeling was performed using MATLAB with a 2.3 GHz Intel dual core processor, the benchmarks indicate high computational feasibility. As such, the minimal computation time supports the algorithms use in an operational environment.

5. Experimental Results

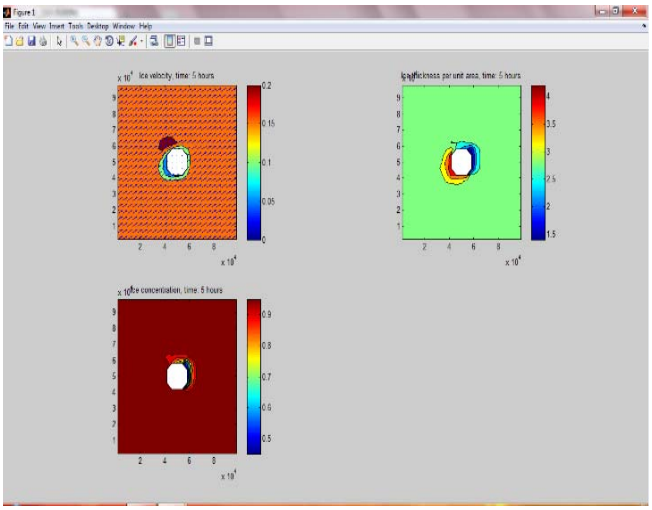


Figure 2: Thickness figure

velocity will be different from middle it means islands having more ice on that point and in between no ice this will effect in thickness case and concentration figure.

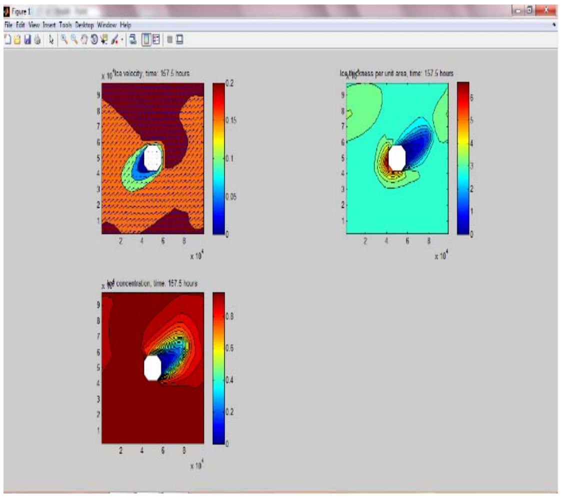


Figure 2: Thickness from top to bottom

Again from the outer boundary will start thickness in which we calculate from top to bottom approach.

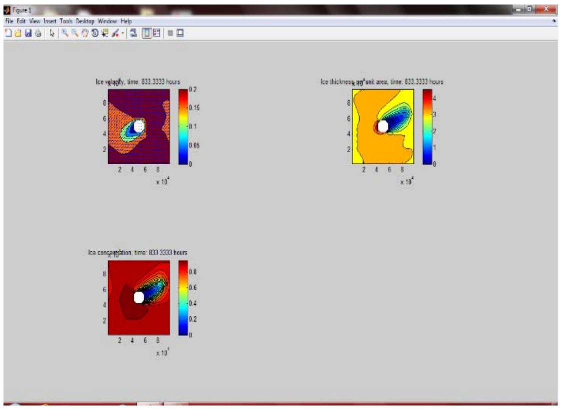


Figure 3: Thickness with mess graph

Similarly in all case will be continue at the end we get result in which thickness will be calculate like in side of diagram we give mesh graph in which 0-4 point which show their level of finding something. in the case of concentration also same thing.

6. Conclusion

Sea ice is an important application. For image source RADARSTAT 1 is the main source. But it has some disadvantages that its results were not accurate. So for accuracy automated algorithms were developed for radar 1 for better results. In this paper we concluded that radar1 and radar 2 were unable to give accurate value of ice. So in this paper we proposed a new technique which is based upon pixel segmentation and gives accurate result of thickness.

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