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Color Detection using K-Nearest Neighbors Classification Algorithm

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Abstract - Color Recognition plays very 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 very important role in many applications. This paper is based on color classification by K-Nearest Neighbor classification algorithm and R, G, B Color Histogram is used to train KNN algorithm. It can recognize eight different colors namely Yellow, Voilet, Orange, White, Green, Red, Blue, and Black.

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

1.INTRODUCTION

Color plays a important role in human daily life for recognition. Color plays crucial role on how we perceive and analyze things around us. Based on primary colors (Red, Green, Blue), a lot of color models were established to quantitatively measure color. Quantitative color measurement is one of the key component in color science, scene analysis, detection and tracking. RGB and HSV color model are one of the simple color models that are widely used today in detection and tracking. There are many important real-world applications in which color detection can be applied, such as skin color detection, traffic light detection, vehicle color recognition, image segmentation, biometric identification, video surveillance, and etc.

2.LITERATURE SURVEY

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

In 2018, Shima Ramesh maniyath [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 the database. HSV segmentation algorithm is used to segregate soil part from the background of given input image. Images are classified based on their RGB values using K-NN and images are labelled using Munsell soil notation. The output is obtained as per the Munsell soil notation.

In 2018, M. Mary Deepa et al.[3] proposed a method for using color threshold for identification of 2-D images using the RGB Color model to detect colors. The colors detected here are blue, red, green, magenta, cyan. The given 3-D color image is converted into grey-scale image, then the 2 images are subtracted and 2 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 and metric for every marking area is calculated using bounding box and its properties. The shade of each image element is detected by analyzing RGB value of each pixel.is detected by analyzing RGB value of each pixel.

In 2016, can eyupogl[6] proposed color face recognition using K-NN 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 model and K values. The colour space models are HSV, RGB and YIQ. Finally, results are compared with each other. Based on the mentioned 2 tables, the classification accuracy of K-NN and classification accuracies of PCA and K-NN, 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, SK Niranjan 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 - classifier with 4 distance measures to examine the impact. Result of 98% was obtained using K nearest neighbor having K value as 3 and Euclidean distance measure for colour histogram features. In theoretical approach, accuracy around 20% was obtained.

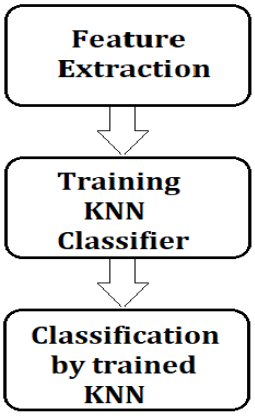
In 2013, Mihir Narayan Mohanty et al.[12] proposed Statistical approach for color recognition. It begins with the image possession and boundary detection of the object is done to distinguish it from the background. The binary values of different layers Id obtained using iterative method. For processing pixel wise Region of Interest (ROI) was used. Statistical method is used to determine threshold that helps in colour detection of an object. Thresholding method is

applied over the ROI obtained, the detection of the colour of the given object is performed.

3. METHODOLOGY

3.1. SYSTEM FRAMEWORK

Color classification is done by using K-NN classifier algorithm. The K-NN classifier is trained by image R, G, B Color Histogram value. The work-flow for the procedure is given below. The general procedure Color Recognition system includes feature extraction, training KNN classifier, classifcation by trained KNN.



3.2. IMPLEMENTATION

The plan is to implement a machine learning model to recognize different colors namely Green, Black, White, Violet, Orange, and so on. Feature extraction is performed to get the R, G, B Histogram values of the training images. Necessary feature extraction methods will be used to extract multiple features from the images. KNN algorithm is trained using R, G, B Color Histogram values. By using machine learning KNN classifier algorithm, the color of the given input image will be detected and then evaluate the model.

FEATURE EXTRACTION

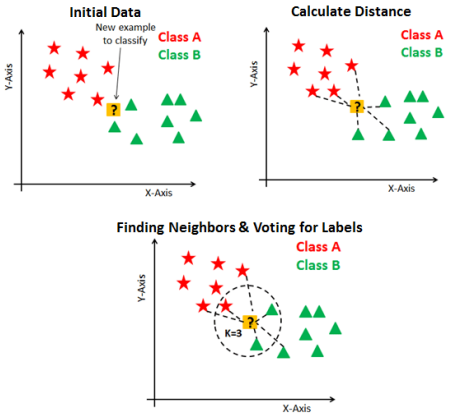
Color Histogram is the presentation of the distribution of different colors present in an image. For the images, a histogram will represent the no. of pixels that have colors in a fixed list of color range, which span the image color space, to get the achievable colors. We can get RGB color histogram of images. For example, plot the RGB color histogram for red image is given. Bin no. of histogram is used which will have the peak value of pixel count for R, G and B as feature, we can create feature vector for training using the dominant R, G and B value.

TRAINING K-NN CLASSIFIER

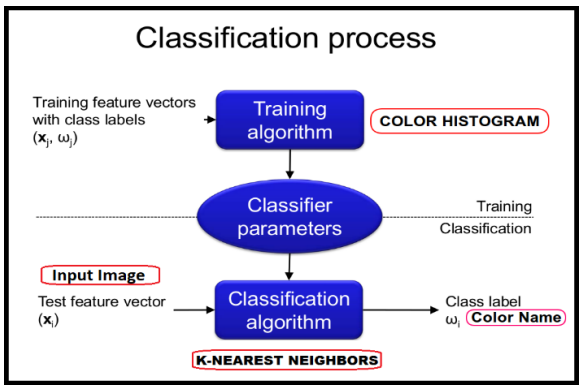
K-NN is the commonly used algorithm and it is the simplest algorithm for identifying different patterns in regression and classification problem. It is an unsupervised and this algorithm is called lazy learning algorithm. Working of K-NN starts by first calculating the distance of one test observation from all the available observations of training dataset and later followed by finding 'K' nearest neighbors of it. The above step is carried out for each test observation and this is how the similarities present in the data is found. In order to make the algorithm work best on the dataset we need to choose the most suitable distance metric. There are a lot of different methods to calculate the distance available, Euclidean distance has been chosen in this implementation. Euclidean distance function is set default in the SK-learn K-NN classifier in python. It is the measurement of straight-line distance between 2 points present in the Euclidean space.

$$d(x, y) = \sqrt{\sum_{i=1}^{n}(y_i - x_i)^2}$$

Classification by trained KNN:



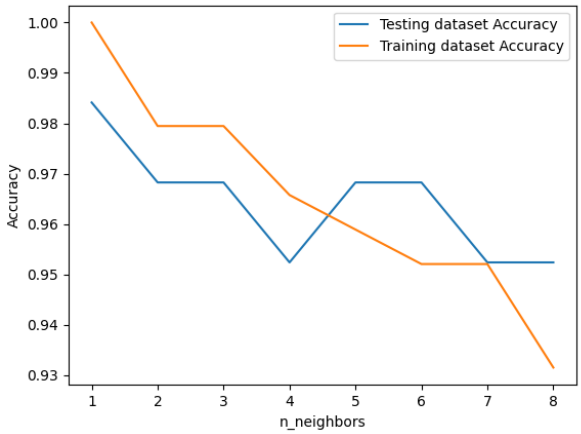
Algorithm that is used to implement classification, is called as Classifier. The term "classifier" is referred as the mathematical function, which is implemented by classification algorithm, which plots the given data into a category. K-NN is a algorithm that stores all the available cases and also classifies new cases based on the similarity measures (For Example., distance functions).



4. RESULTS AND DISCUSSION

Report	precision	recall	f1-score	support
black	0.93	1.00	0.96	13
blue	1.00	1.00	1.00	7
green	1.00	0.89	0.94	9
orange	0.89	1.00	0.94	8
red	1.00	1.00	1.00	7
violet	1.00	1.00	1.00	8
white	1.00	1.00	1.00	6
yellow	1.00	0.80	0.89	5
accuracy			0.97	63
macro avg	0.98	0.96	0.97	63
weighted avg	0.97	0.97	0.97	63

Precision, Recall, f1-Score, Support



Accuracy graph

5. CONCLUSIONS

Color recognition is an important step in most of the image processing applications. Color detection has received significant interest in most of the computer visions due to the wide range of applications including video surveillance, face indexing and so on. In this project, we present color recognition method using KNN classifier which is trained by RGB color histogram. The training data has a huge importance in accuracy. This model can classify Green, Orange, Red, Blue, Yellow White, Black, and Violet. For classifying more colors and improving the accuracy we should consider large training dataset.

In Future Color identification in real-time comprises limited colors but we wish to expand the data on which our KNN classifiers are trained to give more accurate results. In our project only 8 basic colors can be detected, we can improve the model to classify more colors and to improve the accuracy and to detect various colors desired by the user. It can be improved to detect Different shades of colors and not just the basic colors. In the existing project only single color is being detected from the given input image, it can me improved to detect multi-colors in single input image. color detection from an image can be developed further and used as a feature in software for photo editing, video editing or it may be used in color selecting and mixing software or in face detection. And real-time color identification can be used in self-driving cars, robotics and can be applied to many more technical applications.

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