MTHM602 N/A

Trends in Data Science and AI (T, TERM2 2021/2) **Coursework:** Individual Report - S Das
Cover Sheet ID: 1073068 **Submission Deadline:** Tue 3rd May 2022 12:00
Student Code: 630012729 **Personal tutor:** Dr Mark Callaway

First marker's comments:

1. You attempt forest fire detection using deep neural networks trained on images. The introduction offers a clear motivation for the importance of the research in general and deep learning for fire detection in particular.
2. The introduction also offers a good discussion of the importance of type-I vs type-II errors over standard classification accuracy metrics for critical applications.
3. CNN with transfer learning have been tested on a few forest fire datasets. CNNs were used for feature extraction followed by training an SVM for classification.
4. Deep neural networks LSTM, RNN are mainly time series methods and here the goal is image classification. It is better to talk about standard MLP vs CNN architectures rather than time series structures.
5. The Keras implementation function calls, model selection and Dataframe are described in good detail. Table 1 compares numbers of parameters to tune CNN architectures, accuracy and size. It would also have been beneficial to add model training time for comparison.
6. The algorithms were tested on standard CPUs, it might be worthwhile to test scalability on free GPU credits on google Colab or refer to as future work.
7. The description of the SVM offers some mathematical detail that is not always entirely clear, for example, expression (4) is introduced as “hinge loss function utilised for this” were “this” appears to refer to the use of a soft margin, and you write that expression (5) “is now minimised”, but it is not clear how this compares to a hard margin. The description of the kernel trick is intuitively clear, again the mathematical detail is a little ambiguous, for example, the parameters “C” is used in various places (expression (5) has “C”, expression (7) has “C” and “c”, are these all equal?)
8. The description of the hybrid CNN-SVM model and the performance metrics are explained well.
9. In principle, using CNN for feature extraction and using hybrid CNN-SVM for classification is okay. However, a simple classification can also be done without the kernels on the extracted features. For benchmarking purpose, such results would have been valuable.
10. All transfer learning models seem to work very well since it has been trained on larger multiclass image datasets.
11. Four different performance metrics were compared but it is important to highlight for this application, which metric can be better trusted over others and why?
12. Training the model on multiple independent datasets makes the results more credible. However, the similarities and differences of the datasets can be better discussed relating to the results.
13. Confusion metric plots show dataset 2 had more misclassification rate (~0.1 difference). Is it because of the size of images or what potential reason?
14. Fig. 8 convergence graphs should be compared for all tested models and if they were tested multiple times to check average converge speed for better reproducibility.
15. Fig. 9 shows that images with a sunset/sunrise have been misclassified as fire. It would be good to show a few more examples. Also, what are the potential reasons of other type of error – missing a fire detection? A few image examples would be useful for the reader to understand the misclassifications better.
16. With image augmentation, the results are definitely better. A few examples of the augmented images will be better. Also, what are the numbers in the bracket in table 3, if not improvements from the base model?
17. Classification metrics are compared in good detail. However, the SVM_R and SVM_F acronyms should be described.
18. Good justification of preferring recall as the final model has been presented.
19. References can be better formatted. ArXiv references are better to be replaced by peer reviewed articles.
20. Graphs and pictures are beautifully formatted and make a good scientific case to the lay audience about the problem being solved. While citing references with et al., it is a customary to add the number [1, 2, ...] immediately after et al. not at the end of the sentence. There are some odd page breaks at the end of the report, and the tables in the appendix could be formatted a little better to improve accessibility.

Overall, very nice, almost publishable quality work in good, applied data science forums if the suggested changes can be made. All authors seem to have contributed equally and the work done on the different components of the report appears comparable.

Second marker's comments:

Agreed mark:

IMPORTANT: This feedback sheet is for student guidance only, and therefore the mark is subject to the approval of the Board of Examiners.

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