Volume 4, Issue 2, February-2017, pp. 13-19 ISSN (O): 2349-7084

International Journal of Computer Engineering In Research Trends

Available online at: www.ijcert.org

Survey on Different Applications of Image Processing

Ajin P Thomas, Sruthi P.S, Jerry Rachel Jacob, Vandana V Nair, Reeba R

Sree Buddha College Of Engineering, Alappuzha ,India

ajinpthomas@gmail.com , sruthips395@gmail.com, jerryjacobsbce@gmail.com,

vanduv0312@gmail.com, Reeba.amjith@gmail.com

Abstract:-In Imaging Science, Image processing is processing of images using mathematical operations by using any form of signal processing for which the input is an image, a series of images, or a video, such as a photograph or video frame; the output of image processing may be either an image or a set of characteristics or parameters related to the image. These image processing techniques can be used to perform applications in real-world. This image processing technique helps to improve various aspects related in the real- world. Some of these applications are in the field of health science, security assurance and augmented reality and also this can be applied in real-time applications. All these applications are performed by using image processing as its basic platform.

---

1. Introduction

Most image-processing techniques involve treating the image as a two-dimensional signal and applying standard signal-processing techniques to it. Images are also processed as three-dimensional signals with the third-dimension being time or the z-axis. Image processing usually refers to digital image processing, but optical and analog image processing also is possible. The acquisition of images (producing the input image in the first place) is referred to as Imaging.

Image processing techniques can be used to perform various applications such as in the health field, security applications, augmented reality, and real-time applications and so on.

In health science application, image processing can be done along with color compensation technique in LCD display so that people suffering from Color Vision Deficiency can view the display devices as normal people do.

Security related applications, image processing techniques are applied to biometrics, that is, metrics related to unique human characteristics and biometrics authentications are used as a form of identification and access control and hence provide security for various applications.

In real-time applications, image enhancement techniques are histogram equalization (HE) and curve let transformation. HE technique is commonly employed for image enhancement and curve let the transformation identified and separate bright regions of the image.

In augmented reality, image processing the blended with augmented reality to focus on the mobile apps field, wherein there are many SDK's (Software Development Kits) available for the creation of these AR such as AR Toolkit, Argon etc.

The introduction of image processing and application of image processing in the real-world issues, hence become a great evolution of technology.

2. Applications of Image Processing

2.1 Health Applications

 DOI:10.22362/ijcert/2017/v4/i1/xxxx

Image processing can be done in reducing the issues related to health. One of the major applications of image processing in health area is "the image processing using color compensation using LCD display for Color Vision Deficiency".

It is mainly implemented in order to help people with Color Vision Deficiency to view the display devices and to perceive various colors in the display devices as normal people do.

Color Vision Deficiency

Color Vision Deficiency (CVD) is an inability or decreased ability of a person to perceive color differences under normal lighting condition. There are approximately 200 million individuals worldwide who suffer from some kind of color vision deficiency (CVD). Dichromacy is a moderately severe color vision deficiency in which one of three basic color mechanisms is absent or not functioning.

There are three types of Color Vision Deficiencies. They are:

- Protonopia is a severe type of color vision deficiency caused by the complete absence of red retinal photoreceptors.
- Deuteranopia is a type of color vision deficiency where the green photoreceptors are absent.
- Tritanopia is a very rare color vision disturbance in which there are only two cone pigments present and a total absence of blue retinal receptors.

Normaltrichromacy& Anomalous Trichromacy

Human normal vision is called normal trichromacy. In general, people perceive object's color and brightness when light reflected off an object's surface is detected by visual cells.

A condition in which there is a variance of proteins that constitute a given photo-pigment is defined as anomalous trichromacy. If the altered photo-pigment is the one associated in normal color vision specifically with the L, M or S cones, the condition can be further classified as protanomaly, deuteranomaly, and tritanomaly, respectively.

Dyschromatopsia

Dyschromatopsia is a condition in which ability to perceive a color is defected. It is often called color blindness and color vision deficiency. These symptoms are mainly caused by inheritance.

People classified to have color blindness lack one or two of the three cone cells. People with color vision deficiency have all three cone cells but the ones that do not function normally.

CVD Compensation Algorithm

The intensity of each RGB perceived by people with CVD could be drawn by the CVD conversion matrix. With an assumption that the inversion of the converted matrix will allow people with CVD to perceive colors as normal trichromats do, an algorithm was developed. If an image is converted with the algorithm in order, an adjusted image is produced. Inverse CVD matrix results in intensification of the weaker colors, and therefore it is common to have overflow in RGB gray level. The normalization of the image reduces the overall brightness of the image, so the backlight of LCD has to be controlled to compensate for the decrease in brightness.

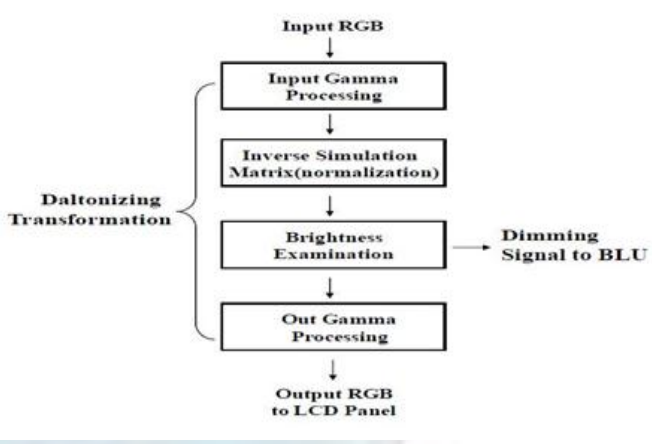

Fig 1: An algorithm for adjusting an image for people with CVD

An inverted matrix can produce a processed image for people with CVD. However, the image is dimmer after applying Simulation matrix because the inverted image is normalized when the gray level exceeds a certain point. It has proposed a solution for the brightness issue by controlling the backlight property of LCD display. After examining how much luminosity decreased during the image process, LCD backlight is strengthened to compensate for the loss.By applying inverse Simulation matrix to the original image, colors with which people with CVD are weak are amplified. When any one of RGB exceeds a certain data level the screen can hold, brightness of each RGB is normalized based on the maximum value of RGB.

When the brightness of the colors decreases, people with CVD will perceive the same colors as it is done. However, image is dimmer, and thus the quality of an image is not the same. So, we propose a method to resolve problems with the brightness by using backlight property of LCD displays. When inverse simulation matrix is applied to an image, some pixels can have max luminance exceeding 100% brightness data that a display can reproduce. Because overflowing pixels cannot be expressed on a display, all pixels are normalized by the maximum luminance among overflowing pixels. Therefore, the brightness of the whole image will be dimmer. Since LCD display has backlight, it can provide solutions for this dimming problem.Before normalizing the RGB data of the inversed image, it is saved the maximum brightness. Maximum brightness after the normalization was obtained, and the maximum brightness before the normalization was divided by the one after as shown in the equation below. This value is BL gain and with that value, backlight compensated the brightness of the normalized image.When backlight brightness is adjusted with compensated dimming value with pulse width modulation output, people with CVD will perceive not only the same colors but the same brightness as the normal person view the image.

*Output BL Value = Original BL Value * BL Gain*

This methodology can be applied for the people with tritanomaly by the same process used for Protanomaly and Deuteranomaly. The model achieved such condition by strengthening defected colors. However, this led to a problem where the RGB value went over the RGB data level that an LCD display can produce. Therefore, we had to normalize the whole RGB data based on the maximum data value of RGB data. Because this process leads to decrease in the brightness of the whole image, our model manipulated the backlight property of the LCD display. Analyzing the brightness before the normalization and the one after the normalization, Backlight Unit was amplifier.

2.2 Security Related Applications

Biometrics refers to metrics related to human characteristics. Biometrics authentication (or realistic authentication) is used in computer science as a form of identification and access control. Biometric identifiers are the distinctive, measurable characteristics used to label and describe individuals. Biometric identifiers are often categorized as physiological versus behavioural characteristics. More traditional means of access control include token-based identification systems, such as a driver's license or passport, and knowledge-based identification systems, such as a password or personal identification number. Since biometric identifiers are unique to individuals, they are more reliable in verifying identity than token and knowledge-based methods; however, the collection of biometric identifiers raises privacy concerns about the ultimate use of this information.

Palmprint Identification

A palm print refers to an image acquired of the palm region of the hand. It can be either an online image (i.e. taken by a scanner or CCD) or offline image where the image is taken with ink and paper. The palm itself consists of principal lines, wrinkles (secondary lines), and epidermal ridges. It differs to a fingerprint in that it also contains other information such as texture, indents and marks which can be used when comparing one palm to another. Palm prints can be used for criminal, forensic, or commercial applications. Advantages of using palmprint over fingerprint is that some people will not have clear fingerprint due to their physical work or problematic skin. Fingerprint provides only smaller area for feature extraction compared to palmprint. Fingerprint requires high resolution for capturing ridges while palmprint requires only low resolution to capture principle lines and ridges.

A palmprint identification has mainly four steps:

- Palmprint acquisition: palmprint image is captured by palmprint scanner.
- Pre-processing: a coordinate system is set up on the basis of boundaries of fingers so as to extract a central part of a palmprint for feature extraction.
- Feature extraction : we apply a filter to extract information from central part.
- Matching: a distance measure is used to measure similarity of two palmprints.

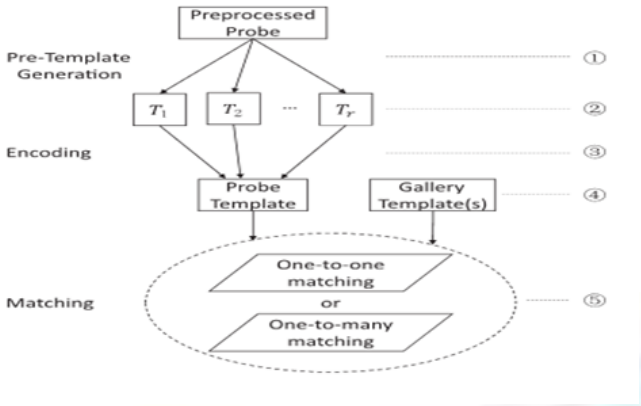

Fig 2: Algorithm for palmprint identification

Here we assume that all palmprint images in the dataset are pre-processed, such as image normalization and the region of interest segmentation. This framework is generalised to unify feature extraction and matching stage for palmprint identification. The feature extraction stage consists of pre-template generation followed by their consolidation in encoding stage. The T1,T2,…describe the intermediate results usually generated by the convolution operation between filters and pre-processed probe. Encoding of these multiple intermediate results generates the final feature template which can effectively characterize the palmprint image. The probe template, regarded as a feature, is matched to templates generated from the gallery. Each template can be seen as a feature matrix, each entry on the matrix is an encoded feature code. There are two kinds of prominent feature matching strategy:

(a)one to one and

(b)one to many matching strategy.

For one to one matching strategy, the Hamming distance between the codes with same position is returned as the final distance. For one to many matching strategy, the code in one template matrix is matched to the neighbourhood of the corresponding code in another matrix , and the minimum Hamming distance is returned as the final distance.

Challenges

There are two key challenges in accurately matching two palmprint images. The first one is relating to the accurate representation of features which is seriously influenced by the noise introduced on the surface due to sweat, dirt etc. The other challenge is resulting from inaccurate alignment of matched palmprints which is mainly contributed from the palmprint deformations due to surface pressure such as stretching.

Solutions to these problems include:

Most efficient methods reported in literature employ feature encoding strategy instead of using numerical feature values as representative feature. Such discretization of precise feature values reduced the influence of noise and also helps to enhance matching speed. The one to many matching strategy may help to accommodate the misalignment between the matched templates which is mainly introduced due to the deformations during the imaging.

2.3 Quality Enhancement Related Applications

A very popular technique for image enhancement is histogram equalization (HE) and curvelet transformation. HE technique is commonly employed for image enhancement because of its simplicity and comparatively better performance on almost all types of images. Another widely used technique is curvelet transformation. This technique is identified and separate bright regions of the image, but more error rate and low peak signal to noise ratio (PSNR).

Brightness Preserving Hybrid Model

The Hybrid transformation model can be classified in to three parts:

- Discrete cosine transformation
- DWT using haar transformation
- Image fusion

Architecture of Hybrid Transformation Model

Hybrid transformation model consist of six components-

1. Load Input Image
2. DWT Using Haar Wavelet
3. Discrete Cosine Transform
4. Image Fusion
5. Inverse DWT
6. Output Image

1) Load Input Image

a) Take an image like 'lena.jpeg'.

b) Load image into two coordinates (I, MAP) where, I is the intensity value of load input image and MAP is the probability of color image map range is 256×3.

2) DWT Using Haar Wavelet

a) Find the histogram of input image. This histogram shows the distribution of pixel value above color bar of the color map. The color map, must be at least as long as the largest index in I. After, find histogram image I create array returns the size of matrix I in variable row and columns.
b) Now, apply DWT, first select level=1 For decomposition of image. According to level, image is divide in to four parts cA approximation coefficients, and cH, cV, cD, detail coefficients.
c) Now select cA coefficient part and create a matrix of cA pixel values, find total no of pixel in coefficient part by multiplication of row and column. Then repeat this process for next level, in this level decomposition of only cA part not detail coefficient part because this process is identified only low-band in the image.
After decomposition of image for enhancing the brightness of the image by transforming the value using adaptive histogram equalization operation on small regions in the image called tiles image, rather than the entire image. Brightness, especially in homogeneous areas,
d) Noise presented in the image for detecting noise on this area is limited.
e) Two element vector of positive integer specifying the no of tiles by row and column [M,N]. M, N must be at least 2, the total no of tiles is equal to M×N, by default value of M by N is 8×8.After apply of adaptive histogram equalization image will be smooth image.

3) Discrete Cosine Transformation Technique

a) Smooth image passed through DCT.DCT is used for contrast enhancement, it performed input image as 8×8 sub block in array of integer, this array contain on each pixels gray scale level. Images lie at low frequencies; these appear in the upper left corner of the DCT. For enhancement since the low frequencies values represent higher frequencies, and are very low frequencies values presented in the image to be neglected with low vision distortion. This is used for better contrast and noise free input image.

4) Image Fusion

a) Image fusion is process of combining the relevant information from a set of image, into a single image.
b) In this model used pixel level image fusion means image is fused by intensity of pixel in low band and high band.
c) In this architecture select low band image by dwt and contrast enhance image by DCT are fused by image fusion technique maintaining the Integrity of the Specifications.

5) Inverse DWT

After image fusion result apply inverse dwt on fused image, after inverse DWT intensity level of the pixels is recognized or restored image domain.

6) Output Image

After the process of hybrid transformation image is enhanced by contrast, preserving brightness and noise free image will generate.

Algorithm of Hybrid Transformation

Steps in the hybrid transformation algorithm:
a) Start
b) Load input image, for example I='lena.jpeg'. Create MAP for stored in M×N matrix form with range 256×3.after MAP image is stored in [M, N] = (I, MAP).
c) Apply histogram process for finding an intensity level of pixel in the input image. After finding histogram of image 'I' create an array and return the size of matrix 'I' in variable row and column.
d) Select level = 1 then apply DWT, image is decomposed into four parts, Approximation coefficient storage cA, Horizontal detail coefficient cH, storage. Vertical detail coefficient CV storage, Diagonal detail coefficient cD storage. Repeat the process up to decomposition length D (in step f).
e) Select cA part and create matrix of cA, find total no of pixels (M×N).
f) For grayscale images, pixels of this type images lie at low frequencies; these appear in the upper left corner of the DCT. For enhancement since the low frequency values represent higher frequencies, and are very low frequency values presented in the image to be neglected with low vision distortion. This is used for better contrast and noise free input image.

2.4 Augmented Reality Applications Using Image Processing

Augmented Reality was just a vision in the 80's because of the slow processing power of computers; the computers could not process large amounts of images and position. But with increase in processing power of computers we are able to generate augmented reality scenes. The main focus of AR is in the mobile apps field, wherein we have many SDK's (Software Development Kits) available for creation of these AR such as AR Toolkit, Argon.

Software Requirements For AR

AR Strategies used by companies:

• BMW Z4: By downloading the software and printing the 3D symbol, holding it in front of your webcam will allow you to see your own miniature BMW Z4, this acts as a canvas where you can manipulate the color of the car and even drive it around using your keyboard. This gives the customer a realistic feel of driving a BMW, thereby creating a desire to own one.

• Ray- Ban: A company famous for its sunglasses for over 8 decades has also adopted the use of AR for selling its sunglasses. Despite the difficulty to sell the products such as sunglasses or even provide a user experience.

Ray- Ban has developed a virtual webcam mirror lets you virtually try on sunglasses and by just moving your head around you can see how the shades look from different angles. Moreover ,you can try on different color shades and vary the light intensity and vary the opacity of the glass.

Application of AR In Recent Technologies

• Mobile technology and AR: It is a perfect match as we have seen in the numerous apps developed. The future of AR is almost tailor made for wearable technology like the smart watches or the wearable glasses. Although prototypes of the Google Glass and the Samsung Gear watch are available there is still a lot of room for improvement in both the hardware and software regions.

It is being still looking for suitable lightweight and comfortable materials for building frames of the glasses and watches in an attempt to make them more compact and user friendly. There are very limited API's available for development of AR for mobile apps, considering hardware's such as the Google glass one must first buy the glass before being able to develop apps for it. There are no emulators where test can be carried out, it has to be done using the physical hardware device which is expensive and not easily accessible. It will definitely see a large change in the way in which games will be developed and experienced by the gamer.

The industry has come a long way from the 8 bit games to the AR games being developed by Oculus Rift all in the span of half a century. There is a whole new level of user interaction where a person actually feels involved in a game and is not staring into a monitor or a screen. It is a great opportunity for developers to focus on giving not only making games that are visually appealing using AR but also create a personalized experience for the gamer which was previously not possible. Along with a great experience there is also a new dimension created in the multiplayer games and the way in which two or more gamers can play with each other. It will be completely different from the traditional way of sharing high scores or playing over a LAN. AR offers more real time interaction and a holistic experience where the game play doesn't depend on the processor speed but depends on the game's true ability. Virtualization and AR: There is also an opportunity to create a virtual environment for things that are humanly impossible, such as flying or deep sea diving which gives the customer a feel of what they would be unable to do physically otherwise moreover it ensures safety as it is not prone to risk and carried out in a virtual environment.

3. Conclusion

Image processing is a method to convert an image into digital form and perform some operations on it, in order to get an enhanced image or to extract some useful information from it. It is a type of signal dispensation in which image is the input, like video frame or photograph, and output may be an image or characteristics associated with that image. Usually the image processing system includes treating images as a two dimensional signal while applying already set signal processing methods for them. Image processing is widely used in various fields such as in medical science, security improvement area, real-time applications, and augmented reality and so on. Image processing has thus become a rapidly growing technology today, with its various aspects of a business.

4. References

[1] Dalton, John, ―Extraordinary Facts Relating to the Vision of Colour‖, London: Cadel and Davins,. 1798, pp. 28–45.

[2] G. M. Machodo, ―A Physiologically-based Model for Simulation of Color Vision Deficiency‖ IEEE Transaction on Visual and Computer Graphics Vol. 15. No 6. 2009, pp. 1291-1298

[3] G. M. Machodo, Manuel. M. Oliveira.―A Model for Simulation of Color Vision Deficiency and A Color

Contrast Enhancement Technique for Dichromats‖, pp. 74, 2010

[4] V.Kanhangad, A.Kumar,and D.Zhang, "Contactless and pose invariant biometric identification using hand surface,"IEEE Trans, Image Process,, vol. 6, no. 3, pp. 1415-1424, May 2011

[5] The Hong Kong Polytechnic University (2015), Implementation Codes for 3D Palmprint Matching.

[6] W.L Li, L. Zhang, and D. Zhang, "Three dimensional palmprint recognition,"in Proc, IEEE Int.Conf.Syst., Main Cybern.., Oct 2009, pp. 4847-4852.

[7] P. Rajavel, "Image Dependent Brightness Preserving Histogram Equalization", IEEE Transactions on Consumer Electronics, Vol. 56, No. 2, May 2010

[8]. Yeong-Taeg Kim, "Contrast enhancement using brightness preserving bi-histogram equalization," IEEE Transactions on Consumer Electronics, vol. 43, no. 1, pp. 1-8, Feb. 1997.

[9]. Soong-Der Chen and Abd. Rahman Ramli, "Contrast enhancement using recursive mean-separate histogram equalization for scalable brightness preservation," IEEE Transactions on Consumer Electronics, vol. 49, no. 4, pp. 1301- 1309, Nov. 2003.

[10] Ronald Azuma, Yohan Baillot, Reinhold Behringer, "Recent Advances in Augmented Reality" , Computers & Graphics, November 2001.

[11] Avery, B., Thomas, B., and Piekarski, W, "User Evaluation of See-Through Vision for Mobile Outdoor Augmented Reality.", In 7th Int'l Symposium on Mixed and Augmented Reality. pp 69-72. Cambridge, UK. Sep 2008.

[12] Feng Zhou ; Duh,H.B.-L. ; Billinghurst, M. "Trends in augmented reality tracking, interaction and display" A review of ten years of ISMAR Mixed and Augmented Reality 2008. ISMAR 2008. 7th IEEE/ACM International.

