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Developing Real Time Vein Pattern Extracting Algorithm for Vein Viewer

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ABSTRACT: Vein Viewer has already developed electro-optical visual device to help clinicians. This device improves peripheral vascular access and patients also satisfied with it. Image of the skin acquired by color CCD(Charge Coupled Device) and NIR(Near-infrared) CCD. Since obtained image has lower contrast, to emphasis on blood pattern and to show in real time, image processing is needed. Image processing will be processed with this process. 1. High pass filtering 2. High boost filtering 3. Histogram equalization 4. Gaussian smoothing. Finally, to extract blood pattern Liukui Chen image processing method will be deployed.

KEYWORDS: Vein Viewer, Image Processing, Near-infrared, Real Time.

I.INTRODUCTION

Realtime vein imaging system based on projection method consists of 3 stages. First, with a near infrared image, vein pattern could be acquired. Second, relative blood flow could be calculated from laser speckle image. Third, projection method that display on the skin of surface within a shortest time. In this paper, real-time vein pattern extracting algorithm developed to deploy the third party of realtime vein imaging system.
This paper consists of three chapters. First, programming and interface design. Second, image processing. Third, system evaluation.

II. PROGRAMMING AND INTERFACE DESIGN

To operate and control the camera, system interface constructed by using C# programming. The image will be modified to display image in real time. It could control the camera function, so that it will acquire the image or could stop taking image. It could save the frame and change to projection mode. It also could display white light, color image, black and white, vein impression image output, vein pattern extraction and display of modified vein flood image.

III. IMAGE PROCESSING

Acquired blood image contain several problems to display. Near infrared light was used to get the image, so it has low contrast. Since it make difficult to identify the blood vessel, it should be transformed. To emphasis only the blood pattern, image processing will be performed. Image processing method has several steps. First, high pass filtering will be done. Second, high boost filtering will be executed. Third, histogram equalization will be performed. Lastly, Gaussian smoothing will be done.

To emphasis the vein pattern in the original image of the vein in the real time, above image process will be carried out. To extract vein and near tissue of the border line, high pass filter will be used. High pass filter will extract the dot and line component and then based on original image and acquired image, high boost filtering methodology implemented.

$$f_{highboost}(x,y) = (k-1) * f(x,y) + f_{highpass}(x,y) \qquad (1)$$

Through the high boost filter, low frequency domain will be preserved and high frequency domain could be empathized. And it makes possible to extract vein pattern. By using k-value, boundary area line could be controlled. Improved vein image using high filter boost filtering could smoothing the histogram to increase the contrast. Histogram visualize the

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distribution of image brightness by graph. Smoothing operation increase the dynamic range of brightness and it could improve the low contrast image.

$$p(r_k) = {}^{n_k}/_{n}; k = 0,1,2, \ldots, \ -1 \quad (2)$$

$$s_k = \mathrm{T}(r_k) = {}_{j=0}^{k}p(r_k); k = 0,1,2, \ldots, L-1 \quad (3)$$

Calculating the fraction of p(rk) by random number of grey pixel nk divided by total number of pixel n. With the cumulative distributed function of the total number of gray level would reconstruct the histogram. The image with improved contrast will be processed to delete the noise with 3X3 mask size Gaussian smoothing operation. And then final image will be displayed in the image box.

IV. SYSTEM EVALUATION

Light source uniformity is one of the most important factor. Optimization of source uniform could improve the image. Optimized region of interest could be deducted based on total uniformity of light source. To evaluate the total light source uniformity, histogram analysis and coefficient of variation calculated. Figure 1 shows the image of light source and figure 2 is the histogram of light distribution.

$$\text{Coefficient of variation} = {}^{std}/_{m} \quad (4)$$

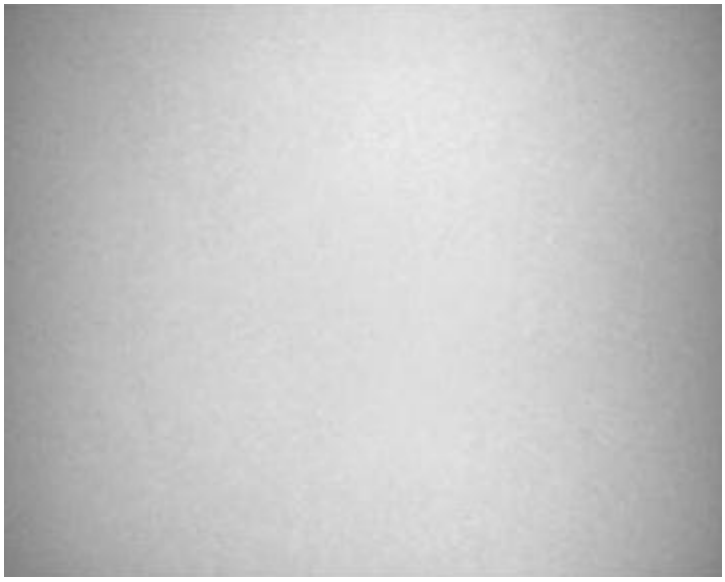

Fig1. Total Light Source

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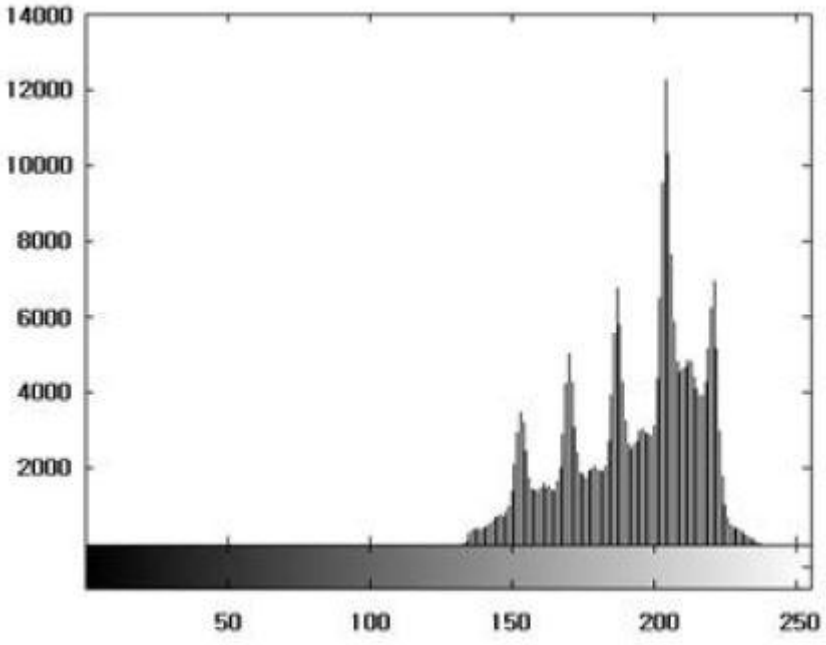

Fig2. Brightness Histogram

Coefficient of variation is the ratio of standard deviation to mean. It could represent the relative dispersion degree of the light source. Total light source coefficient of variation is 11.6% and the range of brightness of the image is 125. To acquire the optimized image of light source uniformity, the interest area of resolution is 600X480 based on the center of the image. Coefficient of variation in the modified interest area has improved 4.3% and the range of brightness of the image histogram decreased 52%.

V. CONCLUSION

This research is about the first stage of development of real time vein pattern extracting algorithm for veinviewer. Vein image obtained using near infrared light that has the best transmittance to the skin. Preliminary experiment showed that current image process has improved coefficient of variation.

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