

Reply to Anonymous Referee #3 from 04 Nov 2017

Note: Author responses are in plain text following the original referee comment shown in italicized text.

Please note that there is a previous effort to realize an open source package for sea ice feature detection: Sea Ice Imagery Classification with Machine Learning and High-Performance Computing, XSEDE 2016 Polar Compute Hackathon - Sea Ice Team, Contributors: Alek Petty, Andrew Barrett, Xin Miao, Phil McDowall, Vivek Balasubramanian, <https://github.com/polar-computing/SeaIce> Is there any relationship between the author's package with the XSEDE 2016 package? Please cite it if necessary.

We had not seen that package prior to this review. Our work has no basis in the code referenced. We appreciate being informed about another activity and future collaboration between our efforts and this project may be beneficial to the community. Citation does not seem to be warranted since the code referenced does not appear to be published yet.

L9: What is “dm-scale”?

‘dm’ here stands for decimeter – the SI term for 10^{-1} meters.

The terms used in manuscript are not consistent. L13: . . . melt ponds and submerged ice, so this is definition used in (Miao, 2016). This includes two subclasses: melt pond (MP) and coastal submerged ice. So how did author calculate MP coverage in L364? How to extract MP from the broad category of “melt ponds and submerged ice”? Please make it clear.

The definition we use for melt ponds is stated in section 3.3.2, line 243 to 244, and we are consistent with the usage throughout the manuscript. Our definition is not the same as that used in Miao et al. (2016), as we do not differentiate between melt ponds and coastal submerged ice. We explicitly clarify this difference on lines 245-249. From a shortwave optical albedo standpoint it is unnecessary to separate these classes, and therefore we do not attempt to extract melt ponds according to this narrower definition. Other works present methods to separate these (Miao et al., 2015, for example) that could be applied to the results presented here for users interested in that application.

We have changed the category name to be “melt ponds and submerged ice” to alleviate some of the confusion for this category.

L165: Did author consider the possible image distortion due to tilting of sRGB and other images?

For this work, no. As we are not trying to answer any scientific questions based on this sRGB imagery specifically, we did not attempt to correct image distortions. The algorithm is able to classify images even with small amounts of off-nadir distortion. Applications that seek to use sRGB imagery to answer scientific questions should address any image distortion present. As sRGB imagery is not standard (unlike WorldView), correcting image distortion must be done on a case by case basis using positioning, pointing, and lens information which was not available in the data we worked with.

L225: One of the major feature of RF is that it only need a small amount of samples, very suitable in labor-intensive remote sensing project like sea ice detection.

This is true: We have added “[...] even with relatively small training datasets” to line 228.

L236: How did you separate regular melt pond (fresh water) and melt-through MP (salt water)? Why not use the technique provided in (Miao, 2016)?

We did not differentiate between fresh water melt ponds and salt water melt ponds. Our motivation lies in short wave optical properties of melt ponds and from that perspective the distinction between salt and fresh water is not important. We added line 241 to clarify this: “Our surface type definitions focus on the behavior of a surface in absorption of shortwave radiation and radiative energy transfer”. However, melt ponds that are completely melted through were classified as open water based on their unique spectral characteristics (Figure 5).

L 256: I think it makes sense to combine 3.3.4 and 3.3.5 to 3.3.3.

Thank you for the suggestion. We have combine sections 3.3.4 and 3.3.5 into a single section describing all of the attributes calculated for each image object.

L191&L255: Did author consider the shadow issues? Shadow is an interesting sea ice feature, please refer to Xin Miao, Hongjie Xie, Stephen F. Ackley, Songfeng Zheng, "Object-Based Arctic Sea Ice Ridge Detection From High-Spatial-Resolution Imagery", IEEE Geoscience and Remote Sensing Letters, 13(6): 787-791, 2016.

L307: Can you provide an example? I don't understand why.

In lines 259-265 we have edited the description of shadow detection to better illustrate our approach, and in lines 316-323 we have edited the description of detecting ridges in neighboring regions.

Shadows are an interesting feature of sea ice, but classification of shadow regions is beyond the scope of this paper. We are not trying to present shadow or ridge detection as a stand-alone feature. In spring panchromatic WorldView imagery, shadows look similar to melt ponds, and lines 259-265 is a simple method to address the similarity.

The example presented in line 316 (was 307) is an example of how using neighborhood statistics help identify the classification of an object, and we have reworded it this to be more apparent.

L367: Section 3.6 is very confusing. What do you mean by "larger sample"? Is it "larger number of samples"? What is "metric" here? L374: you mean 'observer' not 'user', rite?

We agree that this section as written was confusing, and we have restructured much of this paragraph to increase its clarity. The larger sample assessed the accuracy of 1000 pixels instead of 100. User and observer were referring to the same thing, and we have simplified this to a single term.

L381: Figure 7 refer to Figure 8? Very confusing here.

No, but there was a typo in describing Figure 7 here. This sentence has been edited to be more precise in its reference to Figure 7.

L 389: Fig. 8??

This line correctly references Figure 8. We have rearranged the order of this sentence to be more clear.

L405: Only 4.1 not 4.2? Then author could remove this subtitle.

We've added a section 4.1 here to divide this section into 4.1 and 4.2

Comment: L596: Very positive contribution by sharing the training set!

Thank you!