PREDICTION OF RAINFALL OVER KERAL USING DEEP NEURAL NETWORK

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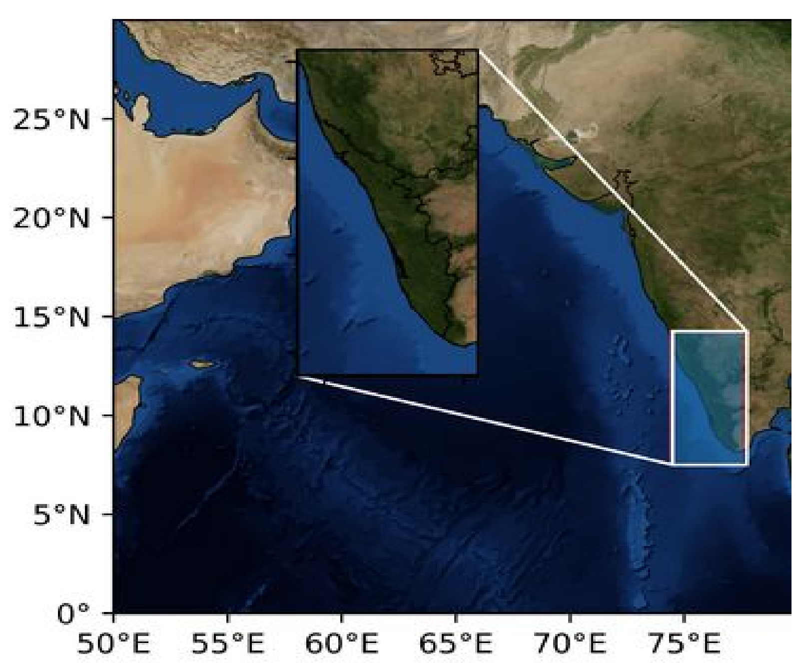
Introduction

- The prediction of rainfall has always been a challenging job for the weather forecasters. The recent changes in the climate has a major impact on changing the rainfall patterns. (Goswami et al. 2006)
- Conventional numerical weather prediction models often fail to accurately forecast few day ahead rainfall as these methods are uncertain to perturbations which in-turn leads to erroneous results.
- It is necessary to explore alternate methods for predicting the rainfall.

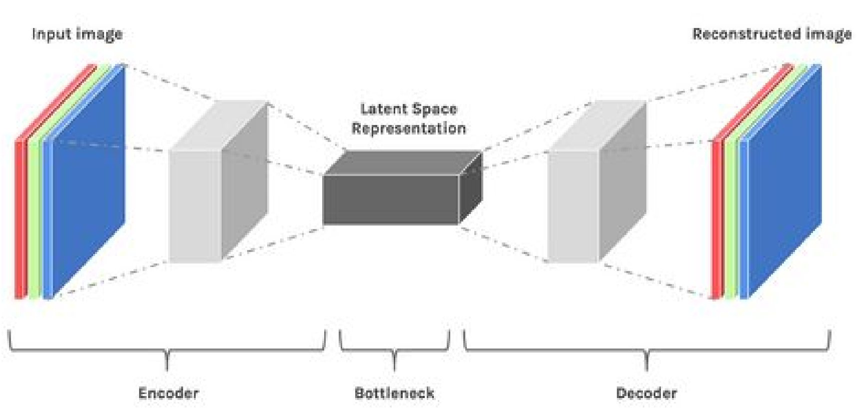
Objectives

The objective of our study is to build a deep neural network model which can accurately predict the rainfall a few days ahead accumulating over the Kerala region during the Indian Summer monsoon season.

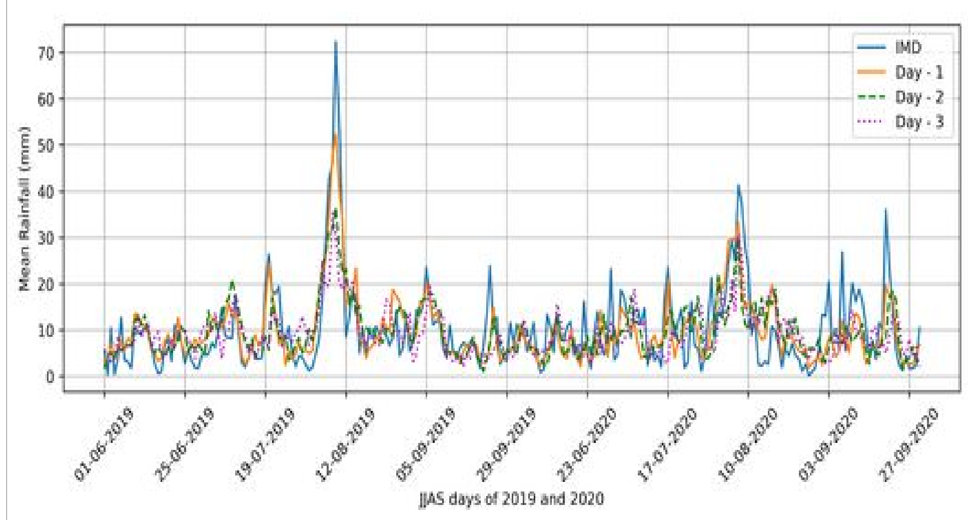
Methodology & Study Area



- This algorithm is inspired by an auto encoder network having an encoding and a decoding part. The encoder-decoder part of the network learn the patterns from the inputs using a series of convolution and max-pooling layers.
- The inputs used for training our neural network is inspired from the work of (Xavier, et al 2018)
- With the help of a stacked auto-encoder network we are training our model with the predictors: Wind-speeds at 850 and 200 hPa levels, Divergence and Vorticity at 850 hPa level and the total cloud liquid water vapor content.
- For the present study IMD's gridded rainfall data is used as the ground truth.



Results



- The time-series plot of mean rainfall of JJAS during 2019 and 2020 show interesting results as the model trained with one day ahead data was able to capture all the significant peaks of the ground truth.
- The error plot convincingly shows how the model trained with T-1 data performs well by providing with very small than that trained with T-2 and T-3 data.
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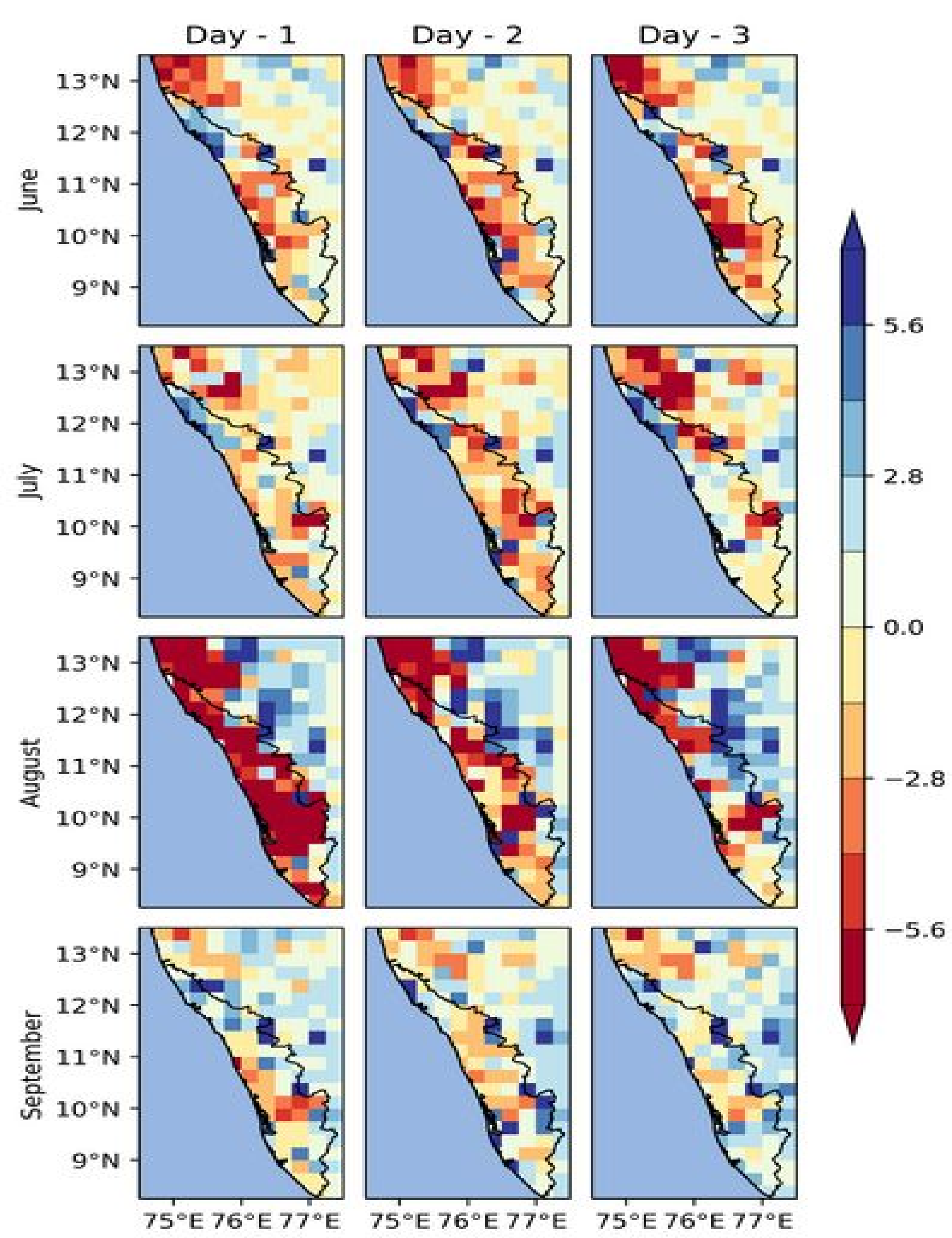

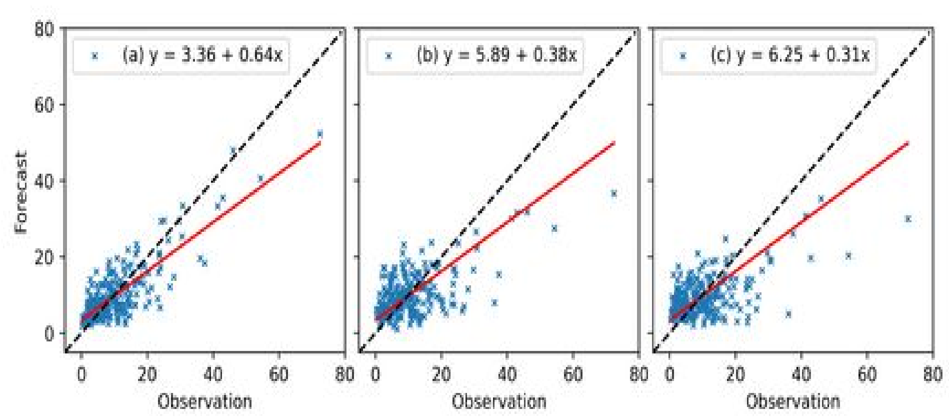

- The scatter also signals how the models accuracy starts diminishing by feeding with two day and three day ahead data fro training.
- The model trained with T-1 day data was able to achieve an RMSE score of 4.827 and a Pearson correlation coefficient value of 0.887 for 2019 and for 2020 the RMSE score and Pearson correlation coefficient slightly decreased to 5.85 and 0.70 respectively.

Conclusion

- The prime focus of the study was to reduce the forecast errors and false alarms while predicting rainfall. For this we have developed a deep neural network model which feeds on with the relevant meteorological parameters such as U850, U200, Divergence and Vorticity of wind-speed at 850 and 200 hPa and Total cloud liquid water content.
- The efficiency of the trained model was determined by validating the model against a data which has not been a part of training.
- Comparing to the analytical models which rely on complex dynamical equations our neural network model is computationally faster and was also successful in reducing percentage of false predictions.

Acknowledgments & References

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