Impact Factor (SJIF): 3.632

International Journal of Advance Research in Engineering, Science & Technology

e-ISSN: 2393-9877, p-ISSN: 2394-2444

Volume 3, Issue 3, March-2016

Enhancement & Restoration of Real Time Color Image Based on ARM 11

Grishma J Patel[1], Dimpal N Agrawal[2]

[1]PG Student, Electronics & Communication, SOCET, Ahmedabad, Gujarat, India.

[2]Asst. Professor, Electronics & Communication, SOCET, Ahmedabad, Gujarat, India.

Abstract – *In this paper, considering the adaptive characteristics of human visual system, a new color image Enhancement algorithm based on human visual system adaptive filter is proposed. The new algorithm is divided into three major parts: obtain luminance image and background image, adaptive adjustment and color Restoration. Image restoration and enhancement is one of the leading research areas in the field of digital image processing. This chapter deals with the basic aspects of image restoration and enhancement, and also discusses about the application of soft of soft computing technique such as Fuzzy Logic in solving restoration and enhancement problems. Image restoration attempts to reconstruct or recover an image that has been degraded by using a priori knowledge of the degradation phenomenon. The principal objective of image enhancement is to process a given image so that the result is more suitable than the original image for a specific application. It accentuates or sharpens image features such as edges, boundaries, or contrast to make a graphic display more helpful for display and analysis.*

Keywords – *Color Image Enhancement Algorithm, Adaptive Filter, Camera Module, Image processing.*

I. INTRODUCTION

Image enhancement is one of the most important image processing technology which is necessary to improve the visual appearance of the image or to provide a better transform representation for future automated image processing such as image analysis, detection segmentation and recognition. Many images have very low dynamic range of the intensity values due to insufficient illumination and therefore need to be processed before being displayed

Large numbers of techniques have focused on the enhancement of gray level images in the spatial domain. The enhancement doesn't increase the inherent information content of the data, but it increases the dynamic range of the chosen features so that they can be detected easily.

The greatest difficulty in image enhancement is quantifying the criterion for enhancement and, therefore large number of image enhancement techniques is empirical and require interactive procedures to obtain satisfactory results. Image enhancement methods can be based on either spatial or frequency domain techniques.

Image enhancement methods may be categorized into two broad classes: transform domain methods and spatial domain methods. The techniques in the first category are based on modifying the frequency transform of an image. Whereas techniques in the second category directly operate on the pixels, however, computing a two dimensional (2-D) transform for a large array (image) is a very time consuming task even with fast transformation techniques and is not suitable for real time processing.

All Rights Reserved, @IJAREST-2016

II. Spatial Domain Enhancement Methods

Spatial domain techniques are performed to the Image plane itself and they are based on direct Manipulation of pixels in an image.The operation can be formulated as $g(x,y) = \mathbf{T}[f(x,y)]$, where g is the output, f is the input image and T is an operation on f defined over some Neighborhood of (x, y).According to the operations on the image pixels, it Can be further divided into 2 categories: Point Operations and spatial operations (including linear And non-linear operations.What is Refrigeration?
"The method of reducing the temperature of a system blow surrounding temperature & maintain it at the lower temperature by continuous absorbing the heat from system."

III. Frequency Domain Enhancement Methods

These methods enhance an image f(x,y) by Convoluting the image with a linear, position Invariant operators. The 2D convolution is performed in frequency Domain with Spatial domain: $g(x,y)=f(x,y)*h(x,y)$Frequency domain: G (w1, w2) =F (w1, w2) H(w1,w2) .

IV. Simple intensity transformation

(a). *Image negatives*

Negatives of digital images are useful in numerous applications, such as displaying medical images and photographing a screen with monochrome positive film with the idea of using the resulting negatives as Normal slides. Applications such as displaying medical images and photographing a screen with monochrome positive film with the idea of using the resulting negatives as Normal slides. Transform function T : g(x,y)=L-f(x,y), where L is the max. Intensity.

Fig.1. Original Image

Fig.2. Negative Image

All Rights Reserved, @IJAREST-2016

b). Contrast stretching

Low-contrast images can result from poor Illumination, lack of dynamic range in the image Sensor or even wrong setting of a lens aperture During image acquisition. The idea behind contrast stretching is to increase the Dynamic range of the gray levels in the image being processed.

Fig.3.Original Image

c). Compression of dynamic range

Sometimes the dynamic range of a processed image far exceeds the capability of the display device, in Which case only the brightest parts of the images are Visible on the display screen.An effective way to compress the dynamic of Pixel values is to perform the following intensity Transformation function: s = c log (1+|r|) Where c is a scaling constant and the logarithm Function performs the desired compression.

(d). Histogram equalization

The objective is to map an input image to an output Image such that its histogram. is uniform after the Mapping. Let r represents the gray levels in the image to be Enhanced and s is the enhanced output with a transformation of the form s=T(r)

Assumption:

1. **T**(*r*) is single-valued and monotonically increasing in the interval [0,1], which preserves the order from black to white in the gray scale.

2. $0 \leq T(r) \leq 1$ for $0 \leq r \leq 1$, which guarantees the Mapping is consistent with the allowed range of Pixel values.

3. Using a transformation function equal to the Cumulative distribution of *r* produces an image whose gray levels have a uniform density, which Implies an increase in the dynamic range of the Pixels.

Fig.4. Original Image

All Rights Reserved, @IJAREST-2016

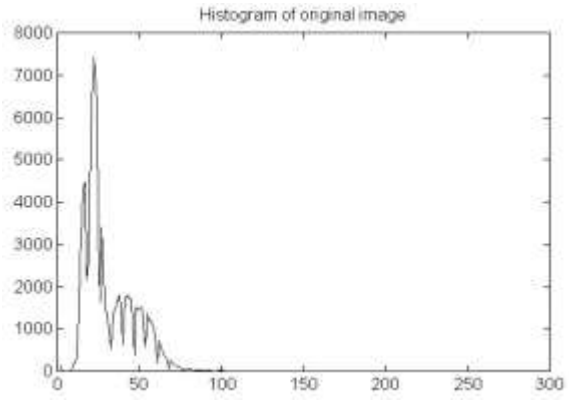

Fig.5. Histogram of Original Image

V. Open CV-Python Tutorials

OpenCV was started at Intel in 1999 by **Gary Bradsky** and the first release camout in 2000**. VadimPisarevsky** joined Gary Bradsky to manage Intel's Russian software OpenCV team. In 2005, OpenCV was used on Stanley, the vehicle who won 2005 DARPA Grand Challenge. Later its active development continued under the support of Willow Garage, with Gary Bradsky and Vadim Pisarevsky leading the project. Right now, OpenCV supports a lot of algorithms related to Computer Vision and Machine Learning and it is expanding day-by-day.

Currently OpenCV supports a wide variety of programming languages like C++, Python, Java etc and is available on different platforms including Windows, Linux, OS X, Android, iOS etc. Also, interfaces based on CUDA and OpenCL are also under active development for high-speed GPU operations.OpenCV-Python is the Python API of OpenCV. It combines the best qualities of OpenCV C++ API and Python language

(a). OpenCV-Python

Python is a general purpose programming language started by **Guido van Rossum**, which became very popular in short time mainly because of its simplicity and code readability. It enables the programmer to express his ideas in fewer lines of code without reducing any readability. Compared to other languages like C/C++, Python is slower. But another important feature of Python is that it can be easily extended with C/C++. This feature helps us to write computationally intensive codes in C/C++ and create a Python wrapper for it so that we can use these wrappers as Python modules.

This gives us two advantages: first, our code is as fast as original C/C++ code (since it is the actual C++ code working in background) and second, it is very easy to code in Python. This is how OpenCV-Python works; it is a Python wrapper around original C++ implementation. And the support of Numpy makes the task easier**. Numpy** is a highly optimized library for numerical operations. It gives MATLAB-style syntax. All the OpenCV array structures are converted to-and-from Numpy arrays. So whatever operations you can do in Numpy, you can combine it with OpenCV, which increases number of weapons in your arsenal.

All Rights Reserved, @IJAREST-2016

Besides that, several other libraries like SciPy, Matplotlib which supports Numpy can be used with this. Since OpenCV is an open source initiative, all are welcome to make contributions to this library. And it is same for this tutorial also. Besides that, several other libraries like SciPy, Matplotlib which supports Numpy can be used with this. So OpenCV-Python is an appropriate tool for fast prototyping of computer vision problems.OpenCV introduces a new set of tutorials which will guide you through various functions available in OpenCV-Python.

This guide is mainly focused on OpenCV 3.x version (although most of the tutorials will work with OpenCV 2.x also).A prior knowledge on Python and Numpy is required before starting because they won't be covered in this guide. Especially, a good knowledge on Numpy is must to write optimized codes in OpenCV-Python.

(b). ARM 11(Raspberry Pi)

New innovative technology revolves around how much a product is capable of implementing along with its price. The Raspberry Pi crosses off both criteria because it is a cheap effective computer which is capable of much more. What makes it so convenient is that so much can be done with itfrom a security system to a VPN server. The possibilities are endless! Like any other computer it can accept several programming languages including Python.

Most importantly, security can be a necessity today and the Pi has the ability to become a camera security system with a cost under 80dollars. Regular security systems lead Up to prices within the range of thousands.Who would want to buy a single camera forever 100 dollars just to setup on their front door, when they can buy a 29 dollar camera which even notifies them via email?You would never have to worry about looking back through recording because the Pi Security System would send you an email whenever someone comes by your home.

Most of all the Pi Security Camera system is very user friendly. Anyone who has the required materials can do it with a few additional installations of files and save themselves a great amount of money. Not to mention, they would gain an efficient security system.

Fig.6. Raspberry Pi Module B+

A Raspberry Pi is a thirty five dollar, credit card sized computer board which when plugged into an LCD and attachment of a keyboard and a mouse, it is able to complete the functions of any regular PC can. Like a

All Rights Reserved, @IJAREST-2016

PC.It have RAM, Hard Drive (SD Card), Audio and Video ports, USB port, HDMI port, and Ethernet port. With the Pi, users can create spread sheets, word-processing, browse the internet, play high definition video and much more. It was designed to be a cost friendly computer for users who needed one.

There are two models, Model A and B+. Model B+ is the faster containing 512MB of RAM as well as the ability to over clock. The Raspberry Pi gets powered via a regular 5V micro USB port and uses between 700-1000mA. For projects requiring more power than 1 Amp an externally powered USB hub is needed. The GPIO pins on the board require16mA each, the camera module requires 250mA, HDMI requires 50mA while keyboard and mice requirements vary. Powering the Raspberry Pi using batteries is possible however it is not recommended because batteries do not provide stable power which can harm the system.

The Pi does not contain its own Wi-Fi connection yet it does have an Ethernet port. It can also support certain models of Wi-Fi dongles such as the Edimax Nano Adapter. This can also cause the system to slow down. Over clocking is possible, however, it is important to note that the proper methods have to be followed or else this may harm the Pi.

(c) Camera Module

The Camera Board on the Raspberry Pi is a small printed circuit board with a camera on it.The PCB is connected to a ribbon cable which connects to the Pi itself on its own port. The ribbon can be extendable. The camera on the board is very small (5MP camera); and is comparable to the ones used on cell phones today. As for now it is the only Camera made specifically for the Pi therefore these specifications cannot be updated. Since it uses 250m externally powering the Pi should be sufficient enough for the camera.

If more items are connected, however, once again an externally powered USB hub is needed USB powered webcam can be used along with a PIR sensor to be able to achieve motion detection. For this case only a camera board is needed.

Fig.7. Raspberry Pi Camera Module

In order for the camera to be enabled it is necessary to go to the raspberry pi configuration settings and selecting Enable Camera. The camera can be used as a regular camera as well as a motion detecting camera.In that case it is not necessary to download the configuration file. Commands in the terminal such as take snapshots while other commands such as the one below can make a video.

```
Raspstill –o imagename.jpg
```

Take snapshots while other commands such as the one below can make video .

```
Raspivid –o videoname.h264
```

All Rights Reserved, @IJAREST-2016

Raspberry Pi contains software titled Motion that allows the Pi Camera to turn into a motion detecting camera.A specific configuration file is used to make any adjustments regarding the behavior of the camera. It allows the adjustment of the picture taking settings, streaming settings, image settings, motion detecting settings and much more. This file is to be obtained from online due to the fact that it does not come with the installation of Motion. When the camera board is turned other command used, runs the configuration file.That it does not come with the installation of Motion. When the camera board is turned on the command used, runs the configuration file.

Most programs come with a configuration file which allows the user to make any adjustments to adjust or advance the program. Motion is no different; however, for convenience is that the proper configuration file can be downloaded from a drop box. This file has been available to the public by a user who has worked with the Motion program. Once the tar file is downloaded it has to be extracted.

VI. Work done in Open CV

(a). 2D Convolution (Image Filtering)

As in one-dimensional signals, images also can be filtered with various low-pass filters (LPF), high-pass filters(HPF) etc. LPF helps in removing noises, blurring the images etc. OpenCVprovides a function cv2.filter2D**()** to example, we will try an averaging filter on an image. A 5x5 averaging filter kernel will look like below:

$$K = \frac{1}{25}\begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \end{bmatrix}$$

Operation is like this: keep this kernel above a pixel, add all the 25pixels below this kernel, take its average and replace the central pixel with the new average value.It continues this operation for all the pixels in the image.

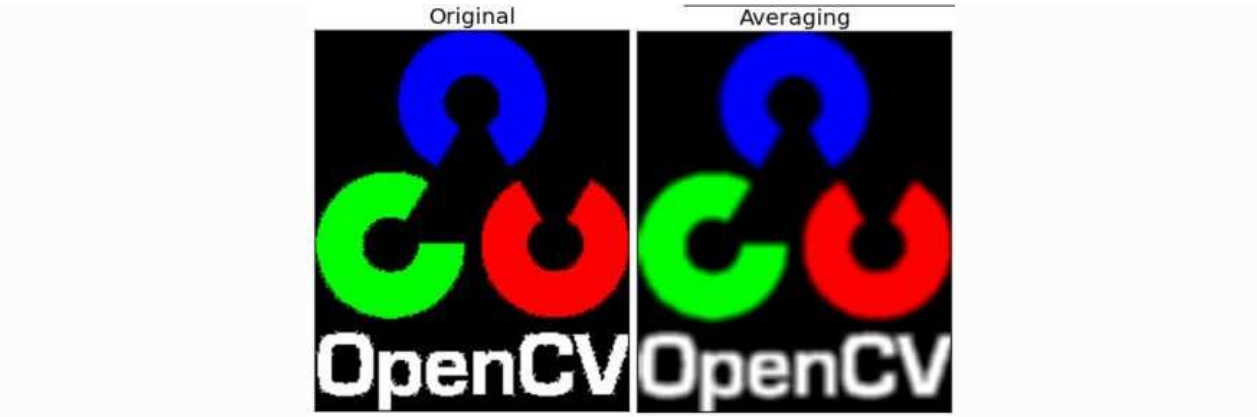

Figure 8: Original & Averaging image

(b). Image Blurring (Image smoothing)

All Rights Reserved, @IJAREST-2016

Image blurring is achieved by convolving the image with a low-pass filter kernel. It is useful for removing noises.It actually removes high frequency content (eg: noise, edges) from the image.So edges are blurred a little bit in this operation. (Well, there are blurring techniques which doesn't blur the edges too). OpenCV provides mainly four types of blurring techniques.

1. Averaging

This is done by convolving image with a normalized box filter. It simply takes the average of all the pixels under kernel area and replaces the central element. This is done by the function cv2.blur () or cv2.boxFilter (). Check the docs for more details about the kernelWe should specify the width and height of kernel.A 3x3 normalized box filter would look like below:

$$K = \frac{1}{9}\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$$

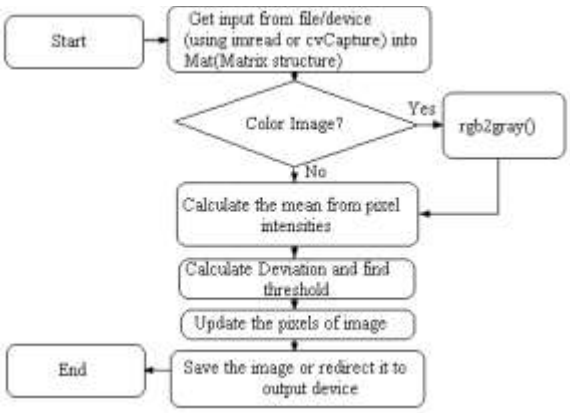

Figure 9: Flow chart of averaging filter

VII. Future work

By using open CV, I will Working on open CV to get the better image result improvement in future. & I will develop a multiscale retinex algorithm in future.I will also try to implement the algorithm to enhance an image in different enhancement degree. It will found that the algorithm developed for the Raspberry Pi executes successfully and gives a very colorful image. The future scope will be the development of adaptive algorithms for effective image enhancement using Fuzzy Logic and Neural Network.

VIII. Application

Image restoration and enhancement techniques are widely used in the field of computer vision, video surveillance, medical and satellite image processing etc.Producing visually natural is required for many important areas such as vision, remote sensing, dynamic scene analysis, autonomous navigation, and biomedical image analysis.

Satellite images are used in many applications such as geosciences studies, astronomy, and geographical information systems. One of the most important quality factors in images comes from its resolution.

All Rights Reserved, @IJAREST-2016

Resolution of an image has been always an important issue in many image- and video-processing applications, such as video resolution enhancement as:

[1] Feature extraction

[2] Satellite image &

[3] Resolution enhancement

IX. Conclusion

Image enhancement algorithms offer a wide variety of approaches for modifying images to achieve visually acceptable images. The choice of such techniques is a function of the specific task, image content, observer characteristics, and viewing conditions. Different Algorithms have better visibility, the details are clear & the colors are vivid and natural. We implemented the algorithm to enhance an image in different enhancement degree. It was found that the algorithm developed for the Raspberry Pi executes successfully and gives a very colorful image.

The parameters vary in order to restore human Skin color and it enhances a color image in a particular Enhancement degree to restore original color. Therefore we conclude that the proposed method enhances color image in a particular degree effectively.

REFERENCES

1. Xinghao Ding, Xinxin Wang, Quan Xiao, School of Information Science and Technology, Xiamen University, 2010.
2. Kota Murahira and Akira Taguchi, Department of Biomedical Engineering, Tokyo City University, 2014.s
3. Funt B, Ciurea F, McCann J. Retinex in MATLAB [J]. Journal of Electronic Imaging, 2004.
4. R.C. Gonzalez and R.E. Woods, Digital Image Processing 3rd ed., Pearson Education, 2008.
5. R.S. Berns, F.W. Balmier, and M. Saltzman, Balmier and Saltzman's Principles of Color Technology, 3rd Ed. New York: Wiley, 2000.
6. D. H. Choi, I. H. Jang, M. H. Kim, and N. C. Kim, "Color image enhancement using single-scale retinex based on an improved image formation model" 16th European signal processing conference, Aug. 2008.
7. J. C. Clement, M. Parbukunmar, and A. Basker, "Color image enhancement in compressed DCT domain" ICGST GVIP Journal, vol. 10, no. 1, pp. 31-38, Feb. 2010.
8. Wang Shou-jue, Ding Xing-hao, Liao Ying-hao, Guo dong-h Novel Bio-inspired Algorithm for Color Image Enhancement,Acta Electronica Sinica, 2008.10, Vol.36, No.10: 1970-1973.(in Chinese)
9. Huang Kai-qi, Wang Qiao, Wu Zhen-yang, Multi-Scale Color Image Enhancement Based on Human Visual Properties. Journalof Circuits and Systems, 2003.12, Vol.8, No.6: 113-117. (in Chinese)

All Rights Reserved, @IJAREST-2016