



North Indian Ocean Tropical Cyclone Intensity Prediction using Machine Learning Classifiers and Analysis

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Tropical Cyclone intensity estimation of North Indian Ocean is quite challenging and requires huge amount of computational power and data collected over open oceans to improve efficiency for meteorologists. Prediction and estimation of the intensity has been very challenging for meteorologists and researchers. Intensity estimation is difficult because of the complicated physical mechanisms of atmosphere. Best Track data of TCs collected from Indian Meteorological Department (IMD) is used for intensity prediction. This research compares different Machine Learning (ML) classifiers based on different predictors received from Indian Meteorological Department (IMD). The five predictors which are used for estimating the intensity of TCs are Latitude, Longitude, Central Pressure, Pressure Drop and Maximum Sustained Wind Speed (MSW) [1]. Random Forest achieved the best accuracy in prediction.

This research takes the best track data from IMD, of 97 TCs during 2001- 2020 over NIO containing five different predictors. There are 2965 instances of 39 TCs. A relative analysis is done to measure accuracy using various ML classifier. An analysis approach is done to understand the cycles and occurrence of TCs.

Earlier Dvorak techniques were used for estimating the intensity of the tropical cyclones wherein which they identified cloud patterns and categorized cyclones based on that. Later Machine Learning application were introduced to classify tropical cyclone intensities based on the predictors. Currently, some Deep Learning architectures are being used to improve the intensity prediction due to the gain in computational speed.

The best track data of the past 20 years comes from the Regional Specialized Meteorological Center (RSMC) New Delhi, India. The research work is shown in figure 1. Seven intensity scales are used according to IMD [2].

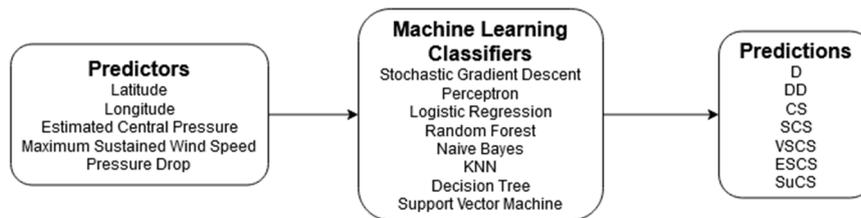


Figure 1. Diagram of the proposed work

This research was performed over NIO with the best track data available on IMD. The best track data of 97 individual storms with 2965 instances are taken for the research. The obtained result show that the TC predictors such as MSW and pressure drop strongly affect the accuracy of the classification. On the other hand, latitude, longitude do not affect the accuracy of the classification. One limitation of this research is that the predictive ML models presented here uses only the best track data. In the future, other predictors can be used to determine the robustness of the ML classifiers. Random Forest achieved the highest accuracy score of 99.16.

[1] Chinmoy Kar, Sreeparna Banerjee, “Tropical Cyclone Intensity Prediction Using Best Track Data Over North Indian Ocean by Machine Learning Classifiers”, 2021 IEEE International India Geoscience and Remote Sensing Symposium (InGARSS), 2021, doi: 10.1109/InGARSS51564.2021.9792071.

[2] Rizwan Ahmed, M. Mohapatra, Ram Kumar Giri, Suneet Dwivedi, “An evaluation of the Advanced Dvorak Technique for the Tropical Cyclones over the North Indian Ocean”, Tropical Cyclone Research and Review, 2021, doi: 10.1016/j.tcr.2021.11.003.