Segmentation of sea ice and open water from ship radar images using U-net

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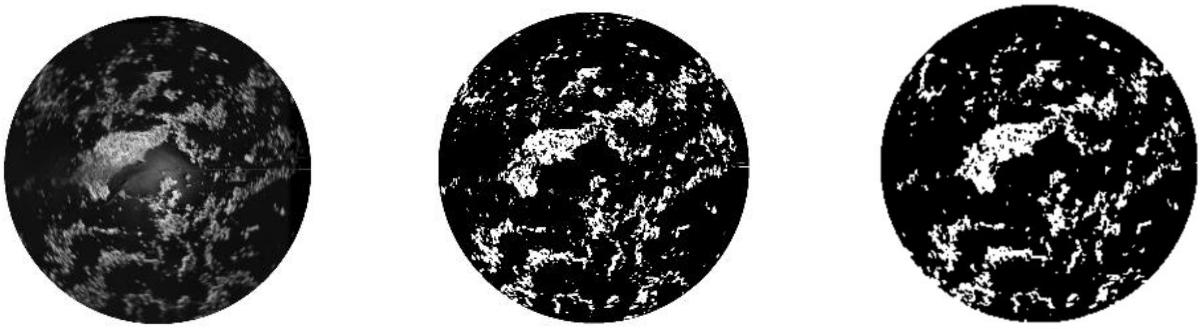
With global warning, there has been a growing economic interest in shipping in the Arctic. Espencially the Northern Sea Route (NSR) has opened up as a possible avenue of trade in containerized products between Asia and Europe. The sea ice has caused significant damage to ships. It is important to accurately obtain the position and size of sea ice from ship radar images. In order to search a route from the ship radar image, it is important to divide the sea ice and the open water. However, it is difficult to obtain the sea route in the radar images of a ship because there are various noise and distortion such as sea clatter and radio wave attenuation with respect to distance.

Figure.1(a) is a ship radar image that provided at lat. 79 degrees 57,236 N and long. 142 degrees 31,540 W by Canadian Coast Guard Ship (CCGS) Louise S. St-Laurent in August, 2012. In the center of the radar, the brightness is higher due to sea clutter. And the brightness decreases as going away from the center of the radar. It is not possible to easily separate sea and sea ice from the ship radar image.

A U-net which is one of deep learnig, is useful technque for complex image segmentaion. The network is based on the fully convolutional network. The radar image in Figure.1(a) is input to the U-net.In our method, in order to create desired data corresponding to input data, multiple temporally continuous images are superimposed to supplement missing sea ice due to noise in Figure.1(b). Figure.1(c) shows the esitmated image by the U-net. As shown in this figure, sea and sea ice are separated from ship radar image.



(a) input image (b) desired image (c) resulting segmentation from the U-net

Figure 1. Simulation results.

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