Idea/Approach Details

The problem relates to development of a deep Convolutional Neural Network (CNN) for Tropical Cyclone intensity estimation using half-hourly INSAT-3D IR Images and development of a web application for visualization of the imagery.

Our Machine Learning Lifecycle follows:

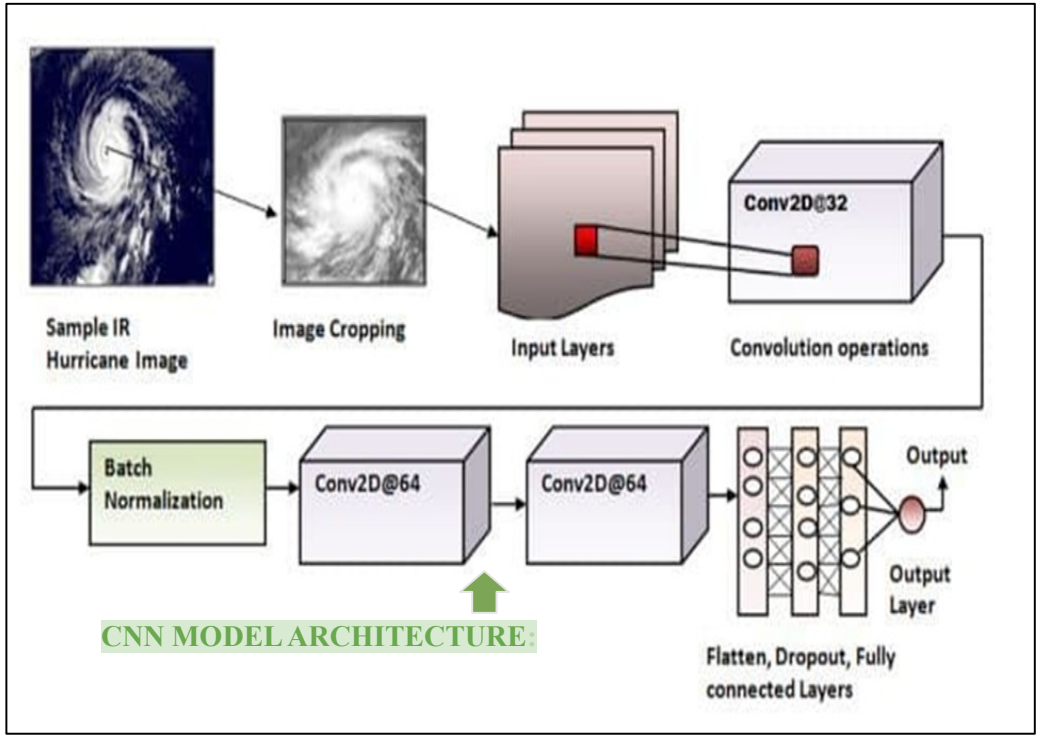
Data Collection: Datasets of Cyclones captured by INSAT-3D over the Indian Oceans are available since 2014. These datasets are used for training and testing of the Model. These observations are available at every 15-minute interval and are very useful in cyclone intensification.

Data Preprocessing: Images are cropped to 50x50pxData augmentation(flip and rotatory generators) are used to increase the number of training dataset

Building model: The input layer is followed by Conv2D layer. The first Conv2D layer is trained with 32 filters, 50x50px input shape and with stride of 1x1. Batch normalization layer is also used after the first Conv2D layer to normalize the data which is then followed by the max pool layer. All in all 3 Conv2D layers are used followed by max pool layer the output of which is flattened and is fed to the Fully connected dense layer(FCN), also 3 "FCN " are used the output of which is our estimated intensity. "Relu" is used as the activation function in Conv2D and "FCN" layers.

Training: For the training part, we have used a batch size of 64 and trained the CNN model over 100 epochs. **RMS** prop is used as the optimizer to optimize the model. Mean Squared Error is used as our loss metric.

Validation/Testing: We have used K-fold validation with 5 folds to validate our CNN model. About 1/5 of the data-set is used for validation over 5 iteration and the predictions are averaged out which gives us our model avg. loss.



CNN MODEL ARCHITECTURE:

Tech Stack :

Machine Learning :

1. Tensorflow/Keras.
2. Matplotlib, numpy, pandas.

Front-end:

1. Reactjs(Javascript library/ framework),
2. Mapbox API (for map).

Back-end:

1.Django(Python Framework).

Database:

1.PostgreSql.

Editors:

1.Pycharm, vscode

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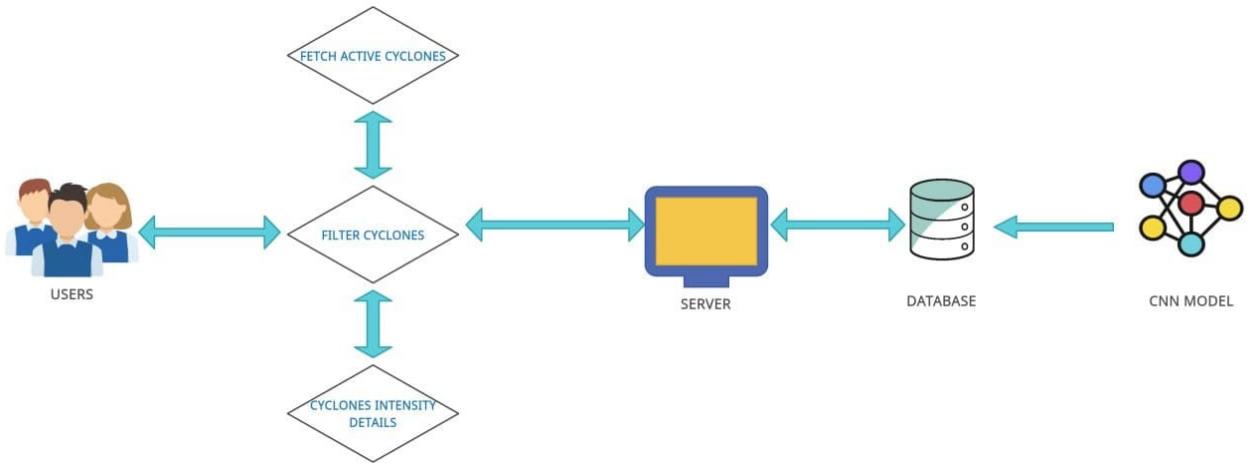
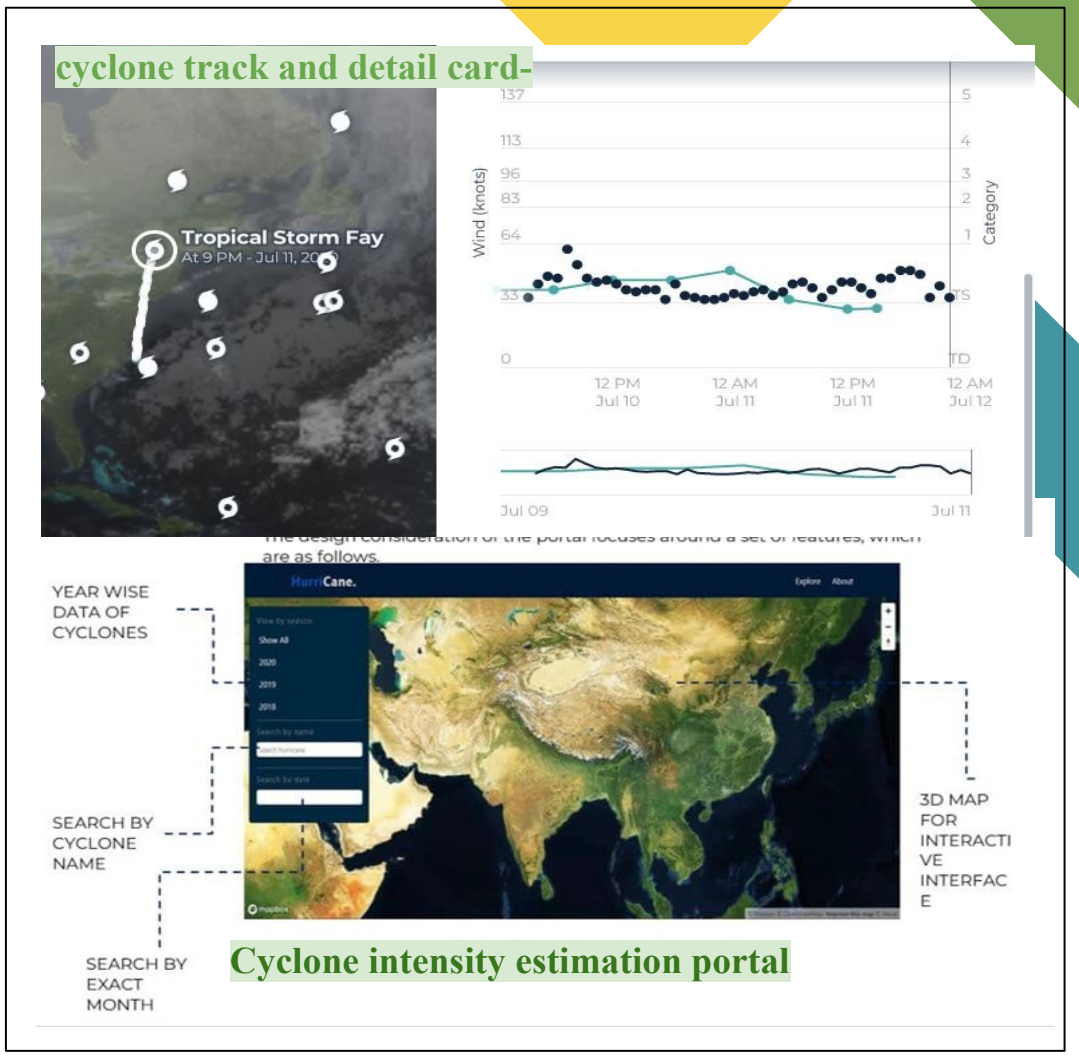
Use Cases



Our prototype follows:

- Intensity estimation by the CNN model which is then stored in a database with other relevant data about the cyclone.
- The user then can access these information from the website. The simple and interactive User Interface of the website allow users to filter cyclones. The filtered cyclones are then visualized on the map and upon clicking on one, user can access different information about the cyclones on the cyclone detail card. Graphical comparisons of estimated intensities are also represented on the card.
- Users can also access live cyclones on the map with their estimated intensities.
- Different map layers can be imposed on the map for scientific purposes.



Show stopper

1. Real time cyclone tracking and intensity estimation.
2. Different map layers.
3. Cyclone tracks.
4. Graphical comparison of estimated intensities.