Review of "Ice crystal images from optical array probes: Compatibility of morphology specific size distributions, retrieved with specific and global Convolutional Neural Networks for HVPS, PIP, CIP, and 2DS" – Jaffeux et al. (2024)

This study leverages optical array probe data from a recent field campaign to build, test, and apply convolutional neural networks for the identification of ice crystal morphology. Ice crystal morphology in clouds is a particularly useful characteristic, as it can shed light on the evolution of ice crystals. Until recently, identify ice crystal morphology from in situ data has been thwarted by the time and effort needed to manually characterize the data. Recent advances in machine learning have made it possible to build advanced models that can complete the categorization processes in a faction of the time that it takes a human to do so and with very high accuracy.

This work demonstrates this approach using data from several probes to build convolutional neural networks (CNNs), with reasonable accuracy. However, the novelty of the work as well as the presentation of the research is lacking, or at least needs to be better explained. As such, this paper needs to undergo rather significant revisions before it can proceed with the review process.

Major Comments:

1) Regarding the CNNs, there is almost no information on what was actually done. CNNs represent a range of possible machine learning algorithms. These details are absolutely needed for the work conducted in this paper to be reproducible, as well as for the reviewers and readers to determine if the approach is viable for the application.
2) The novelty of this work is lacking, and in fact many recent studies that have conducted similar work are not even mentioned. These studies need to be discussed in the introduction (in general, the introduction lacks sufficient information on the problem at hand and how others have tried to resolve it). These studies also need to be discussed in the context of the new findings and thus to show what is new/different/novel in the current work. Recent works of relevance that have applied CNNs to this exact problem include, but are not limited to, Pryzybylo et al. (2022), Zhang et al. (2023), and Schmitt et al. (2024a,b). These papers are mentioned in passing but not highlighted. Mainly, the introduction really needs to highlight what has been done in this field and explain the novelty of the current work.

Minor Comments:

1) Acronyms need to be defined the first time they are used.
2) Please consider having a native English-speaking person review the paper for grammar.

References

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