

Chapter 1

1. Introduction

1.1 overview

In real world, human eye can detect and differentiate colors from predefined acknowledge or by experience from traditional learning, then the eyes can sense the color it sees and the mind interprets what that color is. in computer vision the color detection or color sensation mechanism is almost the same as in human eyes but it should be programmed using algorithms and some logic procedures that enables the CPU to take that piece of color and apply the proper mathematical and logical operations in order to take a decision of what color that piece include according to its acknowledge about all color names.

Color refers to the human brain's subjective interpretation of combinations of a narrow band of wavelengths of light. For this reason, the definition of "color" is not based on a strict set of physical phenomena. Therefore, even basic concepts like "primary colors" are not clearly defined.

Light colors, more formally known as additive colors, are formed by combining red, green, and blue light. Color is the perceptual ability of human beings to identify the aspects of things. In any image processing techniques, pre processing is usually done on intensity components rather than color or tone. The color of an object changes with the illumination changes in its background and it is relatively tricky to predict it correctly. So it is necessary to maintain a constant color even if there is a variation in background or illumination. A color space helps to organize and describe the color components of an image effectively[1].

Hue is a term describing a pure color, that is, a color not modified by tinting or shading. In additive colors, hues are formed by combining two primary colors. When two primary colors are combined in equal intensities, the result is a "secondary color".

Color has been a great help in identifying objects for many years. The process of color classification involves extraction of useful information concerning the spectral properties of object surfaces and discovering the best match from a set of known descriptions or class models to implement the recognition task [2]

With knowledge of color models and different color formats we can represent the color information of the input digital image acquired by a camera or scanner that can recognize three primary ingredient spectrums; red, green, and blue from the light beam [3].

That considered the primary components. The properties that used to distinguish different colors are brightness, hue, and saturation; these parameters are classified into two components; luminance (the brightness) and chrominance (hue and saturation),

color detection in image sequence has been an active research area in the computer vision field in recent years' due to its potential applications such as monitoring and surveillance, human computer interfaces, smart rooms, intelligent robots, and biomedical image analysis and skin[4].

Also color is one of the most visually distinguishable characteristics, causing that the majority of the existing solutions take advantage of that and use the dominant colors (DCs) to describe the image content.

The application of such algorithms are called machine learning algorithms, which adopted by the artificial intelligence in computer software engineering. Machine learning algorithms used in computer vision operations are using digital image processing procedures with some logic approaches, one of the basics and commonly used approaches of logic is the fuzzy logic or the unbounded logic which refer to using the traditional logic but with more than two states, so this enables multiple choices or states since the output is not limited to only zero or one.

Fuzzy sets theory has been successfully applied to many image processing and pattern recognition problems. Fuzzy techniques offer a non-linear and knowledge driven framework for coping with the ambiguity and

vagueness often present in digital images, associated mostly with the definition of various elements such as edges and regions, or faces. Defining a suitable membership function to describe an image property is not a trivial task, since it depends on various factors that introduce different types of uncertainties, which finally translate into additional uncertainties about the membership function itself. Therefore, we must carefully seek more flexible, or even intuitive, ways in order to model uncertainty [5].

The fuzzy logic has many applications in color detection approaches such as face detection, skin color detection, human detection, object color differentiation, and lately it's been also used as a part in some human face emotions detection programs.

1.2 Problem statement

In robotics and mechatronics devices use sensors and some hardware peripherals that allow the CPU to do thing that human can do according to a specific set of events. The CPU gets the events from the sensor peripheral and make the decision with the proper actuator. However in computers user interface applications some complex artificial intelligence should be used as machine learning algorithm to implement the sense of detection in the software especially digital image processing applications.

1.3 Proposed solution

Using the fuzzy logic approaches adopts some datasets of colors information and with the image processing techniques, image application can be more intelligence and reliable for advanced usage and various applications.

1.4 Aim and objectives

The main aim of this study is to investigate how processors are able to investigate and deal with colors using the fuzzy logic approaches in software.

- Best fuzzy structure will be proposed

- Using MATLAB software results to extract the most dominant color in the image and implement some color model conversions for that image.
- To implement a MATLAB based software that uses machine learning fuzzy logic to detect and sense colors into an image.

1.5 Scope

This research cover the area of color detection technique along with fuzzy logic system.

Generally, in this study we managed to perform three different functions that deals with images and colors, the major one the using the fuzzy logic to implement a color detection application, then implementing a dominant color detection application, then implementing basic conversions between RGB, HSV, HIS color models. The whole idea of this study is implemented and performed using MATLAB programming environment.

The fuzzy logic color detection algorithm main function is implemented into two parts, first implementing a fuzzy logic color learning and saves the colors information into a predefined dataset, then after saving some colors into the dataset the second part is to examine all the information of the predefined colors into the acquired image and compare all the known colors with image color and extracts the required color that matches the user demand if found in the dataset by using leaner interpolation method.

For the dominant color detection function, we managed to extract the RGB value of the dominant color by compute Euclidian distance of each color to all colors. And for conversation between RGB, HSV, and HSI image color models we used a built-in color space function added with the software. The detailed description about this methodology is described later in the third chapter.

1.6 Chapter Organization

The rest of this thesis is as follows:

Chapter One: Introduction provides a brief overview of some of the issues that are of concern to those working in the field of color recognition . This chapter will also look at the overview of the whole studies, the problem statements, research questions, aims, and the scope of this study as well as examining the contributions this research can make to the field of color inspection.

Chapter Two: Literature Review provides background information and review of related work in the area of color inspection. This study proposes fuzzy logic based solutions, the chapter also review color models.

Chapter Three: Research Methodology defines the methodology followed in this research to achieve the study's objectives. This chapter illustrates, and explains methods that are used include project's flow, analysis, and all programming used in this project

Chapter Four: Result and discussion defines the simulation followed in this research to achieve the study's objectives. This chapter shows all the analysis and result from the simulation and calculation that have been compute.

Chapter 5: Conclusion and recommendation concludes the study research and gives recommendations future development.