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Color Recognition using K-Nearest Neighbors Machine Learning classification algorithm trained with Color Histogram Features.

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Abstract - *Color recognition plays important role in image processing techniques, for applications based on color, like object recognition, face recognition, skin color recognition etc. The accuracy of color recognition plays an important role in many applications. This paper is based on color classification by K-Nearest Neighbors classification algorithm and R, G, B Color Histogram is used to train KNN algorithm. It can recognize eight different colors namely White, Black, Orange, Yellow, Green, Red, Blue, and Violet.*

Key Words: **Feature Extraction, K-Nearest Neighbors Classifier, Color Histogram.**

1. INTRODUCTION

Many applications require real-time image processing like motion detection and color recognition. Color recognition has many applications including biometric identification, video surveillance, and object tracking. K-nearest neighbors (KNN) is widely used in neural network and machine learning algorithm. KNN algorithm is a supervised classification algorithm that needs labelled data to train on. By Using color histogram feature extraction, which is one among the image processing techniques, the features that distinguish these colors are determined. These features increase the effectiveness of the KNN classifier.

2. LITERATURE SURVEY

In 2020, **Rabia Bayraktar et al.[1]** proposed Colour recognition using colour histogram feature extraction and K-nearest neighbour classifier. The KNN classifier is used to distinguish twelve different colours. These colours are black, blue, brown, green, navy, orange, forest green, pink, red, violet, white and yellow. Colour histogram feature extraction method is used to extract features that distinguish the colours. Black and pink have the best accuracy (90%) with K=5. However, violet and yellow have the best ROC curve values. It can be seen from the results that training data and K value are very important in classification accuracy, and the accuracy is increased with appropriate training dataset and correct selected K values.

In 2018, **Shima Ramesh Maniyath et al.[2]** proposed soil colour detection using digital image processing. MATLAB coding is used for the process. From Munsell soil chart images is used for creation of database. HSV segmentation algorithm is used to segregate soil section from the background of given input image. Images are classified based on their RGB values using KNN and images are labelled with Munsell soil notation. The output is acquired as per the Munsell soil notation.

In 2018, **P. Sudharshan Duth et al. [3]** proposed a method for using color thresholds for identification of 2-D images using the RGB Color model to detect colors. The colors detected here are red, green, blue, magenta, cyan and yellow. The given 3-D color image is converted into Grey-Scale image, then the two images are subtracted and two dimensional black and white picture is obtained, unwanted noise from the image is removed by median filtering. Detecting with a linked component digital images are marked in linked region. Metric for every marking area is calculated using bounding box and its properties. The shade of each image element is recognized by analyzing RGB value of each pixel.

In 2016, **Can Eyupoglu.[6]** proposed Color Face Recognition Using KNN Classification algorithm and PCA. KNN is used for classification of color face images. Initially k-NN classifier used to perform the classification. Later, Principal Component Analysis (PCA) and k-NN classifier are used together to extract features of color face images and to simplify the image data. The applications are tested for different color space models and k values. The colour space models are HSV, YCbCr, RGB and YIQ. Finally, experiment results are compared with each other. Based on the mentioned two tables, the classification accuracies of KNN and classification accuracies of PCA and KNN, the increase of k value decreases the classification accuracies. Besides, the change of k value does not affect the classification accuracy in some situations.

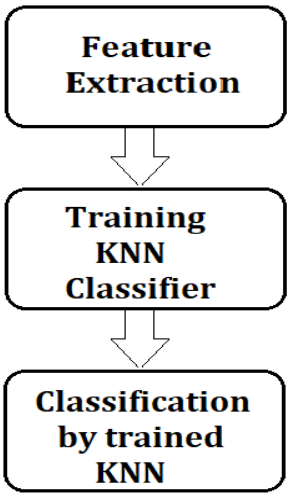
In 2015, **S Siddesha et al.[9]** presented a method for classification of raw arecanut. Classification is based on colour attributes. Colour moments and colour histogram along with KNN algorithm is used for classification of raw arecanut. This model uses KNN classifier with four distance measures to examine the impact. Result of 98.13% was obtained using K nearest neighbor having K value as 3 and Euclidean distance measure for colour histogram features. In theoretical approach, accuracy of 20% was obtained.

In 2013, **Sidhanta Kumar Kar et al.[12]** proposed statistical approach for color detection. It begins with the image acquisition and boundary detection of the object is done to distinguish it from the background. The binary values of

different layers id obtained using iterative method. For processing pixel wise Region of Interest (ROI) was used. Statistical method is used to determine threshold that helps in color detection of an object. Thresholding method is applied over the ROI obtained, the detection of the color of the given object is performed.

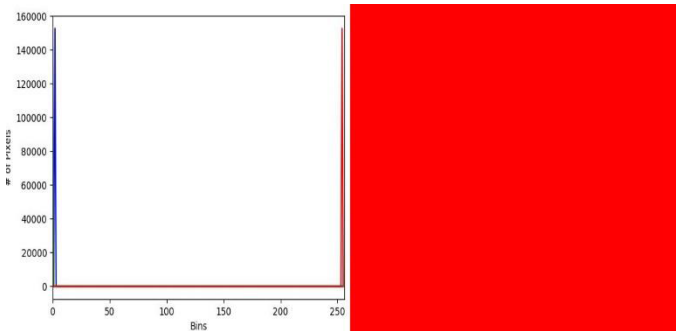
3. METHODOLOGY

Color classification is done by applying K-Nearest Neighbor algorithm. KNN is trained by using R, G, B Colour Histogram values. The general steps involved are stated below:



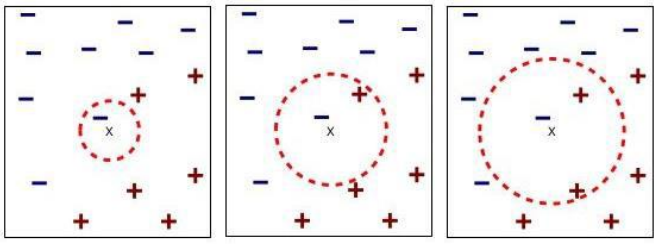
3.1 Feature Extraction

Color Histogram represents the color distribution of an image. In digital images Color histogram refers to amount of pixels that have colors in a list of color ranges, that distance the image's color space, that is set of all possible color values. RGB color histogram of an input image can be obtained, for red images, plot of RGB color histogram is given below. Bin number of histogram is used with the highest value of pixel count for RGB as attributes so we can get the dominant RGB values for making feature vectors for training. The RGB values for each training image is obtained by color Histogram and is labelled because KNN classifier is a supervised learning algorithm.



3.2 Training KNN classifier

KNN classifier algorithm is trained using RGB Colour Histogram values.

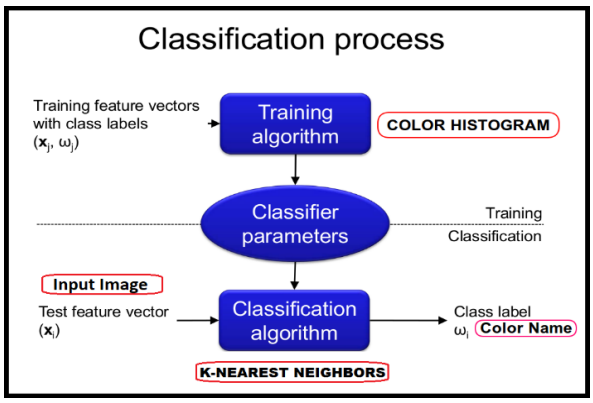


(a) 1-nearest neighbor (b) 2-nearest neighbor (c) 3-nearest neighbor

K-nearest neighbors of a record x are data points that have the k smallest distance to x

3.3 Classification using trained KNN

An algorithm which executes classification in a concrete execution, is known as a classifier. The word "classifier" refers to the mathematical function, which is executed using a classification algorithm, that plots given data to a group. KNN algorithm stores all the cases obtained and classification of new cases is done on the basis of similarity measure.



4. CONCLUSION

In this paper, we present color recognition method using KNN classifier which is trained by RGB color histogram. The training dataset plays a very important role in classification accuracy. It can classify eight different colors namely White, Black, Orange, Green, Yellow, Red, Blue, and Violet. For classification of more colors and for increasing the accuracy large training dataset can be used.

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