A COLOR ENHANCEMENT USING HISTOGRAM MODIFICATION OF COLOR AND DEPTH IMAGES

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ABSTRACT: Image enhancement is a process of improving the quality of image by improving its feature. Image contrast enrichment techniques have been largely studied in the past decades. The histogram change in frame of the color and depth image histograms are first distribute into subintervals using the Gaussian mixture model. Contrast enhancement increases the total contrast of an image by makin light colors lighter and dark colors darker at the same time. Image enhancement is the process of applying these techniques to facilitate the development of a solution to a computer imaging problem. Here they introduce a new global contrast enhancement algorithm using the histograms of color and depth images. Adjusting the color contrast of an image is a process of increasing or decreasing the differences between the RGB color values of the image. By using this process of image contrast enhancement algorithm that perform the histograms of both color and depth images. The divided sub-histograms are then separately cover using the predicted Gaussian parameters. The contrast of the image is increased without a large amount of change in the color of the image. The depth image is constructed from the left and right view of the same image. On the basis of the histogram modification framework, the color and depth image histograms are first partitioned into subintervals using the Gaussian mixture model. The positions partitioning the color histogram are then adjusted such that spatially neighboring pixels with the similar intensity and depth values can be grouped into the same sub-interval. By estimating the mapping curve of the contrast enhancement for each sub-interval, the global image contrast can be improved without over-enhancing the local image contrast. Experimental results demonstrate the effectiveness of the proposed algorithm.

I. INTRODUCTION

Image processing is any form of signal processing for which the input is an image, 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. Most image- processing techniques involve treating the image as a two-dimensional signal and applying standard signal- processing techniques to it. Image processing usually refers to digital image processing, but optical and analog image processing also are possible. Image processing is closely related to computer graphics and computer vision. 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 input is image, like video frame or photograph and output may be image or characteristics associated with that image. Usually Image Processing system includes treating images as two dimensional signals while applying already set signal processing methods to them.

Importing the image with optical scanner or by digital photography. Analyzing and manipulating the image which includes data compression and image enhancement and spotting patterns that are not to human eyes like satellite photographs. Output is the last stage in which result can be altered image or report that is based on image analysis. The two types of methods used for Image Processing are Analog and Digital Image Processing. Analog or visual techniques of image processing can be used for the hard copies like printouts and photographs. Image analysts use various fundamentals of interpretation while using these visual techniques. The image processing is not just confined to area that has to be studied but on knowledge of analyst. Association is another important tool in image processing through visual techniques. So analysts apply a combination of personal knowledge and collateral data to image processing.

IMAGE contrast enhancement techniques have been extensively studied in the past decades. Among various contrast enhancement approaches, histogram modification based methods have received the greatest attention owing to their simplicity and effectiveness. In particular, since global histogram equalization (GHE) tends to over-enhance the image details, the approaches of dividing an image histogram into several sub- intervals and modifying each sub-interval separately have been considered as an alternative to GHE . The effectiveness of these sub-histogram based methods is highly dependent on how the image histogram is divided. The state-of-the-art algorithm models the image histogram using the Gaussian mixture model (GMM) and divides the histogram using the intersection points of the Gaussian components. The divided sub-histograms are then separatel stretched using the estimated Gaussian parameters.

II. SYSTEM DESIGNS

A. SYSTEM ARCHITECTURE:

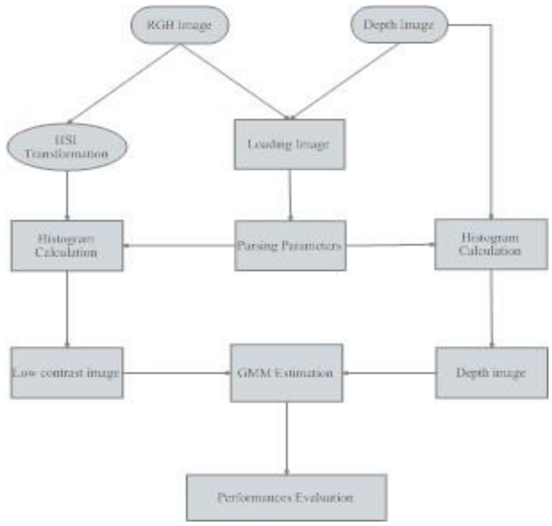

Fig 1 System Architecture

B. FLOW DIAGRAM:

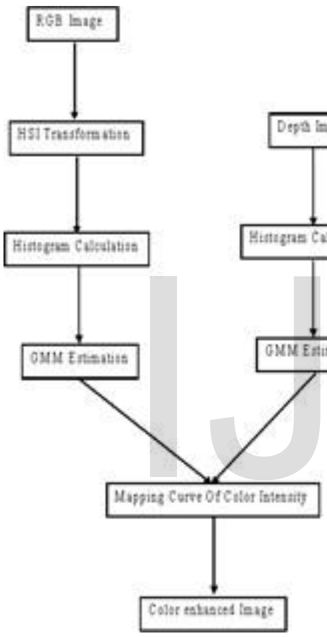

Fig 2 Flow diagram

III. MODULES AND MODULE DESCRIPTION

A. MODULES:

- DEPTH IMAGE GENERATION.
- HSI SEPARATION.
- HISTOGRAM CALCULATION.
- GMM ESTIMATION.
- COLOR ENHANCEMENT.

B. MODULE DESCRIPTION

DEPTH IMAGE GENERATION

Depth images are obtained by stereo vision method. The 3D information can be obtained from a pair of images, also known as a stereo pair, by estimating the relative depth of points in the scene. These estimates are represented in a stereo disparity map, which is constructed by matching corresponding points in the stereo pair. Color depth, also known as bit depth, is either the number of bits used to indicate the color of a single pixel, in a bitmapped image or video frame buffer, or the number of bits used for each color component of a single pixel. For consumer video standards, such as High Efficiency Video Coding the bit depth specifies the number of bits used for each color component. When referring to a pixel the concept can be defined as bits per pixel which specifies the number of bits used. When referring to a color component the concept can be defined as bits per channel bits per color or bits per sample. Color depth is only one aspect of color representation, expressing how finely levels of color can be expressed (a.k.a. color precision); the other aspect is how broad a range of colors can be expressed (the gamut). The definition of both color precision and gamut is accomplished with a color encoding specification which assigns a digital code value to a location in a color space.

Two different depth maps can be seen here, together with the original model from which they are derived. The first depth map shows luminance in proportion to the distance from the camera. Nearer surfaces are darker; further surfaces are lighter. The second depth map shows luminance in relation to the distances from a nominal focal plane. Surfaces closer to the focal plane are darker; surfaces further from the focal plane are lighter, (both closer to and also further away from the viewpoint).

HSI SEPARATION

The Hue, Saturation and Intensity values were separated from the RGB image. Hue is the degree to which a color can be described as similar to or different from color that are described as red, green, blue, and yellow. Saturation is the degree of difference between a color and gray. Intensity is the brightness or dullness of colors. Intensity is the measure of amount of light intensity perceived by eye regardless of the color. HSL are the most common cylindrical coordinate representations of points in an RGB color model. Developed in the 1970s for computer graphics applications, HSL are used today in color pickers, in image editing software, and less commonly in image analysis and computer vision.

The two representations rearrange the geometry of RGB in an attempt to be more intuitive and perceptually relevant than the Cartesian (cube) representation, by mapping the values into a cylinder loosely inspired by a traditional color wheel. The angle around the central vertical axis corresponds to "hue" and the distance from the axis corresponds to "saturation". These first two values give the two schemes the 'H' and 'S' in their names. The height corresponds to a third value, the system's representation of the perceived luminance in relation to the saturation.

Perceived luminance is a notoriously difficult aspect of color to represent in a digital format (see disadvantages section), and this has given rise to two systems attempting to solve this issue: HSL (L for lightness) and HSV or HSB (V for value or B for brightness). A third model, HSI (I for intensity), common in computer vision applications, attempts to balance the advantages and disadvantages of the other two systems. While typically consistent, these definitions are not standardized, and the abbreviations are colloquially interchangeable for any of these three or several other related cylindrical models. Note also that while "hue" in HSI refers to the same attribute, their definitions of "saturation" differ dramatically. (For technical definitions of these terms, see Color-making attributes.)

HISTOGRAM CALCULATION

Histogram is the graphical representation of the tonal distribution of the image. The histogram value of the input image and the depth image is calculated. The histogram values were compared and the positions where the histogram values were changing is identified and the points were located.

Contrast enhancement techniques in the second subgroup modify the image through some pixel mapping such that the histogram of the processed image is more spread than that of the original image. Techniques in this subgroup either enhance the contrast globally or locally. If a single mapping derived from the image is used then it is a global method; if the neighborhood of each pixel is used to obtain a local mapping function then it is a local method. Using a single global mapping cannot (specifically) enhance the local contrast. One of the most popular global contrast enhancement techniques is histogram equalization (HE). The histogram in the context of image processing is the operation by which the occurrence of each intensity value in the image is shown. Normally, the histogram is a graph showing the number of pixels in an image at each different intensity value found in that image. For an 8 -bit grayscale image there are 256 different possible intensities, and so the histogram will graphically display 256 numbers showing the distribution of pixels amongst those grayscale values. Histogram equalization is the technique by which the dynamic range of the histogram of an image is increased. HE assigns the intensity values of pixels in the input image such that the output image contains a uniform distribution of intensities.

It improves contrast and the goal of HE is to obtain a uniform histogram. This technique can be used on a whole image or just on a part of an image. This method usually increases the global contrast of many images, especially when the usable data of the image is represented by close contrast values. Through this adjustment, the intensities can be better distributed on the histogram. This allows for areas of lower local contrast to gain a higher contrast without affecting the global contrast.

Histogram equalization and accomplishes this by effectively spreading out the most frequent intensity values. The method is useful in images with backgrounds and foregrounds that are both bright or both dark. In particular, the method can lead to better views of bone structure in x -ray images, and to better detail in photographs that are over or under- exposed.

Histogram equalization is a specific case of the more general class of histogram remapping methods. These methods seek to adjust the image to make it easier to analyze or improve visual quality. The above describes histogram equalization on a grey- scale image. However it can also be used on color images by applying the same method separately to the Red, Green and Blue components of the RGB color values of the image. Still, it should be noted that applying the same method on the Red, Green, and Blue components of an RGB image may yield dramatic changes in the image's color balance since the relative distributions of the color channels change as a result of applying the algorithm.

GMM ESTIMATION

This uses the Gaussian functions to estimate the identified histogram changing points. This will shows us which histogram points has to be changed further. GMM is a probabilistic model for representing the presence of subgroups (i.e.) the values belonging to a particular color intensity within an overall histogram calculated.

A GMM is a natural model to use if a class contains a number of distinct subclasses, as is often the case (for example, forest textures of different types of trees in an aerial image). An alternative to GMMs would then seem to be to treat the components of the GMMs for each block as hidden states (effectively, „subclasses‟), and to couple them to each other spatially, thus producing a 2D HMM. While this might seem like a good idea, the parameter estimation problem becomes much harder, both algorithmically and because there are more parameters to be estimated from the same limited amount of data. In addition, since the semantics of the hidden states is a priori unknown, it is not clear that the dependencies introduced by the HMM are present. We choose to adopt the simpler approach, to be confirmed a posteriori by comparison with the HMM alternative as used, for example, by Li and Gray. This work defines Gaussian mixture models (GMM) of colored texture on several feature spaces and compares the performance of these models in various classification tasks, both with each other and with other models popular in the literature. The work evaluates the classification performances on variety of „color‟ and „structure‟ features and finds which the most appropriate one are. In addition the work suggests several methods for combining the „color‟ and „structure‟ information and analyzes the influence of the model selection of the GMM and the influence of using a diagonal covariance versus the full covariance of the Gaussian.

COLOR ENHANCEMENT

Mapping Curve of Color Intensity is obtained by comparing the estimated histogram of original and the depth image. The region that has to be modified is identified and they are modified. The final result is the contrast enhance color image.

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. 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.

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. It is often necessary to enhance details over small areas. The number of pixels in these areas may have negligible influence on the computation of a global transformation, so the use of global histogram specification does not necessarily guarantee the desired local enhancement.

IV. ALGORITHM DESCRIPTION

Stereo computer vision has always been a computationally intensive task. The algorithm must match pixels on one image to the corresponding pixels in another image. Most stereo algorithms use the epi polar constraint in order to reduce the window search to a one dimensional search. The idea is that any pixels along a scan line in one image will have its corresponding pixels on the same scan line in the other image. If the pixels were not on the same scan line, the search would have to be two dimensional which would increase the complexity of the algorithm. The first algorithm I attempted to use was a Sum of Absolute Differences stereo algorithm. The principle behind this algorithm is to use a window of pixels in right eye image and subtract the pixels from another window of the same size in left eye image. The process then repeats itself by moving the window in the left image along a line. The line represents the possible levels of disparity between the two images. The larger the disparity is, the closer the object is to the viewer. A disparity of 0 represents infinity, as an object extremely far away will appear at the same position for both eyes. The process assumes that the epi-polar constraint is satisfied. We use the absolute of the subtraction of the pixels from one window to another and sum them up into a result. The stereo vision program was written based on a free program called SVV. The code is a simple example of how to retrieve webcam images using V4L. The example was modified to use 2 cameras and perform an SAD algorithm on the two retrieved images. The resulting disparity map was combined with the two frames to display all three images at once in a window for testing purposes, but is removed in the final result. The program was also modified to accept two images from the console.

V. RESULTS

In order to evaluate the performance of the proposed algorithm, the Middlebury stereo test images were used in our experiment. The depth images were obtained using the stereo matching algorithm [10] as shown in Fig. 3. The pixel values of the color images were then divided by 4 to simulate low-contrast input images. Using the same histogram partitioning and mapping curve generation methods in [2], the effectiveness of the proposed algorithm can be evaluated by comparing the results obtained with and without modifying the histogram sub-intervals, respectively. The amount of modification in the histogram sub-intervals is dependent on . Fig. 4 shows that the layer labeling result S_{1*} became more spatially uniform as increased. We empirically found that =1000 performed well in enhancing the contrast of images. The results given hereafter were obtained using =1000.

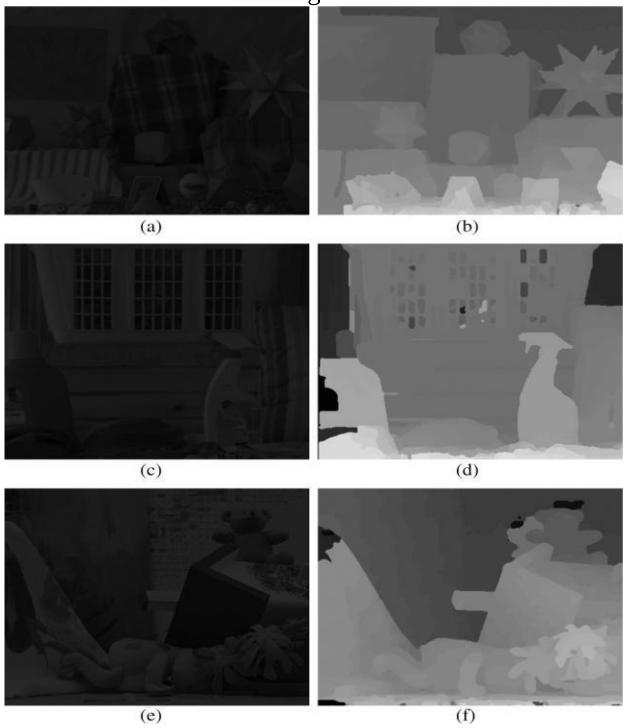

Fig. 3. Test color and depth image pairs. (a)-(b) Moebius (463×370),(c)-(d)Laundry (447×370), (e)-(f)Teddy (450×375).

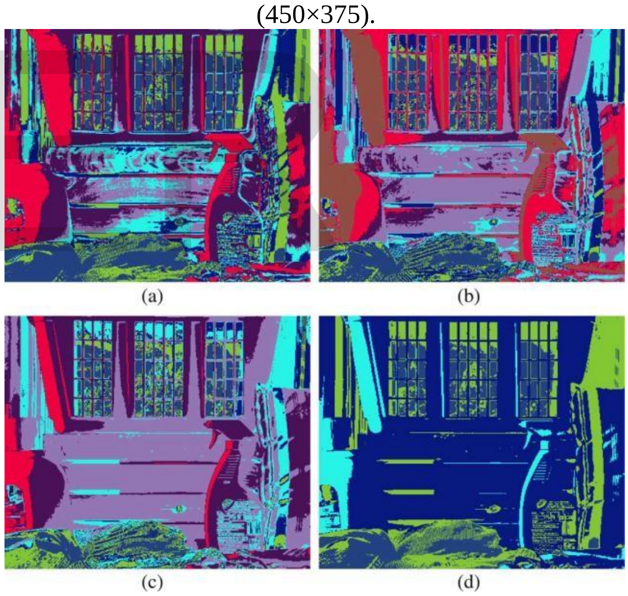

Fig. 4. Segmented image layers of Laundry obtained by the proposed algorithm with (a) =10, (b) =100 , (c) =1000 , (d) =10000 .

VI. CONCLUSION

In this letter, they proposed a new histogram-based image contrast enhancement algorithm using the histograms of color and depth images. The histograms of the color and depth images are first partitioned into sub-intervals using the Gaussian mixture model. The partitioned histograms are then used to obtain the layer labeling results of the color and depth images. The sub-intervals of the color histogram are adjusted such that the pixels with the similar intensity and depth values can belong to the same layer. Therefore, while a global image contrast is stretched, a local image contrast is also consistently improved without the over-enhancement. They plan to extend our layer-based algorithm to a segment-based algorithm by using a joint color-depth segmentation method.

The contrast of the image can be improved without introducing visual artifacts that decrease the visual quality of an image and cause it to have an unnatural look. The experimental results show the effectiveness of the algorithm in comparison to other contrast enhancement algorithms. Obtained images are visually pleasing, artifact free, and natural looking. A desirable feature of this paper is that it does not introduce flickering. This is mainly due to the fact that the method uses the input (conditional) histogram, which does not change significantly within the same scene, as the primary source of information. This method is applicable to a wide variety of images. It also offers a level of controllability and adaptability through which different levels of contrast enhancement, from histogram equalization to no contrast enhancement, can be achieved.

REFERENCE

[1] T. Arici, S. Dikbas, and Y. Altunbasak, "A histogram modification framework and its application for image contrast enhancement," IEEE Trans. Image Process., vol. 18, no. 9, pp. 1921–1935, Sep. 2009.

[2] T. Celik and T. Tjahjadi, "Automatic image equalization and contrast enhancement using Gaussian mixture modeling," IEEE Trans. Image Process., vol. 21, no. 1, pp. 145–156, Jan. 2012.

[3] M. Abdullah-Al-Wadud,Md. H. Kabir, M.A.A.Dewan, andO. Chae, "A dynamic histogram equalization for image contrast enhancement," IEEE Trans. Consumer Electron., vol. 53, no. 2, pp. 593–600, May 2007.

[4] T. Luft, C. Colditz, and O. Deussen, "Image enhancement by unsharp masking the depth buffer," ACM Trans. Graph., vol. 25, no. 3, pp. 1206–1213, Jul. 2006.

[5] J. Kopf, M. F. Chen, D. Lischinski, andM. Uyttendaele, "Joint bilateral upsampling," ACM. Trans. Graph., vol. 26, no. 3, pp. 1–5, Jul. 2007.

[6] S.-W. Jung, "Enhancement of image and depth map using adaptive joint trilateral filter," IEEE Trans. Circuis Syst. Video Technol., vol. 23, no. 2, pp. 258–269, Feb. 2013.

[7] W. Hachicha, A. Beghdadi, and F. A. Cheikh, "Combining depth information and local edge detection for stereo image enhancement," in Proc. Eur. Signal Process. Conf. (EUSIPCO), 2012, pp. 250–254.

[8] S.-W. Jung, J.-Y. Jeong, and S.-J. Ko, "Sharpness enhancement of stereo images using binocular just-noticeable-difference," IEEE Trans. Image Process., vol. 21, no. 3, pp. 1191–1199, Mar. 2012.

[9] M. M. Subedar and L. J. Karam, "Increased depth perception with sharpness enhancement for stereo video," in Proc. SPIE 7524 Stereoscopic Displays Appl. XXI, 2010, pp. 1–8.

[10] Q.Yang, "A non-local cost aggregationmethod for stereo matching," in Proc. IEEE Conf. Comput. Vis. Pattern Recogn., 2012, pp. 1402–1409.

[11] M. Figueiredo and A. Jain, "Unsupervised learning of finite mixture models," IEEE Trans. Patt. Anal. Mach. Intell., vol. 24, no. 3, pp. 381–396, Mar. 2002.

[12] J. Delon,A. Desolneux, J.-L. Lisani, andA. B. Petro, "A nonparametric approach for histogram segmentation," IEEE Trans. Image Process., vol. 16, no. 1, pp. 253–261, Jan. 2007.

[13] S.-W. Jung and S.-J. Ko, "Depth sensation enhancement using the just noticeable depth difference," IEEE Trans. Image Process., vol. 21, no. 8, pp. 3624–3637, Aug. 2012.

[14] D. Scharstein and R. Szeliski, "A taxonomy and evaluation of dense two-frame stereo correspondence algorithms," Int. J. Comput. Vis., vol. 47, no. 1, pp. 7–42, Apr.–Jun. 2002.

[15] K. Lai, L. Bo, X. Ren, and D. Fox, "A large-scale hierarchical multiview RGB-D object dataset," in Proc. IEEE Int. Conf. Robotics and Automation (ICRA), 2011, pp. 1817–1824.

[16] D. Min, J. Lu, and M. N. Do, "Depth video enhancement based on weighted mode filtering," IEEE Trans. Image Process., vol. 21, no. 3, pp. 1176–1190, Mar. 2012.