Joint Research Centre for Engineering Structure
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In reference to amt-2021-405 "Identification of tropical cyclones via deep convolutional neural network based on satellite cloud images":

The authors appreciate greatly the referee for his valuable comments and suggestions. We will address these concerns below.

Comments from reviewers:

-Referee #1

General comments:

1. This paper focuses on the identification of TCs based on satellite cloud images via DCNN techniques. Two models are proposed to deal with identification issues associated with two kinds of SCIs that are widely utilized in this field. Visualization techniques are further adopted to examine how the DCNN models work internally. Overall, the article is well organized and written. Both the methodology (including datasets and models/methods) and main results are presented and discussed clearly and reasonably. The results are interesting and useful. This reviewer suggests the article be accepted after minor revision.

Response: Thanks for the reviewer's comprehensive summary of this work and the encouraging comments. The manuscript has been revised carefully based on the received comments.

Specific Comments:

2. Abstract: "lack of concerns on the identification of TC fingerprint from SCIs have become a potential issue, since it is a prerequisite step for follow-up analyses". Please revise this sentence to improve its readability, meanwhile, have may be replaced by has.

Response: This has been replaced by "Although great achievements have been made in this field, there is a lack of concerns on the identification of TC fingerprint from SCIs which is usually involved as a prerequisite step for follow-up analyses" in the updated manuscript.

3. L66: there lacks a blank

Response: Revised accordingly.

4. Line 131: tend--tends

Response: Revised accordingly.

5. Section 2.2.1: the authors use rotation technique for data augmentation. As discussed in this section, some information of the image may be lost. Will this operation result in any influence on the identification results?

Response: Thanks for the meaningful comments. The authors agree with the reviewer's opinion that TC images generated via rotation manipulations will lose some information, but this operation should result in insignificant, if any, effects on the prediction performance of the proposed model. The reasons are given as follows.

Usually, a DCNN model consists of millions of coefficients which should be quantified reasonably during the training process. Thus, it is important for the model to have sufficient training samples to account for various types of issues. Unfortunately, there are usually insufficient samples in practices. To this end, rotation techniques are often adopted in the field of image identification. By adopting this technique in this study, two benefits can be achieved: (a) there will be more samples, which is greatly helpful for the identification performance of some image-types associated with limited samples; (b) the generalization ability of the model can be improved effectively.

Although TC images generated via rotation operations will lose some information, it does not mean that such operations will result in degraded performance of the model. After all, AI techniques may work in a quite different way with human beings, and many factors exist which can be adopted by the proposed model to provide acceptable prediction results. Actually, the overall performance of the DCNN models can be examined directly and objectively based on the identification results obtained during the testing stage. Results presented in the manuscript demonstrate that the DCNN model does performance well in terms of prediction accuracy. To further show that rotation techniques will not degrade the model performance, Table 1 compares the overall performance of the proposed model during the testing processes that are respectively based on TC images without rotation operations and those after rotation manipulations. It is seen that there is nearly no difference between the two kinds of results.

Table 1. NWPO image prediction performance of the TG-2 model during testing process

Parameter	Accuracy	Precision	Recall	F1-Score
Result of the image rotation	97.23%	96.11%	98.13%	97.26%
Results of the image is not rotated	97.82%	97.96%	97.80%	97.92%

3. Line 148: have—has

Response: Revised accordingly.

4. Line 174: to judging

Response: Revised accordingly.

5. Lines 178, 182, 208: format (especially for where)

Response: Thanks for pointing out this typo. Revised accordingly.

6. The authors proposed two DCNN models. Although associated prediction results seem to be quite good, how about the comparative performance of these models against others?

Response: Thanks for the useful comments. In fact, we have compared the performance between the model proposed in this study and other classification models (e.g., VGG16, ResNet50). The specific evolutionary curve and model comparison results are listed in Figure 1 and Table 2 (take L image for example). Results show that the stability of our model is slightly higher than the other two models, and the overall performance is also better than that for the other two models. Because this article focuses more on how to use the proposed model to identify TC images, we have not presented the comparison results.

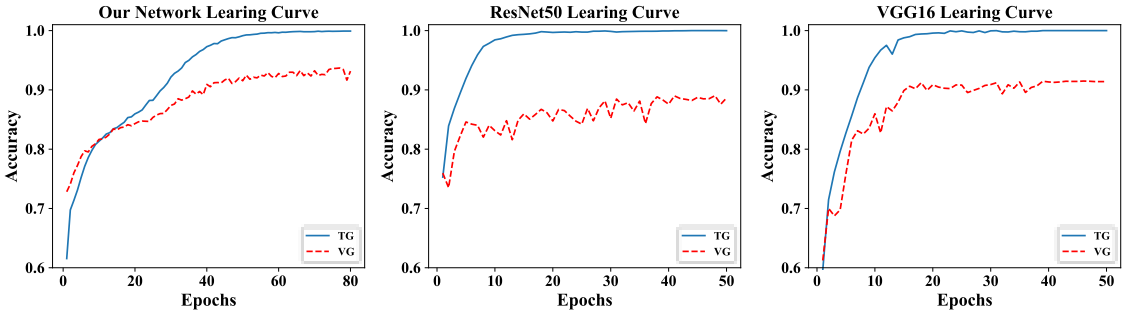

Figure 1. Evolutional curves of the prediction accuracy of three DCNN models for L images

Table 2. L image prediction performance of the three model during testing process

Parameter	Accuracy	Precision	Recall	F1-Score
Our model	93.38%	90.12%	98.22%	94.00%
ResNet50	88.75%	86.11%	93.85%	89.81%
VGG16	88.94%	89.37%	91.70%	90.52%

7. The authors report two types of heat maps which vary with each other evidently. Are there any reasons for why there will be such two kinds of heat maps?

Response: Several potential reasons are given as follows:

(i) There are indeed some patterns of features that can be only recognized by the DCNN model, and these features are quite different from those to which human beings are familiar.

(ii) DCNN models work in a quite different way from human beings. It seems that they only focus on whether the predictions are accurate, but do not concern if the prediction methodology is reasonable. It is possible that for some samples, DCNN models just make correct prediction results, but the methods (i.e., heat maps) are not

reasonable.

(iii) The working performance of the DCNN model depends greatly on the quality of SCIs and associated label information. As discussed in the article, some label information provided by meteorological institutes may not be accurate. The inaccuracy of such information results in abnormal features in associated heat maps.

(iv) It remains a challenging work to explore how network works internally, and current visualization techniques are not good enough to provide perfect heat map results.

8. Section 3.2.1: it seems that to use the IP technology the authors have to extract zoom-in view of TCs from the NWPO picture If it is the case, how to do this?

Response: Thanks for the meaningful comments. The image pyramid is random clipped according to the best TC tracking data. Firstly, the TC in the NPWO image was located using the best latitude and longitude provided by China Meteorological Administration. Then, we selected some TCs randomly, and extracted associated TC images according to different proportions. Measures were also adopted during the extraction process so that the proportions among pictures with large, medium and small scales are basically 1:1:1. In addition, non-TC medium and small-scale images are randomly cropped from large-scale samples with non-TCs, so that TCs would not appear in these images. Finally, we mixed these images with three scales together for training and validation.

The authors would like to express their sincere acknowledgement again for the reviewers' pertinent and insightful comments on this manuscript, which are much helpful for the improvement of the quality of it.

Sincerely yours,

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