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Detection of Efficient Piscary for Trawling on South_East Coast of Indian Ocean for Fisheries

Catherin Selva Charjana A[1], Jothika A[1], Durga A[1], Rajesh Kanna R[2]

[1]Computer Science and Engineering, Agni College of Technology

[2]Assistant Professor, Department of Computer Science and Engineering, Agni College of Technology

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ABSTRACT:

Fishing is one of the main source of income for many peoples in the coastal area. Trawling is a most common method of fishing which uses a fishing net for getting large number of fishes. Due to various environmental changes the number of fishes and the number of efficient fishing zones are reduced. So it is taking more time for the fishermen to search the efficient fishing zone. In order to make the work easier many studies have been done for the prediction of potential fishing zone by considering the various attributes. Majority of the models are based on the advanced machine learning and deep learning algorithms. Our prediction model is trained with the sample oceanographic dataset by advanced machine learning algorithms. The prediction will be mostly based on the main attributes like sea surface chlorophyll and sea surface temperature. The research involves the collection and pre-processing of relevant data such as sea surface temperature, sea surface chlorophyll, atmospheric temperature, fishing catch data and many more. The model will provide 96.5% accuracy after analyzing the model with various approaches and algorithms.

Key words: CSV Dataset, Machine learning and Efficient Trawling zone.

I.INTRODUCTION

7million people are living along the Indian coastline, which covers the distance of 8100km.Most of the people living in the coastal line are depended on fishing for their livelihood.Locating the efficient piscary for trawling is always a challenging task for fishermen. They spend more time in searching the efficient zone for trawling. Due to global warming and environmental changes the number of efficient trawling zones were reduced. This will lead to search for a trawling zone even longer. The traditional approach for trawling is that the fishermen will search for the efficient trawling zone manually andthey will catch the fishes. In order to make their work easier we have created a machine learning model that will detect the efficient trawling zone automatically and accurately by considering some important attributes related to the efficient trawling zone. However, the information included in these data is a collection of oceanographic measurements taken at various locations in the ocean. The goal of the system is to predict the efficient piscary for trawling which is highly complex andspecialized task owing to the variety of circumstances, particularly in the case of rapid environmental changes. It is a significant area of Machine learning in oceanography. An machine learning model will analyse the oceanographic data and provides the suitable prediction.

The traditional approach that the fisher man will follow to find the efficient piscary for trawling is they will look at the foam in the water and also the birds nearby. According to them if the birds are flying around the particular region then those birds are searching for their prey which is a fish so in that region the fishermen can easily lookout for small fishes that usually the prey for those birds. The modern approach of finding the efficient zone is by considering the oceanographic data .The main oceanographic data that determines the efficient trawling zone is Sea surface temperature (SST) and Sea surface chlorophyll (SSC).These two oceanographic measurement plays a major role in determining the efficient zone . Chlorophyll - a which forms the pphytoplankton that will be the food for major aquatic animals . SSC rich area can have more number of fishes. SST also plays a major role in the reproduction of the fishes .By considering more oceanographic data we can predict the efficient piscary for trawling accurately with our machine learning system.

Our system employs the following modules (i) preprocessing (ii) feature Importance(iii) classification (iv)prediction. Published scientific work is also a huge help in recognizing one's own potential. Now, we'll go over the tried-and-true methods for publishing a research paper in a journal.

Once the input dataset containing training and testing datasets has been loaded, Preprocessing is the next phase that is carried out to remove missing and noisy data from the input dataset, which contains training and testing datasets. A comprehensive selection of data preparation, interpolation, and normalizing is included in the SKlearn library. The subsequent module, a feature selection, will then receive the preprocessed data back. The preprocessed data will be passed into a subsequent module to train the model. To choose the best features, recursively remove characteristics, compress the dataset, and quantify the significance of features, four feature selection techniques are utilized. These are the four techniques: Univariate Selection, Feature significance, Principal component analysis, and recursive feature deletion. The classifier will employ the SVM method. It is considered to be among the finest classifiers for categorizing datasets as a consequence.

The next step is to anticipate the outcome when the classification module has been finished. The outcome prediction using a confusion matrix is the last module. Compared to other methods, it yields better results. A model should be able to predict the outcome under all circumstances and have a high accuracy rating because one class will have more data examples than the others.

II. RELATED WORK

In this Section, we looked at a few studies that demonstrate how Machine learning is linked to the efficient Indian fishing zone.

[1] Author name:

Muhammad Muhammad1,2, AgusWidi Priana1,3, Junaidi M. Affan1,2, HaekalAzief Haridhi1,2, Irwan Irwan1,2, SyarifahMeurah Yuni4, Ichsan Setiawan1,2*

Description:

The dataset used in this was collected by a direct interview with 10 fishermen and also the SST and Chlorophyll-a data of a particular year. In this the, feature importance is given to the SST. Their prediction is fully based on the sea surface temperature. They extract information from each image using Sea as application which produces ASCII data. The mapping of potential fishing zone is done in Aceh Besar waters.

[2] Author name:

ElierArmas 1,2, Hugo Arancibia 1 and Sergio Neira 1,3,4,*

Description:

In this the author proposed a research technique that suitable for a identification of fishing zone of a particular species. They proposed a Artificial neural network forecasting model. This model will predict the potential fishing zone by considering the previous catch data. They created Generalized linear model (GLM) and Generalized additive models (GAM) for the assumption of fishing zones. The model has been trained with the probability collected from the previous catch data .The neural network model to predict efficient fishing zone is the interesting method with practical applications.

[3] Author name:

Jintao Wang, Wei Yu, Xinjun Chen, Lin Lei & Yong Chen

Description:

The research has been done on the Northwest pacific ocean. The fishery data were obtained from the ChineseSquid-Jigging Technology Group of Shanghai Ocean University from July to December during 2003–2013. The data were digitized from fishing logs of the Chinese commercial squid fishery operating on the traditional fishing ground between 35°–45° N and 145°–165° E in the Northwest Pacific. They proposed the artificial neural network model that predicts the fishing zone of sqiud with attributes SST and Chlorophyll-a. And the accuracy of this result is 80%.

[4] Author name:

Fauziyah⇑, Agung Setiawan, FitriAgustriani, Rozirwan , Melki, Ellis NurjuliastiNingsih, T. ZiaUlqodry

Description:

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[5] Author name:

The Author

Description:

Indian National Middle for Ocean Data Administrations (INCOIS) gives brief term angle forecasts using Inaccessible Detecting (RS) and Geographic Data Framework (GIS) Strategies. determined Chlorophyll and Ocean Surface Temperature (SST) data are the fundamental inputs for producing this information. The advisories on the PFZ over Middle eastern Ocean and Narrows of Bengal from the warm infrared channels of NOAA-AVHRR and optical groups inIRS-P4 OCM.MODIS Water information. landing centres/ angling towns covering the whole coast line of India. Features such as maritime fronts, winding designs, whirlpools, rings and up-welling regions are distinguished from the adherent pictures, exchanged to navigational charts and given as PFZ advisories. These forecasts are dispersed with an thought to misuse the fishery assets of Goaina economical way and to bridge the hole between evaluated and harvested potential. The increment in capture, CPUE and net benefit for anglers from Goa underlines the significance of lackey based angle estimate and proficiency.

[6] Authorname:

N.V.S. Natteshana and N. Suresh Kumarb

Description:

The Research direction for further application of the various methods and obtaining a better estimate of Potential Fishing Zone for certain coastal areas of Tamil Nadu is represented. In the proposed research work the entire process of identify cation of Potential fishing zone is to carried out for a coastal areas in Tamil Nadu. First the input satellite captured details are pre-processed using Nonlocal means filter and gamma filter. By using the spatial and temporal clustering methods a spatial temp temporal potential fishing zone is obtained which can be used as a ground truth for further classification. In the process of classification three classifiers are to be used namely KNN, Neural network and Boosted regression tree and a decision level fusion is to be done to best utilize a classifier for the process of classification of a region into PFZ or not. Then there is also a usage of statistical models of Generalized Additive model and generalized linear model and then it is compared with a SVM classifier and the results obtained are tabulated.

[7] Author:

The Author

Description:

Using geospatial techniques in order to accurately map the potential fishing zones based on sea surface temperature (SST) and chlorophyll -a content in conjunction with active use of GPS navigation systems can go a long way in improving the output of the fishing community. For this study, satellite data of sea surface temperature and chlorophyll-a content product of MODIS aqua 250 meters, 8 day composite was used. Secondary field survey of Fish and Agriculture Organization (FAO) in month of October was used to assist the fish catch, SST and Chlorophyll-a concentration in Exclusive economic zone (EEZ) of Pakistan, The next step was to establish a GIS database of fish catch data along with the geographical coordinates of the catch spot.

III. DATASETS

A collection of oceanographic measurements made at several oceanic locations made up the dataset used in this investigation.

It includes characteristics such as Month, Year, SSC, SST, SLP, AT, RH, Total Catch, and Total oil.

Throughout time, the data was gathered at regular intervals. The crucial oceanographic details are contained in each row of the data.

Attributes Details :

SSC-Sea surface chlorophyll

SST-Sea surface temperature

AT- Atmospheric temperature

RH-Relative humidity

SLP-Sea level pressure

TC-Total catch

TO-Total oil

The SSC property represents the amount of chlorophyll present at the ocean's surface, which is a sign that phytoplankton is present. Several marine animals depend heavily on phytoplankton as a food supply, and it is the foundation of the oceanic food chain. The SST feature stands for sea surface temperature, which plays a significant role in deciding where certain fish species are found. The AT and RH qualities stand for the atmosphere's temperature and humidity, which can affect the ocean's temperature and current patterns. The SLP feature depicts the atmospheric pressure acting on the ocean's surface, a crucial element in influencing the strength and course of ocean currents. Plankton and fish species distribution may be impacted by these currents. The availability of fish is directly reflected by the TC property, which shows the total amount of fish caught in a specific area. The total amount of oil in a given area is represented by the TO attribute, which can have a detrimental effect on the marine ecosystem, consequently, the availability of fish.

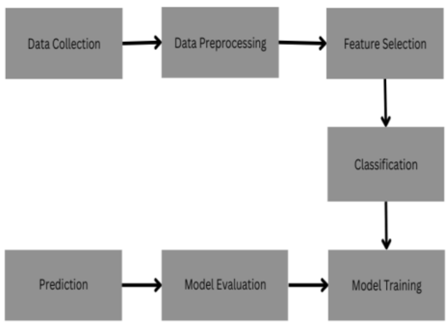
IV. PROPOSED SYSTEM

The proposed prediction system's primary modules include preprocessing, classification, training, and result prediction. Finding an effective trawling zone is essential for the fishing industry since it can boost catch rates while decreasing time and expense spent on fishing operations. The objective is to create a machine that can anticipate the accurate trawling zone efficiency.

We have incorporated new attributes that may be significant features for the prediction in order to address the problems in traditional approaches. The XGboost and random forest algorithms are then utilized to make the prediction. By integrating many decision trees, the ensemble approaches XGboost and Random forest will improve prediction accuracy. These algorithms are effective at handling missing data and outliers, which improves the model's effectiveness. In terms of accuracy, the suggested system performs better in this situation. The proposed system is more focused on the prediction's efficacy and accuracy.

Eventually, a validation accuracy of 96.5% is found.

Fig:1-FLOW DIAGRAM OF THE PROPOSED SYSTEM:



V. MODULES

Modules includes:

a. Input
b. Preprocessing
c. Feature selection and importance
d. classification
e. Training and testing
f. prediction

a. INPUT MODULE:

Based on the input variables like SSC, SST,AT,RH and TC, the model will predict the efficient trawling zone. Important details about the patients are included in each row of data.

b. PREPROCESSING MODULE:

b.1 shuffling and interpolating the dataset:

interpolates the missing values using cubic interpolation along each column using the interpolate method.
Then forward filling and backward filling is applied on the interpolated data to replace the remaining missingvalues with the nearest valid observation along each column using the f-fill and b-fill methods respectively.
Finally, the data frame is casted to a float data type using the as type method and stored in a new data frame variable nedf for further analysis.

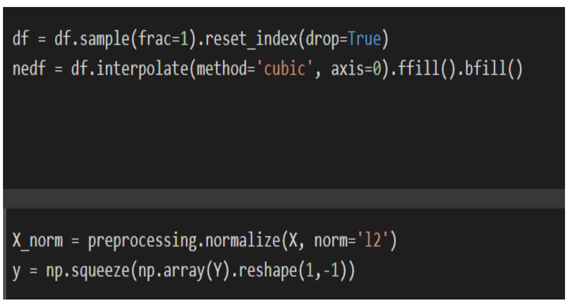


Fig2: PREPROCESSING DATA FIGURE:

b.2 Normalizing the data:

the preprocessing module from the sklearn library is imported. The normalize function is used to normalize the data in the numpy array numpy array is reshaped using np. Array (Y) reshape(1,-1) to ensure it has the correct shape for further operations. The np. squeeze function is then applied to remove any redundant dimensions from the reshaped array, resulting in a 1-dimensional array called y.

This is done using the squeeze function with the axis parameter set to 0, indicating that the operation should be applied along the first axis (rows).

c. FEATURES SELECTION AND IMPORTANCES:

The preprocessing step ,when the missed and noisy data are removed is followed by the feature selection and importance.

Now ,only the unnecessary attributes have been removed from the data to make classification easier.

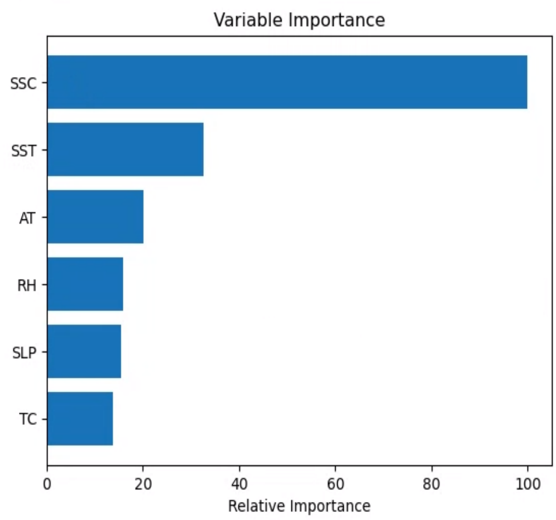
The input features X and target variable y are defined.

There are four feature selection techniques used:

The four best characteristics are chosen using a single variable and the chi squared (chi ^2) statistical test for non-negative features.

Recursive Feature Elimination (RFE): The RFE builds a model on the attributes that remain after recursively deleting other attributes. The attributes (and attribute combinations) that are most effective in predicting the target attribute are determined using the model's accuracy. Principal Component Analysis (PCA): PCA use linear algebra to compress the dataset. The relevance of features can be calculated using bagged decision trees, such as Random Forest and Extra Trees.

Fig 3: FEATURES IMPORTANCE:



d . CLASSIFICATION MODULE:

This module will receive the preprocessed data, which will then be divided into training and testing datasets.

The suggested system for detecting possible fishing zones includes a crucial component called the categorization module.

The module's job is to divide the input data into appropriate and unsuitable fishing zones, or suitable and unsuitable fishing zones.

The module accepts the preprocessed data as input, along with the total catch and oceanographic measurements such as sea surface temperature, sea surface chlorophyll, atmospheric temperature, relative humidity, sea level pressure, and total oil spill. Several classification techniques are used to train and assess the models after dividing the data into training and testing sets. A variety of criteria, including the confusion matrix, precision, recall, F1 score, and accuracy, are used to determine the classification models' accuracy. To improve classification, the scikit-learn module in Python was used to create three classification algorithms: SVM, Decision Tree, and Naive Bayes.

The aforementioned code initializes the SVM, Decision Tree, and Naive Bayes classifiers and uses the fit function to train them on the preprocessed data. The classes of the test data are then predicted by the classifiers using the predict function. Finally, the confusion matrix is calculated and the accuracy of the classifiers is assessed using the accuracy score and confusion matrix functions, respectively. A variety of metrics, including the confusion matrix, precision, recall, F1 score, and accuracy, were used to assess the classifiers' performance.

Fig4: CLASSIFICATION

```
from sklearn.metrics import accuracy_score
from sklearn.metrics import confusion_matrix
from sklearn.metrics import precision_recall_curve
result1 = clf.predict(X_test)
confusion_matrix(y_test,result1)
print(accuracy_score(result1,y_test))
from sklearn import tree
clfD = tree.DecisionTreeClassifier()
clfD.fit(X_train,y_train)
result2 = clfD.predict(X_test)
accuracy_score(y_test,result2)
confusion_matrix(y_test,result2)
from sklearn.naive_bayes import GaussianNB
gnb = GaussianNB()
gnb = gnb.fit(X_train, y_train)
pred = gnb.predict(X_test)
print(accuracy_score(pred,y_test))
confusion_matrix(y_test,pred)
```

```
0.7096774193548387
0.9354838709677419
array([[ 9,  0],
       [ 2, 20]])
```

e. TRANING AND TESTING MODULE:

A critical stage in the construction of a machine learning model is the training and testing module.

The data in this module is split into two sets: training and testing, and the model is trained on the training set and tested on the testing set to gauge its effectiveness.

After the data has been divided, several classification algorithms, including Support Vector Machines (SVM), Decision Tree, Naive Bayes, Random Forest, and XGBoost, are used to train the machine learning models on the training set. The models are evaluated on the testing set once they have been taught to assess their performance. Each model's predict method is used for this. The accuracy score function from the SKlearn. metrics module is then used to assess the accuracy of each model. The performance of each model can be compared using these accuracy scores and confusion matrices in order to determine which one is most accurate at identifying possible fishing zones.

f. PREDICITION:

The confusion matrix is used in the final model to analyze the data. Because one class can have more instances than another, a model may consistently predict the major class and have a high accuracy score even when it does not predict the minor classes. unlike the others.

In this situation, confusion matrices are useful.

A table arrangement known as a confusion matrix aids in viewing the various results and classification jobs. It generates a table containing each classifier's actual and predicted values. As a result, it precisely estimates the effective trawling zone.

Fig5: CONFUSION MATRIX

```
confusion_matrix(y_test,predXGB)

array([[ 9,  0],
       [ 0, 22]])
```

VI. RESULT AND FUTURE WORKS:

The important feature of our approach is that we were able to estimate probable fishing zones by using oceanographic parameters such as sea surface temperature, sea surface chlorophyll, ambient temperature, relative humidity, sea level pressure, total catch, and total oil.

We gathered the data, processed it, selected the features, and trained a variety of classifiers, including SVM, decision trees, Naive Bayes, and XGBoost, random forest, and. Based on accuracy score and confusion matrix, we assessed the performance of each model and decided that the XGBoost model was the top performer. In this study, we proposed an automated approach of efficient piscary prediction for trawling, which will be very advantageous to the Fisherman.

Future work could have the advantages of versatility, cost-effectiveness, and quicker execution. The suggested strategy is an effective way for fishermen to determine the productive trawling zone, according to research and analysis. More attributes can be added in the future for development. To produce a more reliable prediction system, one can try building more adaptive models as well as combining the results from different models.

We can develop a technique for predicting effective piscary for trawling that is more accurate and dependable with additional developments and enhancements.

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[3] Detection of potential fishing zones for neon flying squid based on remote-sensing data in the Northwest Pacific Ocean using an artificial neural network Jintao Wang a,b,c,d, Wei Yua,b, XinjunChena,b,c,d*, Lin Leia,b,c,d, and Yong Chenb ,eaCollege of Marine Sciences, Shanghai Ocean University, Shanghai 201306, China; bCollaborative Innovation Center for Distant-water Fisheries, Shanghai 201306, China; cNational Engineering Research Centre for Oceanic Fisheries, Shanghai Ocean University, Shanghai 201306, China;

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