The Cryosphere Discuss.,
https://doi.org/10.5194/tc-2018-167-RC1, 2018

The Cryosphere Discussions
Open Access
EGU

Interactive comment on "Brief communication: Rapid machine learning-based extraction and measurement of ice wedge polygons in airborne lidar data" *by* Charles J. Abolt et al.

I. Nitze (Referee)

ingmar.nitze@awi.de

Received and published: 21 September 2018

General summary: The manuscript with the title "Rapid machine learning-based extraction and measurement of ice wedge polygons in airborne lidar data" describes the application of novel convolutional neural network (CNN) image recognition concepts for the delineation of ice-wedge polygons from DEM data. The methodology was tested in two different sites in northern Alaska. The application of state-of-the-art image recognition methods is a rather new and unexplored approach in remote sensing applications of the cryosphere. The paper has a strong technical focus and describes the methods thoroughly. Delineating ice-wedge polygon networks is an essential task for quantify-

Printer-friendly version

Discussion paper

ing ground ice, predicting the resilience against degradation and understanding local scale hydrology. In contrast to the positive novelty of the paper, this paper lacks several major points. The authors remain very vague in the results sections, with practically no quantification or accuracy assessment of the results. To the reader it is hard to estimate the accuracy strengths and weaknesses of the method, as the results are presented rather qualitatively. Furthermore, the title suggests that the authors used Lidar data as their key input. This is somewhat misleading, as they used DEMs, which are based on Lidar data, but could be technically processed from other sources. As this manuscript has a technical focus I would really like to see a flowchart in this paper, as this will help to follow the processing chain much better. Furthermore, the authors did not mention any software (programming languages, packages) they used, which might be interesting for the readers. For the review process I am interested to see the code and the data. Overall I see a good potential for publication due to the interesting application of novel image recognition methods for delineating IW-polygons. However, the manuscript needs improvement in several sections, particularly in the results and discussion section. Therefore I recommend a major revision. Specific comments are stated below.

1. Title: The title is somewhat misleading as you used a high-resolution DEM instead of Lidar data. The source data for the DEM creation was Lidar, but not not essential for your study, therefore I recommend to change the title.

2. 1:17. The first sentence is in my opinion out of place and it would be better to state the objective of the study after introducing the general problem.

3. 2:8. Landsat8 → Landsat 8 (add space)

4. 2:18. It might be necessary to use the full name (Alaska) first and introduce the abbreviation. Adding the country name might be helpful for readers that are not familiar with US state abbreviations.

5. 2:24. You did not analyze Lidar imagery. It is a DEM derived from Lidar data.

6. 2:31. Before you used AK, here you write Alaska. Please try to be consistent or introduce the abbreviation at the first instance.

7. Section2 (2:30 ff). Fig S1: Can you provide a more detailed map (e.g. aerial/satellite image + bounding box) of the processed tile locations and probably some coordinates? Currently it is not possible to easily find your processed areas.

8. Section2 (2:30 ff). Could you provide more detail about the types of polygons? This information would be a good fit in this section. The Alaskan Arctic Coastal Plain Polygonal Geomorphology Map (Lara, 2015) + your own observations could be a good source for that.

9. 3:23. You use the term “trough”. This term might work well for HCP, but LCPs also have rims. Using trough may not work well for the general variety of ice-wedge polygons and implies that you can only detect edges of HCP. Do the LCP still have small troughs between the rims? It seems so for at least some of the Polygons in your figures.

10. 3:24. “assigned a negative intensity proportional to its Euclidean distance from the closest trough”. As this is a “distance transform” (to my knowledge) you could name it in parentheses. This would enhance the understanding of this part.

11. 4:2 Here you use both units (meters and pixels) in other cases you use only one of these. Please check if you could be somewhat more consistent.

12. 5:17 Double negation (“would not delineate any polygon whose center did not include”) should be avoided.

13. 6:8 It would help if you could show you the location/extent of training data visually in your figures.

14. 6:12 “several iterations”. Please be more specific.

15. 6:17. “we calculated the relative elevations of polygon centers at the Prudhoe Bay

training site". Why not both? I do not see the reason not doing it for Barrow.

16. 6:20 Section 4: The entire section is very vague and too qualitative. It completely lacks quantification of your results. Please add quantitative results and a proper accuracy assessment with independent training and validation areas to this section. The discussion is ok, but probably need some relation to similar studies and how your method performs in comparison with similar studies. Furthermore, it would be nice if you could discuss the transferability of your method to DEMs of other origin or spatial resolution.

17. 7:28. Here again, you are using DEM rather than Lidar

18. 7:30 "using a training workflow that can be completed in a single afternoon". One could argue if this sentence sounds quite sloppy. Maybe you could improve the style.

19. Please check the formal requirements if all sub-figures need to get enumerated instead of A/ and left/right

20. Figure 3: Do the colorized edges add any information? It clearly makes sense for polygons, but rather not for lines.

21. Figure 3: Legend/Colorbar: Adding the polygon type, LCP for negative, HCP for positive values (if I understand correctly) would help to understand Fig 3A more quickly.

22. Figure 3: "A" is hard to read with the colorful background. I suggest to either change the font color or add a box (or similar) in the background.

Interactive comment on The Cryosphere Discuss., https://doi.org/10.5194/tc-2018-167, 2018.