Name : Omor Bin Amjad Chowdhury
ID:23241085

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1. Summary

1.1 Motivation/Purpose/Aims/Hypothesis

During the early 21st century, there were several problems regarding land management in GBRCA due to loss of nutrients, soil erosion and increased sediment loads caused by livestock grazing. The objective of this paper is to develop accurate spatio-temporal models for predicting ground cover in GBRCA where livestock grazing has caused a significant increase in soil erosion and sediment loads that negatively affect the Great Barrier Reef. The aim is therefore to come up with an early alert tool against land degradation so as to enhance proactive land use planning, make it easier for farmers to plan their operations.

1.2 Contribution

Vis a vis various spatial dimensions, this study evaluates two deep learning models namely Convolutional LSTM (ConvLSTM) and Predictive Recurrent Neural Network (PredRNN) for predicted future ground cover. The report shares findings about how these models can be applied in diverse environments as well as an evaluation of their performance on site-specific and GBRCA-wide scales.

1.3 Methodology

The purpose of this study is to explain how to use the seasonal ground cover data as well as climate and hydrological data such as rainfall, temperature, soil moisture and runoff in the input stage. Site specific training and GBRCA-wide training are the two levels employed for training. Historical data were utilized in model building while test data that had not been used were held back to predict the next season ground cover. Mean Absolute Error (MAE) and Structural Similarity Index Measure (SSIM) were some of the performance assessment measures employed.

1.4 Conclusion

Study results indicated that both the ConvLSTM and the PredRNN managed to predict ground cover of the subsequent season accurately, but the latter performed better in terms of accuracy and efficiency. Nevertheless, the accuracy of these models changed according

to seasons and locations, with difficulties experienced in regions having low ground cover. The models have potential for use as early alert systems for land degradation in the GBRCA.

2. Critiques or Limitations

2.1 1st Critique/Limitation

The models were less accurate in places where ground cover was limited and spatial variability high making it difficult to predict ground cover across diverse environmental situations.

2.2 2nd Critique/Limitation

There was a comparison made between the performance of PredRNN and ConvLSTM wherein the former proved to be better than the latter in terms of accuracy. However, PredRNN has been found to demand a lot more computational power hence making it less relevant for use in extensive systems without appropriate computing facilities available.

2.3 3rd Critique/Limitation

Seasonality was the main aspect of which this research study sought to predict the ground cover, while in the long run, such predictions could be marred due to accumulating errors as the study found that moving in the direction of multiple seasons contributed to faster decay in PredRNN.

3. Synthesis: Potential Applications/Future Possibilities

3.1 1st Potential/Idea of a New/Follow-Up/Extension Paper

For future research, it is recommended that there be a more elaborate inclusion of intricate environmental parameters such as specific attributes of soil and the behavior of livestock in motion to these models thus increasing their power of prediction in areas of large extent differences.

3.2 2nd Potential/Idea of a New/Follow-Up/Extension Paper

(Optional alternative) In the same way, another area of investigation can be directed towards the improvement of computational performance in PredRNN or generating a combined model that would incorporate the advantages of both ConvLSTM and PredRNN which will help bring it closer to feasibility for use within extensive contexts in real time applications.