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Identification of Sea-Ice Floes and the Floe Size Distributions Based on Probabilistic Distribution Function

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Abstract— We use the Probabilistic distribution function that used for the separation of the dark ice and light ice. This assumes the variance for the distribution function, and there is no same variance for all the all variables. So, there is no same priority for the same clusters. Therefore, this process is applied for the edge detection process. After this we apply the morphological process for the enhancement of shape on the images. After that, classification of the ice and the floes distribution are carried out. Our simulation result shows the identification process of ice which is efficient compared to the existing process.

Keywords : Pixel , image , MIZ , GVF

I. INTRODUCTION

An automatic method for identifying the outlines of ice floes is as follows: This is almost the same as the result of very careful manual digitization. This method consists of identifying a set of edge pixels and grouping them into clusters which are centered about a principal curve. Each cluster corresponds to a floe and the corresponding principal curve is the estimated floe outline. The method involves several new statistical techniques: (1) A way of estimating closed principal curves that reduces both bias and variance and is robust to outliers. Here, outliers take the form of melt ponds on the surface of ice floes. (2) The erosion-propagation (EP) algorithm provides initial estimates of floe outlines.

This combines the existing idea of erosion front mathematical morphology with that of local propagation of information about floe boundaries.

The marginal ice zone (MIZ) is defined as the area where open ocean processes, including specifically ocean waves, alter significantly the dynamical properties of the sea ice cover. Ocean wave fields comprise short waves generated locally and swell propagating from the large ocean basins. As they encroach on the ice cover, ocean waves are scattered, cause the ice cover to bend and potentially to break into smaller fragments that can also eventually be reduced to a slurry. The horizontal components of the wave motion make ice floes collide with each other, which further alters their shape and size.

There are two theories on which sea ice dynamics rely. The first one deals with continuum ice sheets scattered with cracks and ridges, where the deformation field follows a plastic constitutive rule. From this theory has originated the so-called viscous-plastic class of numerical models, which is used in virtually all large-scale models of the Arctic. It gives a good representation of the sea ice behavior in the central ice pack, but its validity is questioned in certain flow regimes, especially in the MIZ where sea ice is all broken-up. Because waves are the main factor influencing the nature of the ice cover in the MIZ, for example by limiting the size of the floes and altering atmosphere to ocean coupling, an adequate model must include their effects in some way.

In imaging science, image processing is processing of images using mathematical operations by using any form of signal processing for which the input is an image, such as a photograph or video frame; the output of image processing may be either an image or a set of characteristics or parameters related to the image. Most image-processing techniques involve treating the image as a two-dimensional signal and applying standard signal-processing techniques to it.

Image processing usually refers to digital image processing, but optical and analog image processing also are possible. This article is about general techniques that apply to all of them. The acquisition of images (producing the input image in the first place) is referred to as imaging.

Closely related to image processing are computer graphics and computer vision. In computer graphics, images are manually made from physical models of objects, environments, and lighting, instead of being acquired (via imaging devices such as cameras) from natural scenes, as in most animated movies. Computer vision, on the other hand, is often considered high-level image processing out of which a machine/computer/software intends to decipher the physical contents of an image or a sequence of images (e.g., videos or 3D full-body magnetic resonance scans).

Isolating the ice floes in the remotely sensed data is a challenging task – both manual and by machine. The ice floes float in the background sea-ice in different shapes and sizes. These are not fully separated from one another, and do not have clear demarcation to decide their boundaries. In addition, grey-level difference between the background and the ice floes

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is not significantly high, especially for medium-sized floes (typically 50–500 pixels), and also varies across the image to fix a global threshold value as is done in many image segmentation applications. Here to separate sea-ice floes into individual ice floes, the method we use called Probabilistic Distributive function method is adopted which divides the ice floes into dark ice and light ice and it is a fully automated manner. For separating the seemingly connected ice floes into individual ice floes, an algorithm called Gradient vector algorithm is applied. When the individual ice floes are identified, the floes boundaries are applied, the floe size distribution are calculated.

II. MODULE DESCRIPTION

1) Ice Pixel Extraction

It is the first module in our project, which extracts the pixel form the ice images. Naturally sea ice is whiter than the open water under different normal conditions. The ice pixels are extracted by using the thresholding methods.

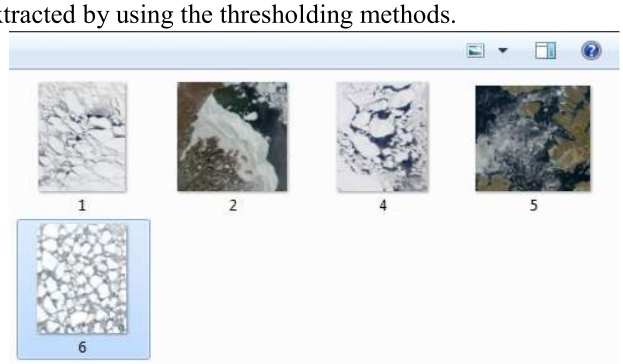

Fig. 1.1. Pick an Image File

Then the light ice has larger pixel intensity than the threshold while the dark ice with pixel intensity values between the threshold and water, such as ice pieces under the water surface may not be identified and they are considered as water from a threshold method. Here we use probability distribution function is used for the separation of dark ice from the open water.

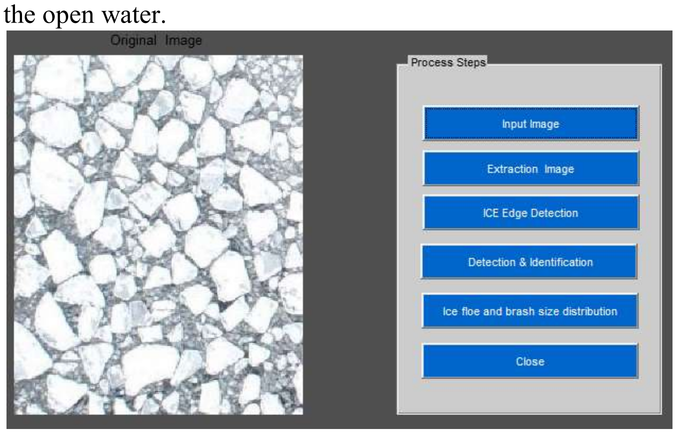

Fig. 1.2. Main View

We get the image by comparing the dark ice and the light ice.

2) Ice Edge detection

It is the second module in the project, which uses the Gradient Vector Flow (GVF) method for the edge detection and it solves the problem of identifying the individual ice floes that are very close to each other.

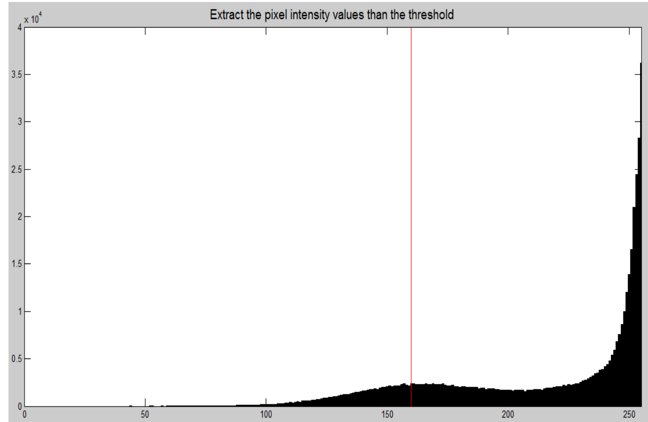

Fig. 1.3. Extarct the Fixel Intensity

This can be identified by the boundaries between apparently connected floes have a similar brightness to the floes themselves. This GVF algorithm operates on the gray scale images, which preserve the real boundary images and weak boundary images.

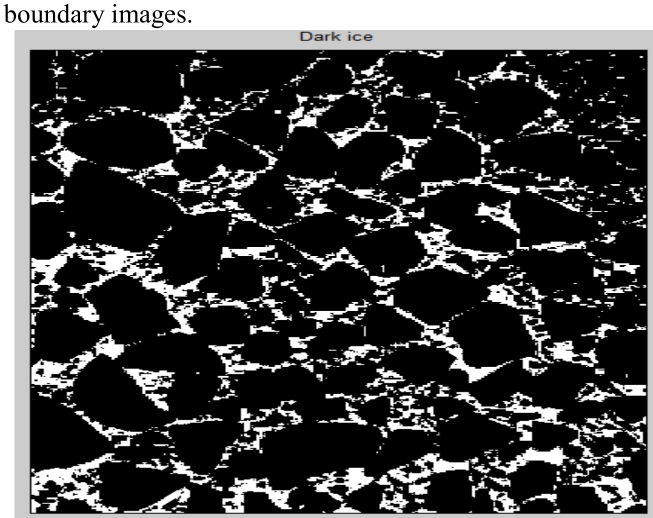

Fig. 1.4. Dark Rice

There is an automatic counter installation algorithm is devised to increase the efficiency of the ice floe segmentation method based on the GVF snake algorithm.

3) Ice shape Enhancement

It is third module in our project to enhance the shape of the project. In order to smooth the shape of the ice floe, morphological cleaning method is used after the ice floe identification process. This process is a defined as the combination of first morphological closing and then morphological opening on an image.

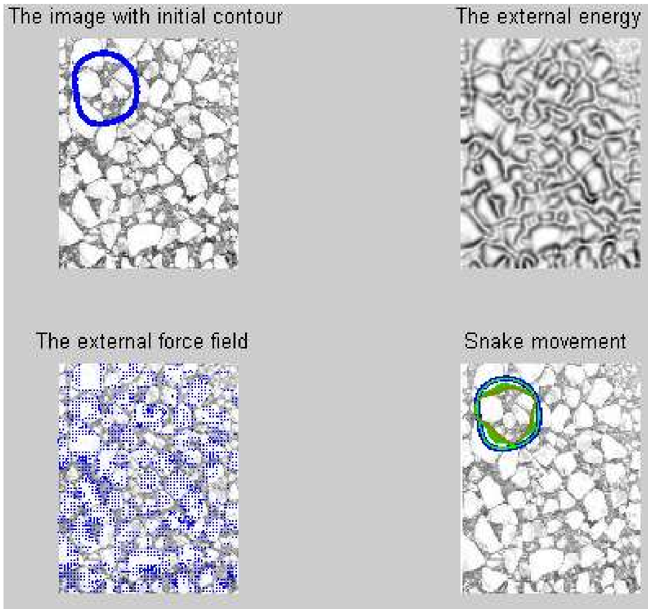

Fig. 1.5. Shape View

The closing process smoothes the counter of the objects and joins narrow breaks, fills long thin gulfs, and fills holes smaller than the structuring element.

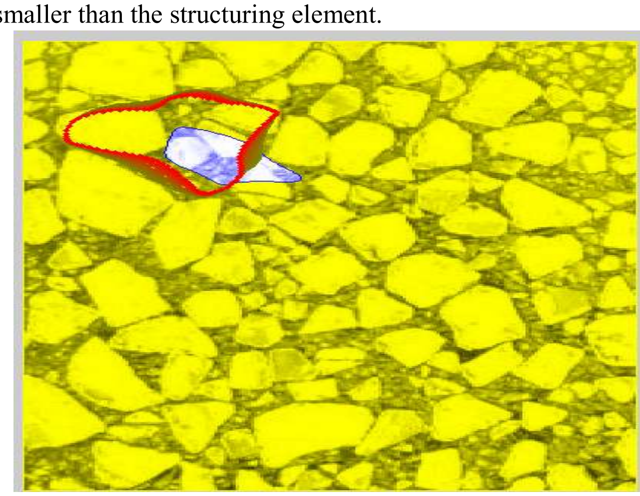

Fig. 1.6. Color View

Then the opening process removes complete regions and thin protrusions.

4) Ice type classification and floe distribution

It is the final module in our project that identifies the ice types based on the threshold values. In order to distinguish the brash ice from ice floes in our algorithm we propose the threshold value.

Here the ice pieces with size larger than the threshold are considered as the ice floes, whereas the smaller pieces are considered as the brash ice and the remaining pixels are the slush.

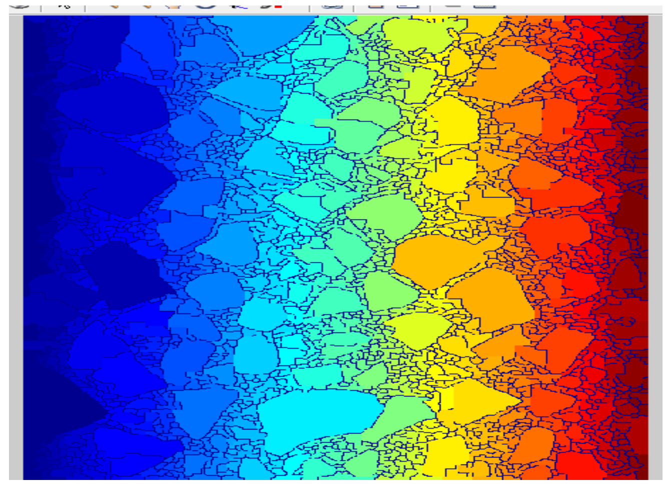

Fig. 1.7. Ice Classification View

III. CONCLUSION

Image processing is a process of processing the images using the mathematical formation. Here we overcome the challenge is identifying the ice floes. The ice floes identification process has four steps; they are i) Ice Pixel Extraction, the pixel extraction is done by the K-means clustering algorithm, which separates, the dark ice and light ice. ii) Ice Edge detection, the Gradient Vector Flow algorithm is proposed for identifying the weak boundaries. iii) Ice shape Enhancement, here the Morphological process is taken for the Ice floe identification. iv) Ice type classification and floe distribution, here the types of ice floes are identified such as Brash Ice, water, slush and ice floes. Our experiment results show the process of identification.

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