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AI BASED APPLICATION FOR MULTIPLE COLOR DETECTION IN REAL TIME

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ABSTRACT
Most image processing applications begin with color detection, especially those that rely on color information such object tracking, road sign detection, face and skin color detection, and object detection. The efficacy of earlier modules in an image processing program directly influences the performance of later modules, hence color detection accuracy is critical. This work presents an artificial intelligence (AI) application that uses a hierarchical expert ensemble to recognize different colors in real-time. The suggested hierarchical structure of neural networks performs better in color detection than traditional neural network classifiers, according to both qualitative and quantitative analyses of the data.

Keywords: Object Recognition, color segmentation, real time processing, computer vision

1.INTRODUCTION
The identification of pixel color classes inside images is largely dependent on color detection, and recent research has highlighted a number of applications that make use of this technique. One well-known use of color-based image processing is skin detection, which has advanced reliable and effective human body detection and tracking [1]. By utilizing the RGB color space, a better method described in [2] increases face detection accuracy and lowers the equal error rate from 3.3% to 1.8%. Another use is color-based license plate detection [3], and a neural network-based method for tracking and tagging cars in video data [4] has been suggested. In the field of quality control, a neural network-based color identification system in the HSI color space has assessed the quality of tea fermentation over 50 photos with 94% accuracy [5]. Preprocessing methods include converting images from RGB to HSV (or HSI) color space in order to improve color detection performance in traffic sign detection [6]. For the purpose of analyzing their influence on tracking performance, the RGB space is likewise transformed to the HSV and YCbCr color spaces [7]. This notion that RGB space is sensitive to variations in illumination forms the basis for these activities. Color space conversion is therefore frequently employed to lessen the effects of illumination. Because it can withstand variations in illumination caused by the weather, the HSI color space is favored over RGB for the detection of road signs [8]. Nevertheless, there is a chance that uneven illumination will continue [9]. Fascinatingly, some research indicates that target color segmentation in RGB color space is more successful than in HSI [8]. This suggests that the RGB color space could still provide better color identification performance without conversion, even with its uneven illumination issues. Real-time color detection has become popular in AI-based applications. The constraints of standard color spaces can be overcome by advanced AI algorithms, which can handle numerous color detections at once. These artificial

intelligence (AI) systems offer significant gains over traditional techniques by using complex algorithms to adapt to changing lighting conditions and conduct precise color identification in real-time. More than fifty years have passed since color identification became a prominent field of study. New developments have investigated a number of approaches, such as AI-based applications for multiple color recognition in real-time. By comparing the value of the target color channel with the other two channels in the RGB model, Manuel G. et al. (2020) used an extreme color channel approach. The target color is assigned to the color channel with the highest value. Three color models were employed by Jayme et al. (2016) to obtain correct results: RGB, HSV, and CIE Lab. After applying three different color transformations using RGB-related equations, they chose the best outcome.

Related Work

Machine learning (ML) is designed to enable computers to learn from data rather than follow explicit instructions. Unlike traditional programming, where predefined instructions guide the machine, ML relies on providing data to help the system learn and adapt its responses. This approach is particularly significant in applications involving large volumes of data, where simpler models may struggle to capture the complexity, leading to underfitting and inaccurate predictions. Conversely, overly complex models can lead to overfitting, where the model becomes too intricate to interpret effectively.

In the realm of machine vision, neural network techniques offer notable advantages over conventional methods, especially for complex tasks such as color detection. One traditional approach involves using the K-Nearest Neighbors (KNN) algorithm combined with feature extraction techniques like Color Histograms, Color Correlograms, and Color Moments. K-Means clustering is another established method for color extraction from images, utilizing various color spaces such as RGB, CMYK, and HSV to categorize image data.

AI-based applications for multiple color identification in real-time have been the focus of recent developments. For example, a color recognition system that uses the CNN classifier trained on RGB color histogram data can correctly identify hues like Violet, Red, Blue, Orange, Yellow, White, and Black. This approach emphasizes how crucial a carefully selected training dataset is to improving classification accuracy. Furthermore, powerful color recognition algorithms that can distinguish between different color colors and make accurate predictions are developed using programs like Python and OpenCV. The efficiency of real-time color detection applications is further increased by the usage of OpenCV, which makes it easier to distinguish monochromatic colors.

The writers of the paper "An Image Processing Technique for Color Detection and Distinguishing Patterns of Similar Color: An Aid for Color Blind People" [27] offer a method for identifying the color and borders of an image that satisfies the objective of the study. The complete work environment is low-cost, realistic, flexible, and effective thanks to the development tools LabVIEW IMAQ vision and vision assistance, which are used to identify the color and edge of a color image. Likewise, the authors of [28] demonstrated innovative real-time color recognition skills for vision-based human-computer interaction, with an emphasis on extracting basic colors. By using a statistical technique, they addressed problems with color-based picture segmentation and vision-based color recognition. First, an image is taken and object boundaries are detected in order to distinguish the item from the background.

Next, an iterative process is used to obtain the binary values of the different layers. Processing of the data was done using a pixel-by-pixel Region of Interest (ROI). Using a statistical method, the threshold is established to help with an item's color identification. The ROI is obtained and the color of the given item is detected by applying the threshold technique. The efficiency and versatility of vision-based systems will be improved by these developments, which are essential for AI-based applications that require real-time multiple color detection.

3.ANALYSIS

3.1 Overall Framework

Overall Framework The major phases in the implementation of the colour detecting algorithm are depicted in figure 1.

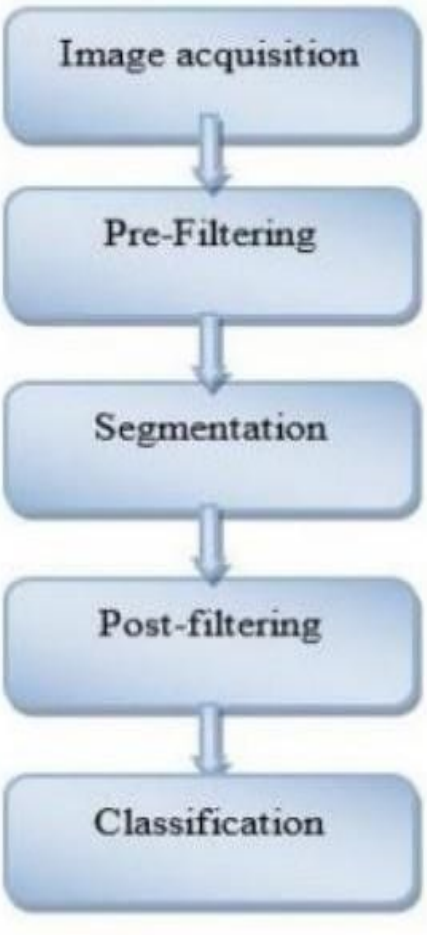

Figure 1. Framework of color detection

Image Acquisition:

The process of taking the pictures that will be utilized for additional processing is known as image acquisition. This is the initial step in the process because without a photo, no processing can be done. Here is a collection of different photographs. When the photos are taken, they are unaltered.

Filtering:

Noise is a crucial component to take into account when editing digital photos. Every time a photo is taken, there's a chance that it contains some kind of noise. An image with noise looks erratic, textured, uneven, or white. Therefore, in order to eliminate noise from the image, we must use the proper filters. The median filter is applied in order to filter. This filter is spatially nonlinear.

Segmentation:

Image segmentation is frequently used to split an image into many segments with comparable characteristics or properties, or to eliminate a piece of an image with similar qualities or values. A picture can be segmented using a variety of techniques. Segmentation methods encompass edge-based, clustering, region-based, and thresholding approaches. There are several techniques to dissect the threshold approach to segmentation. This stage involves the first conversion of the image from RGB to HSV. Next, the upper and lower bounds of the color component are established. After the hue is thresholder to view the outcomes, the image is shown back in its original RGB color space.

Classification:

Machine learning methods are becoming are becoming more and more common in image processing. supervised, unsupervised, and reinforced are the three categories of machine learning approaches.

Supervised methods teach the algorithm using labeled inputs and outputs. In unsupervised learning, the input used to train the system is neither labeled nor categorized. An agent using reinforcement must be able to sense and understand its surroundings, act upon its observations, and learn by making mistakes.

4.SYSTEM ARCHITECTURE

4.1 Existing Systems:

The RGB (Red, Green, and Blue) color model is widely used by current color recognition systems to recognize and categorize colors. These systems frequently make use of image processing methods and algorithms that are built into Python libraries like OpenCV or MATLAB. The RGB color model, which is helpful for many applications such as object detection, quality control, and interactive interfaces, displays colors as a combination of red, green, and blue values. Many of these systems are still built to handle video feeds or static displays, providing dependable operation under controlled lighting settings.

Labels	Red	Blue	Yellow	White	Black
Red	4	1	0	0	0
Blue	0	6	0	0	0
Yellow	0	0	10	0	0
White	0	0	0	10	2
Black	0	0	0	0	6

Table 1

4.2 Proposed Work:

For one image's color detection (Figure 1). Use the raggares library to create an argument parser by taking an image as output. The drawing method calculates the RGB values of the pixels that we double-click. When the double click is made, the (x, y) coordinates of the mouse pointer confirm that the function framework is correct. RGB values within the mouse's x and y coordinates are computed. Following the acquisition of the RGB value, which can reveal our proximity to the color, we measure the distance and choose the one with the least distance.

The formula that we used to measure the distance: absolute value of $\{(R-Rth\ color)+(G-Gth\ color)+(B-Bth\ color)\}$

The closest color in the dataset will be updated in the window once the distance between it and other colors has been determined. The color name from the dataset is then updated in the RGB values with each double click.

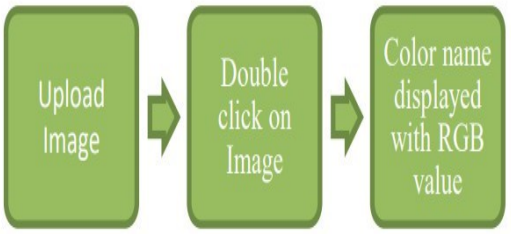

Figure 2. color detection in single image

Using the color dataset, we trained CNN algorithms for real-time color identification. Specifically, we extracted features, created the color's vector data, and then used a CNN classifier to compare the extracted data with the dataset's points.

5.RESULT:

This study is devoted to color detection through the use of a CNN trained on RGB color histograms. Among the eight (8) hues it can distinguish are black, blue, green, orange, red, violet, white, and yellow. Photographs from unsplash.com are used to introduce colors, and each color has multiple training data points that are used to build datasets for every color. To support more processes, the data set could be expanded. Utilizing digital image processing technology, the CNN algorithm was created and is utilized by the program.

The specific classes are displayed in the row above, while the anticipated classes are displayed in the column. The classifier produced a total of 53 predictions, of which four were for anger, seven for disgust, ten for fear, ten for happiness, nine for neutrality, eleven for sadness, and two for surprise. In actuality, however, there were really six incidents of anger, six of disgust, ten of fear, twelve of happiness, six of neutrality, ten of sadness, and three of astonishment.

6.SCREENSHOTS:

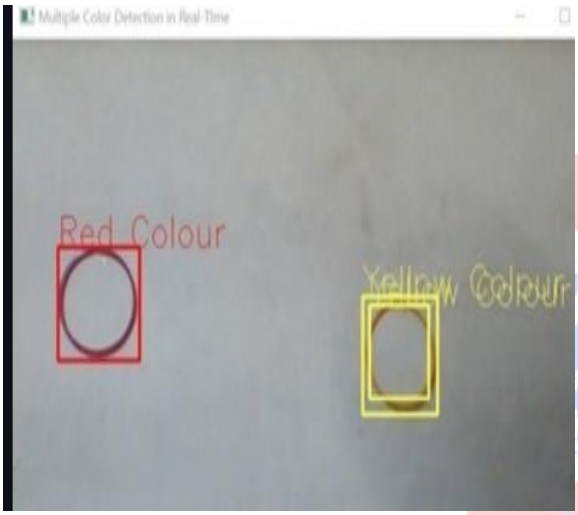

Figure 3. color name display

Figure 4. color identification of an image

7.CONCLUSION

For many applications, color detection is a critical intermediate step in color picture processing. Color detection performance strongly affects other processing, which might result in major improvements or general degradation. With the use of a hierarchical neural network structure that can precisely identify pixel colors, we present an AI-based application in this study that can detect numerous colors in real time. Even while single-neuron structures are also efficient in categorizing colors, our approach performs better overall as complexity grows.

8.REFERENCES

1. Manpreet Kaur, “Color-Based Object Detection MATLAB GUI," International Journal of Scientific & Engineering Research, Volume 5, Issue 6, June 2014.
2. Raquib Buksh, Soumyajit Routh, Parthib Mitra, Subhajit Banik, Abhishek Mallik, and Sauvik Das Gupta, “MATLAB-Based Image Editing and Color Detection," International Journal of Scientific and Research Publications, Volume 4, Issue 1, January 2014.
3. Gonzalez, R.C., Woods, R.E.: Digital Image Processing, p. 465
4. Natasha Sharma. (2019): Importance of Distance Metrics in Machine Learning Modeling
5. March 2007 [5] S. Borah, M. Bhuyan, and H. Saikia, “ANN-based Color Detection in Tea Fermentation," Proc. of ICVGIP’2002, pp. 226-229, ISRO, Ahmedabad, India, 16-18 December’ 2002.
6. H. Fleyeh, “Color Detection and Segmentation for Road and Traffic Signs," Cybernetics and Intelligent Systems, 2004 IEEE Conference on, vol. 2, pp. 809–814, 2004.

7. Ahmed, F., Bari, H., & Hossain, E. (2014). Person-independent countenance recognition supports compound local binary pattern (CLBP).
8. Happy, S. L., George, A., & Routray, A. (2012, December). A real-time countenance classification system using local binary patterns In Intelligent Human Computer Interaction (IHCI), 2012 4th International Conference on (pp. 1–5)IEEE. 10.2