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Discussions

Interactive comment on "Improving Cloud Type Classification of Ground-Based Images Using Region Covariance Descriptors" *by* Yuzhu Tang et al.

Anonymous Referee #3

Received and published: 18 November 2020

The manuscript appears to present evidence that using special kind of localised feature extraction in images, together with a specialised measure of similarity between these features, it is possible to train a support vector machine to pick between a set of cloud types that the authors have defined.

Unfortunately the manuscript has structural issues, unclear formulations and lacks details in parts which hampers its ability to communicate the research to the reader. In addition the manuscript lacks evidence of the physical relevance of the particular cloud types used - how specifically are these cloud types important for climate predictions and weather forecasting?

The performance analysis is a bit weak as the datasets used are quite small in size (784 for SWIMCAT and 500 zenithal). I would suggest using data-augmentation (random rotations and zoom) to create two orders of magnitude more images to work with. In addition, because random subsets of the datasets are used for training and validation it is unclear to me whether the performance difference to prior work is actually due to random chance (training/testing on easier partition if the datasets) or whether the technique presented here is indeed better. It is common in machine learning datasets to train all models on the same training set and validate against the same validation set (see for example CIFAR http://www.cs.toronto.edu/~kriz/cifar.html and MNIST http://yann.lecun.com/exdb/mnist/).

In addition there are structural issues in the manuscript, for example many sentences combine terms that are not on equal footing and often it is not detailed how and why specific assertions are evidenced. For example in the introduction's first sentence: it is true that "clouds have a strong impact" on "Earth's energy budget", but it isn't clear how clouds having a "strong impact" on "climate modelling" or "weather prediction". Further, line 24 goes on to talk about "weather monitoring" rather than "modelling" which are not equivalent. Finally, a extensive list of publications covering "cloud coverage measurement" and "cloud classification", but this publication doesn't appear to be about "cloud coverage". The fact that there is "additional interest" doesn't evidence that "cloud type classification" is in great need, or is that in fact what these papers state?

Specific comments:

Abstract:

l 10: "Cloud types are important indicators of ... short-term weather forecasting" - this sentence doesn't make sense. "Cloud types" can't "indicate" "weather forecasting"

l 11: "The meteorological researchers can benefit from the automatic cloud type recognition of massive images captured by the ground-based imagers". Why is this true? Also, I would leave out "The" in "The meteorological" and the word "massive".

l 12: "However, by far it is still of huge challenge to design a powerful discriminative classifier for cloud categorization" - why is it a huge challenge?

l 14: "BoF is extended from Euclidean space to Riemannian manifold by k-Means clustering, in which Stein divergence is adopted as a similarity metric" - what is the relevance of this? Why is this done?

l 15: "The histogram feature is extracted by encoding RCovDs of the cloud image blocks with BoF-based codebook" - the term "histogram feature" hasn't been explained yet, what is this? How is it relevant to the technique/results of this paper?

l 17: "The experiments on the ground-based cloud image datasets validate the proposed method and exhibit the competitive performance against state-of-the-art methods." - this should instead specify exactly what the improvements on previous work is, give the numbers that indicate the improvement and what the implications of these improvements are.

General:

- the section on "Feature extraction" should be before "Region Covariance Descriptors" since the covariance descriptors used the features.

l 102: the relationship between w in the "Rectangular region R with size w x w" and the width of the input image isn't specified.

I would be happy to review this article again once the above issues have been addressed and a general read through considering the "how" and "why" of each sentence are detailed. The technique presented is interesting and the results encouraging, but the presentation needs improving, details need adding and comparison to prior work could benefit from more comprehensive analysis.