ZKG INTERNATIONAL

ISSN: 2366-1313

Catching Unauthorised Fishing in Oceans using Machine Learning

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Abstract: *In this project we are using regression model algorithm to detect unauthorised fishing and to implement this project we are using vessel dataset from Global Fishing Watch. Global Fishing Watch will have details of each fishing boat or vessel and this GFW will attach sensors to each vessel and whenever this vessel is in water then sensor will send data to GFW and by analysing this dataset GFW can extract vessel ID and can detect whether vessel is doing authorised fishing or unauthorised fishing. GFW analysing this data manually so in this project we are using GFW dataset to train regression model and upon receiving new records then regression model will predict whether that new record data is doing normal or unauthorised fishing.*

Keywords: *Unauthorized Fishing, Normal fishing, Regression model, GFW, Machine learning*

I. INTRODUCTION

Globally the fishing industry 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 the 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

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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 fisheries are monitored by the RFMOs. They check for the type of the vessel and they check the purpose. If they suspect any kind 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[1].

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[2].

II. LITERATURE SURVEY

The Ministry of Maritime Affairs and Fisheries (KKP) confirms that it will take joint action against fish thieves in the Indonesian sea. After shooting 19 operating boats during 38 June, the KKP again managed to capture two illegal fishing boats in the Sulawesi Sea and the Strait of Malacca. The arrest cannot be separated from the success of the monitoring system operated in the control center of the PSDKP KKP General Directorate which detected the activities of the two ships. "Our officials have once again arrested the perpetrators of fish theft in the waters of the Sulawesi Sea and Strait of Malacca," Acting Antam Novambar said. The Director General of the Oversight of Marine Resources and Fisheries, who is also the Secretary General of the KKP in his announcement, on Saturday (6/12/2021). Antam explained that the interception control achieved by the whaling supervision vessels 1 and Shark 08 may want to be carried out effectively due to the correct statistics from the PSDKP KKP PUSDAL Directorate General. "This is evidence that the integrated monitoring device we have developed works very effectively," Antam explained. Now Antam has not denied that in recent days it has been strengthening surveillance in some water areas at risk of illegal fishing. This is done because based on information from the PUSDAL and

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aerial surveillance, many activities are thriving in the border area [3].

Kevin Bray et al. [4] 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. Albeit dynamic investigation is compelling in conducting the examination, it likewise implies more expense than static examination [5]. 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 [6]

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[7].

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

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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 [8].

III. PROPOSED METHODOLOGY

We used the regression model to identify the vessel's behavior and determine if a vessel is fishing or not.

- According to the given data, every vessel has a unique id based on characteristics of vessels like we can identify whether it is a commercial good vessel, raw material goods vessel, etc.
- Regression model based on AIS location data, speed of the vessel, type of the vessel.
- In this, we will collaborate with GFW to detect fishing activity in the ocean using data from satellite, automatic identification system AIS collected from different vessels around the world.
- GFW is an organization that analyzes data from the automatic identification system (AIS), which is collected by satellites and terrestrial receivers, to identify apparent fishing behavior based on the movement of vessels over time.

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

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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.

IV. IMPLEMENTATION

We are using linear regression to train the data which in turn uses ensemble 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 (y) 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 mode.

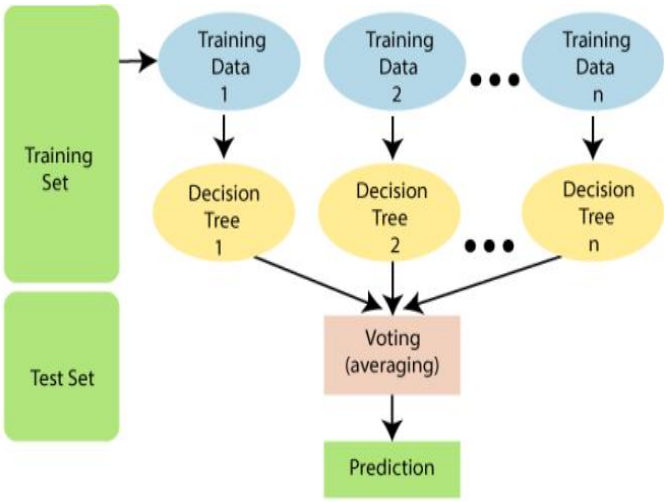

Fig.1 Working of the random forest algorithm

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.

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Step-4: Repeat Step 1 & 2

PROCESS OF IMPLEMENTATION

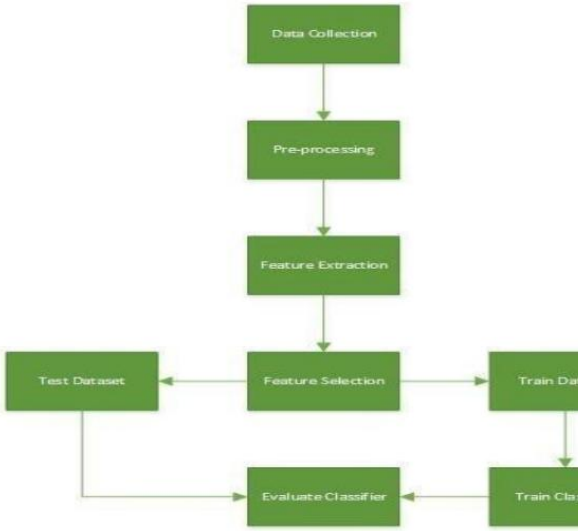

Fig.2 Implementation process

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 .

V. RESULTS

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.

SYSTEM ARCHITECTURE

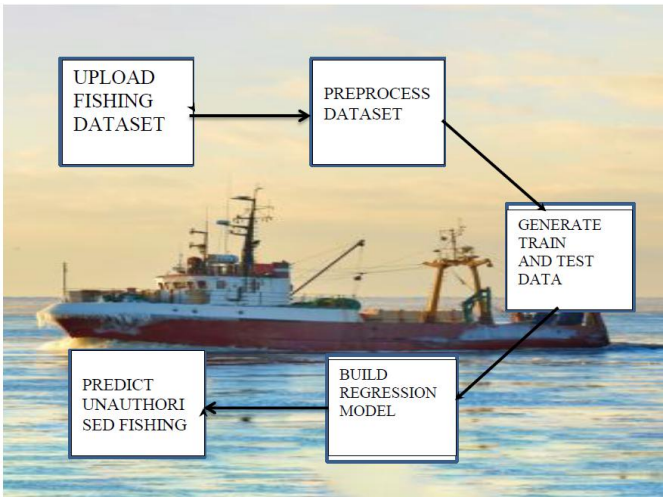

Fig.3 System architecture

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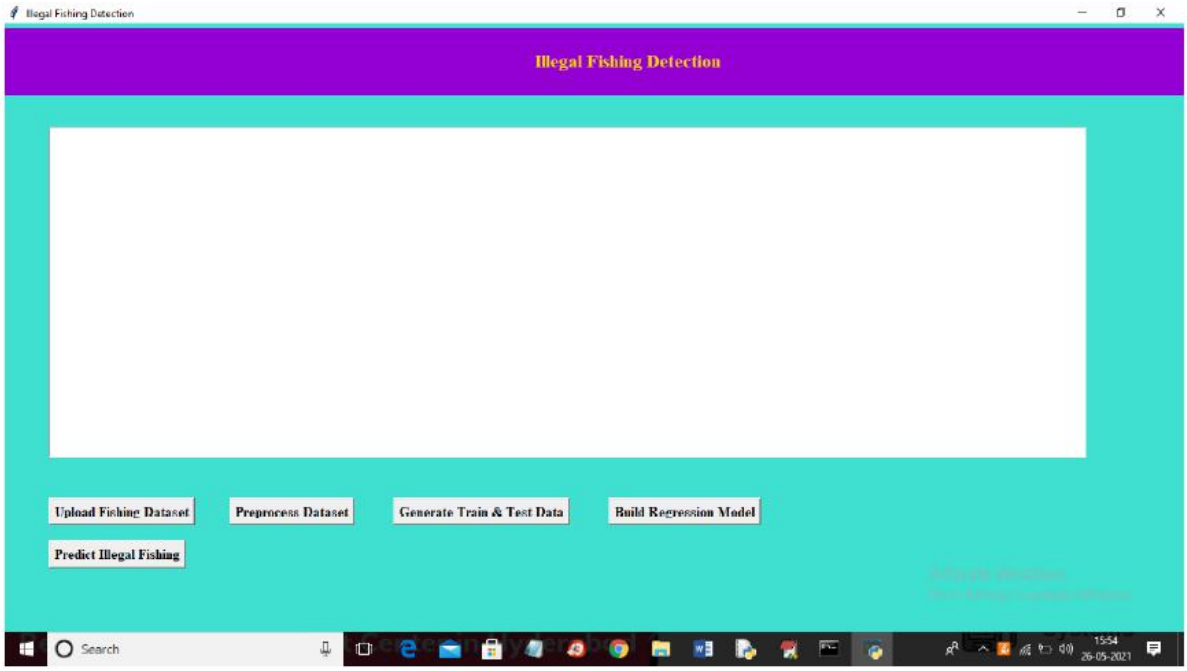

Fig.4 To run project double click on _run.bat‘ file to get above screen and click on Upload Fishing Dataset

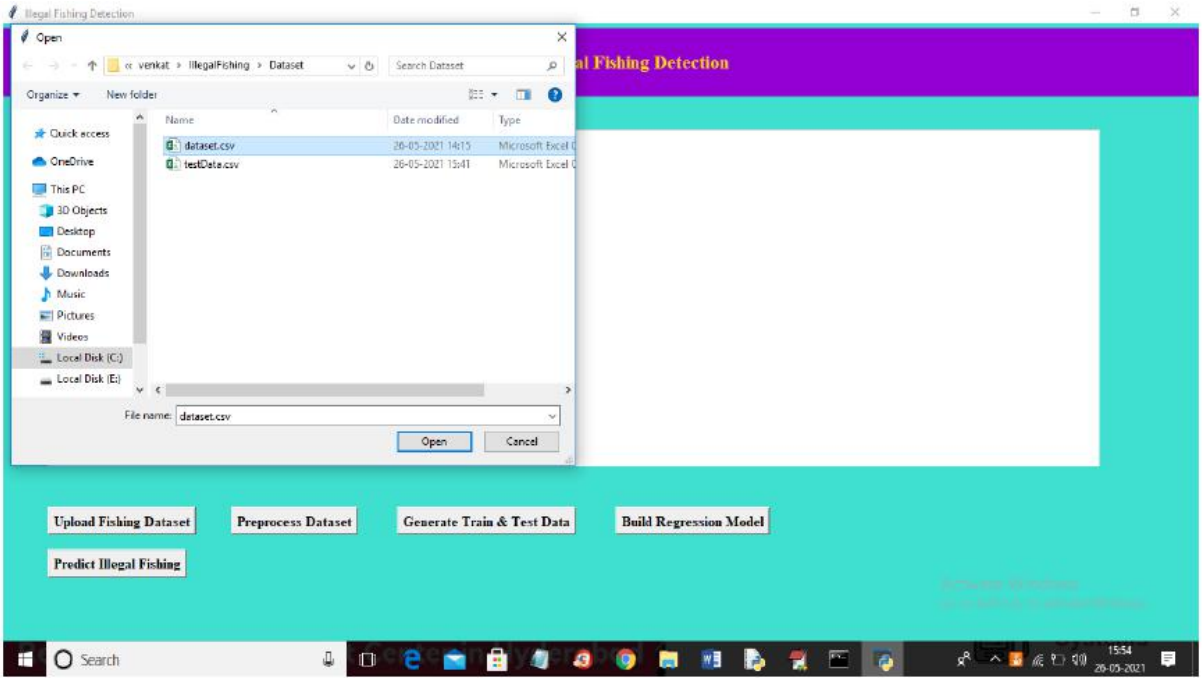

Fig.5 In above screen I am selecting and uploading _dataset.csv‘ file and then click on _Open‘ button to load dataset and to get below screen

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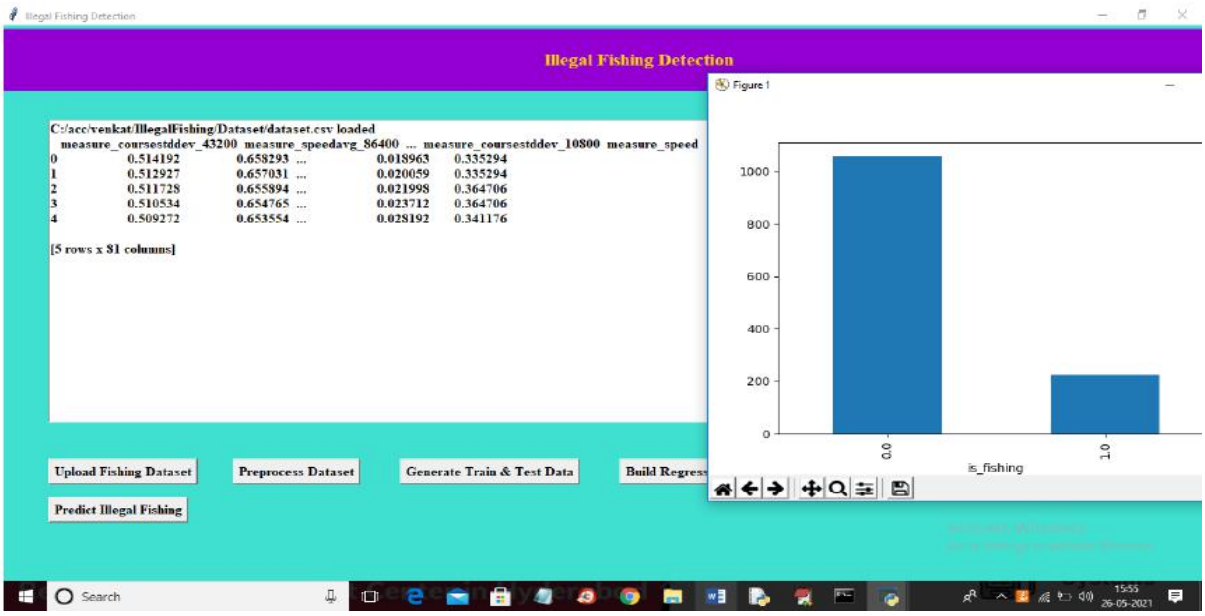

Fig.6 In above screen we can see dataset loaded and I am displaying few records from dataset in text area and in above graph I am displaying number of normal fishing records and number of illegal fishing records. In above graph x-axis represents class label values 0 and 1 (where 0 means normal fishing and 1 means illegal fishing) and y-axis represents count of records in that class label.Now click on _Preprocess Dataset' button to replace empty values with 0.

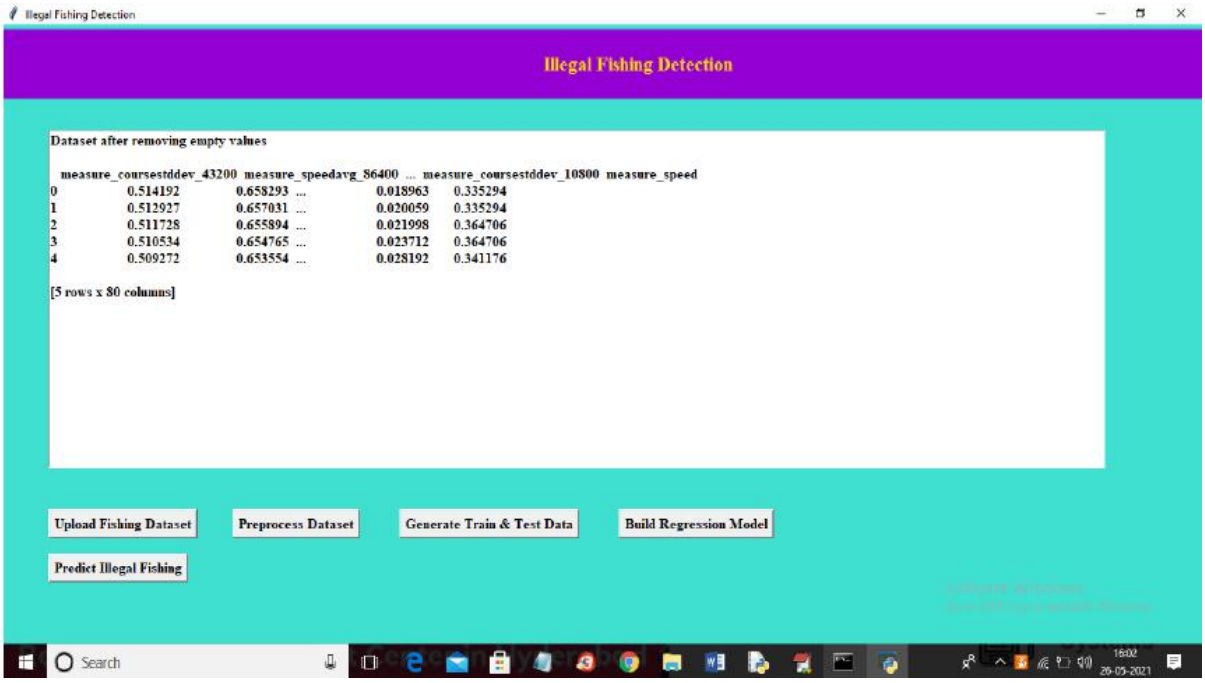

Fig.7 In above screen all empty values in dataset are replaced with 0 and now dataset is ready and now click on _Generate Train & Test Data' button to split dataset into training and testing where application used 80% dataset for training and 20% for testing.

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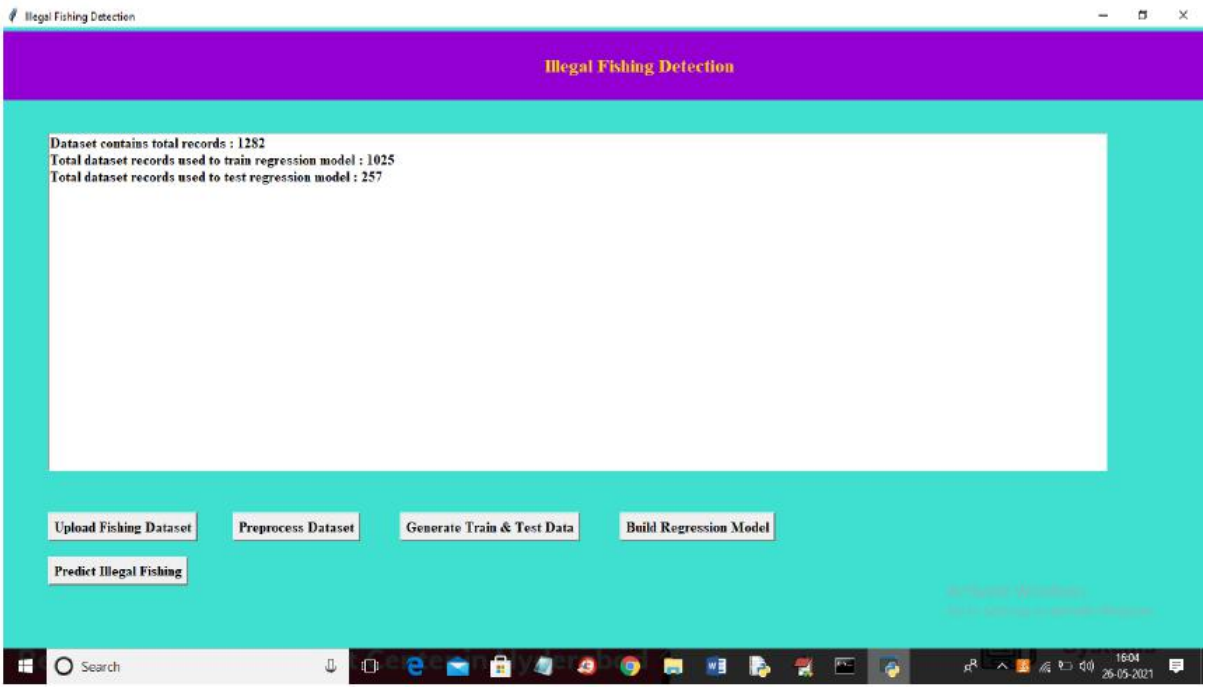

Fig.8 In above screen dataset contains 1282 records and application using 1025 records for training and 257 records for testing and now train and test data is ready and now click on _Build Regression Model‘button to train regression with about dataset and then calculate prediction accuracy on test data

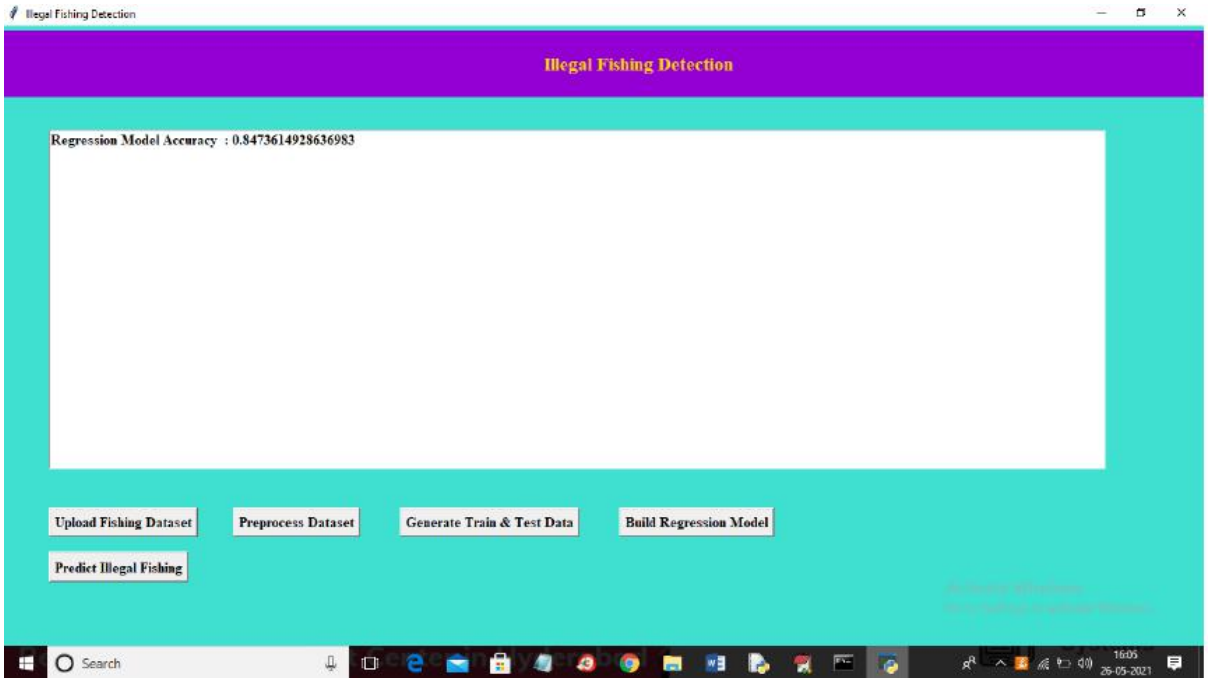

Fig.9 In above screen we got 84% accuracy for test data using regression model and now click on _Predict Illegal Fishing‘button to upload test data and then regression model will predict whether test data is having normal or illegal fishing.

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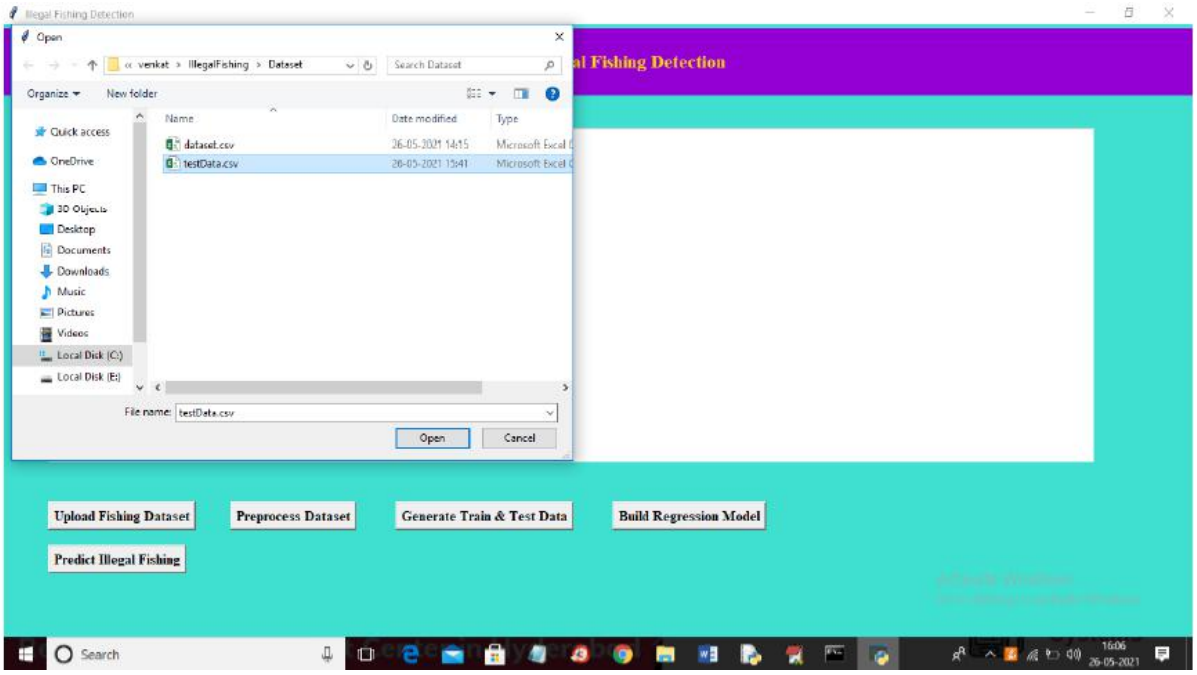

Fig.10 In above screen selecting and uploading _testData.csv‘ file and then click on _Open‘ button to load test data and to get below result

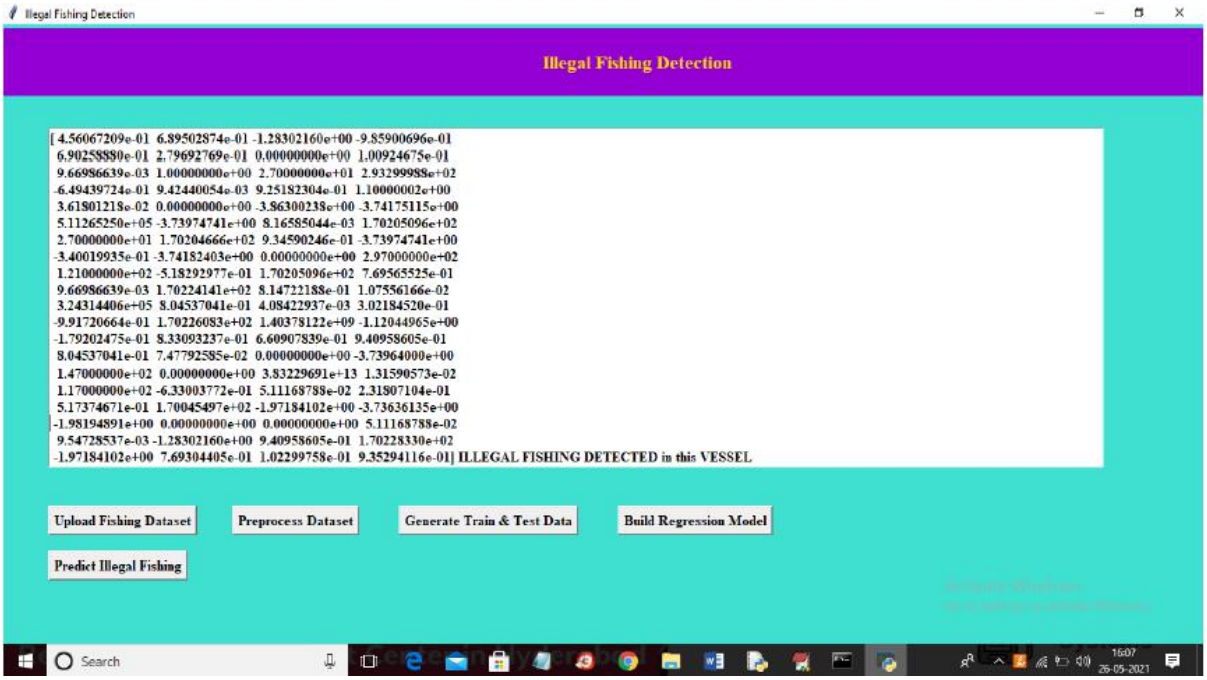

Fig.11 In above screen in square bracket we can see vessel test values and after square bracket we can see prediction result as _ILLEGAL FISHING DETECTED in this VESSEL‘ or _NO ILLEGAL FISHING DETECTED in this VESSEL‘. You can scroll down above screen text area to view all records.

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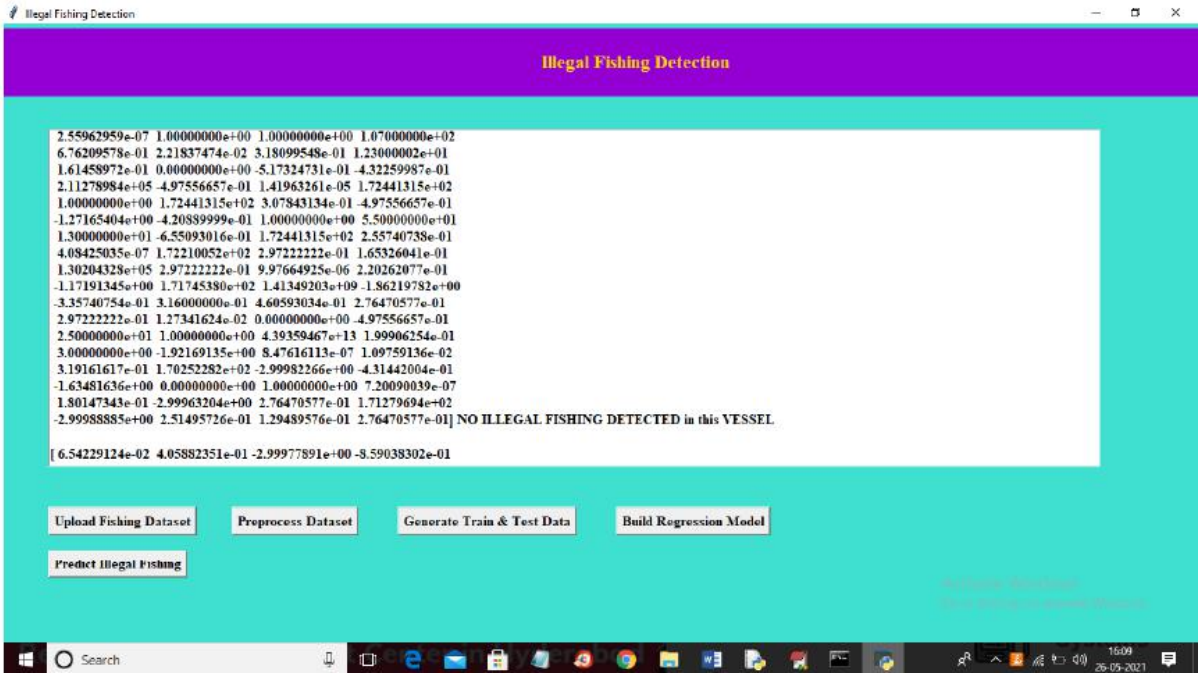

Fig.12 In above screen for second vessel we got predicted result as ‗No Illegal Fishing Detected' and you can scroll down above text area to view all result.

VI. CONCLUSION

We conclude that it is our responsibility to protect our seafood and to keep many fishes alive.

- By use of our project, we protect that unreported fishing and can find unauthorised 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, by means of all this, we can reduce unreported, illegal fishing.

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