

CATCHING ILLEGAL FISHING USING RANDOM FOREST AND LINEAR REGRESSION MODELS

B. Padmaja¹, K. Mounika², P. Sowjanya³, P.V.S. Keerthana⁴, K. Tejaswini⁵

¹⁻⁵Department of Computer Science and Engineering, Vignan's Institute of Engineering for Women,
Visakhapatnam, A.P, India.

Abstract: Fishing businesses facing a major financial problem throughout the globe due to illegal fishing. Through this illegal fishing, we are pushing many fish populations to extinction. This paper proposes illegal fishing using data analytics and machine learning techniques. In existed papers they used data manipulation in illegal fishing data because of that there was a delay in catching the illegal vessels and in that system the data given is manual. In our paper, we are proposing data analytics to find these vessels.

We can gather the primary data from the Global Fishing Watch (GFW), we analyze this data and find the vessels whether they are used for illegal fishing or legal. Based on the sensors attached to the vessel we can find AIS location data, type of the vessel, and speed of the vessel. By our model, we can predict illegal fishing and can take necessary actions against the illegal fishing boats.

Keywords: Illegal Fishing, Normal fishing, Regression model, GFW

INTRODUCTION:

Globally the fishing takes seafood worth up to \$23.5 billion. Every year this fishing business grows efficiently. Illegal fishing is one of the big back steps in this business. Illegal fishing is defined as no authorization against conservation and management measures by Regional Fishery Management Organization (RFMOs).

Due to this type of fishing, we face issues in the economic growth of this business. Through this type of high-risk fishing, many of the species were extinct. Unreported fishing and illegal fishing are causing high damage to the economy illegal fishing is the loss worldwide is between \$6 billion to \$15 billion.

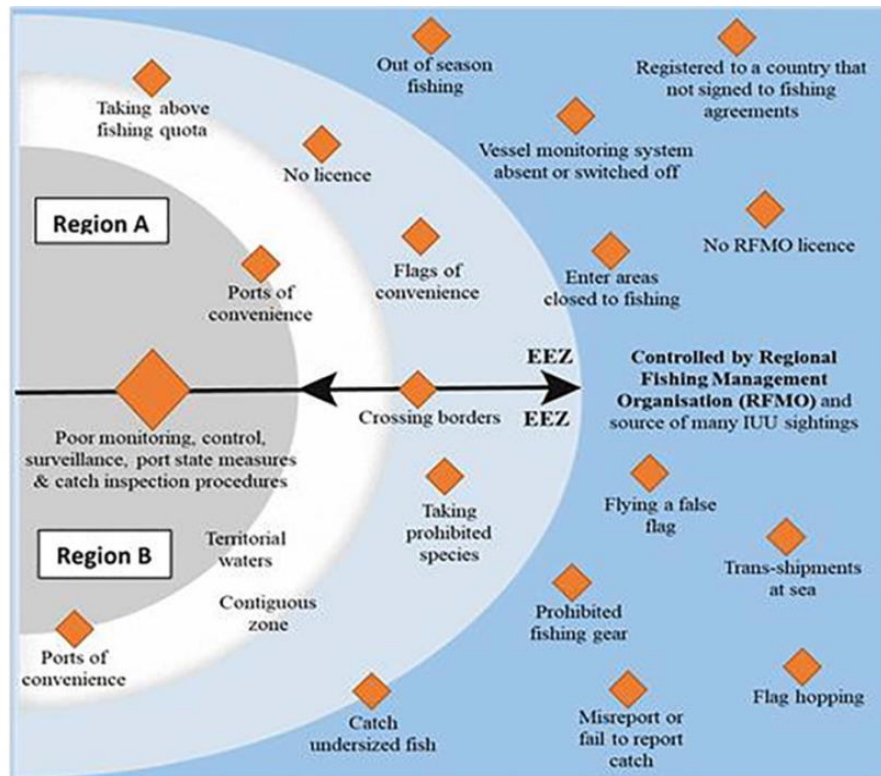
Whenever there is this type of issue it becomes a national issue and every vessel that has done such illegal activity will be facing severe punishment. These illegal fishing are monitored by the RFMOs. They check for the type of the vessel and they check the purpose if they suspect and king of illegal aspect they immediately act. They use the satellite for monitoring SAR (Synthetic aperture radar).

They monitor every vessel that enters the sea and record the data of every ship, the period of the ship in the sea, and its purpose. Through this, they stop such activity and protect the sea.

MOTIVATION:

In the previous work on this illegal fishing project is done by the GMU engineering team. But the flaw in the previous project is that the decision is done based on the human decision. They used the basic techniques of data classification so because of that they face issues in catching illegal fishing.

This data is captured but not used properly. The judgment is done by this and then they proceed for the further issue. So by this delay in decision making this system is not much successful in decreasing illegal fishing.

ILLEGAL FISHING ACTIVITIES:**LITERATURE SURVEY:****A GLOBAL REVIEW OF ILLEGAL, UNREPORTED AND UNREGULATED (IUU) FISHING (Kevin Bray) Collated and Edited by Kevin Bray[66]**

This paper reports the views of regional fisheries bodies, and others, on the extent and impact of IUU fishing and on possible measures to combat it. The review confirms that IUU fishing is of considerable concern to these organizations. Common features of IUU fishing include the lack of effective control of fishing vessels by some flag States; the difficulty experienced by regional fisheries bodies in applying responsible fisheries management measures to the vessels of non-Parties. The review reports the specific measures already adopted, or under consideration, to combat IUU fishing in areas of national jurisdiction, within the regions of responsibility of regional fisheries bodies and on the high seas.

2.1.1. (2017). Kaspersky Security Bulletin: Overall Statistical For. Accessed: Jul. 12, 2018. [Online]. Available: <https://securelist.com/ksb-overallstatistics-2017/83453/>

Albeit dynamic investigation is compelling in conducting the examination, it likewise implies more expense than static examination [3]. In this manner, it is important to locate a powerful mix plan to take care of these issues. In this work, we propose a malware order framework Malscore dependent on likelihood scoring and AI. We initially produce grayscale pictures from crude malware as static highlights and concentrate local API call successions by executing malware in the sandbox as unique highlights.

2.1.3.A Reinforcement Learning Approach to Tackle Illegal, Unreported and Unregulated Fishing

Illegal, unreported, and unregulated fishing is a worldwide problem that is causing local and global financial losses, depleting natural resources, changing our diverse ecosystem, and causing undue pressure upon the fishing industry. This paper presents a Reinforcement-Learning-based approach to response generation once this type of fishing event has been detected. The Fuzzy Actor-Critic Learning technique is used to train one or more pursuers to effectively catch an evader. This technique is utilized on both the pursuer and evader vessel agents to simulate real-world illegal and unreported fishing pursuit events.

Deep Nets Spotlight Illegal, Unreported, Unregulated (IUU) Fishing

The need for increased global surveillance and enforcement efforts to combat Illegal, Unreported, Unregulated (IUU) fishing is well known. This paper describes the current research status in developing a novel technique of associating

Automated Identification System (AIS) anti-collision messages to satellite vessel detects. Each detected ship image has a wealth of information which allows the development of dark ship tracking and identification. A dark ship is a ship that is not broadcasting AIS.

Estimating the Worldwide Extent of Illegal Fishing David J. Agnew¹*, John Pearce², Ganapathiraju Pramod³, Tom Peatman², Reg. Watson³, John R. Beddington^{1,4}, Tony J. Pitcher³

Illegal and unreported fishing contributes to overexploitation of fish stocks and is a hindrance to the recovery of fish populations and ecosystems. This study is the first to undertake a worldwide analysis of illegal and unreported fishing. Reviewing the situation in 54 countries and on the high seas, we estimate that lower and upper estimates of the total value of current illegal and unreported fishing losses worldwide are between \$10 billion and \$23.5 billion annually, representing between 11 and 26 million tonnes. Our data are of sufficient resolution to detect regional differences in the level and trend of illegal fishing over the last 20 years, and we can report a significant correlation between governance and the level of illegal fishing. This paper provides the baseline against which successful action to curb illegal fishing can be judged.

A FRAMEWORK TO LEARN BEHAVIOURS OF FLAG OF CONVENIENCE FISHING VESSEL ACTIVITIES

Flag of convenience (FOC) vessels is a common practice in which vessel owners register their ship in another country other than the ship owners. This policy creates difficulties in enforcing regulations from the owner's company. Mainly, FOC vessels are usually a part of the dark fleet. These vessels are typically invisible to the authorities because they are registered abroad and create problems for management. In fisheries, illegal, unreported, and unregulated (IUU) activities often use FOC vessels as cover. Typically, the country of origin is unable to track vessels registered as FOCs. Thus third-party information must be acquired to detect FOC interactions with domestic vessels. In this research, with the Global Fishing Watch providing information on FOCs and along with our data aggregation techniques, methods are developed to detect and monitor FOC vessels conducting activities with domestic vessels and enforce laws to prevent IUU actions.

SATELLITE MONITORING PROVIDES ADVANTAGE IN ENDING ILLEGAL FISHING

To find suspected illegal fishers, national authorities have long relied on conventional maritime patrols, which are costly, inefficient, often dangerous, and largely ineffective. After Pew and our partners weighed options for a better way to end illegal fishing, we turned to the skies. Eyes on the Seas goes well beyond simply using satellites to track vessel movement. Each user, such as a government agency or fishery management body, can tailor the system. For example, users can specify which area of the ocean to monitor and whether to include vessel data from all boats or only certain ones. The platform recognizes the telltale patterns of fishing and generates alerts, in near-real-time, when suspicious activity is detected, such as vessels fishing inside a marine reserve or a known illegal operator fishing in an area where it is banned.

THE OBJECTIVE OF THE PROJECT:

Currently, there are very few models or analytics that exist for detecting illegal fishing without the physical search and seizure by law enforcement human resources. Modeling both fishing behavior and the illegal fishing enterprise will expose the data necessary to model and predict potential illegal fishing activity to focus law enforcement human resources on physically searching areas with a higher probability of detecting illegal activity. By using shipping vessels on board trackers, a methodology has started to be derived for describing typical fishing behavior using data from legal fishers. Multiple institutions are collecting and refining this data as well as developing algorithms to detect illegal activities. Leveraging their work as a starting point and fusing these and other data sources an effective model can be developed to identify IUU fishing. Even with the available data trying to solve this problem globally is a very difficult task. It will be important to scope the project to a specific region, potentially targeting only certain fish populations to make the models more meaningful.

IMPLEMENTATION:

We are using linear regression to train the data which in turn uses ensembling learning. Linear regression is one of the easiest and most popular Machine Learning algorithms. It is a statistical method that is used for predictive analysis. Linear regression makes predictions for continuous/real or numeric variables such as **sales, salary, age, product price**, etc. A linear regression algorithm shows a linear relationship between a dependent (y) and one or more independent (x)

variables, hence called linear regression. Since linear regression shows the linear relationship, which means it finds how the value of the dependent variable is changing according to the value of the independent variable.

Algorithm: Random Forest is a popular machine learning algorithm that belongs to the supervised learning technique. It can be used for both Classification and Regression problems in ML. It is based on the concept of **ensemble learning**, which is a process of combining multiple classifiers to solve a complex problem and improve the performance of the model.

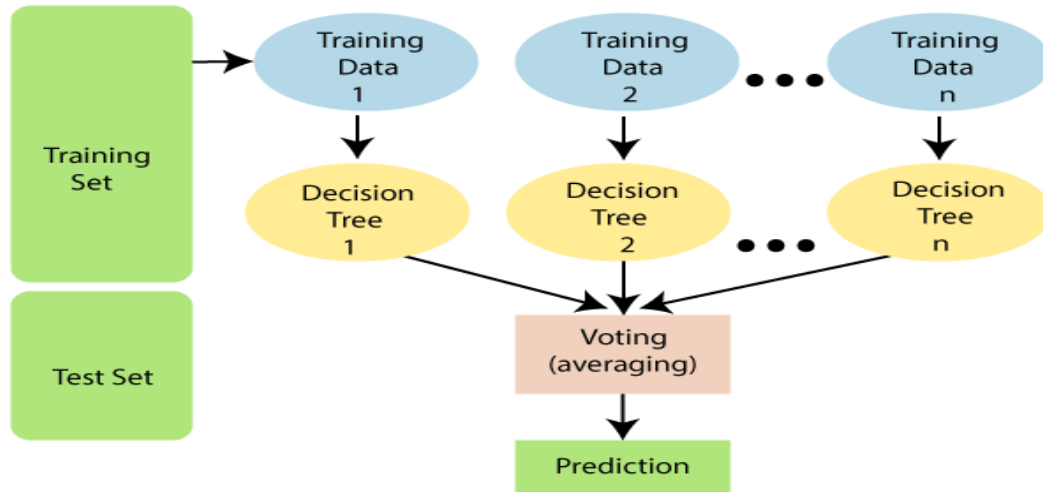
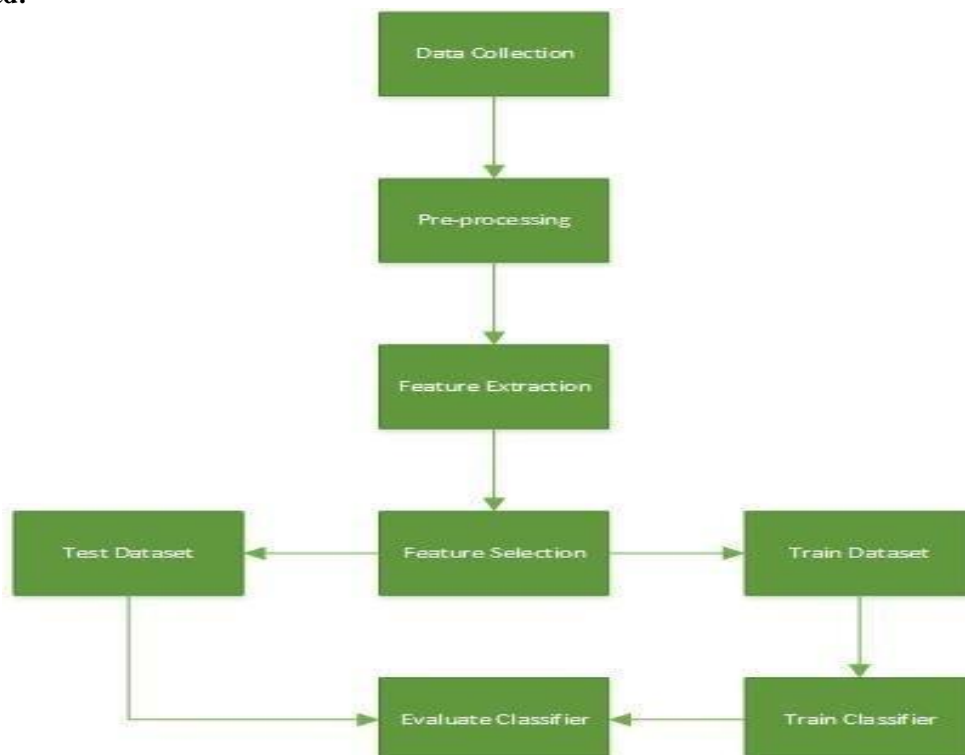


Fig: working of the random forest algorithm

Working of the algorithm:

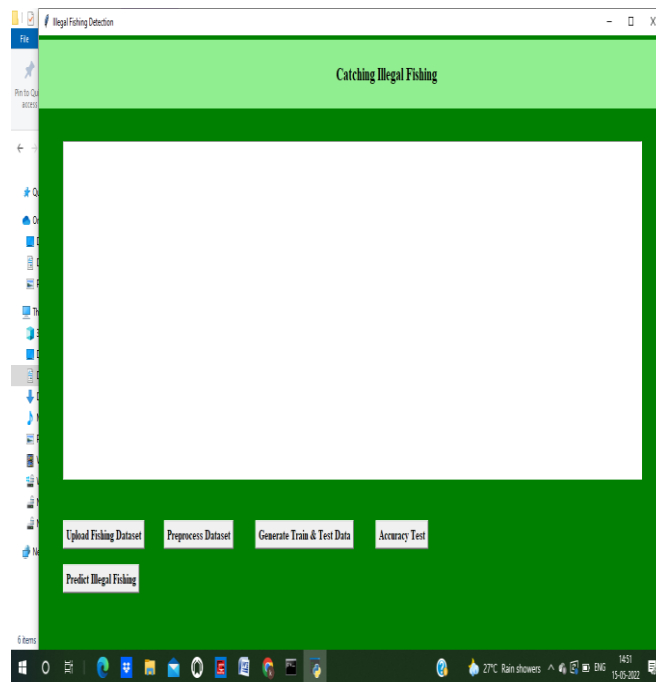
- Step-1:** Select random K data points from the training set.
- Step-2:** Build the decision trees associated with the selected data points (Subsets).
- Step-3:** Choose the number N for the decision trees that you want to build.
- Step-4:** Repeat Step 1 & 2.

Steps involved:

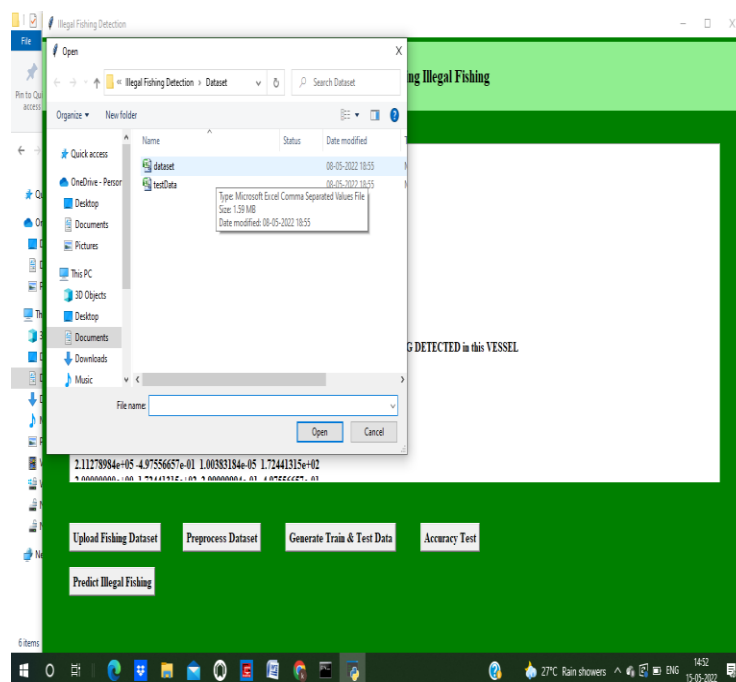


The above steps are the process that is involved in the development of the system. Initially, the dataset is collected, and it is then made to undergo processing and feature extraction. Then the data is trained into the system by using the random forest classifier. Therefore, whenever the test data is given to the system, it checks selected features of the data with the trained feature by testing using the same classifier used before. The application uses 80% dataset for training and 20% for testing.

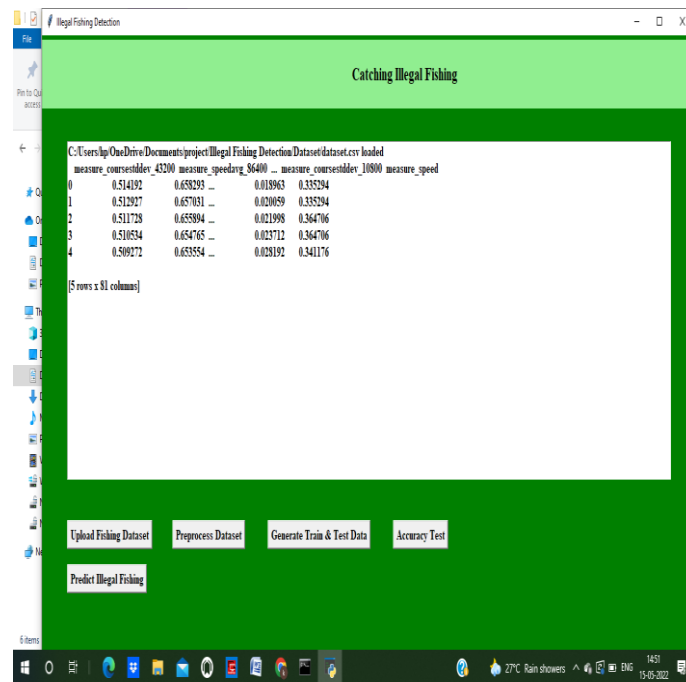
RESULTS:



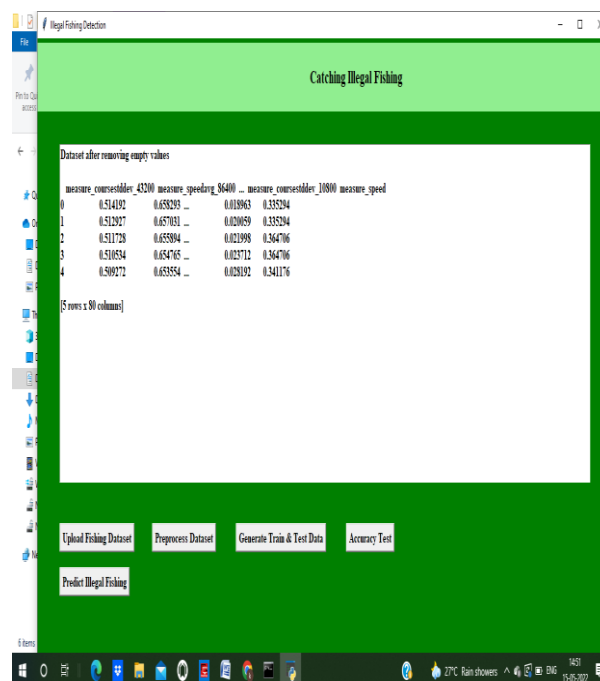
In the above screen, we have to click on the 'Upload Fishing Dataset' button to upload a dataset



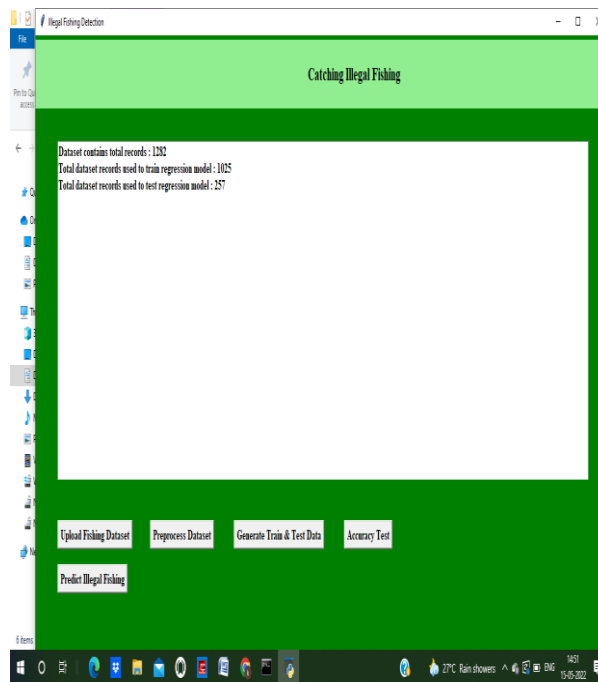
In the above screen, I am selecting and uploading the 'dataset.csv' file and then clicking on the 'Open' button to load the dataset and to get the below screen



In the above screen, we can see the dataset loaded and I am displaying a few records from the dataset in the text area in the above graph I am displaying several normal fishing records and the number of illegal fishing records. In the above graph, the x-axis represents class label values 0 and 1 (where 0 means normal fishing and 1 means illegal fishing) and the y-axis represents the count of records in that class label. Now click on the 'Preprocess Dataset' button to replace empty values with 0

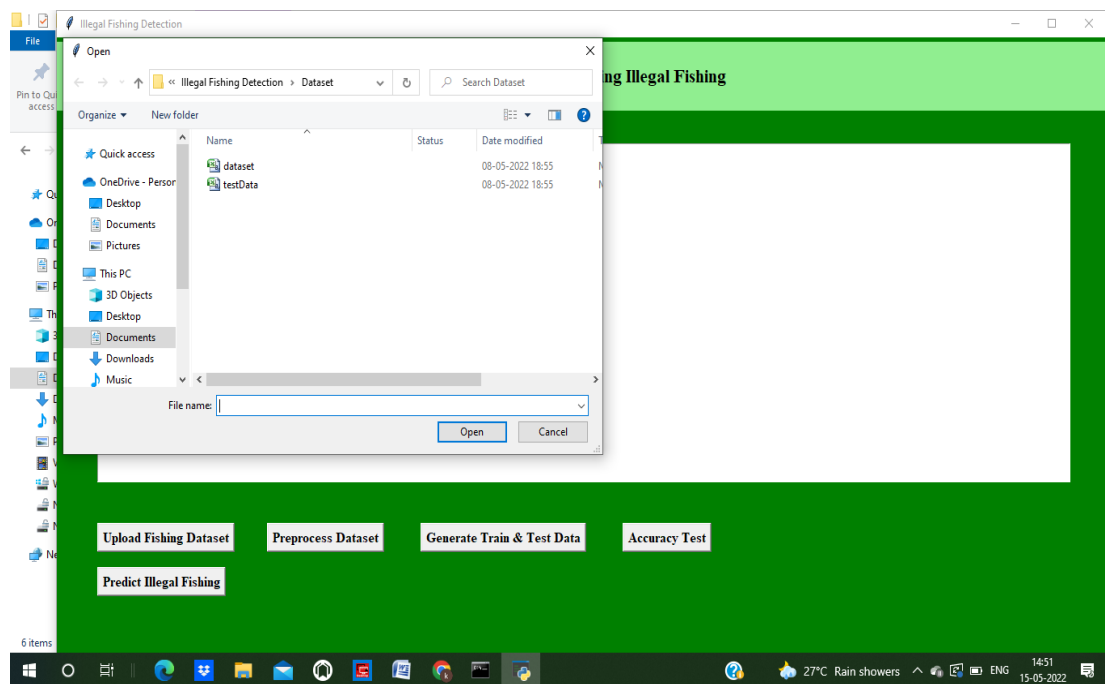


In the above screen, all empty values in the dataset are replaced with 0 and the dataset is ready now click on the 'Generate Train & Test Data' button to split the dataset into training and testing where the application used 80% of the dataset for training and 20% for testing.

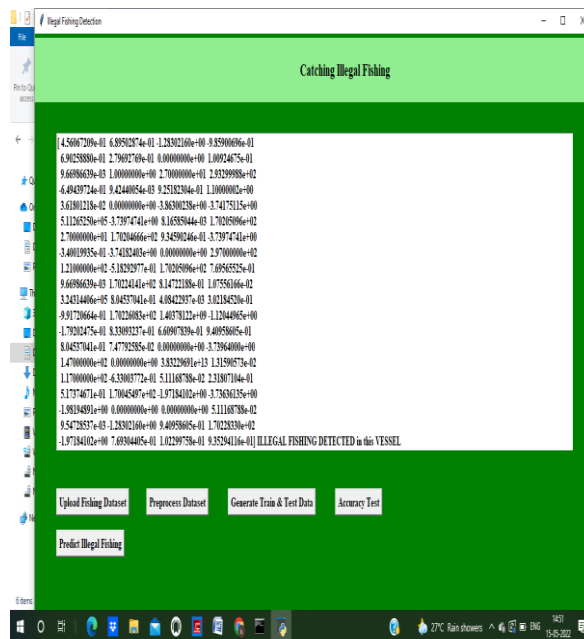


In the above screen, the dataset contains 1282 records and applications using 1025 records for training and 257 records for testing now train and test data is ready now click on the 'Accuracy Test' button to train regression with about dataset and then calculate prediction accuracy on the test data

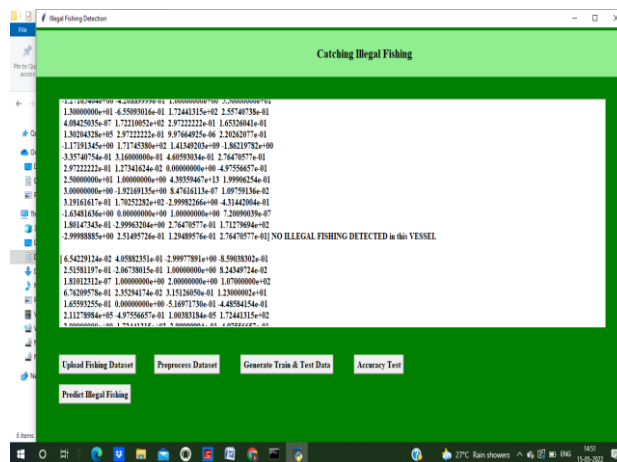
In the above screen, we got 84% accuracy for test data using the regression model now click on the 'Predict Illegal Fishing' button to upload test data, and then the regression model will predict whether the test data is having normal or illegal fishing



In the above screen select and upload the 'testData.csv' file and then click on the 'Open' button to load the test data and to get the below result



In the above screen in the square bracket, we can see vessel test values and after the square bracket, we can see prediction results as 'ILLEGAL FISHING DETECTED in this VESSEL' or 'NO ILLEGAL FISHING DETECTED in this VESSEL'. You can scroll down above the screen text area to view all records.



In the above screen for the second vessel, we got the predicted result as 'No Illegal Fishing Detected' and you can scroll down the above text area to view all results.

CONCLUSION:

Our project concludes that It is our responsibility to protect our seafood and to keep many fishes alive. IUU fishing is one of the many to improve our fishing resources around the world and secure the health of our oceans. Now IUU's latest technology is used to monitor the vessel's location, their course, and records every detail of the vessel which enters the oceans. By the use of our project, we protect the unreported fishing and can find illegal fishing vessels. By mear of SAR satellite, we can continuously monitor the geographical location and can record every detail. to keep monitoring such activities even google has formed the GFW (Global fishing watch) utilizes all the activities to stop such illegal activities. So employing all this, we can reduce unreported, illegal fishing

As the system detects the region where the illegal fishing is being done, the law enforcement team does not need to visit every major harbor for investigation and they can easily catch the illegal fishers within a less time using this system. Thereby it reduces their time of investigation and they do not need to waste their as in the manual process.

**REFERENCES:**

1. <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0004570>
2. https://www.researchgate.net/publication/321362001_A_Reinforcement_Learning_Approach_to_Tackle_Illegal_Unreported_and_Unregulated_Fishing
3. <https://www.fao.org/iuu-fishing/background/what-is-iuu-fishing/en/>
4. https://www.researchgate.net/publication/349552270_Multi-gent_Machine_Learning_A_Reinforcement_Approach
5. <https://ieeexplore.ieee.org/abstract/document/9174577>
6. <https://dl.acm.org/doi/10.1145/3397536.3422267>
7. <https://www.science.org/doi/10.1126/sciadv.abb1197>
8. <https://www.mdpi.com/2072-4292/11/3/293>
9. <https://www.frontiersin.org/articles/10.3389/fmars.2022.798893/full>
10. <https://www.pnas.org/doi/10.1073/pnas.2016238117>
11. <https://www.sciencedirect.com/science/article/pii/S1574954121001758>
12. <https://www.frontiersin.org/articles/10.3389/fmars.2017.00050/full>