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A Novel Feature Extraction Method Based on Re-Retrieval Phase using Image Processing

T. Venkat Narayana Rao[#1], Akshit Mandala[#2]

[1]*Professor, Computer Science and Engineering,*
[2] *Student, Computer Science and Engineering,*
Sreenidhi Institute of Science and Technology, Ghatkesar, T.S, India.

***Abstract* — Artificial intelligence, Machine learning, Computer vision have been an important area of research in the field of Internet of things and Image processing. Image extraction and detection are one of the most important techniques used to identify a particular feature or a pattern in an image. Several algorithms and methodologies were proposed for this purpose using different approaches. Here, a simple algorithm has been proposed for identification of misplaced object or hidden patterns without the use of complex mathematical operations. The system aims at faster search time and identification of the desired object using simple mathematical techniques effectively.**

***Keywords* — Digital Image Processing, Machine Learning, Artificial Intelligence, Computer Vision, Virtual Reality.**

I. INTRODUCTION

Image Processing

Image processing is one of the forms of processing for which the input is an image or a video frame, the output of image processing could be either an image or a set of features or parameters related to the image. It involves enhancing a raw data into a suitable format that can be used for various applications. Most image-processing techniques involve treating the image as a two-dimensional quantity and apply standard processing techniques to it. Image processing is usually referred to as digital image processing, but optical and analog image processing also are possible. There are numerous digital image processing techniques such as Histogram processing, Local enhancement, Smoothing, Sharpening, Color segmentation, Digital image filtration and Edge detection [1][2].

The common steps used for inspection of any image includes [3]:
Step1: Pre-processing of the acquired image
Step2: Segmentation of Image
Step3: Feature extraction
Step4: Recognition of Feature .

Color Spaces

To utilize color as an information entity in the varied applications, an appropriate method for representing the color signal is needed. Color spaces provide a rational method and mathematical model to specify an order, manipulate and effectively display the object colors taken into consideration. Thus, the selected color model should be applicable to cast the problem's statement and the solution.

The process of selecting the suitable color format involves knowing how color signals are generated and what information is needed from the signals. Color model literature can be found in the domain of modern sciences such as physics, engineering, artificial intelligence, computer science and philosophy [4].

There are different color models such as [2]:

(a) RGB model

In RGB color model, each color appears in its primary spectral components of red, green and blue. It is based on Cartesian coordination system defined by the three chromaticities such as blue, green, and red additive primaries and can produce any chromaticity that is the triangularly characterized by those primary colors. The complete specification of an RGB color space also requires a white point chromaticity and a gamma correction curve.

(b) CMYK model

The CMYK color model is a subtractive color model, used in color printing, and is also used to depict the printing process itself. CMYK refers to the four inks used in some color printing: cyan, magenta, yellow, and key (black). Though it varies by print house, press operator, press manufacturer and press run, ink is typically enforced in the order of the abbreviation. The "K" in CMYK stands for key since in four-color printing cyan, magenta, and yellow printing plates are carefully keyed or aligned with the key of the black key plate. Few sources theorize that the "K" in CMYK comes from the last letter in "black" and "K" was chosen since "B" already means blue. The CMYK model works by partly or completely masking colors on a lighter, usually white, background. The ink decreases the light that would otherwise

be reflected. Such a model is described as subtractive because inks "subtract" brightness from white.

(c) Y Cb Cr model

YCbCr, YCbCr, or Y Pb/Cb Pr/Cr, also written as YCBCR or YCBCR, is a family of color spaces used as a part of the color image pipeline in video and digital photography systems. Y is the luma component and CB and CR are the blue-difference and red-difference chroma components. Y (with prime) is distinguished from Y which is luminance, meaning that light intensity is non-linearly encoded using gamma correction. YCbCr is not an outright color space; rather, it is a way of encoding RGB data. The actual color portrayed depends on the actual RGB primaries which are used to display the signal. Therefore, a value represented as YCbCr is anticipated only if standard RGB primary chromaticities are used.

(d) HSI model

HSI refers to hue, saturation and intensity. Hue is the attribute that describes a pure color (pure orange, red or yellow) whereas saturation gives a extent of the degree to which pure color is diluted by white light and Brightness/Intensity which is a subjective descriptor that is practically impossible to measure. This model decouples the intensity component from the color-carry information in a color image.

Image Processing Techniques

Image acquisition basically deals with capturing or generating an image of the concerned object through various means and transferring it to a computing device for further processing. During the stage of processing, various techniques such as noise removal, transformation, equalization etc. are used to enhance the image.

Image segmentation is one of the most important steps in image processing, as it involves the feature extraction based on pattern or characteristics. It can be obtained by simple thresholding techniques, edge or boundary detections or by complex transforms [2].

Once the segmented image is obtained, the detection of the feature is more like a Classification or Pattern recognition. These approaches would help in judging whether the object under observation is normal or defective, it might include predefined set of cases or it might involve a comparison of extracted features with the information already present in the database. Digital image processing is one of the most admiring technologies due to its enhancing features and techniques that can be easily adaptable to various applications in order to resolve the complex scientific investigation or research.

II. LITERATURE SURVEY

Since Image Extraction and Detection is one of the most important aspects of image processing, Various algorithms have been proposed and they work in their own methodologies but the research is still ongoing for much more effective and efficient algorithm enhancement. Some methods use various transformations or filtering methodologies to extract images , some use various approaches such as fuzzy logic [5][6].

Although there are existing algorithms, a much more robust and simple algorithm has to be established to achieve the image extraction and detection much effectively. This paper aims at proposing an efficient algorithm that would recognize an object of concern in an image and detect it automatically using simple mathematical operations as shown in figure 1 [7][8].

III. THE PROPOSED SYSTEM

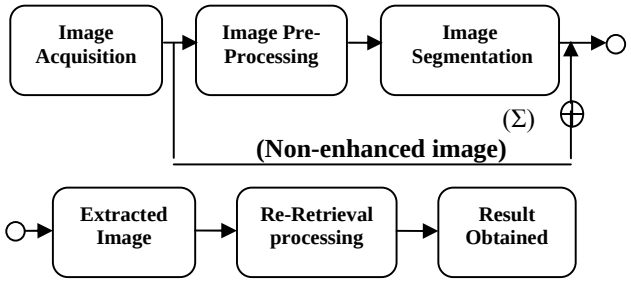


Figure1. System level Block Diagram

Overall System level Block diagram has been pictorially represented in the Figure1. The working of each module shall be further explained below.

System Analysis

The system consists of five phases. Each phase can have one or more stages. The phases can be classified as follows:

(A) Acquisition phase
(B) Enhancement phase
(C) Extraction phase
(D) Re-Retrieval phase
(E) Conclusion phase

(A) Acquisition phase

Acquisition phase is the input stage to the system and it consists of acquiring an RGB image from a digital camera or a video frame whose resolution is with VGA size of (640px × 480px).

(B) Enhancement phase

This particular phase involves two stages as explained below.

(i) Stage One

This stage involves choosing a suitable color format for processing. Since YCbCr color model approaches more suitable for processing, YCbCr color model shall be chosen. Hence, RGB model has to be converted to YCbCr model and **'Y'** component shall be extracted from the converted image as shown in the Figure 2.

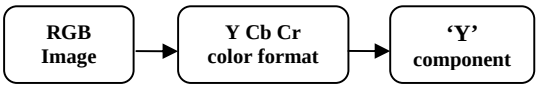


Figure 2. Enhancement phase - Stage one Processing

(ii) Stage Two

This stage involves choosing a suitable threshold for segmentation of the image for extraction of the desired area of interest in the image. It results in the binary image for ease of processing.

This stage involves noise filtering with newly defined **"Neighbor algorithm"**.

(a) Binary image formation

This stage involves the conversion of the obtained **'Y'** component from the previous Stage into a Binary format as shown below.

If a(x, y) <= 'Threshold', Then a(x, y) = '0'
else a(x, y) = '1' (1)

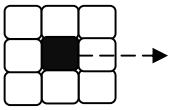
Where, a(x, y) is a pixel in a 2-Dimentional image with coordinates x and y.

(b) "Neighbor Algorithm" for noise removal

This algorithm proposes to remove the noise in the binary image so that the optimization can be achieved and it will ease in the detection of the desired object. It aims at providing a simple technique to reduce the noise in the desired region of interest.

The technique is explained below in the Figure 3.

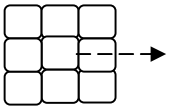
Before processing:



Pixel a(x, y) = '0'

If a(x, y) is value '0' and
{a(x-1, y), a(x+1, y), a(x-1, y-1), a(x+1, y-1),
a(x-1, y+1), a(x+1, y+1), a(x, y+1), a(x, y-1)} is value '1';
Then a(x, y) is '1'. (2)

After processing:



Pixel a(x, y) = '1'

Where, a(x, y) is a pixel in a 2-Dimentional image with coordinates x and y.

Figure3. Neighbor Algorithm

As per Figure 3, if any pixel's adjacent and diagonal pixels are of value '1' and if that pixel is of '0' value, the pixel value will be assigned to '1'.

(C) Extraction phase

This phase involves the addition of enhanced image from enhancement phase and the original image (without any enhancement). It is required to focus only on the desired object so that it will be ease in detecting the object.

(D) Re-Retrieval phase

This phase involves a proposal of a new algorithm called "Re-Retrieval algorithm" that mainly focus on detecting the desired object existence or not. For this purpose, the following approach is followed based on automatic detection of object existence. This can be used in automated systems in order to avoid manual analysis. The process involves two stages:

(i) Extraction of the image:

The existing image stored in the database has to be fetched and it is segmented with the predefined threshold. The image will be converted to Binary format for further analysis.

(ii) Object existence:

The object existence or not can be found out by adding the extracted image from the Extracted Phase and the segmented image from the database.

If the resultant image, do not contain the features of the concerned object, then the object is not present else it is present. The features of the object shall be stored and mapped accordingly during comparison in order to identify the correct object.

(E) Conclusion Phase:

The result obtained can be seen as a TRUE (indicating object existence) or FALSE (no object existence) on a visual display. It can be also fed to an LED display to glow GREEN if an object is present or RED when an object is missing.

IV. ANTICIPATED RESULTS

With the complete development of the proposed system, we anticipate to achieve the following:

a. Faster and smart processing based on artificial intelligence and data mining.
b. Autonomous search engines which can be deployed in search and rescue operation.
c. Small hand held app device for personal use so as to expedite the search of objects in case they are misplaced.
d. This can be also a great help for the visually impaired.
e. Development of smart device wherein people are able to fed sketches or images in the system and can scan the area of search. Future extension to this can be an audio or visuals to determine the existence of the particular object.
f. It can be further taken as a research in virtual reality.

V. CONCLUSION

With the simple mathematical techniques, features or patterns can be extracted and used in varied applications. Also with the advent of signal processing and advancements in the field of Artificial Intelligence, Data Mining & Digital Image Processing, it is possible to develop a system where in the users are able to input the sketches or images of an object or a pattern under search. The system can also be automated to scan the area and auto learn the pattern. Input can be either image or audio, thus minimizing human interference. This is particularly important in cases where trained human resource is scarce, but the search and rescue operation needs to be performed in minimal time like natural calamities or war situation to improve the chances of finding live humans.

VI. FUTURE SCOPE

With the outline of the proposed system discussed in this research paper, future work would revolve around realizing the processing techniques and its outcome. Also, the focus is to make an illumination invariant algorithm and extension even to the audio processing shall be realized for optimal and multi-functional product development.

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