IEEE student hackathon on
Geospatial Technology for Sustainable Development (GTSD - 2023)

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Cyclone Detection for Disaster Management using Satellite images

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REPORT

Introduction:

- Disaster management is the process of preparing for, responding to, and recovering from natural or man-made disasters.
- It involves various measures like risk assessment, emergency preparedness, response, and recovery.
- During emergency, GIS can aid in decision-making by providing real-time spatial data analysis on the location of the disaster, affected populations, and available resources.
- Cyclone Detection is detecting if there is cyclone present or not in a certain region from satellite images

Problem Statement:

Developing tools and strategies to improve disaster management.

Objective:

To develop a application for disaster management (Cyclone) incorporating Sustainable Development Goals (SDGs).

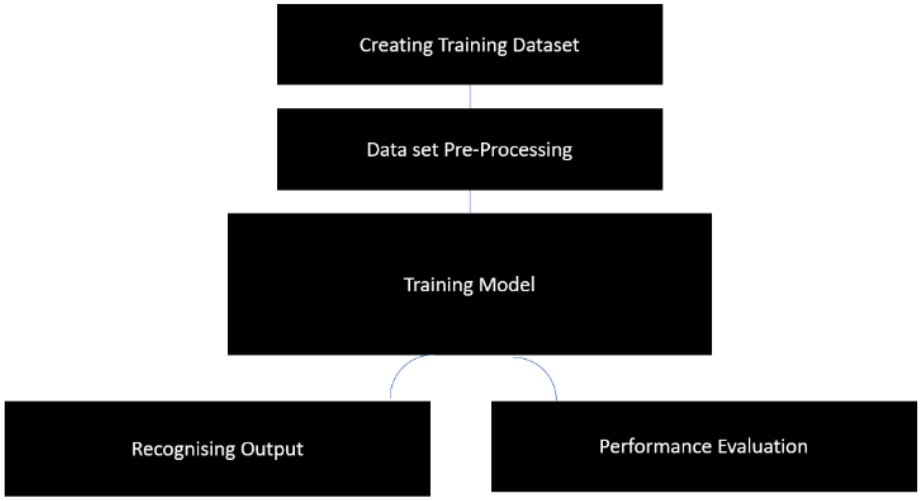
Proposed Solution:

Our proposed solution consisting of an objection detection model to identify cyclones from satellite image (SDG #9), hence giving early warning about for disaster management.

So that authorities can take appropriate action to minimize the loss. (SDG #11)

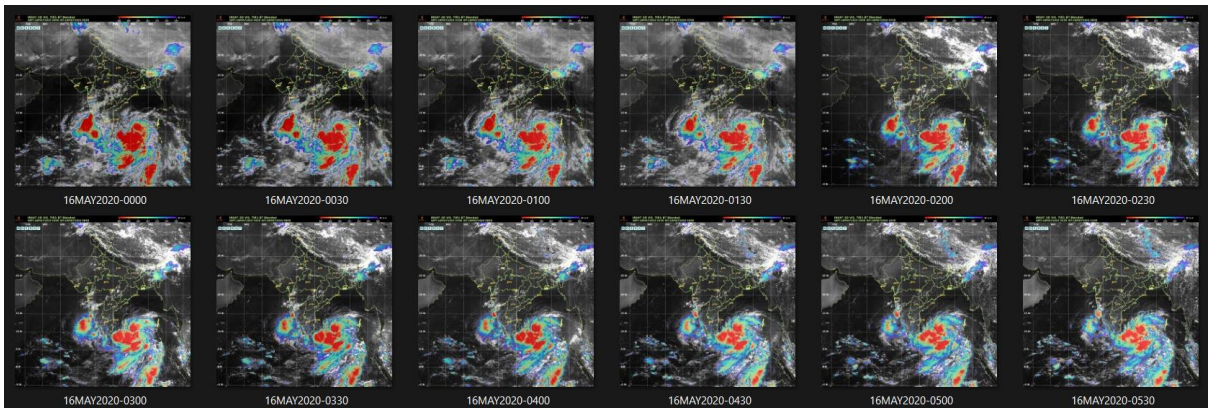
SDG #9: INDUSTRY, INNOVATION AND INFRASTRUCTURE
SDG #11: SUSTAINABLE CITIES AND COMMUNITIES

Methodology:



Sample Dataset:

MOSDAC Dataset

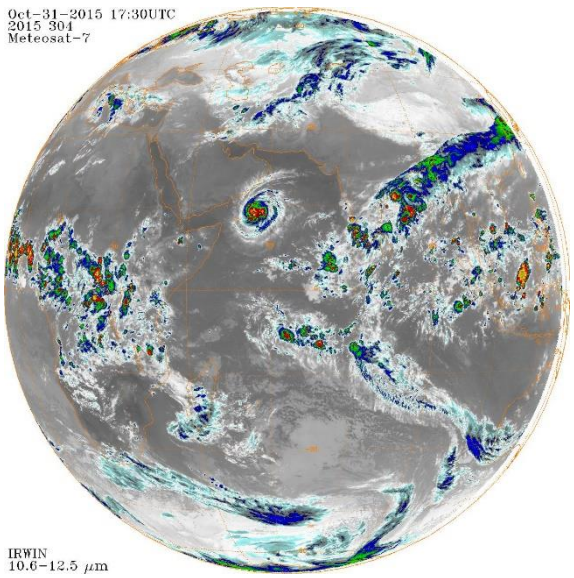


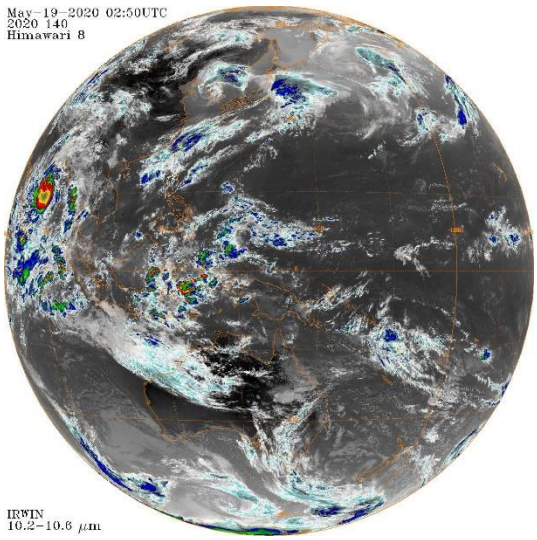
Source: MOSDAC, INSAT-3D (Collected in 2022)

Link: Included in GitHub submission

No. of images: ~2400

NOAA Dataset (National Oceanic and Atmospheric Administration)

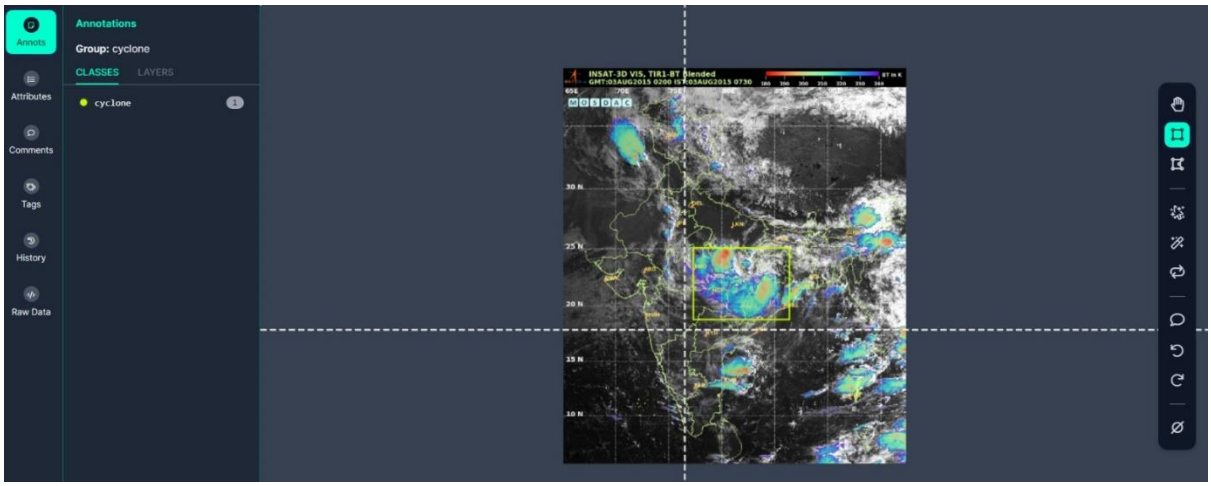


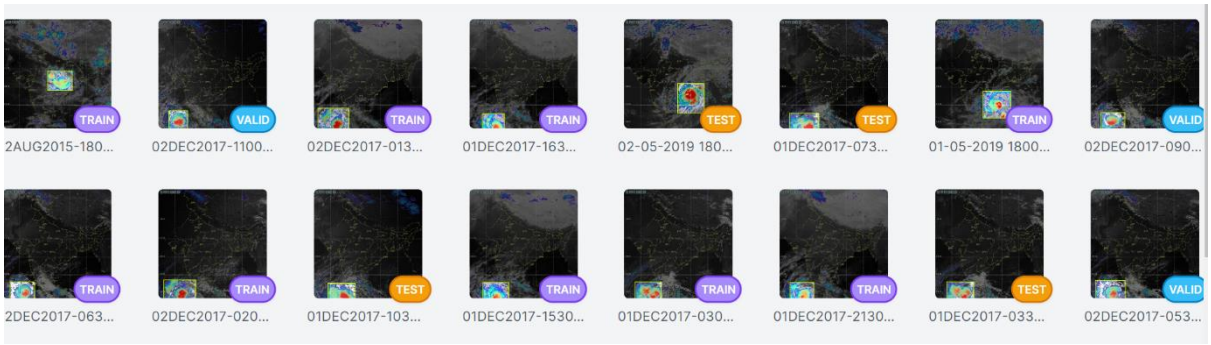


Link: https://www.ncdc.noaa.gov/gibbs/

Image Annotation & Train test Split:

Bounding Box Annotation is done using Open-Source Platforms.



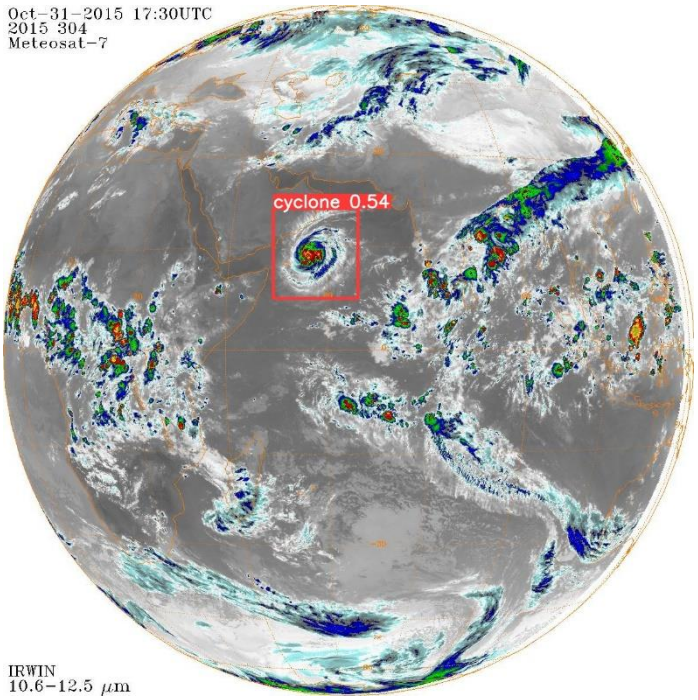


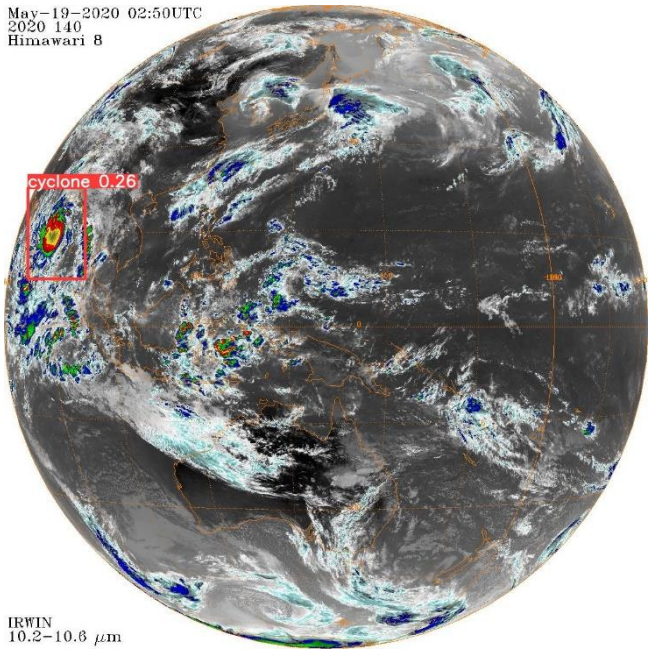
Training

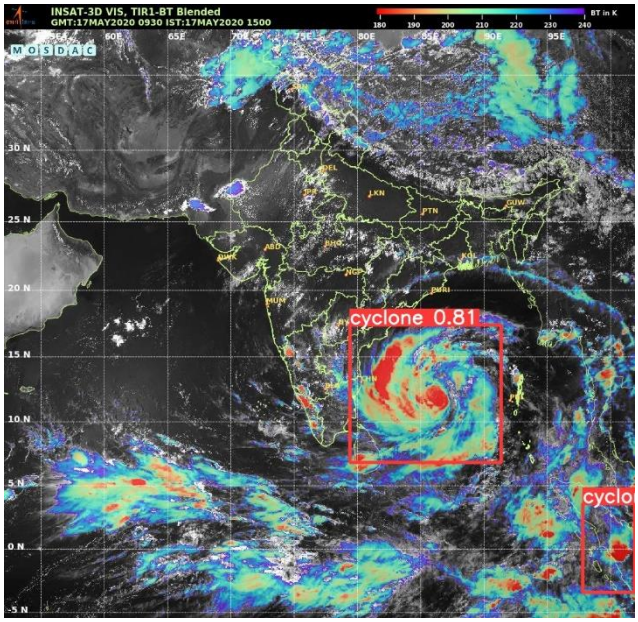
We trained the yoloV8 Object Detection Model and here are the results

Class	Images	Instances	Box(P	R	mAP50	mAP50-95):
all	56	56	0.965	0.982	0.991	0.611

Results:


Oct-31-2015 17:30UTC
2015 304
Meteosat-7
cyclone 0.54
IRWIN
10.6-12.5 μm


May-19-2020 02:50UTC
2020 140
Himawari 8
cyclone 0.26
IRWIN
10.2-10.6 μm


INSAT-3D VIS, TIR1-BT Blended
GMT:17MAY2020 0930 IST:17MAY2020 1500
BT in K
cyclone 0.81
cyclo

Conclusion:

With this project we can detect the cyclone from satellite images and built an automated waring system to inform us about the cyclone as soon as possible hence respective disaster management steps can be taken to reduce the death toll as well as to be better prepared for the upcoming event.

Improvements / Future Scope:

Our system providing comparable accuracy but can be improved further by adding more training data in various conditions.

This method can be further applied to various other disaster management like Forest Fire, floods, tsunami and droughts incorporating with time series data.

Reference:

- **https://www.mosdac.gov.in/ (MOSDAC)**
- **https://docs.ultralytics.com/ (YOLO v8)**
- **https://www.ncei.noaa.gov/ (NOAA)**