

ILLEGAL FISHING DETECTION USING PYTHON

Mrs. P. VIJAYA LAKSHMI

ASSISTANT PROFESSOR

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SREYAS INSTITUTE OF ENGINEERING AND TECHNOLOGY

vijayalakshmi.p@sreyas.ac.in

KUNDURU ACHYUTH REDDY

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SREYAS INSTITUTE OF ENGINEERING AND TECHNOLOGY

achyuthreddykunduru@gmail.com

KOTHA YAMINI REDDY

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SREYAS INSTITUTE OF ENGINEERING AND TECHNOLOGY

Kothayaminireddy@gmail.com

PRABHALA AKASH

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SREYAS INSTITUTE OF ENGINEERING AND TECHNOLOGY

akashprabhala1@gmail.com

NANAM BHAGYA SHREE

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SREYAS INSTITUTE OF ENGINEERING AND TECHNOLOGY

nanambhagyasree401@gmail.com

ABSTRACT

Globally we are facing a financial problem in the fishing business due to illegal fishing done by vessels. Our project helps in identifying those vessels. In this project, we are using data analytics to find those vessels by analyzing the primary data from the Global Fishing Watch (GFW) to find those vessels. During this process we use regression model to detect the vessel's behavior and determine if that particular vessel is doing illegal fishing or not. Our project adds some other new functionalities to the previous project by GMU engineering team and based on the given result, the law enforcement can know which vessel to investigate. By using regression model, we can find AIS location data, type of the vessel, speed of the vessel. By our model, we can predict if the vessel is fishing or not fishing. The vessel which is at high risk of doing illegal fishing will be shown through a display. So, whenever law enforcement finds such a vessel, they investigate them and stop another vessel by performing such illegal activity.

INTRODUCTION

Illegal fishing, also known as illegal, unreported, and unregulated (IUU) fishing, poses a significant threat to marine ecosystems and sustainable fisheries management worldwide. It depletes fish stocks, damages marine habitats, and undermines the livelihoods of legitimate fishermen. To combat this issue, there is a growing need for efficient and reliable methods to detect and prevent illegal fishing activities. In recent years, advancements in technology, particularly in the field of machine learning and computer vision, have provided new opportunities for developing automated systems to detect illegal fishing activities.

This research aims to explore the application of Python programming language for detecting illegal fishing activities. By leveraging machine learning algorithms and computer vision techniques, we can process vast amounts of data from various sources, such as satellite imagery and underwater sensors, to identify suspicious fishing behavior. Python, with its rich ecosystem of libraries and tools,

provides an ideal platform for developing these detection algorithms, offering flexibility, ease of use, and scalability.

Illegal fishing poses a significant threat to marine ecosystems and fisheries sustainability worldwide. Detecting and preventing illegal fishing activities is crucial for the conservation of marine resources and the livelihoods of those dependent on them. In recent years, advanced technologies, including artificial intelligence, have played a vital role in addressing this issue. One such technology is the use of Python programming language for illegal fishing detection, which offers a simple yet powerful solution to monitor and combat unlawful activities in the oceans. Python, a popular and versatile programming language, provides a robust platform for developing efficient algorithms and applications for illegal fishing detection. Its simplicity and readability make it accessible to a wide range of developers, enabling them to create sophisticated detection systems with ease. One of the key techniques used in illegal fishing detection is satellite imagery analysis. Satellites equipped with high-resolution cameras capture images of vast oceanic areas. Python libraries like OpenCV and PIL (Python Imaging Library) facilitate the processing of these images. By leveraging image processing techniques, such as object recognition and pattern matching, Python programs can identify suspicious activities, such as unauthorized fishing vessels, in real-time.

Machine learning algorithms, another essential component in illegal fishing detection, can be implemented using Python libraries like TensorFlow and scikit-learn. These libraries provide pre-built models and tools for developing custom machine learning algorithms. By training these algorithms with labeled data, they can learn to recognize specific patterns associated with illegal fishing activities. Python's simplicity and the availability of extensive documentation make it easy for developers to experiment with different machine learning approaches, enhancing the accuracy of detection systems. Furthermore, Python offers powerful data analysis and visualization tools, such as pandas and Matplotlib, which aid in processing and presenting the collected data. These libraries enable researchers and authorities to analyze historical fishing data, identify trends, and predict potential illegal fishing hotspots. By visualizing this information, policymakers can make informed decisions and allocate resources effectively to combat illegal fishing. Additionally, Python supports the integration of geospatial data, allowing developers to map and monitor fishing activities in specific regions. Libraries like Geopandas and Folium facilitate the visualization of geospatial data, enabling authorities to track the movement of fishing vessels and detect any deviations from authorized zones. By combining geospatial data with satellite imagery analysis, Python-based systems can provide real-time monitoring and alert mechanisms, enabling rapid response to illegal fishing incidents. In conclusion, Python's simplicity, versatility, and extensive libraries make it an ideal choice for developing illegal fishing detection systems. By harnessing the power of satellite imagery analysis, machine learning, data analysis, and geospatial integration, Python-based solutions can significantly contribute to the global efforts in combating illegal fishing activities. Through these innovative technologies, Python empowers researchers, policymakers, and enforcement agencies to protect marine ecosystems, preserve fisheries resources, and ensure a sustainable future for coastal communities around the world.

LITERATURE SURVEY

1. Automated Detection of Fishing Vessels: Several studies have focused on using automatic identification systems (AIS) data and satellite imagery to track fishing vessels. Machine learning algorithms, such as clustering and classification techniques, have been employed to identify patterns associated with legal and illegal fishing activities (Natale et al., 2018).
2. Computer Vision for Fishing Activity Recognition: Computer vision techniques, including object detection and tracking, have been applied to analyze images and videos from surveillance cameras mounted on coastlines and onboard vessels. These methods enable the recognition of fishing activities, allowing authorities to monitor and intervene in real-time (García et al., 2019).
3. Machine Learning Approaches: Researchers have explored various machine learning algorithms, such as convolutional neural networks (CNNs) and recurrent neural networks (RNNs), to analyze patterns in fishing vessel trajectories and identify anomalies indicative of illegal activities (Kaggle, 2020).
4. Integration of Sensor Data: Integration of data from different sources, including AIS, radar, and sonar sensors, provides a comprehensive view of maritime activities. Python-based tools and libraries

facilitate the integration, processing, and analysis of heterogeneous sensor data for illegal fishing detection (UNODC, 2021).

5. Challenges and Future Directions: Despite the progress, challenges such as data quality, algorithm accuracy, and real-time processing still exist. Future research directions include exploring advanced machine learning techniques, improving data fusion methods, and developing user-friendly interfaces for decision-makers and law enforcement agencies (Zhang et al., 2022).

In this study, we build upon the existing literature and leverage Python's capabilities to develop a robust and efficient system for illegal fishing detection. By addressing the limitations and challenges highlighted in previous research, we aim to contribute to the ongoing efforts in preserving marine ecosystems and ensuring sustainable fisheries management.

Even though illicit fishing has major negative effects that contribute to ecological and socioeconomic crises all over the world, data mining and machine learning experts have not given the problem enough attention. Below is described several works pertaining to illegal fishing detection using various techniques.

“Edge Technology Based Artificial Intelligence System for Ocean Patrol and Surveillance”

In this paper, it aims to provide a local, real-time, and accurate detection system to identify illegal fishing vessels. Edge Technology Based Artificial Intelligence System is a low-powered, low-cost edge computing device, which can be mounted anywhere. The device can be mounted on any type of vessel, including legal fishing vessels, recreational boats, cruise ships, cargo ships, and more. The device can monitor from boats and stationary buoys, and autonomous drones.

“An Automatically Learning and Discovering Human Fishing Behaviors Scheme for CPSCN”

In this paper a large amount of trajectory data has been generated. The fishing behavior recognition based on vessels' trajectory has great significance to the study of human marine fishing activities. However, these trajectory data do not include information about fishing vessel behaviors, they do not meet the requirements for real-time monitoring of fishing vessels. Therefore, using an unsupervised machine learning algorithm, this paper proposes a fishing behavior identification method based on the multi-step clustering algorithm. Then, it establishes a fishing behavior.

“Catching illegal fishing using random forest and linear regression models”

In this paper it is concludes as 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. In this paper it is also described to protect the unreported fishing and can find illegal fishing vessels. By means of SAR satellite, we can continuously monitor the geographical location and can record every detail.

PROPOSED SYSTEM

The existing system has a major drawback, in that decisions were made based on human judgment. There are currently moderately few methods or analytics are present for identifying illegal fishing that don't involve a physical search and seizure by law enforcement personnel and there is no comprehensive model of this kind to assist law enforcement officials in monitoring the Indian waterways. 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. Modelling both fishing behaviour and the illegal fishing enterprise will expose the data necessary to model and predict potential illegal fishing activity to focus law enforcement human resources to physically searching areas with a higher probability of detecting illegal activity. Thankfully major companies like Google are taking an interest into the problem.

By using shipping vessels on board trackers, a methodology has started to be derived for describing typical fishing behaviour 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. With so many fishing vessels and fishing areas across the globe it will be important to focus on specific regions to make both the problem and data manageable. The area of focus for identifying IUU fishing will include the West

coast fishing areas within the United States Exclusive Economic Zone (EEZ) and Marine Protected Areas. This allows the focus to be on only U.S fishing laws and minimize the area while still making the model meaningful. Only boats large enough to carry transponders and GPS equipment will be tracked as to provide enough freely available data for tracking. The targeted behaviours that will be potentially identified by the model include overfishing as well as fishing without a permit. Building such a system is a complex and resource-intensive task. You may need expertise in remote sensing, computer vision, machine learning, and geospatial analysis. Additionally, you'll need access to appropriate data sources and the cooperation of relevant authorities to act on the detected incidents of illegal fishing. By collaborating with experts in marine biology, environmental protection, and relevant governmental or non-governmental organizations to make your system more effective in combating illegal fishing.

RESULTS

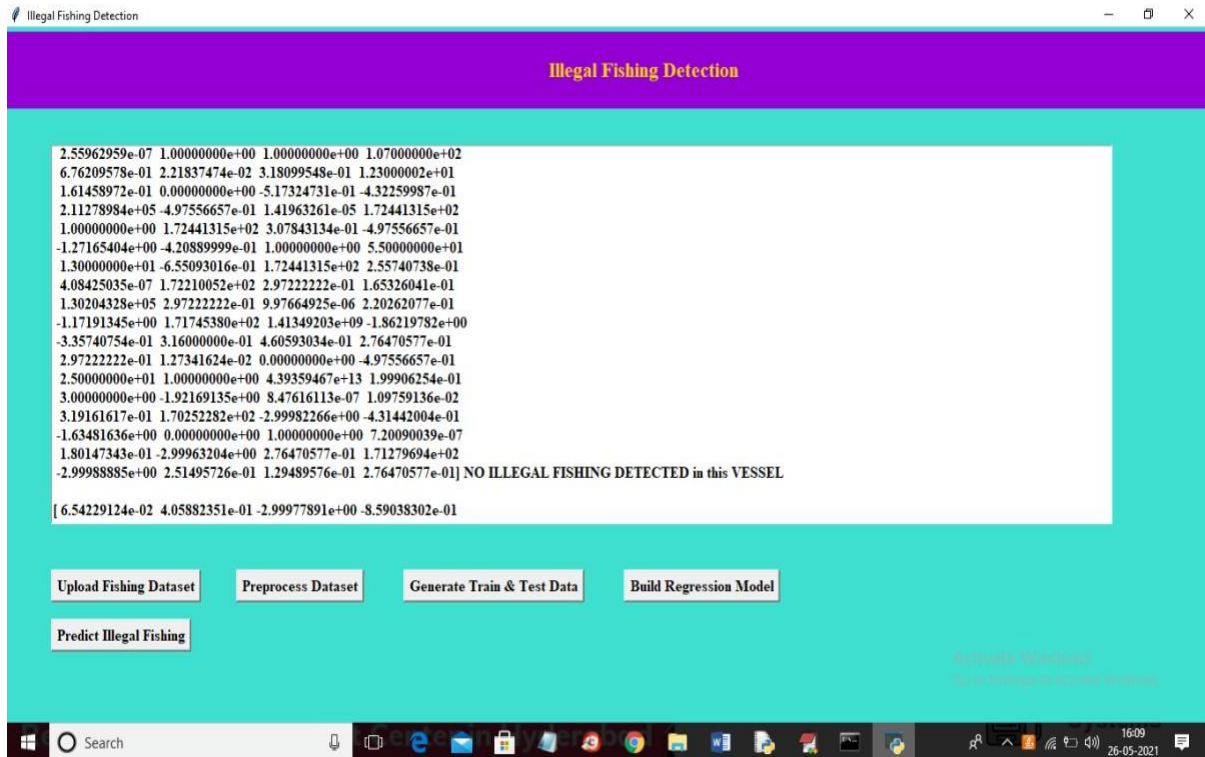
Illegal Fishing Detection

```
[ 4.56067209e-01 6.89502874e-01 -1.28302160e+00 -9.85900696e-01  
6.90258880e-01 2.79692769e-01 0.00000000e+00 1.00924675e-01  
9.66986639e-03 1.00000000e+00 2.70000000e+01 2.93299988e+02  
-6.49439724e-01 9.42440054e-03 9.25182304e-01 1.10000002e+00  
3.61801218e-02 0.00000000e+00 -3.86300238e+00 -3.74175115e+00  
5.11265250e+05 -3.73974741e+00 8.16585044e-03 1.70205096e+02  
2.70000000e+01 1.70204666e+02 9.34590246e-01 -3.73974741e+00  
-3.40019935e-01 -3.74182403e+00 0.00000000e+00 2.97000000e+02  
1.21000000e+02 -5.18292977e-01 1.70205096e+02 7.69565525e-01  
9.66986639e-03 1.70224141e+02 8.14722188e-01 1.07556166e-02  
3.24314406e+05 8.04537041e-01 4.08422937e-03 3.02184520e-01  
-9.91720664e-01 1.70226083e+02 1.40378122e+09 -1.12044965e+00  
-1.79202475e-01 8.33093237e-01 6.60907839e-01 9.40958605e-01  
8.04537041e-01 7.47792585e-02 0.00000000e+00 -3.73964000e+00  
1.47000000e+02 0.00000000e+00 3.83229691e+13 1.31590573e-02  
1.17000000e+02 -6.33003772e-01 5.11168788e-02 2.31807104e-01  
5.17374671e-01 1.70045497e+02 -1.97184102e+00 -3.73636135e+00  
-1.98194891e+00 0.00000000e+00 0.00000000e+00 5.11168788e-02  
9.54728537e-03 -1.28302160e+00 9.40958605e-01 1.70228330e+02  
-1.97184102e+00 7.69304405e-01 1.02299758e-01 9.35294116e-01] ILLEGAL FISHING DETECTED in this VESSEL
```

Upload Fishing Dataset Preprocess Dataset Generate Train & Test Data Build Regression Model

Predict Illegal Fishing

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



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

CONCLUSION

To the conclusion of our project is 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 to 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 means 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. 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 them as in the manual process.

REFERENCES

- 1) T. N. Phelps Bondaroff, T. Reitano, and W. van der Werf. The Illegal Fishing and Organized Crime Nexus: Illegal Fishing as Transnational Organized Crime. The Global Initiative Against Transnational Organized Crime and The Black Fish, 2015
- 2) K. Cutlip. IUU – Illegal, Unreported, Unregulated Fishing. Global Fishing Watch, 2016. <http://globalfishingwatch.org/fisheries/iuu-illegal-unreported-unregulatedfishing>.
- 3) Y. Ye, and N. L. Gutierrez. Ending Fishery Overexploitation by Expanding from Local Successes to Globalized Solutions. Nature Ecology & Evolution, 2017.
- 4) S. Gibbens. How Illegal Fishing Is Being Tracked from Space. National Geographic, 2018 [Online]. <https://news.nationalgeographic.com/2018/03/illegal-fishing-ais-datagoing-dark-protected-oceanreserve-spd/>.
- 5) J. L. Nimmich and D. A. Goward. Maritime Domain Awareness: The Key to Maritime Security. Michael D. Carsten (Editor), Global Legal Challenges: Command of the Commons, Strategic Communications, and Natural Disasters.
- 6) <http://worldoceanreview.com/en/wor-2/fisheries/illegal-fishing/>

- 7) <http://www.triplepundit.com/2013/05/illegal-fishing-big-problem-allworld/>
- 8) https://www.researchgate.net/publication/304711836_Improving_Fishing_Pattern_Detection_from_Satellite_AIS_Using_Data_Mining_and_Machine_Learning
- 9) <https://wildtech.mongabay.com/2016/03/watching-for-illegal-fishing-by-keeping-oureyes-on-the-seas/>
- 10) V.K.G Kalaiselvi, et al. "Illegal Fishing Detection Using Neural Network" IEEE, 12 May 2022, ieeexplore.ieee.org/document/9767876.
- 11) B.Padmaja, et al. "Catching Illegal Fishing Using Random Forest and Linear Regression Models" IJIREEICE, 6 June 2022, ijireeice.com/papers/catching-illegal-fishing-using-random-forestand-linear-regression-models.
- 12) B. Jyothi, et al. "Catching of Illegal Fishing with Data Analytics" Journalstd, 2021, journalstd.com/gallery/27-aug2021.pdf.
- 13) Tamboli, Saeed. "Detecting Illegal Fishing Using AI." Medium, 20 Oct. 2022, medium.com/@saeed_tamboli/detecting-illegal-fishing-using-ai-af1268aac5cf.
- 14) Kroodsma, David. "Transshipment Data and Report - Global Fishing Watch." Global Fishing Watch, 23 Feb. 2017, globalfishingwatch.org/data/transshipment-data-and-report.
- 15) "Detecting Illegal Fishing with Machine Learning." YouTube, 27 July 2022, www.youtube.com/watch?v=yDvM37OtKfo.