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Real-Time object color Identification

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Abstract **- The computer vision field is a rapidly growing field devoted to analyzing and understanding digital images. We can create computer vision projects through OpenCV. In OpenCV image processing processes such as image filtering, simple geometric photo transformation, color space transition, histograms, etc. are covered. Picture and real-time object color identification focus on OpenCV color identification through using the RGB model as well as the K-Nearest Neighbors Classification algorithm trained on r, g, b pixel values. Color identification in the image can be done through the RGB value of the target pixel as input and then calculates the distance, and the nearest color is chosen. From this method, we can identify 800 plus different colors from our datasets including the RGB value of each color. We conduct extraction of features in real-time color identification of objects to extract their RGB color Histogram attributes from training images and trained classification algorithm via RGB Color Histogram attributes. The KNN classifier analyzes the webcam frames and performs feature extraction and then shows the color.**

Index Terms **- Color Histogram, Feature extraction, K-Nearest Neighbor (KNN)**

1.INTRODUCTION

Software applications & devices try to imitate human eyes. Using libraries like OpenCV we can develop computer vision applications. In OpenCV image processing operations such as image color analysis, color space conversion, histograms, etc. are covered. Digital image identification is a program that helps you to instantly acquire the identity of color by simply clicking on it. Then, from each color, we will measure the distance and determine the shorter one.

In Color identification of the real-time object, we can pan the camera towards the target object to identify the color. For this, we trained the KNN classifier on the training dataset which contains color images and can be updated with new colors. Color identification is a technique used in different applications like Photoshop and several other animation software as a color dropper feature. For various AI-based systems or robots color recognition of an object is required. This paper represents an approach based on the K Nearest Neighbor (KNN) classifier and feature extraction to detect the real-time color of an object. The extracted features are being used to get the Color Histogram of training images. RGB Color Histogram attributes are used to train the KNN classification algorithm. Trained K-Nearest Neighbor (KNN) is classified to scan live webcam scene by scene to perform extraction of features from each frame, and then the color is identified by trained K-Nearest Neighbor (KNN) classifier.

Color identification is an area of research and interest for more than five decades. Some of the research surveys are given below.

Manuel G. et.al., 2020 used the method of the extreme color channel, compared with the other two within RGB. Observations: The target color channel value is compared to the other two-color channels in the equations. The color with the greatest channel value is the target color.

Jayme et.al., 2016 used the method of three-color models RGB, HSV, and CIE Lab to determine the final result. Observations: Color transformation is applied using RGB-related equations. The best result was selected after applying transformation 3 times.

I.Al-Bahadlya et.al., 2005 used the method of the intensity of the color determined using two-color models RGB and CMY. Observations: Color pixels are taken as inputs and recorded as RGB then converted to CMY intensities.

Trupti et.al., 2013 used the method of Image Segmentation Using XYZ Color Plane. Observations: RGB values are converted into XYZ color space value Then thresholding is applied to anyone's plane.

Shamik et.al., 2002 used the method of Image Segmentation Using Features from the HSV Color Space. Observations: The RGB value of a pixel is first

transformed to the HSV value, the pixel features are clustered using the K-Means clustering algorithm.
Ramaraj.M, et.al., 2016 used the method of Color Based Image Segmentation. Observations: Performs the image segmentation using the Lab color model.

2. PROPOSED SYSTEM

For color detection in a single image (Figure 1).
To construct an argument parser, take an image as output using the argparse library. The drawing technique computes the pixel RGB values on which we double-click. The (x,y) coordinates of the mouse pointer verify the function framework when the double click occurs. Within the x,y position of the mouse RGB values are calculated. We measure the distance after getting the RGB value that can indicate how nearer we are to color and select one with the smallest distance.
The formula which we used to measures the distance:
distance = absolute value of {(R – R^{ith} Color) + (G – G^{ith} Color) + (B – B^{ith} Color)}
(R-Red G-Green B-Blue)
After calculating the distance from the nearest color in the dataset the nearest color will be updated in the window. Then whenever there will be a double click the RGB values get updated with the color name from the dataset.

Figure 1: Color detection in a single image.

For real-time color identification, we trained KNN algorithms on the dataset of colors in which we perform feature extraction and build the vector data of the particular and then compared it with points in the dataset using KNN classifier.

K-NEAREST NEIGHBOR:

KNN is a supervised classification algorithm. For training purposes, it required labeled data. When data is collected by the K number of nearest data points, KNN is used to highlight it with different unlabeled data.
How K is chosen, If K is too small, the noise points are sensitive. The larger K works just fine. But the majority of points from other groups may include in too large K.

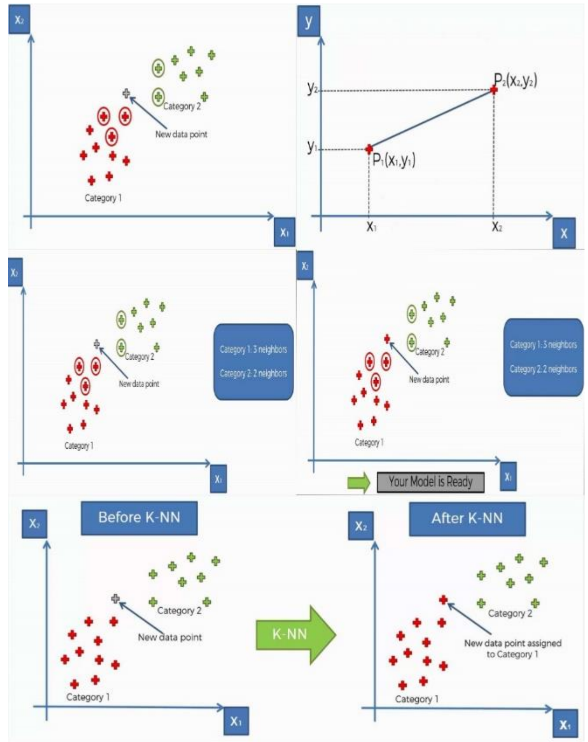

Figure 2: Working of KNN (ref. [16])

Take K=2 as the number k of neighbor. According to Euclidean Distance, choose K=2 as its nearest neighbor of the latest data point.
Euclidean Distance Between two points counted by this Formula:
Euclidean Distance Between P_1 and P_2 = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
The number of data points is counted in each category among these K neighbors. Assign the latest data point to the group where most of the neighbors are counted. New data point assigns to category 1 after KNN.

FEATURE EXTRACTION

A color histogram is one common tool used to reflect color content for feature extraction. The feature of an image can be extracted by its content. E.g., content like position, shape, color, texture, etc. The feature extraction in the proposed system is done by the color content of an image. To get the extracted feature, the image is represented in pixel form. Then further color histogram is used to identify the color.

COLOR HISTOGRAM

The number of pixels from each type is counted by a histogram and can be created simply by reading each image pixel just once and increasing the histogram's corresponding bin. A color histogram is reasonably invariable for transcription, image axis movement, minor off-axis rotation, shifts in size, and partial occlusion.

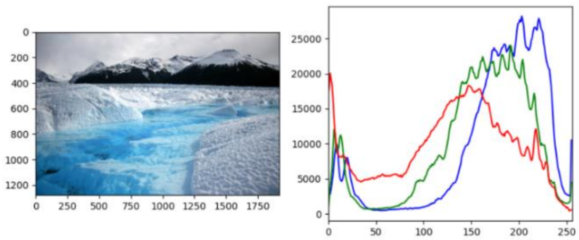

Figure 3: Representation of Color Histogram of an image. (ref. [15])

MODEL ARCHITECTURE

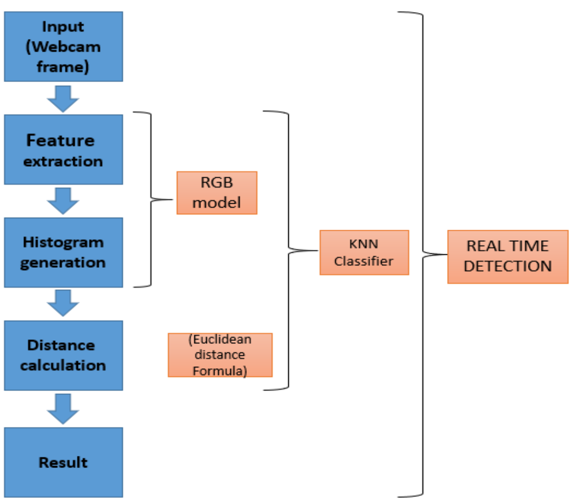

Figure 4: Architecture of Real-Time Color Identification

First, we get the RGB color histogram of images by this feature extraction. For example, the RGB color histogram for the image given below (Figure 5) is plotted.

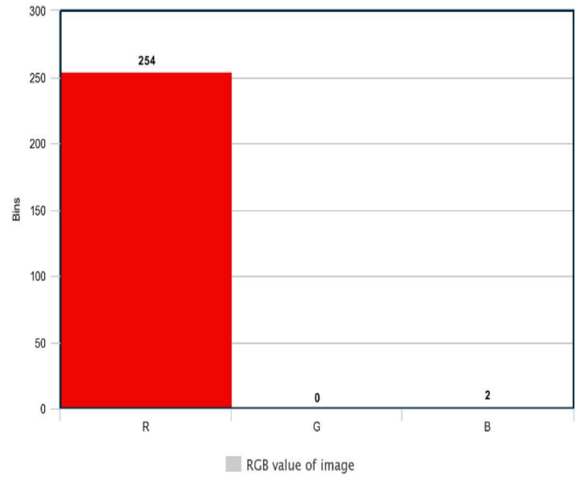

Figure 5: Image and its RGB color histogram.

As the above image (figure 5) is red, therefore red has the greatest value in RGB pixel count. Hence, we can get the ideal values of RGB to construct feature components for training. The predominant R, G, and B parameters of the red picture (Figure 5) are provided as [254,0,2], For example. Each training picture will be labeled because the KNN classifier is a guided learner, we get the dominant R, G, B values using Color Histogram and we deploy these feature vectors in the CSV file, and training feature resultant dataset is created. The vector data generated is fetched by the KNN classifier python class to calculate the Euclidean distance. Using the Euclidean distance formula, we will check the distance between 1 point and 1 other point in your dataset, one by one in all your datasets, the smaller the result between these two estimates, this calculation is the most appropriate.

3. RESULT

Proposed system result

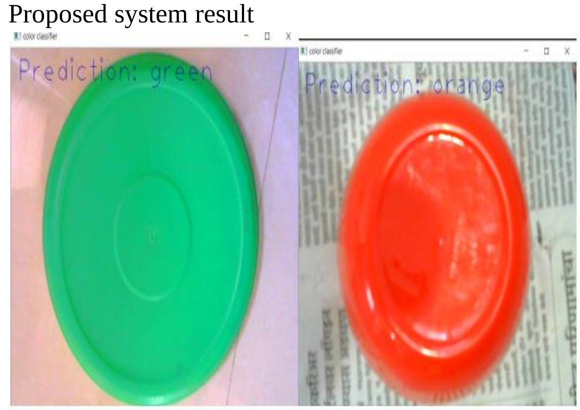

Figure 6: Real-Time Color Identification of an object.

Figure 7: Color Identification in an image

LAB COLOR MODEL

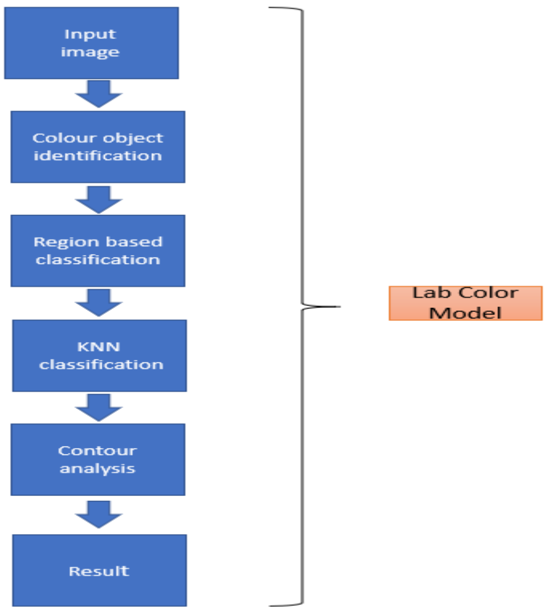

Figure 8: Lab Color Model (Ref. Ramaraj.M, Dr.S. Niraimathi, 2016)

Proposed System vs Lab Color Model (Ref. Ramaraj.M, Dr.S. Niraimathi, 2016)
The proposed system (Fig 4) is a real-time method of color identification where the RGB color histogram of images is generated by this feature extraction using the RGB model. Whereas in Lab Color Model (Figure 9: Lab Color Model (Ref. Ramaraj.M, Dr.S. Niraimathi, 2016) which performs the image segmentation which involves region-based classification, then KNN classification. Though it is done for reaching the approximations there are areas where it doesn't work well for strong contrast (> 7 EV), and especially outside the range [1:100] Cd/m².
If one changes the a and b, it would not be continuous in color, i.e., chromatic elements of a pixel. It adjusts its L brightness. An identical color will be expected at a different brightness (this was the Lab space design objective) but there is still a small shift in the color, more or less indicated depending on the initial color of the pixel.

RGB Model preferred over Lab Color Model
The specific reason why the lab color model is not preferred over the RGB model of the proposed method, because cameras have dynamic ranges that are largely outside of the circumstances under which Lab is accurate, which makes this space more evident in its defects. Any modern camera that uses HDR by default at a Hundred ISO of dynamic ranges between 9 -13 EV Lab isn't meant to accommodate far more dynamic range.
It is quite difficult to force pixel values in lab space, particularly while solving compositing and image blending in video editors with smooth & featheredge. The lab is not suited to practical physical corrections, such as pixelation, denoising, etc.
Whereas the proposed method with the RGB model doesn't get affected by blurring or any other effects on the image. Without showing unwanted side effect faster algorithms can handle more drastic changes, functioning in RGB is better. A lab can also not allow higher dynamic ranges, so after HDR tone mapping, care must be taken while using the Lab components.

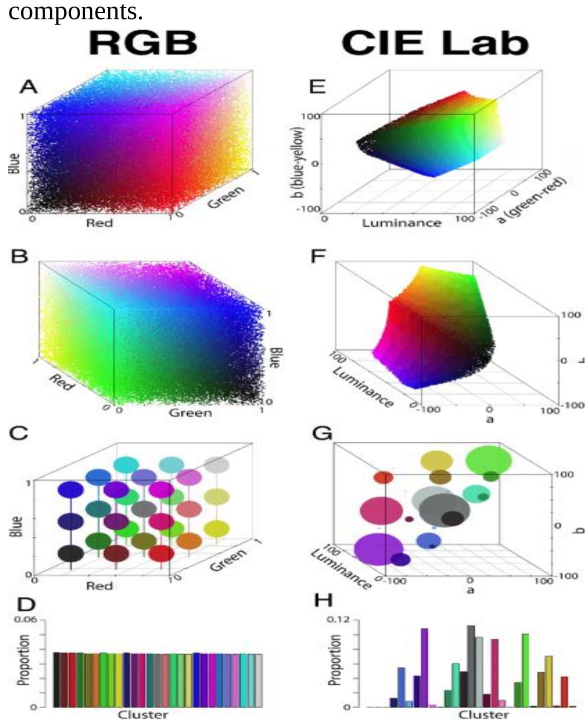

Figure 9: RGB Model vs Lab Color Model

4. CONCLUSION

In conclusion, the color identification application can detect various colors desired by the user. There are other color identification applications but some use complex methods to get the accurate result but still, accuracy is not met in some application where our color detection from image comes in picture in which it can name each color present in the picture because of the dataset on which it is trained consists of 800 plus colors including with their RGB values of each color. 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 the future, 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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