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Feature Based Underwater Fish Recognition Using SVM Classifier

Sunil Kumar C[1], Umagowri R[2], Elangovan M[3]
[1]Professor, Department of Computer Science and Engineering,
Mahendra Engineering College, Mahendhirapuri, Namakkal District, Mallasamudram, Tamilnadu, India.
[2]Assistant Professor, Department of Computer Science and Engineering,
Mahendra Engineering College, Mahendhirapuri, Namakkal District, Mallasamudram, Tamilnadu, India.
[3]Assistant Professor, Department of Computer Science and Engineering,
Mahendra Engineering College, Mahendhirapuri, Namakkal District, Mallasamudram, Tamilnadu, India.

Abstract: An approach for underwater fish recognition based on wavelet transform is presented in this paper. This approach decomposes the input image into sub-bands by using the multi resolutional analysis known as Discrete Wavelet Transform (DWT). As each sub-band in the decomposed image contains useful information about the image, the mean values of every sub-band are assumed as features. This approach is tested on Underwater Photography - A Fish Database. The database contains 7953 pictures of 1458 different species. The database is considered for the classification based on Support Vector machine (SVM) classifier. The result shows that maximum recognition accuracy of 90.74% is achieved by the wavelet features.

Keywords: Underwater fish recognition, wavelet transform, Haar wavelet, SVM Classifier.

I. INTRODUCTION

A model that captures the contextual information from more than a hundred object categories using a tree structure is presented in [1]. A tree based context model that improves the object recognition performance and also provides a coherent interpretation that enables a reliable image querying system by multiple object categories. Group Sensitive Multiple Kernel Learning (GSMKL) method for object recognition to accommodate the intra-class diversity and the inter-class correlation is presented in [2].

The distinct multicolored regions are detected using edge maps and clustering. An illumination and rotation invariant object recognition system is proposed in [3]. The color desriptions from distinct regions covering multiple segments are considered for object representation in [4]. A method used for the category of object recognition by civilizing the popular methods from the following two aspects is proposed in [5]. Models that are used for capturing the contextual information among the hundred object categories using a tree structure are proposed in [6]. It uses objects that contain many instances of different object categories.

A new video surveillance object recognition algorithm is presented in [7], in which improved invariant moments and length-width ratio of object are extracted as shape feature. Bayesian approach of dynamically selecting camera parameters to distinguish a given object from a finite set of object classes is proposed in [8]. The Gaussian process regression is applied to learn the likelihood of image features given the object classes and camera parameters.

II. PROPOSED SYSTEM

The method for underwater fish recognition system is built based on extraction of DWT features in the first step. These features are tested by the classifier where the output is obtained as the second step. These two steps are done for both the training and the testing input images. The framework of our underwater fish recognition system is as shown fig 1.

A.FEATURE EXTRACTION

The feature extraction is the most important step in all machine learning systems. Likewise in our system the DWT features are extracted in each level of decomposition method. Before extracting the features, first the input images undergoes the pre-processing step where the colour conversion of RGB to Gray colour conversion is done. By using these pre-processed images only the DWT features are extracted. The DWT features will be having discrete level of wavelet transform features. This feature extraction is done for various levels of decomposition process. The features extracted are saved as trained database that are used later in classification process.

B.CLASSIFICATION

The same step is done for both the training set and testing sets. The extracted features are stored in the database according to their equivalent index class for the recognition. The features are extracted and are given as the inputs for the classifier as they need two types of inputs like trained database as one input and the tested image features as another input. Then the SVM classifier

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used here will start to compare both the features and separate the image class according to the species in the present.

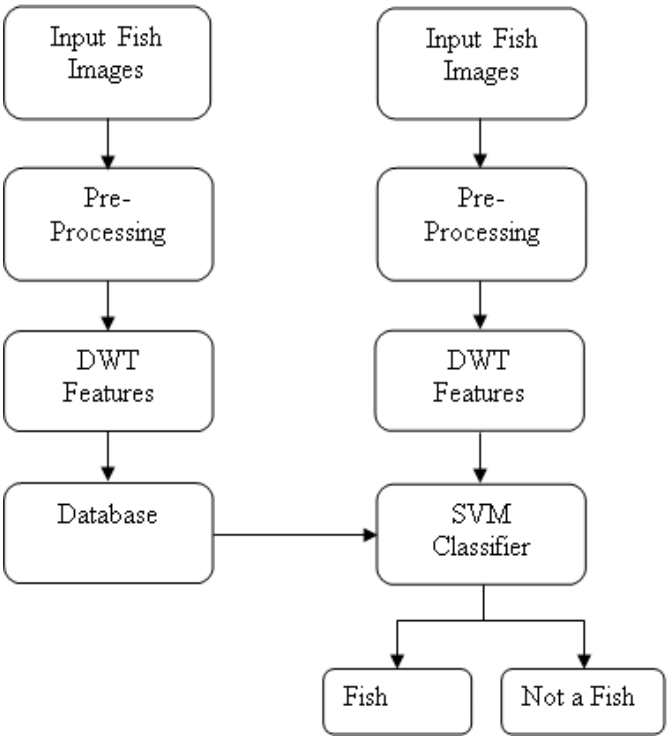

Figure 1 Framework of Underwater fish Recognition System

III. RESULTS

The underwater fish recognition system based on DWT features are tested on Underwater Photography - A Fish Database. The database contains 7953 pictures of 1458 different species. The images are tested and classified by using the SVM classifier. The size of images present in the database are of 256X256 in size and is of 1458 different species. So as to calculate the performance of our proposed system, the given database is separated into two parts namely training and testing set of database images. The DWT features are extracted and are tested and classified by using the SVM classifier as explained above.

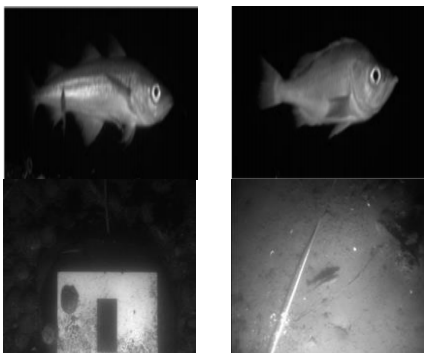

Figure 2: Sample Input Images

Table 1 explains the accuracies of the recognition that are obtained in this system for the underwater fish recognition system. Figure 2 shows the sample input images of the proposed system.

Table 1: Recognition accuracy of the underwater fish recognition system

Level of Decomposition	**Recognition accuracy (%)**					
	^{0}	5^0	0^0	5^0	0^0	0^0
1	7.25	9.57	4.18	7.42	1.04	3.51
2	87.38	78.80	73.02	66.84	58.03	51.71
3	89.91	81.72	77.15	70.45	64.17	58.63
4	95.52	89.31	83.30	75.03	68.76	61.51
5	98.63	94.57	89.85	83.63	76.95	69.57

The approach uses up to 5th level of DWT decomposition. The SVM classifier makes use of Euclidean distance as distance measure for classification. Among the 1458 species used 1429 species are classified accurately and only 39 species are misclassified. Performance of the proposed feature based underwater fish recognition using SVM classifier is shown in the below Figure 3.

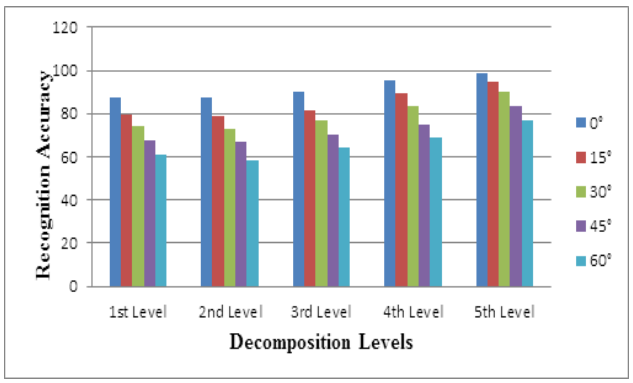

Fig : Performance of the Proposed Underwater Fish Recognition System

IV. CONCLUSION

In this paper, a system for recognition of underwater fish is done based on DWT features and SVM classifier is explained. The system uses the subband energies of DWT as features that are used to represent the type of the fish from the fish database. The system is tested with six different training set that are separated from the database. Result stats that the system gives a good recognition accuracy of 98.63% for the features extracted at 5th level of DWT decomposition and the overall recognition accuracy is 90.74% of db.

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