Atmospheric Measurement Techniques Discussions

Atmos. Meas. Tech. Discuss., author comment AC3
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Reply on RC2

Andrew Geiss and Joseph C. Hardin

Author comment on "Inpainting radar missing data regions with deep learning" by Andrew Geiss and Joseph C. Hardin, Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2021-100-AC3, 2021

Thank you to both reviewers and to the editor for your thoughtful comments. We sincerely appreciate you taking the time to review our work and provide constructive comments! We have used your feedback to improve the paper and have responded to each comment in order below:

"It looks like all the test cases shown in the manuscript are masked manually. I wonder if the authors could include some real cases (with missing/damaged data) to illustrate the practical application performance."

The scheme does not detect or mask low-quality data regions and the CNN expects that the data in the inpainting region has already been masked, so even in practical application an area that needs to be inpainted will need to be masked manually in a similar manner to the examples in the paper. There is no difference between manually masked good data used in the examples or manually masked low quality data because in either case all of the data in the inpainting region is completely removed from the inputs to the CNN before it is inpainted. To automate applying this, one could apply off the shelf blockage masks, but as we wanted to compare the quality of the infilling, and not the blockage masking, we went with manually blanked areas for now.

"Page 7, Line 175: The authors left a gap of 0.5 between clear and cloudy (reflectivity) values, and then use a reflectivity threshold to mask other two fields. I wonder if it is worth adopting a similar strategy for other two fields, instead of masking the output using reflectivity threshold. Please comment!"

P7 L175: We tried this exact approach early on during this study, adding a gap in the normalized velocity data between -0.25, 0, and 0.25 for instance, but the CNN performed worse. We opted not to include this experiment in the paper. It also makes sense to apply the same masks across all three fields to avoid showing spectrum width data where the reflectivity was deemed not to be significant for instance. For dual-polarimetric fields this becomes a more interesting problem as one could choose different masks, but that is beyond the current scope of research. An alternative approach that we have not tried might be to include a separate channel as output from the CNN that will act as a mask.

Because masking based on the output reflectivity gave good results we did not explore this further.

"In Fig. 2, I do not really see any beam blockages. Am I missing anything?"

This figure is solely meant to provide a visual example of each of the inpainting schemes. Some of the inpainting schemes are appropriate for the low level blind zone scenario only (one boundary with data, bottom row of Figure 2), while the others are applicable to either the KaZR outage scenario or the C-SAPR2 beam blockage scenario (two-three boundaries with data). We opted to use a sample from KaZR to demonstrate what the benchmark inpainting schemes look like for the 2-boundary case so beam blockages are not shown in this figure but the same inpainting schemes from panels b-d are also used for the beam blockage cases. We have changed the caption to clarify.

"Page 21, Line 485-490: I understand that the data are trimmed to range gates by azimuth angles so they can be processed at the native resolution. But I do not quite understand why the data were trimmed to 128 degrees and then rotated (why not use the whole scan?). Please clarify!"

L485: This is due to computational limitations while training. The CNN has ~$5x10^6$ parameters and when training we use a minibatch of 8-16 samples, processing the entire scan will exhaust the VRAM on the GPU that was used for training. That said, even with more memory, it may be useful to only process fractions of a PPI scan because the trained CNN can then be applied to data taken during a partial sweep or during a sweep that does not have exactly 1-degree resolution in the azimuth. We have added a note about this on line 500.

"Page 19, Paragraph 470: "prevalance" should be "prevalence" "

Corrected