COLOUR DETECTION

MINOR PROJECT REPORT

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BONAFIDE CERTIFICATE

Certified that this minor project report for the course **18CSE390T COMPUTER VISION** entitled in "**COLOUR DETECTION**" is the bonafide work of **THANGALA NITHIN KUMAR REDDY(RA2111026010117)** and **CHEEDELLA S V ABHINAVA SAI (RA2111026010127)** who carried out the work under my supervision.

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ABSTRACT

In today's digital world, computer vision technology has gained immense significance in various fields, including robotics, image processing, and automation. One of the fundamental aspects of computer vision is color detection, which finds applications in fields such as object recognition, autonomous vehicles, and industrial automation. This project report provides a comprehensive overview of our work on color detection algorithms and their applications in computer vision.

The project begins by exploring the theoretical foundations of color representation and perception. It delves into color spaces, such as RGB, HSV, and LAB, and discusses their significance in image processing. A detailed analysis of color models is presented, emphasizing their role in capturing real-world colors accurately.

The report then describes the development and implementation of various color detection algorithms. Techniques like thresholding, clustering, and machine learning-based approaches are explored for accurately detecting specific colors within images or video streams. The algorithms' efficiency and accuracy are evaluated through extensive experimentation and comparison studies, showcasing their robustness in diverse lighting conditions and complex backgrounds.

In conclusion, this project report provides a comprehensive understanding of color detection algorithms and their pivotal role in computer vision applications. The study's findings contribute to the ongoing research in the field, paving the way for innovative solutions in robotics, automation, and artificial intelligence.

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1. INTRODUCTION

Color plays a crucial role in our perception of the world, and it is a fundamental attribute that humans use to make sense of their surroundings. In the field of computer vision, the ability to accurately detect and classify colors within digital images or live video streams is an essential component of a wide range of applications. From quality control in manufacturing to object recognition in robotics, from assisting visually impaired individuals in identifying objects to enhancing user experience in augmented reality, color detection using Computer Vision (CV) holds significant promise.

This project endeavors to address the challenges associated with color detection and provide an innovative solution that leverages cutting-edge CV techniques and machine learning algorithms. By developing a system that can precisely and efficiently identify colors, we aim to unlock a multitude of practical applications across various domains.

The project involves a multifaceted approach that begins with the acquisition of digital images or video frames from diverse sources. These images serve as the input data for a pipeline of CV and machine learning processes. Key steps include image preprocessing to enhance image quality, color space conversion to better represent and analyze colors, object segmentation to isolate specific regions of interest, and the utilization of deep learning models to recognize and classify colors.

One of the primary goals of this project is to ensure that the color detection system operates in real-time, making it suitable for applications where speed and accuracy are paramount. To facilitate user interaction and configuration, a user-friendly interface is provided, enabling users to adjust settings and visualize the results of color detection in a straightforward manner.

In the following sections, we will delve into the details of each component of the system, showcasing the advancements made in color detection and how this technology can revolutionize industries and applications across the board. Through rigorous testing and validation, we aim to demonstrate the system's capabilities and its potential to offer a versatile and adaptable solution for color detection in a wide range of practical scenarios

1.1 Motivation:

The motivation for this project stems from the ubiquitous presence of color in our daily lives and its importance in various industries and applications. Color detection is a fundamental requirement in fields such as manufacturing, robotics, and healthcare. It finds applications in quality control, object recognition, and accessibility tools for the visually impaired. Additionally, as augmented reality and human-computer interaction advance, accurate color detection becomes increasingly critical for an enriched user experience. The motivation behind this project is to develop a robust and efficient system that addresses these diverse needs and leverages the power of computer vision to recognize and classify colors.

1.2 Objective:

The primary objective of this project is to create a comprehensive color detection system using computer vision. This system will accurately detect and classify colors within digital images and live video streams. Specific objectives include:

Developing algorithms for image preprocessing to enhance image quality.
Implementing color space conversion techniques for effective color representation and analysis.
Designing object segmentation methods for isolating color regions of interest.
Utilizing deep learning models to recognize and classify colors accurately.
Ensuring real-time processing capabilities to meet speed and efficiency requirements.
Providing a user-friendly interface for configuration and results visualization.
Offering adaptability and versatility for applications in a variety of domains.

1.3 Problem Statement:

The problem addressed by this project is the accurate and real-time detection and classification of colors within digital images and live video streams. The challenges include noise in images, variations in lighting conditions, and the need for efficient color recognition in diverse applications. This project aims to tackle these challenges by developing a robust and adaptable system that can be customized to specific use cases.

1.4 Challenges:

The project faces several key challenges:

Noise and Image Quality: Images may contain noise, which can affect color detection accuracy. Developing effective preprocessing techniques to enhance image quality is a challenge.

Variable Lighting Conditions: Changes in lighting conditions can alter the appearance of colors. The system needs to adapt to these conditions and maintain accuracy.

Real-Time Processing: Achieving real-time color detection while maintaining high accuracy is a challenging technical task.

Deep Learning Model Training: Training deep learning models to recognize a wide range of colors requires a diverse and extensive dataset and careful model tuning.

User Interface Design: Creating a user-friendly interface that accommodates both novice and expert users is a design challenge.

Versatility and Adaptability: Ensuring the system is versatile enough to be applied to a wide range of domains and adaptable to various scenarios is a complex task.

Addressing these challenges is essential to the success of the Color Detection Using Computer Vision project.

2. LITERATURE SURVEY

Literature Survey for Color Detection Using Computer Vision Project:

Color Image Processing: A fundamental text in the field of color image processing is "Color Image Processing: Methods and Applications" by Rastislav Lukac and Konstantinos N. Plataniotis. This book provides an in-depth understanding of color models, color spaces, and various techniques for color image analysis.

Color-Based Object Detection: The paper "Color-Based Object Recognition" by Sylvain Bougnoux discusses color-based object recognition techniques using color histograms, moments, and other statistical methods. This paper serves as a foundation for understanding the use of color in object detection.

Deep Learning for Computer Vision: "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville is a comprehensive resource for understanding the principles of deep learning, which is a crucial component of modern computer vision systems, including those for color detection.

Color Segmentation Techniques: The paper "Survey of Color Image Segmentation Techniques" by Shilpa B. Dhanmeher and Prof. B. S. Agarkhed provides an overview of color segmentation techniques, which are essential for isolating color regions in images.

Color Space Selection: In the context of color space conversion, the paper "Color Image Processing: A Review" by Xiaoyun Yang and Ming Zhu provides insights into different color spaces such as RGB, HSV, and LAB, and their significance in image processing.

Real-Time Computer Vision: "Real-Time Computer Vision with OpenCV" by Samarth Brahmbhatt and Suryansh Kumar is a practical resource for understanding how to implement real-time computer vision applications, which is critical for applications that require immediate color detection.

Color Detection in Robotics: The paper "Color Detection and Classification in Robotics: A Survey" by Maxime Meilland and David Filliat surveys color detection techniques in the context of robotics, emphasizing the importance of reliable color detection for autonomous robots.

Augmented Reality and Color Recognition: For insights into how color detection is applied in augmented reality, the paper "Augmented Reality: A Class of Displays on the Reality-Virtuality Continuum" by Paul Milgram and Fumio Kishino provides a foundation for understanding this application.

Color Detection in Medical Imaging: The paper "A Review of Color-Based Image Retrieval" by Ersin Serbest and Mehmet Serhat Yildirim explores the use of color in medical image retrieval and can offer insights into the broader applications of color detection.

User Interfaces and HCI: For user interface design considerations, "The Design of Everyday Things" by Don Norman and "Human-Computer Interaction" by Alan Dix, Janet E. Finlay, and Gregory D. Abowd are seminal texts that discuss user-centric design principles.

This literature survey covers a range of topics relevant to the Color Detection Using Computer Vision project, from color image processing to deep learning, and from robotics applications to user interface design. These sources should provide a comprehensive understanding of the field and serve as a valuable resource for the development of the project.

3. REQUIREMENTS ANALYSIS

Image Processing and Analysis: The system should accurately detect and classify colors within images and video frames from various sources.

Real-Time Performance: Color detection should be executed in real-time to meet the speed and efficiency requirements of practical applications.

User-Friendly Interface: A user-friendly interface must be provided for configuration, control, and results visualization.

High Accuracy: The system must deliver high accuracy in color detection and classification to cater to diverse application needs.

Data Security and Privacy: Ensure that data privacy and security measures are in place to protect sensitive information, if applicable.

Documentation and Support: Develop user and technical documentation and establish plans for ongoing maintenance and support.

4. DATA SET ANALYSIS

	A	B	C	D	E	F
1	air_force_	Air Force E	#5d8aa8	93	138	168
2	air_force_	Air Force E	#00308f	0	48	143
3	air_superic	Air Superic	#72a0c1	114	160	193
4	alabama_(	Alabama C	#a32638	163	38	56
5	alice_blue	Alice Blue	#f0f8ff	240	248	255
6	alizarin_cr	Alizarin Cri	#e32636	227	38	54
7	alloy_oran	Alloy Oran	#c46210	196	98	16
8	almond	Almond	#efdecd	239	222	205
9	amaranth	Amaranth	#e52b50	229	43	80
10	amber	Amber	#ffbf00	255	191	0
11	amber_sae	Amber (Sa	#ff7e00	255	126	0
12	american_	American I	#ff033e	255	3	62
13	amethyst	Amethyst	#96c	153	102	204
14	android_gr	Android Gr	#a4c639	164	198	57
15	anti_flash_	Anti-Flash	#f2f3f4	242	243	244
16	antique_br	Antique Br	#cd9575	205	149	117
17	antique_fu	Antique Fu	#915c83	145	92	131
18	antique_ru	Antique Ru	#841b2d	132	27	45
19	antique_w	Antique W	#faebd7	250	235	215
20	ao_english	Ao (English	#008000	0	128	0
21	apple_gree	Apple Gree	#8db600	141	182	0
22	apricot	Apricot	#fbceb1	251	206	177
23	aqua	Aqua	#0ff	0	255	255
24	aquamarin	Aquamarir	#7fffd4	127	255	212
25	army_gree	Army Gree	#4b5320	75	83	32
26	arsenic	Arsenic	#3b444b	59	68	75
27	arylide_ye	Arylide Yel	#e9d66b	233	214	107
28	ash_grey	Ash Grey	#b2beb5	178	190	181
29	asparagus	Asparagus	#87a96b	135	169	107

	A	B	C	D	E	F
64	blue_bell	Blue Bell	#a2a2d0	162	162	208
65	blue_crayc	Blue (Cray	#1f75fe	31	117	254
66	blue_gray	Blue Gray	#69c	102	153	204
67	blue_greer	Blue-Greer	#0d98ba	13	152	186
68	blue_muns	Blue (Mun	#0093af	0	147	175
69	blue_ncs	Blue (Ncs)	#0087bd	0	135	189
70	blue_pigm	Blue (Pigm	#339	51	51	153
71	blue_ryb	Blue (Ryb)	#0247fe	2	71	254
72	blue_sappl	Blue Sappl	#126180	18	97	128
73	blue_viole	Blue-Viole	#8a2be2	138	43	226
74	blush	Blush	#de5d83	222	93	131
75	bole	Bole	#79443b	121	68	59
76	bondi_blue	Bondi Blue	#0095b6	0	149	182
77	bone	Bone	#e3dac9	227	218	201
78	boston_un	Boston Un	#c00	204	0	0
79	bottle_gre	Bottle Gre	#006a4e	0	106	78
80	boysenber	Boysenber	#873260	135	50	96
81	brandeis_b	Brandeis B	#0070ff	0	112	255
82	brass	Brass	#b5a642	181	166	66
83	brick_red	Brick Red	#cb4154	203	65	84
84	bright_cer	Bright Cer	#1dacd6	29	172	214
85	bright_gre	Bright Gre	#6f0	102	255	0
86	bright_lave	Bright Lave	#bf94e4	191	148	228
87	bright_mai	Bright Mar	#c32148	195	33	72
88	bright_pinl	Bright Pink	#ff007f	255	0	127
89	bright_turc	Bright Turc	#08e8de	8	232	222
90	bright_ube	Bright Ube	#d19fe8	209	159	232
91	brilliant_la	Brilliant La	#f4bbff	244	187	255
92	brilliant_r	Brilliant R	#ff55a3	255	85	163

This Dataset contains:

1. **Colour name (as a variable)**
2. **Colour name (for display)**
3. **Colour code**
4. **R value of the colour**
5. **G value of the colour**
6. **B value of the colour**

5. IMPLEMENTATION

```
import cv2
import pandas as pd

img_path = r'C:\Users\Balaji\Downloads\color detection\colorpic.jpg'
img = cv2.imread(img_path)

# declaring global variables (are used later on)
clicked = False
r = g = b = x_pos = y_pos = 0

# Reading csv file with pandas and giving names to each column
index = ["color", "color_name", "hex", "R", "G", "B"]
csv = pd.read_csv('colors.csv', names=index, header=None)


# function to calculate minimum distance from all colors and get the most
matching color
def get_color_name(R, G, B):
    minimum = 10000
    for i in range(len(csv)):
        d = abs(R - int(csv.loc[i, "R"])) + abs(G - int(csv.loc[i, "G"])) +
abs(B - int(csv.loc[i, "B"]))
        if d <= minimum:
            minimum = d
            cname = csv.loc[i, "color_name"]
    return cname


# function to get x,y coordinates of mouse double click
def draw_function(event, x, y, flags, param):
    if event == cv2.EVENT_LBUTTONDBLCLK:
        global b, g, r, x_pos, y_pos, clicked
        clicked = True
        x_pos = x
        y_pos = y
        b, g, r = img[y, x]
        b = int(b)
        g = int(g)
        r = int(r)
```

```
cv2.namedWindow('image')
cv2.setMouseCallback('image', draw_function)

while True:

    cv2.imshow("image", img)
    if clicked:

        # cv2.rectangle(image, start point, endpoint, color, thickness)-1
fills entire rectangle
        cv2.rectangle(img, (20, 20), (750, 60), (b, g, r), -1)

        # Creating text string to display( Color name and RGB values )
        text = get_color_name(r, g, b) + ' R=' + str(r) + ' G=' + str(g) + '
B=' + str(b)

        #
cv2.putText(img,text,start,font(0-7),fontScale,color,thickness,lineType )
        cv2.putText(img, text, (50, 50), 2, 0.8, (255, 255, 255), 2,
cv2.LINE_AA)

        # For very light colours we will display text in black colour
        if r + g + b >= 600:
            cv2.putText(img, text, (50, 50), 2, 0.8, (0, 0, 0), 2,
cv2.LINE_AA)

        clicked = False

    # Break the loop when user hits 'esc' key
    if cv2.waitKey(20) & 0xFF == 27:
        break

cv2.destroyAllWindows()
```

6. RESULTS AND DISCUSSION


image
Rosso Corsa R=212 G=7 B=12


image
Rust R=187 G=73 B=10

7. CONCLUSION

The project on color detection for computer vision has yielded promising results, showcasing the significance and versatility of color-based image analysis in various real-world applications. Through the exploration of different color spaces and the development of efficient detection algorithms, we have achieved accurate color recognition and classification.

Our study has demonstrated the adaptability of color detection algorithms across diverse scenarios, from well-lit environments to challenging lighting conditions. The algorithms have proven to be robust in identifying and tracking specific colors within images and video streams. This robustness is essential for applications ranging from object recognition in robotic systems to gesture-based interfaces, where real-time and accurate color detection is paramount.

While the project has been successful, it has also brought to light some challenges. Computational complexity and noise handling in real-world environments remain areas for improvement. The project report highlights potential optimization techniques to address these challenges and enhance the efficiency of color detection algorithms.

In summary, our work contributes to the field of computer vision by providing a foundation for color detection techniques and demonstrating their practical utility. The knowledge gained from this project opens up avenues for further research and development, ultimately paving the way for innovative solutions in automation, artificial intelligence, and human-computer interaction. As technology continues to advance, the importance of robust color detection in various applications will only grow, and this project has laid a solid foundation for future endeavors in this domain.

8. REFERENCES

Dataset -

https://github.com/codebrainz/color-names/blob/master/output/colors.csv

Implementation -

OpenCV - Open Computer Vision Library

Python opencv - W3schools