



Dove Species Categories Classification based on Image Processing and Machine Learning Techniques

Sulaya Betsabe Bayancela-Delgado

sulaya.bayancela@epoch.edu.ec

<https://orcid.org/0000-0003-4589-5488>

Facultad de Recursos Naturales.

Escuela Superior Politécnica de Chimborazo – ESPOCH

Omar Rolando Quimbíta Chiluisa

orquimbíta@espe.edu.ec

<https://orcid.org/0000-0002-8332-2173>

Universidad De Las Fuerzas Armadas (ESPE)

Coello-Cabezas Julio

julio.coello@epoch.edu.ec

<https://orcid.org/0000-0002-4823-6763>

Grupo de Investigación en Materiales Avanzados (GIMA), Escuela Superior Politécnica de Chimborazo (ESPOCH)
– Sede Orellana, Ecuador.

Danny Alexander Rivas Sierra

drivas@uteq.edu.ec

Universidad Técnica Estatal de Quevedo, Facultad de Ciencias de la Industria y Producción

Byron Oviedo

boviedo@uteq.edu.ec

<https://orcid.org/0000-0002-5366-5917>

Universidad Técnica Estatal de Quevedo, Facultad de Ciencias de la Ingeniería

Abstract- In this research papers it study about the classification of dove species using machine language and image processing technique. Now a day Image Processing Technique is an advance technology for detail analysis and classification of birds' species to achieve advance result with unique qualities. In this paper the method is broadly categories into the following stages such as preprocessing stage, segmentation stage, feature extraction and K-Nearest Neighbor classifier. This investigation contains 70% for training data and 30% for testing data using dove species images. For investigations the doves species image collected is 200 images during analysis. The dataset used dove images with three classes such as accuracy of mourning dove species, accuracy of European turtle dove species, and accuracy of spotted dove species. The present investigation results that SYMLET5 analysis works well in the classification of the dove species with accuracy of 97% using K- Nearest Neighbor classifier compare with other measures.

Keyword- KNN, classification, SYMLET analysis, machine learning, image processing

1. Introduction

The bird is the unique species or creature on earth that can fly is from the class of aves. As per previous studies birds are found in various sizes from 3cm to 270 cm in length. As per the study

says birds are an only living group of dinosaurs that exist on earth. Birds are the only vertebrate which is featured by feather, hard beaked jaws, high metabolic rate, a four-chambered heart, and a strong lightweight skeleton [1]. The birds are from the bigger kingdom called Animalia. The inner skeleton of the birds is of spindle shape which contains a spine, limbs, and a skull. This spindle shape skeleton helps them to fly more efficiently [2]. The study of the science of birds is called ornithology. As per the study, there are 90000 species of birds and 40 classified birds available all around the world having different characteristics [3]. The bones are hollow in design to make the body lighter. Birds have a great ability to adjust their body temperature with the surroundings to maintain constant body temperature [4]. As the birds used their lower two limbs for movement on the ground hence they are called bipedal species. The upper to limbs they used to fly in the air. The bird body and wings are covered with feathers which protect it in different weather condition and also help them to fly. The legs are only covered with scales. The birds are usually very intelligent and teachable species as they are having a very developed brain. They have a very complex nervous system. Some studies are also saying that birds are from a group of reptiles like lizards, crocodiles, etc [5]. Birds have two sex's male or female which is determined by W and Z chromosomes [6]-[7]. Birds have internal fertilization after copulating a male bird with a female bird. Male birds have ZZ chromosomes and female birds have WZ chromosomes. Birds are an oviparous animal that lays hard-shelled waterproof eggs for their reproduction [8]-[9]. Birds generally eat fruit, nectar, seeds, buds, worms, and various insects and small animals, etc. The digestive system of the bird is made up of unique arrangements as it contains swallowed stones for grinding which compensate the requirement of teeth [10]. Mourning dove is the most important member of the dove species. The other name of mourning dove is American mourning. It is most widespread and abundant North American birds. The color of mourning doves is brown and light gray muted in colors. European turtle dove is the Columbidae bird family. It breeds over south western Palearctic wbrownhich include north Africa. It is slighter and smaller dove, with measures of 26-28cm based on length with weights 100-156g. It is recognized by its brown colour with black and white striped patch into its neck. Spotted dove long and small tailed pigeon native range on Indian subcontinent. In Indian it found in moister region.





Figure 1- Mourning Dove, European turtle Dove, and Spotted Dove

2. Methodology

This research papers follows investigation on dove species classification using image processing techniques with machine learning methodologies using dove images such Mourning dove species, European turtle dove species, and spotted dove species. The method is broadly categories into the following stages such as preprocessing stage, segmentation stage, feature extraction and K-Nearest Neighbor classifier. Data collected from different source for analysis of dove classification with digital technology. Figure 2 represents methodologies for the research papers.

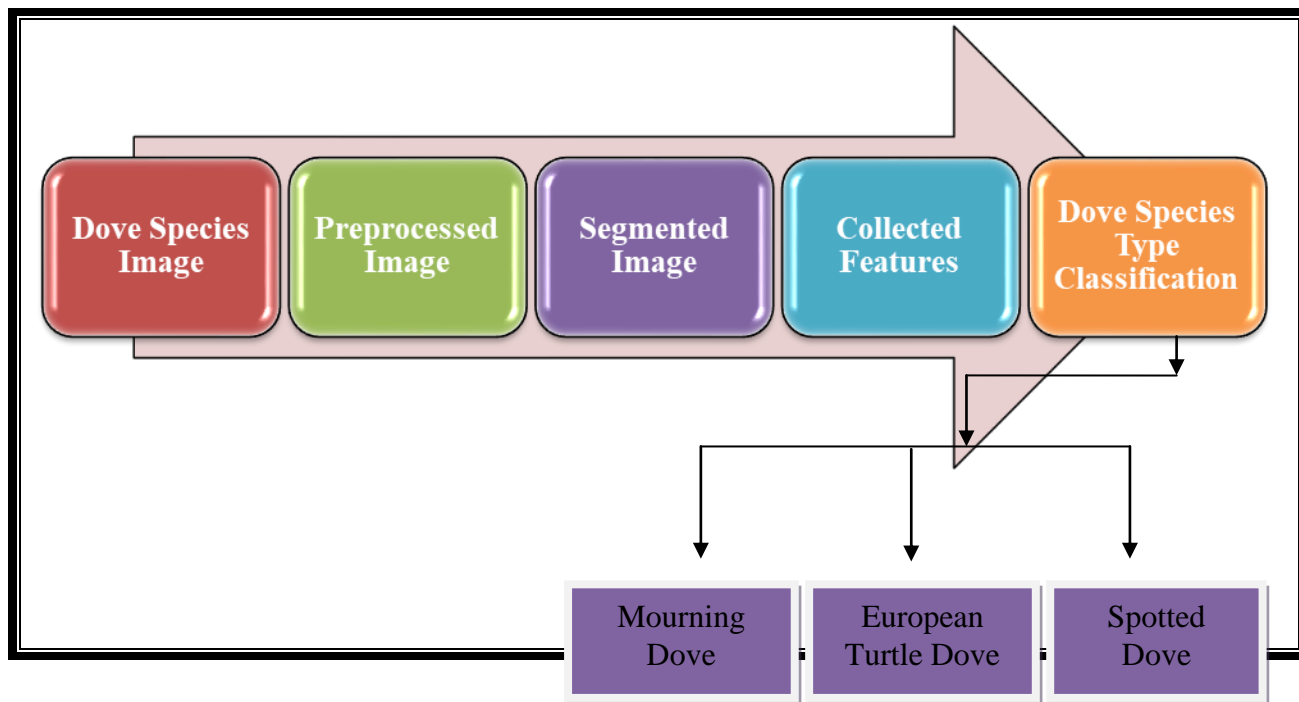




Figure 2- Methodology

3. Preprocessing

Preprocessing method helps in removing of background noise from input images of dove species during investigations. To remove noise from dove species images the median filter is used. Median filters play an important role in removing noise from images. The median filter is a non-linear statistical filter, which describes in spatial domain form. It is smoothing, doves species images by utilizing the median value of the neighborhood pixels over the image. Median value used is 3x3 masks the given matrix shows the marked computed pixel calculation.

Matrix-form with (3x3) Masks
$$\begin{bmatrix} 1 & 5 & 7 \\ 2 & 4 & 6 \\ 4 & 2 & 1 \end{bmatrix}$$

Ste-1: Arrangement in ascending order

1	1	2	2	4	4	5	6	7
---	---	---	---	---	---	---	---	---

Step-2: Secondly computed based on pixel order

1	1	2	2	4	4	5	6	7
---	---	---	---	---	---	---	---	---

$$\begin{bmatrix} 1 & 5 & 7 \\ 2 & 4 & 6 \\ 4 & 2 & 1 \end{bmatrix} \longrightarrow \begin{bmatrix} 1 & 5 & 7 \\ 2 & 4 & 6 \\ 3 & 2 & 1 \end{bmatrix}$$

Original-Image

Median-filter Image

When the median filter used to a dove species image, then the pixel values which are very different from each other are eliminated from the process. By eliminating it select the most nearer pixel from the neighborhood value the process repeats until it achieves the noise-free images.

4. Segmentation

Segmentation method helps in detecting the region of interest area for the particular image which needs to be examined and analysis. The main objective of image segmentation is to find out region-based interest over the dove species image which helps in extracting more detailed information of dove species for characterization.

5. Feature Extraction

Feature extracted used as color based analysis (RGB Colors), mean, standard deviation, ellipticity, entropy, skewness, intensity, and correlation co-efficient with wavelet such as symlet1, symlet2, symlet3, symlet4, symlet5 analysis.

6. Classification

For this research k- Nearest Neighbor classifier method is investigated with three classes such as Mourning dove species, European turtle dove species, and spotted dove species. It is a non-parametric method used for classification. In the KNN classifier, an object is classified according to the majority of votes by its neighbors and the object assigned to the nearest neighbor class among the most common once. The value assign for k is '3' it check four test classes. This investigation contains 70 % for training data and 30% for testing data with k=3. Total numbers of doves species collected is 200 images for investigations.

7. Result and Discussion

This research papers works on study of Dove species classification using image processing and machine learning methods. For this research data collected as 200 dove species images with three categories classes such as Mourning dove, European turtle dove, Spotted dove has been collected for investigation and analysis. Data collected from many official sources for classification of types of dove species during investigation periods. Using classification methods KNN classifier has been considered for classification with 3 classes among them 70% used for training and 30% used for testing features. The methods test the most nearest pixel values for dove species categories classification. During result and discussion following methods are considered sequentially. For classification of methods wavelet analysis such as SYMLET analysis is considered for characterization of dove species.

Table 1: K-NN classifier with symlet1 analysis for Dove species categories Classifications

Dove Species classification Using KNN Classifier										
Symlet1 Analysis										
Features	RC	GC	BC	MV	SD	E-1	E-2	S	I	CC
Accuracy Mourning Dove (%)	72	70	70	68	49	71	43	70	88	63
Accuracy European Turtle Dove (%)	60	66	63	78	78	54	69	65	73	65
Accuracy Spotted Dove (%)	70	77	61	63	89	66	81	50	46	50

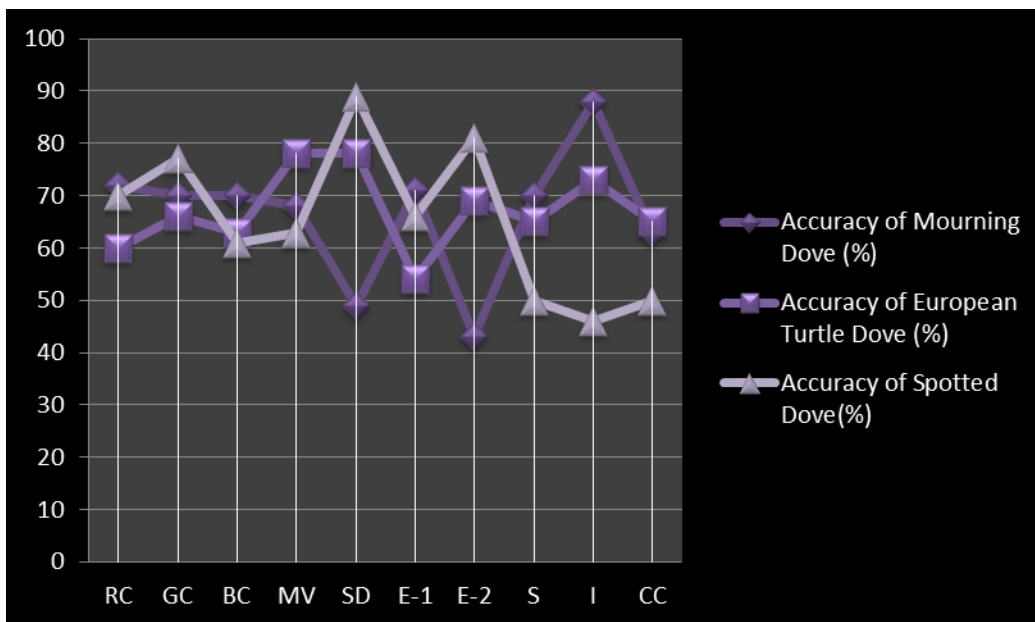


Figure 3- Dove Species Classification using Symlet1 Analysis

Table 1 with figure 3 denotes detailed result of a classification using K-NN classifier and Symlet1 analysis for dove species image categories classification such as accuracy of Mourning dove species, accuracy of European turtle dove species, and accuracy of spotted dove species.

Table 2: K-NN classifier with symlet2 analysis for Dove species categories Classifications

Dove Species classification Using KNN Classifier										
Symlet2 Analysis										
Features	RC	GC	BC	MV	SD	E-1	E-2	S	I	CC
Accuracy Mourning Dove (%)	60	77	75	61	74	76	77	76	43	70
Accuracy European Turtle Dove (%)	63	59	71	73	82	59	91	55	60	72
Accuracy Spotted Dove (%)	88	41	83	57	61	86	76	72	73	71

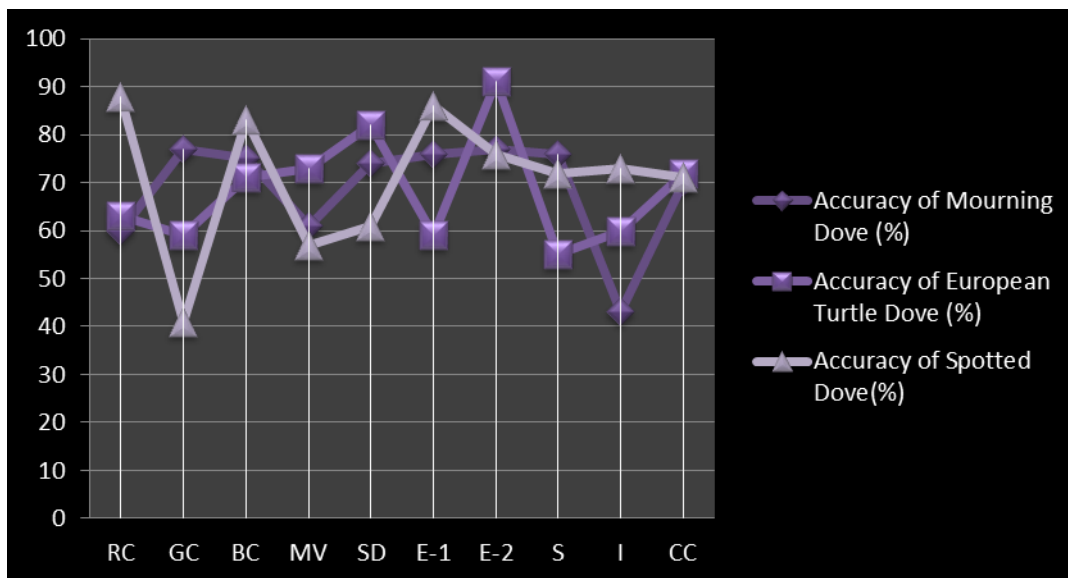


Figure 4- Dove Species Classification using Symlet2 Analysis

Table 2 with figure 4 denotes detailed result of a classification using K-NN classifier and Symlet2 analysis for dove species image categories classification such as accuracy of Mourning dove species, accuracy of European turtle dove species, and accuracy of spotted dove species. Feature extracted are color based analysis (RGB Colors) such as RC, BC, GC, mean (MV), standard_deviation (SD), ellipticity (E-1), entropy (E-2), skewness (S), intensity (I), and correlation co-efficient (CC) with wavelet analysis. The table and figures represents results based on confusion matrix for classification of type of dove species using KNN classifier with 3 classes among them 70% used for training and 30% used for testing features.

Table 3: K-NN classifier with symlet3 analysis for Dove species categories Classifications

Dove Species classification Using KNN Classifier										
Symlet3 Analysis										
Features	RC	GC	BC	MV	SD	E-1	E-2	S	I	CC
Accuracy Mourning Dove (%)	60	79	50	78	55	77	72	55	73	71
Accuracy European Turtle Dove (%)	68	82	60	89	60	85	66	64	72	79
Accuracy Spotted Dove (%)	70	82	87	64	87	80	82	60	80	60

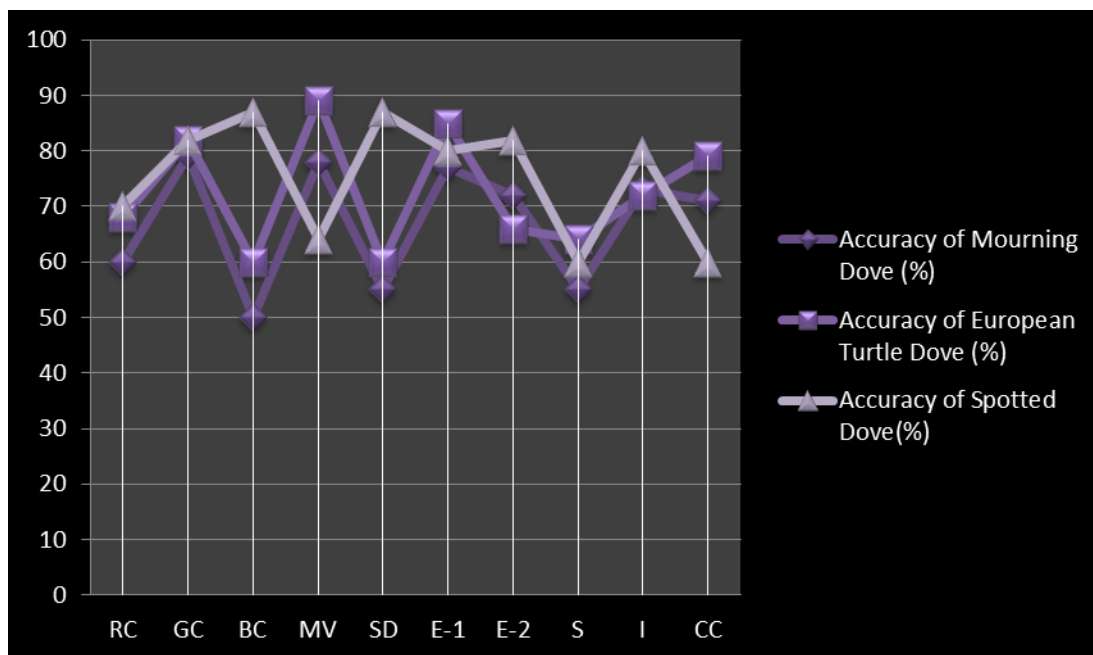


Figure 5- Dove Species Classification using Symlet3 Analysis

Table 3 with figure 5 denotes detailed result of a classification using K-NN classifier and Symlet3 analysis for dove species image categories classification such as accuracy of Mourning dove species, accuracy of European turtle dove species, and accuracy of spotted dove species. Feature extracted are color based analysis (RGB Colors) such as RC, BC, GC, mean (MV), standard_deviation (SD), ellipticity (E-1), entropy (E-2), skewness (S), intensity (I), and correlation co-efficient (CC) with wavelet analysis. The table and figures represents results based on confusion matrix for classification of type of dove species using KNN classifier with 3 classes among them 70% used for training and 30% used for testing features.

Table 4: K-NN classifier with symlet4 analysis for Dove species categories Classifications

Dove Species classification Using KNN Classifier										
Symlet4 Analysis										
Features	RC	GC	BC	MV	SD	E-1	E-2	S	I	CC
Accuracy Mourning Dove (%)	76	60	77	68	80	70	59	70	68	59
Accuracy European Turtle Dove (%)	69	50	68	55	72	40	80	70	91	62
Accuracy Spotted Dove (%)	76	64	73	68	86	70	59	70	60	55

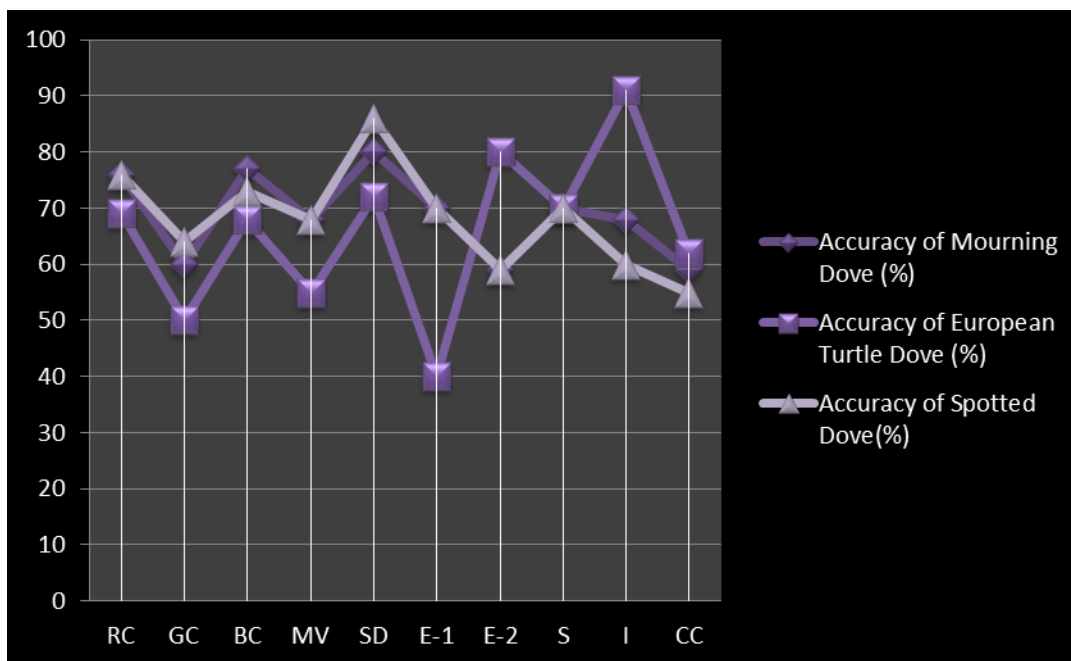


Figure 6- Dove Species Classification using Symlet4 Analysis

Table 4 with figure 6 denotes detailed result of a classification using K-NN classifier and Symlet4 analysis for dove species image categories classification such as accuracy of Mourning dove species, accuracy of European turtle dove species, and accuracy of spotted dove species. Feature extracted are color based analysis (RGB Colors) such as RC, BC, GC, mean (MV), standard_deviation (SD), ellipticity (E-1), entropy (E-2), skewness (S), intensity (I), and correlation co-efficient (CC) with wavelet analysis. The table and figures represents results based on confusion matrix for classification of type of dove species using KNN classifier with 3 classes among them 70% used for training and 30% used for testing features.

Table 5: K-NN classifier with symlet5 analysis for Dove species categories Classifications

Dove Species classification Using KNN Classifier										
Symlet5 Analysis										
Features	RC	GC	BC	MV	SD	E-1	E-2	S	I	CC
Accuracy Mourning Dove (%)	70	77	72	71	64	70	60	50	68	73
Accuracy European Turtle Dove (%)	85	80	88	68	62	69	77	66	71	62
Accuracy Spotted Dove (%)	67	71	61	75	76	97	70	75	78	80

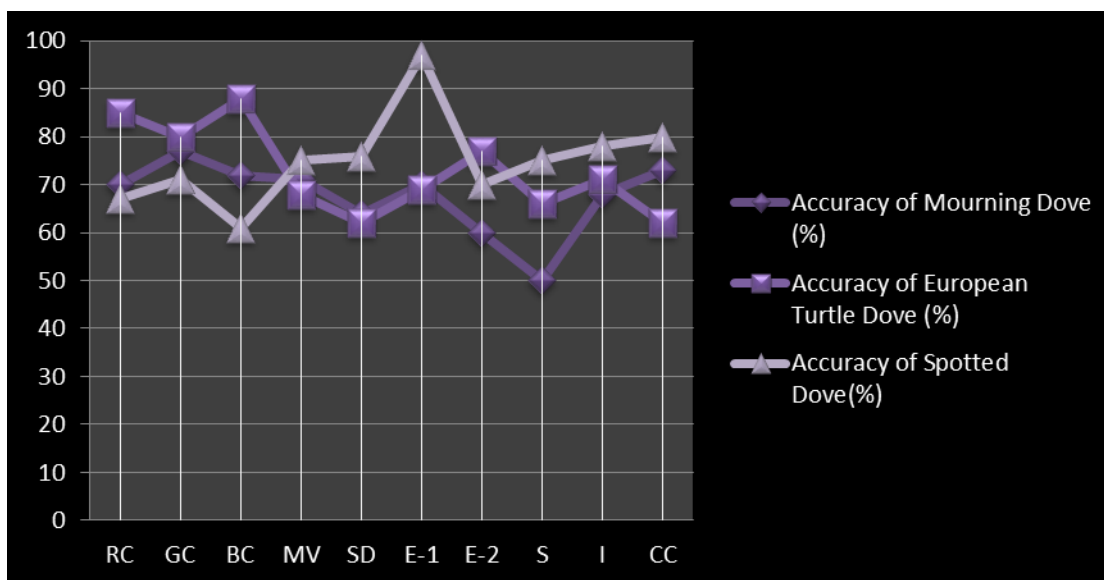


Figure 7- Dove Species Classification using Symlet5 Analysis

Table 5 with figure 7 denotes detailed result of a classification using K-NN classifier and Symlet5 analysis for dove species image categories classification such as accuracy of Mourning dove species, accuracy of European turtle dove species, and accuracy of spotted dove species. Feature extracted are color based analysis (RGB Colors) such as RC, BC, GC, mean (MV), standard_deviation (SD), ellipticity (E-1), entropy (E-2), skewness (S), intensity (I), and correlation co-efficient (CC) with wavelet analysis. The table and figures represents results based on confusion matrix for classification of type of dove species using KNN classifier with 3 classes among them 70% used for training and 30% used for testing features.

Table 6: KNN classifier with Combine SYMLET analysis for Dove Species Classifications

	Symlet1	Symlet2	Symlet3	Symlet4	Symlet5
Accuracy Mourning Dove (%)	88	77	78	80	77
Accuracy European Turtle Dove (%)	78	91	89	91	97
Accuracy Spotted Dove (%)	89	88	87	86	89

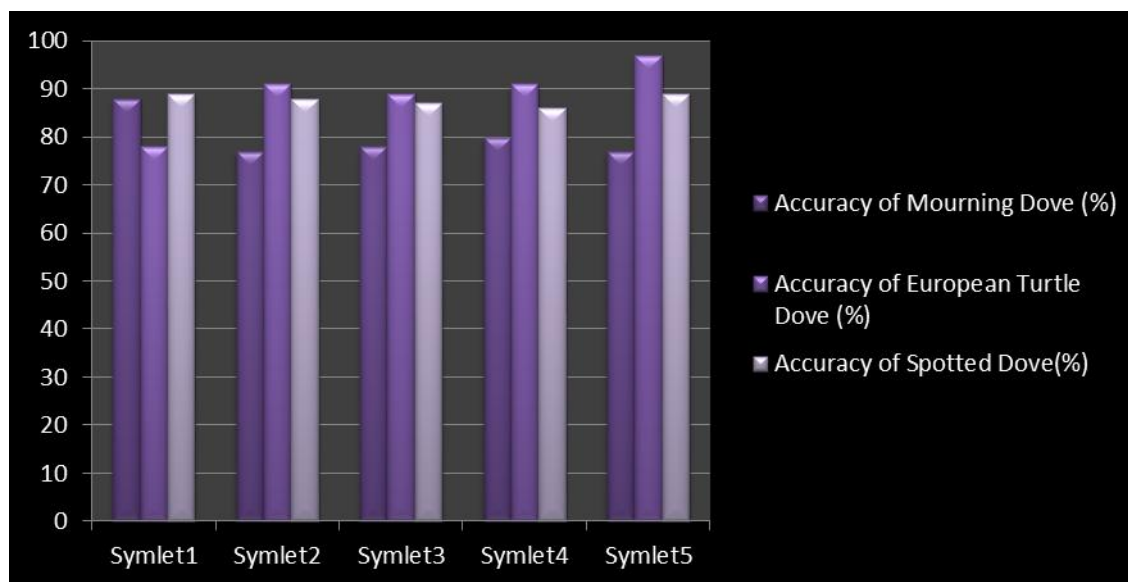


Figure 8- Combined SYMLET analysis with KNN Classifier

Table 6 with figure 8 represents result of classification using K-NN classifier with SYMLET analysis for dove species categories classification such as such as accuracy of Mourning dove species, accuracy of European turtle dove species, and accuracy of spotted dove species. The table and figures represents results based on confusion matrix for classification of type of dove species using KNN classifier with 3 classes among them 70% used for training and 30% used for testing features. Feature extracted are color based analysis (RGB Colors), mean, standard_deviation, ellipticity, entropy, skewness, intensity, and correlation co-coefficient with wavelet analysis. In the KNN classifier, an object is classified according to the majority of votes by its neighbors and the object assigned to the nearest neighbor class among the most common once. The value assign for k is '3' it check three test classes. The present investigation results that Symlet5 analysis works well in the classification of dove species classification with an accuracy of 97% using the K-Nearest Neighbor classifier.

Conclusion

In this research papers it study about the classification of dove species using machine language and image processing technique. Now a day Image Processing Technique is an advance technology for detail analysis of dove species. In this paper the method is broadly categories into the following stages such as preprocessing stage, segmentation stage, feature extraction and K-Nearest Neighbor classifier. This investigation contains 70 % for training data and 30% for testing data with k=3. The dataset used dove images with three classes such as accuracy of mourning dove species, accuracy of European turtle dove species, and accuracy of spotted dove species. The present investigation results that SYMLET5 analysis works well in the

classification of the dove species with accuracy of 97% using K- Nearest Neighbor classifier compare with other measures.

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