Tropical Cyclone Intensity Detection

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Development of a deep Convolutional Neural Network (CNN) for Tropical Cyclone intensity estimation using half-hourly INSAT-3D IR Images

03. Methodology

1. Image recognition process
2. Pre-processing of TC images
3. Feature extraction from TC images
4. Training and testing through MLP

- Collection of TC images
- Pre-processing of TC images
- Features extraction from TC images
- Multilayer perceptron for training and testing

04. Results/Findings

- Our model is showing the RMS (Root Mean Square) error of ~~3 on basis of this we can say that our prediction is correct.

- When people living near coastline areas will get to know about cyclone prior any disaster is happened, they can relocate to another place which ultimately will reduce the deaths happening due to it.

01. Introduction

Development of CNN based model for intensity estimation will be very useful during the initial stage of cyclone formation when determination of accurate center becomes difficult.
A TC is said to be a high-speed rotating storm, characterized by a low-pressure centre with a closed low-level atmospheric movement of winds which produces heavy rain .
According to researchers about 90% of the damage is due to flood by sea water formed by high intensity winds.

02. Objective

The accurate estimation of a TC intensity is essential for forecasters and emergency responders. Our CNN based machine learning model which is hosted on our website will help in determination of accurate center of cyclone in its initial stage. This will help nearby residentials to move before any disaster and it will also help government to be ready handle the situation early.

References

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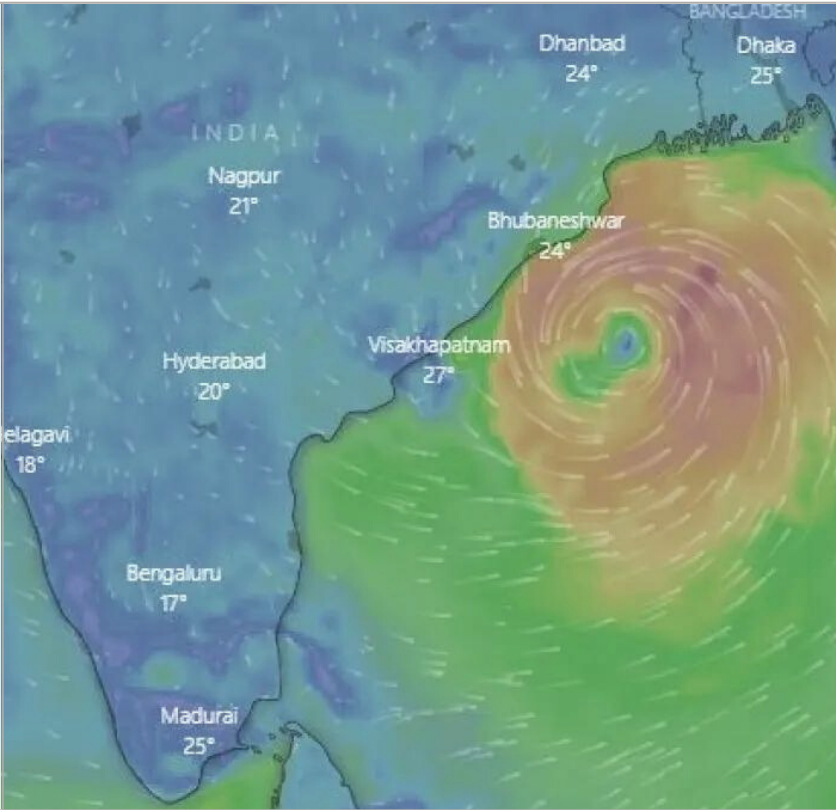
05. Analysis

- Collection of TC images: - TC images are collected from the dataset.
- Pre-processing of TC images: - In the pre-processing step, images are cropped based on ROI. Here images of D, CS and ESCS are passes through Gaussian blur or Gaussian smoothing to remove the noise.
- Features extraction from TC images: - Mean (M), variance (V), density (D), decentricity (DC), area of cyclone (AC) and area of eye (AE) are extracted from a TC image.
- Multilayer perceptron for training and testing: - MLP is an artificial neural network which is used to train and test the proposed model. MLP is a feedforward network with one or more hidden layers . It uses backpropagation algorithm for finding the gradient.

Collection of TC images → Pre-processing of TC images → Features extraction from TC images → Train MLP with featured value → Test MLP with feature values

06. Conclusion

In this study we propose a DL-based model for TC intensity estimation using the H-8 L2 cloud products CLOT, CLTT, CLTH, CLER, and CLTY. The model uses VGG as the basic architecture and integrates "attention mechanism" and "residual learning" to reduce the number of parameters as well as to improve the estimation precision. The model was trained and optimized under six-fold cross-validation data and was further evaluated using independent test data.

Input Layer   Hidden Layer

Neurons   Output Layer