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FISH DISEASE IDENTIFICATION: COMPARISON OF CLASSIFICATION ALGORITHMS USING DEEP LEARNING METHODS

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Abstract: Aquaculture plays a very vital role in the world economy. In our country, Tamil Nadu has the second longest coastal area . Agriculture and fishing provide the majority of people's livelihoods in Ramanathapuram district. Aquaculture has many activities, including chank farming , pearl farming, dry fish farming, shrimp farming, etc. Fish disease is one of the important factors affecting the rural economy. The fish disease is examined as the root cause of mass production and economic deprivation by fish farmers. Species disease detection and behaviour monitoring are the main tasks for human visualization. The objective of this study is to provide a comparative study of the classification algorithms to identify fish diseases. A more advanced system with more computing power can facilitate a deep learning approach. The features of the Epizootic Ulcerative Syndrome (EUS) in fish are extracted in this study.

Key words: Fish Disease, Classification algorithm, image processing, Deep Learning, R-CNN Algorithms

I.INTRODUCTION

Routine diagnosis is an important part of fish health management. Epizootic Ulcerative Syndrome (EUS) is a fungal pathogen, a serious fish disease problem in India and in many countries.It is noted that temperature is a critical factor for fungal growth and fish mortality. There are some other diseases caused by humans, industry wastage, and population. The Existing system demonstrated a comparison between K-means clustering and C-means fuzzy logic. The proposed system has experimented with the Random forest algorithm, lazy and J48 algorithm on infected fish images of Mandapam Regional center of CMFRI. We found that the deep learning technique achieved higher accuracy and efficiency than other methods in most studies.

Deep learning is an important element of data science, which is statistics and predictive modeling. It is extremely beneficial to those who are tasked with collecting, analyzing, and interpreting large amounts of data. Deep learning makes this process faster and easier. Deep learning can be thought of as a way to automate predictive analysis, in which traditional machine learning algorithms are linear, deep learning algorithms are stacked in a hierarchy of increasing complexity and abstraction.

II. LITERATURE REVIEW

Yang X et al. have reported on applications of Deep learning including live fish identification, fish classification, behavioral analysis, size or biomass estimation, and prediction of water quality. When performing fish identification tasks, CNN models show an accuracy 18.5% higher than that of SVM models [1]. Zhoa et al. has reported that the machine learning algorithms and techniques adopted in intelligent fish aquaculture in the past five years are expounded, and the application of machine learning in aquaculture is explored in detail, including the information evaluation of fish biomass, the identification, and classification of fish, behavioral analysis and prediction of water quality parameters [2]. Ahmed MS et al. divide their work into two portions. In this section image pre-processing and image, segmentation has been applied to reduce noise and extract the image. In the portion, we extract the features to classify the diseases with the help of the Support Vector Machine (SVM) algorithm. SVM performs notably with 91.42&94.12 of accuracy [3]. Pauzi SN et al. have reported the objective of this paper is to briefly review the work established in the fish disease detection field with the use of numerous classification techniques of image processing, including

rule-based expert system, machine learning, deep learning, statistical method, and hybrid method. The review involves the improvement in image processing techniques that would be valuable for further advancement in terms of performance [4]. Knausgård KMet al. have proposed a two-step deep learning approach for the detection and classification of temperate fishes without pre-filtering. The first step is to detect every single fish in an image(YOLO)object detection technique. In the second step a Convolutional Neural Network (CNN) with the Squeeze-and-Excitation (SE) architecture for classifying each fish in the image. The existing solution achieves the state-of-the-art accuracy of 99.27% using the pre-training model. These post-training model results are also high; 83.68% and 87.74% with and without image augmentation [5]. Cui S, Zhou Y, and others are experienced that, a data augmentation approach was conducted. In this paper, the overfitting problem is solved by the Dropout algorithm. They conclude the following things (1) Establish the data set to include real blur ocean water condition; (2) CNN to explore an applicable solution for fish detection referred by revising loss function and other parameters; (3) The system is targeted at an embedded system for AUV design with all possible optimizations [6]. Rekha BS, Srinivasan et al. proposed that 3 phase methodology 1. Detection 2. Data augmentation 3. Classification. The CNNs used in the detection module and the classification module achieved a validation accuracy of about 90% and 92% respectively. The future scope includes working on R-CNN for better results in the detection and classification phases [7]. Waleed A.Medhat et al. reported that Identification of diseased fish at early stages is important to prevent spreading fish diseases. The system diagnoses three different types of fish diseases automatically. Different CNN architectures were applied to our collected data-set images in different color spaces. The Alexnet architecture achieved superior results in the XYZ color space [8].

Tseng SLet al. reported that apply the method for underwater fish disease detection using a restricted amount of training data set. This work is based on the U-Net model, modified with different encoders to achieve high accuracy detection and segmentation results [9]. Kappeler A et al.'s authors introduced a video SR algorithm using convolutional neural nets. This paper explains CNN makes use of spatial information as well as temporal information. We introduced an adaptive motion compensation scheme to deal with motion blur and fast-moving objects [10]. Waleed A Medhat et.al authors discussed architecture in the RGB color space and discuss measurements of water's temperature and pH value, and for sending a notice to users' mobile phones as their future work [11].

III. PROPOSED METHODS

In this section the fish species are collected from various coastal area in Ramanathapuram District and CMFRI.we can classify the fishes and also identified the diseased (EUS) fish non(EUS) diseased fish in scales

Figure 1:a.Non-Disease

Figure 2.Diseased fish(EUS)

A. Dataset

An openly available dataset is downloaded from the UCI Machine Learning Repository.

Table 1: Fish Disease Dataset

Fish Disease	Disease Dataset	Fish Disease	Disease Dataset	Fish Disease	Disease Dataset	Fish Disease	Disease Dataset	Fish Disease	Disease Dataset
EUS 1	Yes	EUS 11	YES	EUS 21	Yes	EUS 31	Yes	EUS 41	Yes
EUS 2	No	EUS 12	No	EUS 22	No	EUS 32	No	EUS 42	No
EUS 3	Yes	EUS 13	YES	EUS 23	Yes	EUS 33	Yes	EUS 43	Yes
EUS 4	No	EUS 14	No	EUS 24	No	EUS 34	No	EUS 44	No
EUS 5	YES	EUS 15	YES	EUS 25	Yes	EUS 35	Yes	EUS 45	Yes
EUS 6	No	EUS 16	No	EUS 26	No	EUS 36	No	EUS 46	No
EUS 7	YES	EUS 17	YES	EUS 27	Yes	EUS 37	Yes	EUS 47	Yes
EUS 8	No	EUS 18	No	EUS 28	No	EUS 38	No	EUS 48	No
EUS 9	YES	EUS 19	YES	EUS 29	Yes	EUS 39	Yes	EUS 49	Yes
EUS 10	No	EUS 20	No	EUS 30	No	EUS 40	No	EUS 50	No

B. Classification

The Proposed Methodology to detect the EUS disease in the Fish scale is present or absent in the fish. Various Classification Algorithms are analysed and extract the Scale region and classify with training data set. The KStar is suitable method for detecting and classification of the EUS fish disease images. The current method is given better Accuracy and minimum processing time taken for performance of the new fish classification.

1. J48

J48 algorithm is one of the preeminent machine learning algorithms to scrutinize the data categorically and continuously. When used for this purpose, for example, it takes up more memory and reduces classification performance and accuracy for all types of data.The J48 algorithm is used to classify the data set and improve the performance for accurate results . J48 algorithm is suitable for deep learning methods to analyse the data and identify the dataset and to increase the accuracy of algorithm.

2. K-star

K Star is an instance-based classifier, which means that a test instance's class is determined by the class of training instances that are comparable to it. Its use of an entropy-based distance function sets it apart from other instance-based learners.The K* algorithm is used to measure distance, as a and define the constant attributes and missing values. This algorithm mainly concern with instance-based learner which uses such as classification an evaluation. In this experiment, K* algorithm given the maximum accuracy compare to other algorithms.

3. Decision Table

A clear visual representation for indicating the actions to take in response to certain conditions is a decision table. They are programmes whose results are a collection of deeds. The structural format can be represented using a decision table. We obtained lower accuracy using this approach. Although the decision table is essentially identical, this technique requires that each condition be considered.

4. Ramdom Forest Tree

This algorithm is one of the famous supervised algorithms. It is used for classification and regression problems. The Random Algorithm is suitable for a large range of data items. It is predicated on the idea of ensemble learning, which is the procedure of merging various classifiers to address a complicated issue and enhance the model's performance. It is very flexible. Through this algorithm, the weighted average is 100, but it will take more time for execution.

C. R-Convolutional Neural Network

A convolutional neural network (CNN) is a type of artificial neural network used in image recognition and processing that is specifically designed to process pixel data. A neural network is a system of hardware and/or software patterned after the operation of neurons in the human brain and also worked with all the animals, birds, and spices. R-CNN is one of the first large and successful applications of convolutional neural networks to the problem of object localization, detection, and segmentation.

Region based CNN consists of three modules — Region Proposal, Feature Extractor and Classifier.

Region Proposal. The region proposal tries to detect the species in different regions of different sizes and aspect ratios.

Feature Extractor: Each proposed region will be trained by a CNN network and the last layer will be extracted as features.

Classifier: The features are extracted and to classify the diseased images for each regions.

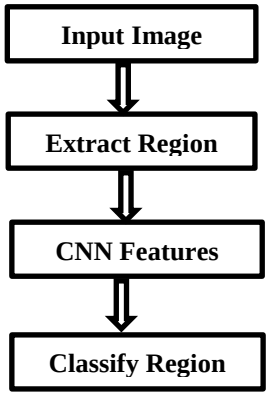

Figure: 3 Architecture of R-CNN

IV SPECIES PROCESSING TECHNIQUES

Image processing is among the most promising technologies for enhancing raw images gathered from external sources such as cameras, satellite sensors, space probes, aircraft, and others .Image processing technique is used to improve the quality of the image and give the technical assurance. The process for fish disease detection involves a fundamental procedure to extract and classify features from infected fish that is implemented in several steps.

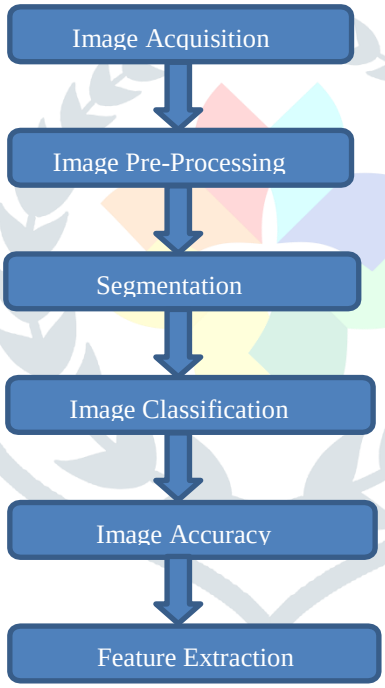

Figure 4: Steps of Methodology

Species Acquisition: The collection or acquiring of images from various coastal areas through the cameras and image sensors. The database was collected from the fishermen of some coastal areas of Ramanathapuram District and CMFRI Mandapam.

Species classification: Separate the disease-infected fish from the healthy fish. The various classification algorithms, such as J48,lazy Kstar ,Decision Tables, and Random Forest has been applied after extracting the feature.

Methods and techniques for classification are evaluated. The convention strategy for segmentation and classification of the object is resolved. Various classification algorithms are applied to calculate accuracy. In particular, the Kstar Algorithm is given great accuracy and efficient time for execution compared to other algorithms.

Table2: Comparision of K means and Kstar Algorithm

S.No	Algorithm	Weighted Avg.Accuracy	Time
1	K-Means	64.74%	0.2
2	KStar	100%	0.1

IV. Result and Discussion:

In this research, we have to apply four algorithms for the classification process. The algorithms are J48, Lazy KStar, Decision Table and Random Forest. The result is the following:

In Table 2, we compare the four different types of classification algorithms based on weighted accuracy and time**.** The results vary in their time and weighted average accuracy. The two algorithms take the same amount of time.but the weighted average accuracy is different. We consider both the weighted average accuracy and the time .

Table 2: Comparision of Classification Algorithms

S.No	Algorithm	Weighted Avg.Accuracy	Time
1	J48	67.74%	0.1
2	Kstar	100%	0.1
3	Decision Table	67%	0.01
4	RandomForest	100%	0.2

Table3: Comparision of K means and Kstar Algorithm

S.No	Algorithm	Weighted Avg.Accuracy	Time
1	K-Means	64.74%	0.2
2	KStar	100%	0.1

This figure compares the four types of algorithm J48,KStar, Decision Table and Random Forest

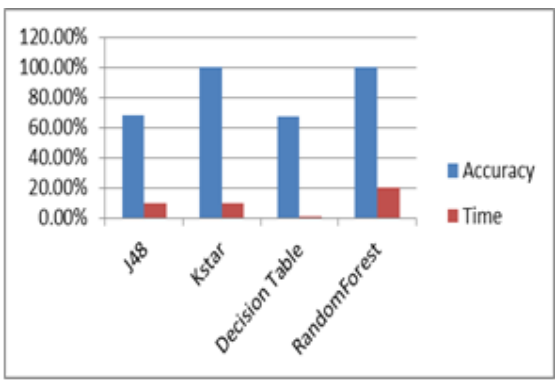

Figure 5: Training Accuracy of Algorithms

This figure compares the proposed algorithm (K Star) and the existing algorithm(K Means).

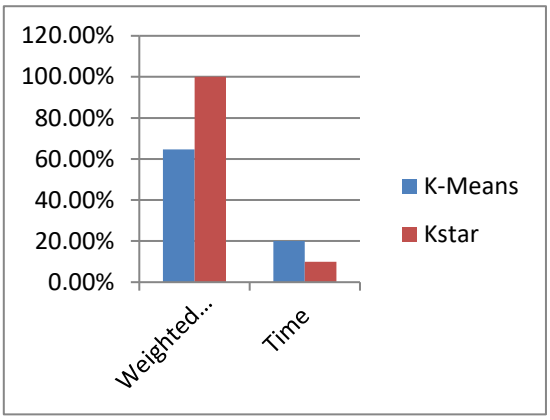

Figure:6 Comparision ofAlgorithm

V. Conclusion

This proposed method was designed to distinguish between the classification of diseased and non-diseased fish in various areas. Many people are economically dependent on fish farming and production in Ramanathapuram District. It will be concluded that many efforts have been made for fish disease detection with the help of image classification studies, which have been conducted. The existing method uses the K-Means classification algorithm for better accuracy and minimum execution time. The proposed method using the Lazy K-Star algorithm takes the minimum execution time for classification and also provides a weighted average accuracy of 100% compared with the existing method. The Lazy K-Star algorithm is exemplary for fish disease classification.

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