Aqua Market Demand Analysis based Fish Recommendation System

By

[1]Dr B.V. Rama Krishna
[1]Associate Professor, Aditya College of Engineering, Surampalem, Pin: 533437, India
[2]D. Lakshmi Neha
[3]Y. Venkata Praveen Kumar
[4]C. ShyamBhaskar
[5]V. Satya Sai Ram Ganesh
[2,3,4,5]Students, Aditya College of Engineering, Surampalem, Pin: 5333437, India

ABSTRACT:

India is one of the fast growing country playing very important role in Aqua market. Being a Peninsula Aqua market is a major resource of national income. The modern technology impacted the way of fishing style in India. Forecasting of aqua resources and identifying the best farming techniques with the help of modern technology improving supply chain management. The Data analytics with Artificial Intelligence (AI) coupled with Machine Learning (ML) identifying best decisions to predict market trends also suggesting the international standards in Aqua market. in this paper we are developing a recommender system with machine learning techniques to classify the fish species available in our territory and analyze their demanding in International and National markets. Also helps to recommend seasonal fish for best investment for aqua farmers. Users who love dishes made with fish may enquire the seasonal fish availability and its nutritional content information from our system effectively. In this work we developed an integrated system for fish species classification with deep learning techniques. The ResNet50 technique used in this work accurately identify fish species from image list. Extracting useful features like habitat details, nutritional values and market demands of specific fish. This approach focused over benifit of stakeholders on fisheries with wide recommendations tom improve market efficiency and consumer education.

Keywords *- Deep Learning, Classification, Singular Value Decomposition (SVD), Convolution Neural Network (CNN), ResNet50.*

LITERATURE STUDY

A novel approach with genetic algorithm based back propagation classification applied by researchers to optimize the performance and weight parameters. They used Potential Local Geometric Features to recognize accurately the isolated fish patterns [10]. The CNN approach to study the fish health with a combination of VGG16 and Image-Net improved the training data as well as testing data quality. It has given 92.4% genuine acceptance rate compared to other algorithm approaches [7]. Researchers focused on surveying the under water fish monitoring domains, application of Deep Learning techniques with AI and projected they are used to analyze visual data to support decision making [1]. Some focused their work on multi water fish classification based on transfer learning and visual transformers. This method uses label smoothing loss function to overcome the problem of overconfidence and over fitting of classifiers [2]. There is a significant research work done on classification of Tuna fish species using GLCM (Grey Level Co-occurrence Matrix) and VGG16 to visualize phenotypic textures among local 3 Thunmus species, using SVM with different kernel functions Tuna fish classification efficiently done [3]. The fish classification with hybrid Genetic Algorithm with Simulated Annealing and Back-Propagation classifier

implemented by some researchers which shown improvement over traditional back propagation approach with 87.7% accuracy [4].

Genetic algorithm with great deluge a meta-heuristic algorithm used for general fish model classification proposed by some researchers used to ideally categorize dangerous and non dangerous fish families effectively [5].

INTRODUCTION

Integrated environment for classification and recommendation is in demand for fisheries. Utilizing deep learning techniques with ResNet50 in this proposed system gives advantage of accurate classification of fish images. Providing fish species details, habitat information, nutritional values and geographical market demands is the key feature we focused in our system. The Singular Value Decomposition (SVD) is efficient to identify Correlational factors among the fish features extracted. The system Integrated with educational elements to enhance consumer knowledge about fish species, their habitats, and the importance of sustainable fishing practices. Collaborating with stakeholders across the fisheries sector, including fishermen, consumers, and regulatory bodies, to ensure the system meets their needs and fosters positive outcomes. The system also aimed to address key challenges in the fisheries sector by leveraging technology to enhance species identification, information dissemination, and recommendation, ultimately promoting sustainability and environmental awareness.

METHODOLOGY

In this work we adopted ResNet50 a 50-Layer Convolutional Neural Network with one Maxpool layer and one average pool layer. It performs powerful Image Classification over large data sets. Establishes residual connections allowing network to learn a set of residual functions that maps the input to desired output. The ResNet performs Deep Neural Network with multiple layers stacked upon each other. Several layers train wide variety of features with great accuracy. Reducing the problems arise in past Image classification models like ILSVRC, ImageNet, COCO and Ensemble.

The incremental noise reduction and growth in accuracy improves the high scale image classification efficiency. The training data used is a collection of tropical and shore fishes across the Indian Territory. The methodology in algorithmic view as follows.

Input:

Fish_Image List, Kernel width, stride matrix, pool matrix, residual blocks

Begin

Step 1: Constructing 7×7 CNN layers for storing training set of images

Step 2: Constructing 3×3 Max-Pool layer stride

Step 3: Additional layers construction

3×3 with 64 kernels gradient improvement

1×1, 3×3 with 256 cores

1×1, 3×3 with 256 cores, 3×3 with 512 cores

1×1 with 2048 cores, 1×1 with 512 cores, 3×3 with 512 cores

Step 4: Constructing average pooling with 1000 nodes with soft max activation function

Step 5: Partitioning of data one for training and one for validation

Step 6: applying CNN classification

Step 7: Extracting feature set as Ψ_{FS} for future data classification

Stop.

The collected fish image data from web resources are subjected to included into residual blocks of 50 layers. The residual block enables deep learning networks to train data by alleviating and vanishing gradient problem. The short circuit connections that bypass certain layers improve the depth of images. The ResNet50 pivot components are supported with SVM model to align preprocessed image vector data into significant axis with alignment. ResNet50 Initiates multiple CNN layers with pivotal components of images. Each layer is paired with batch normalization using Residual Learning Unit activation function. Max pooling layers allow algorithm to down sample feature maps the fully connected layers in output layer perform final classification based on softmax activation.

The Singular Value Decomposition in this work used for generating recommendations based on fish features, market analysis and consumer surveys. The SVD method applied for personalized fish training data collection, it factorizes the image data into matrices of recommendations. This technique uncovers the latent patterns and preferences from user surveys also. Initially SVD decomposes the matrix into three separate matrices User Matrix (U), Singular value Matrix (S) and Item Matrix (V). These matrices collectively capture the underlying latent features that influence user preferences and item characteristics. By retaining only the top-k singular values and their corresponding columns of U and rows of V, the dimensionality of the matrices is effectively reduced while preserving the most significant features.

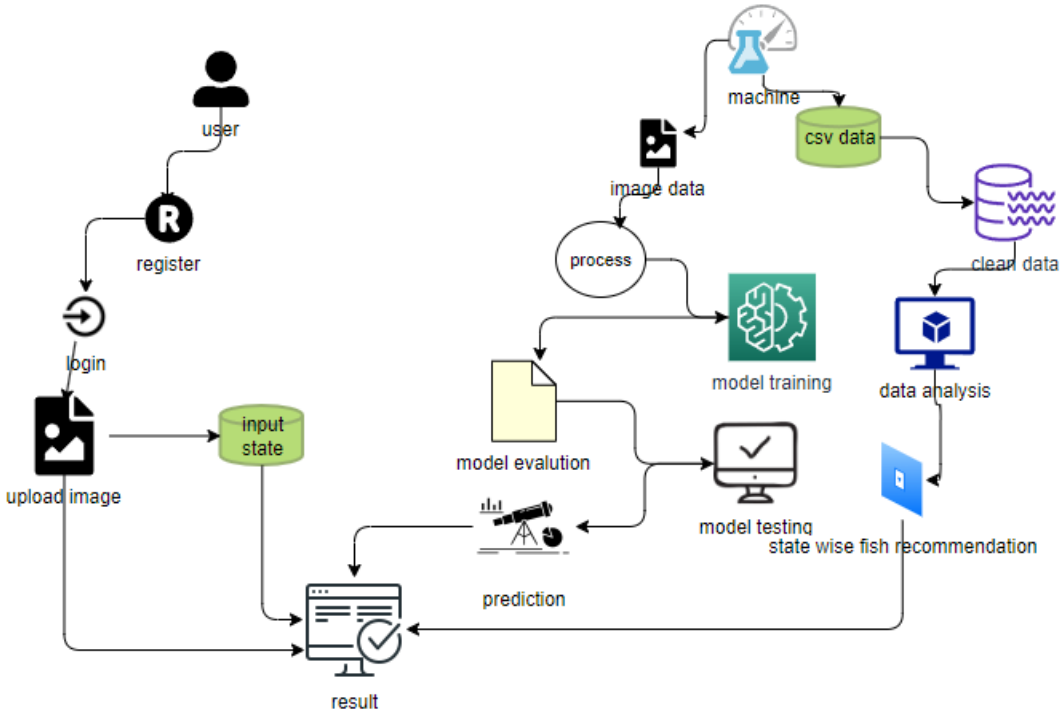

Figure 1: Architectural work flow for Recommendation System

To generate personalized recommendations for a specific user, the reduced matrices are multiplied to reconstruct the original interaction matrix, estimating the user's preferences for unseen items. The system then selects the top-N items with the highest predicted ratings or likelihood of interest for recommendation. By integrating SVD into the system, users receive tailored fish recommendations based on their individual preferences, consumption history, and regional availability. This personalized approach not only enhances user satisfaction but

also promotes sustainable fishing practices by recommending species that align with their preferences and local ecosystems. Furthermore, by combining ResNet50 for accurate species classification with SVD for personalized recommendations, the system offers a comprehensive solution that addresses both the identification and recommendation aspects of the fisheries sector, fostering informed decision-making and environmental consciousness among users.

RESULT ANALYSIS

The application developed using a web portal where users (aqua farmers, stakeholders and customers) must register to this service. After their account activation the home screen opens for user with services like classification and recommendation as shown in figure 2. The figure 3 represents a file dialog box to accept the image of a fish. User can provide fish images belonging to his territory as input. Once the input submitted the CNN algorithm in ResNet50 performs residual deep neural network analysis to identify the fish species for labeling the new input. As shown in figure 4 the user submitted fish image identified with its species features.

Figure 2: Home Screen of System

The information also provides its survival territories across the globe. The details of its harvesting period and seasonal growth of it displayed. The application helps to predict new fish species with the available training data. For every new labeling the data item is added to training data with accuracy in classification. We considered metrics like F-measure, Silhouette score and Gini-Index for evaluating cluster quality during grouping the common fish species belonging to different territories.

Figure 3: Fish Species Classification Interface

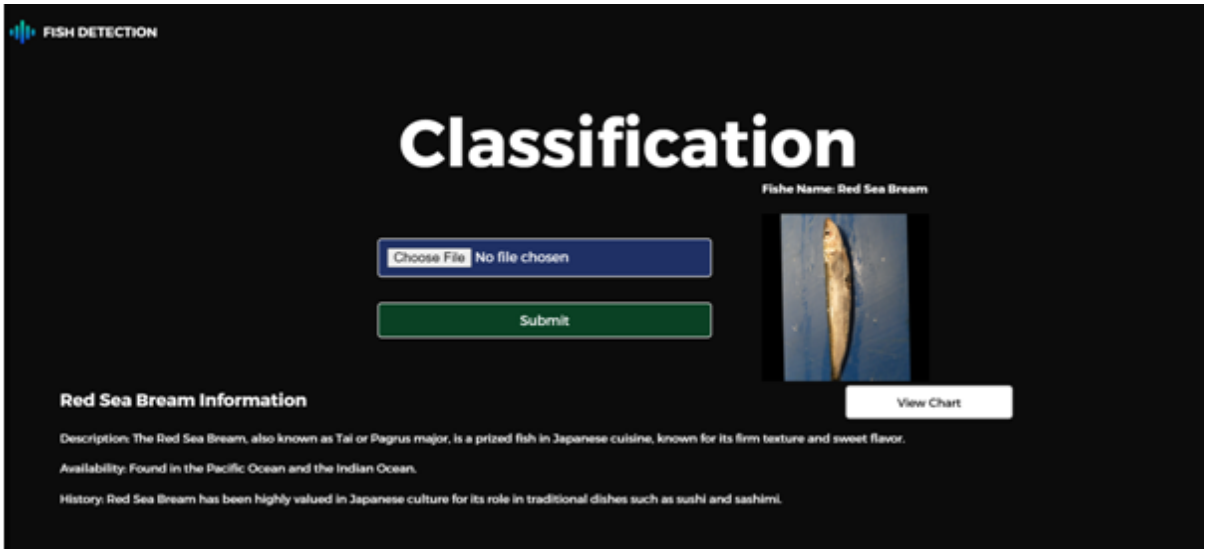

Figure 4: Classification for test data of fish

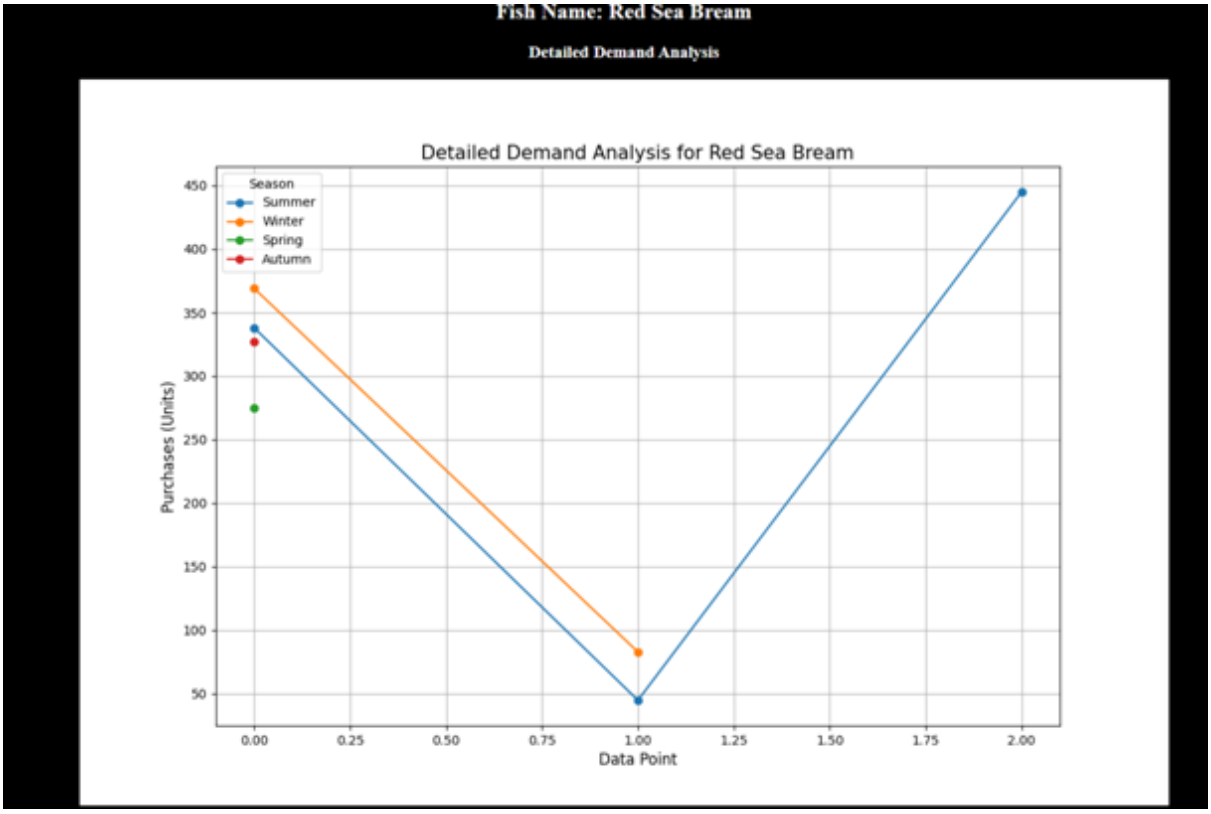

Figure 5: Fish demand chart based on season

The trend analysis algorithms on the other hand generate the seasonal demand analysis of the specified fish species. The figure 5 shows the detailed market demand analysis of ‘Red Sea Bream' fish. During the Autumn and winter the sale is decreasing due to its availability is low.

The purchase demand of this fish increases to peaks during the spring and summer. In this way our application supports the stakeholders of aqua farming or fisheries to plan investment over different fish species in different seasons across the globe. The purchase demand analysis for weekly, monthly and annual also performed with application. These statistics support accurate decision making for aqua farmers. Figure 6 shows the short term demand analysis of ‘Red Sea Bream’ fish purchase in markets. This graph represents the quantity of fish purchase in a period of time, during summer season its purchase demand raising to peak at weekends.

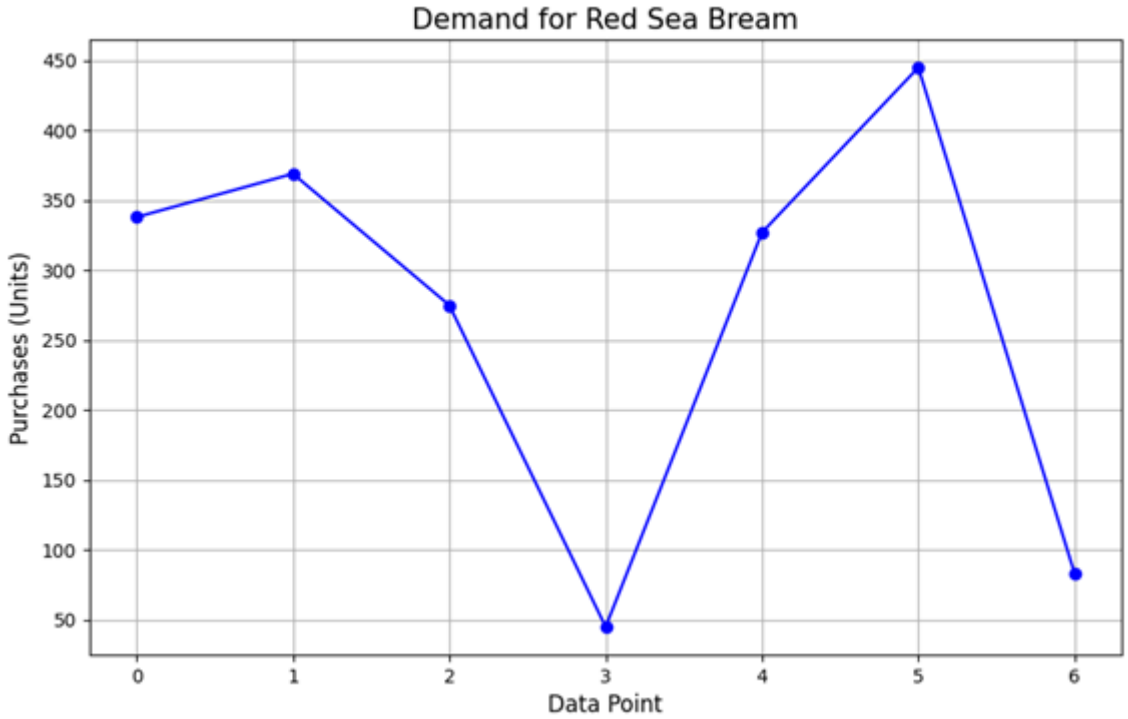

Figure 6: Purchase demand of fish during period of time

The demand analysis also ranks the fish classes according to their sale demand in state wise. The users get information about which fish is having largest purchase demand in different states of territory. Figure 7 shows the ranking of fishes having great demand in Assam state.

Figure 7: State based Fish Demand Ranking recommender

Our application focused on improving the awareness of nutritional facts of recommended fish to consumer as well as improve the decision making of fisheries, aqua farmers and stakeholders to improve their business economy.

CONCLUSION

The ResNet50 Convolutional Neural Network model applied in this paper exhibited good quality of image feature extraction among other CNN algorithms. It supported broad layers and Max-Pool permutation. The algorithm falls under residual neural network category of

Artificial Neural Networks. They form networks of layers with residual stacking of blocks with high dimensionality of features. The ease of this algorithm is highly adoptable to many machine learning classification algorithms such as SVM (Support Vector Machines), SVD (Singular Value Decomposition), Back Propagation Classification and Naive Bayes classifiers. In this paper a portal based service implemented for recommendation of fish species seasonal market for aqua culture. Also for public the recommendation of nutrition facts about available seasonal fishes provided on demand. The objective mainly focuses over protecting aqua environments and improving the cultivation of aqua species.

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