Client Server based Image Enhancement in Android Phones

Manoj Kumar M
Asst. Prof, CSE,
GSSIT, Bangalore

Shiva Sumanth Reddy
M Tech, CSE,
NMIT, Bangalore

.

Brunda P
Asst. Prof, CSE,
VVIT, Bangalore

Srinivasa G
M Tech, MEM
JSSAT, Bangalore

ABSTRACT
A mobile Operating system is an OS for hand held devices or mobiles. Smart phones in today's World are found to be based on different Operating systems. For ex., Nokia's Symbian OS, Apple's IOS, RIM's BlackBerry OS, Microsoft's Windows Phone OS, Google's Android, Samsung's Bada OS, etc., Android has large number of developers writing applications ("apps") that extend the functionality of the devices. As of March 2012 there were more than 725,000 apps available for Android. In this paper we are presenting an image enhancement technique to enhance image on android phones. The terms Server and Server side programming are very commonly used. Generally speaking, a server is an application hosted on a machine and provides some services to other applications (clients) requesting the services. In our application PHP is used at the server side which performs the task of image enhancement. Here the android mobile acts as a Client which is used to capture the image and send it to the PHP server for processing. After processing the image is sent back to the mobile (client). This app can be can be used in the areas such as traffic analysis, medical image analysis, satellite and defence applications, where images captured are required to be enhanced to have a better view. Three different image enhancement algorithms such as Histogram equalization, Brightness Preserving Bi Histogram Equalization (BBHE), Average luminance with weighted histogram equalization (ALWHE) are used for enhancement.

Keywords
Android, Server, client, Image Enhancement, Histogram, BBHE

1. INTRODUCTION
Histogram equalization is the one of the well-known methods for enhancing the contrast of the images in accordance with the sample distribution of an image. Useful applications of the histogram equalization scheme include medical image processing and radar image processing**.** In general, histogram equalization flats the density distribution of the resultant image and enhances the contrast of the image as a consequence, since histogram equalization has an effect of stretching dynamic range. Image Acquisition refers to the capturing of image data by a particular sensor or data repository. Once the image data is acquired, pre-processing often includes removing of noise from the acquired image data. All the above process

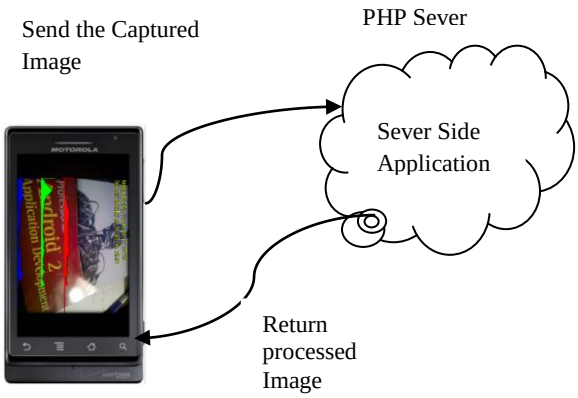


Figure 1: Architecture of the Image processing

will be done in the client side of the model. And the enhancement by using Histogram Equalization is done in the sever side of the model.

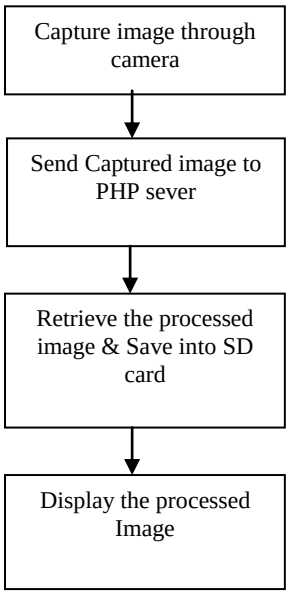


Figure 2: Client Side process model

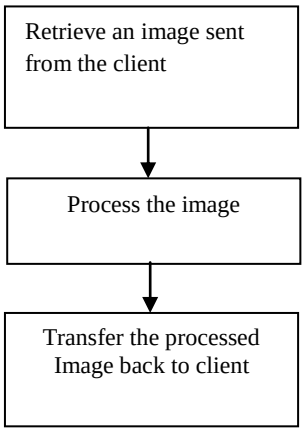


Figure 3: Sever Side process model

2. ANDROID

2.1. Motivation

Image processing on mobile phones is an exciting field with many challenges due to various limitations including hardware and connectivity. Mobile phones with cameras, powerful CPUs, storage devices are becoming increasingly common. Image processing routines such as: addition, convolution, thresholding and edge detection is important for comparison of these systems. Hence information developers and researchers can design complex computer vision and image processing applications while being aware of the limitations and bottlenecks on mobile phones.

2.2. Goals

The goal of the paper is to focus on Image Acquisition, Pre-Processing through implementing image noise removal, and implementing Histogram Equalization and Histogram Equalization based Enhancement method detection on the HTC G1 and Samsung mobile phones using the available Software Development Kit (SDK).

2.3. Approach and Challenges

The Android operating system is preferable for bench-marking due to its recent growth in popularity with varying hardware manufactures. The Android operating system is a part of the Open Handset Alliance. This alliance positions key manufacturers, cellular providers and the Android operating system in a collaborative environment which has caused large growth since October 2008 when the first Android mobile phone was released.

Few challenges when implementing image enhancement algorithms on android based phones include architecting software and optimizing code for

a. Memory limitations
b. CPU limitations
c. Image Quality limitations

3. ENHANCEMENT ALGORITHMS

3.1 Histogram Equalization

3.1.1 Algorithm

Input: An Image file, Row M, Column N
Output: Enhanced Image after histogram Equalization

Steps:

1. Let X = { X (i ,j) } denote a given image composed of L discrete gray levels denoted as $\{X_0, X_1, .., . . , X_{L-1}\}$, where X (i , j) represents an intensity of the image at the spatial location (i , j) and X (i , j) $\in$ $\{X_0, X_1, .., . . , X_{L-1}\}$. For a given image X, the probability density function p (X k) is defined as

$$p(x_k) = \frac{n^k}{n}$$

for **k** = 0 , 1 , . . . , L - 1, where n^k represents the number of times that the level X_k appears in the input image X and n is the total number of samples in the input image.

2. Based on the probability density function, we define the cumulative density function as

$$C(x) = \sum_{j=0}^{k} p(x_j)$$

Where $\mathbf{X_k}$ = x, for k = 0, l, . . , L - 1. Note that C (X_{L-l}) = 1 by definition. Histogram equalization is a scheme that maps the input image into the entire dynamic range, (X_o, X_{L-1}), by using the cumulative density function as a transform function.

3. Define a transform function f(x) based on the cumulative density function as

$$f(x) = X_0 + (X_{L-1} - X_0)c(x)$$

4. Then the output image of the histogram equalization, Y = {Y (i,j) } , can be expressed as

$$Y = f(X) = \{f(X(i,j))| \in X\}$$

Figure 4: Histogram Equalized image

3.2 BBHE

In general, histogram equalization flattens the density distribution of the resultant image and enhances the contrast of the image as a consequence, since histogram equalization has an effect of stretching dynamic range.[3] The BBHE firstly decomposes an input image into two sub-images based on the mean of the input image. One of the sub-images is the set of samples less than or equal to the mean whereas the other one is the set of samples greater than the mean. Then the BBHE equalizes the sub-images independently based on their respective histograms. In other words, one of the sub-images is equalized over the range up to the mean and the

other sub-image is equalized over the range from the mean based on the respective histograms. Thus, the resulting equalized sub-images are bounded by each other around the input mean, which has an effect of preserving mean brightness.

Figure 5: BBHE Processed image

3.3. ALWHE

Average Luminance with Weighted Histogram Equalization (ALWHE) overcomes disadvantage of Histogram Equalization like luminance shifting and washed-out looking. These problems are improved by the average luminance with weighted adaptive machinery. The ALWHE method preserves and modifies the intensity freely. The flowchart of ALWHE is represented as

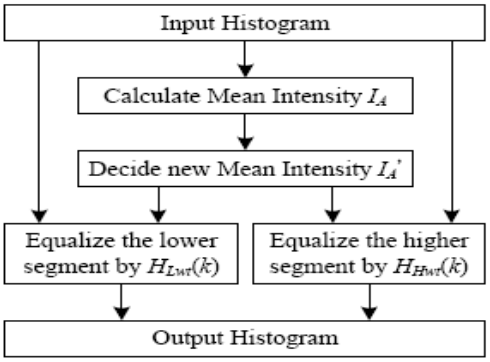


Figure 6: Flowchart of ALWHE

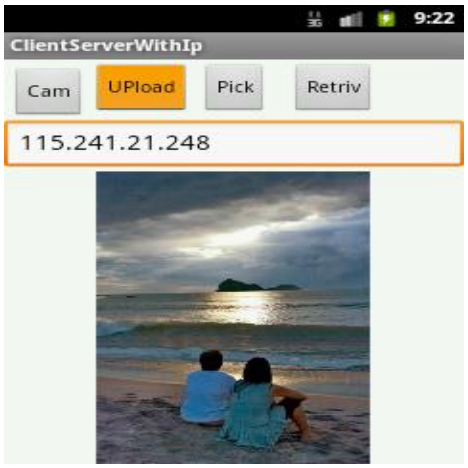
Figure 7: ALWHE Processed image

4. RESULTS

a) Front End Design

b) Android phone Gallery(SD Card)

c) Display the selected image



d) Enter Server IP address

e) Retrieve enhanced image

Figure 8: Input and Output Images

Histogram Equalization is rarely used in some of the consumer electronic products like Televisions due the flattening property. This disadvantage is overcome by using the BBHE which is novel extension of Histogram Equalization. ALWHE is the adaptive enhancement method which overcomes disadvantage of Histogram Equalization like luminance shifting and washed-out looking. The Figure 8 (e) shows the enhanced image using BBHE. By our analysis it is observed that BBHE is more efficient algorithm compared to the other enhancement algorithms discussed above.

5. CONCLUSION

Image Enhancement in mobile phones is a new and existing field with many challenges due to its limited hardware and connectivity. Since the mobile phones comes with less memory and processing power it is difficult to deploy all the applications in to the mobile. This problem is overcome by using the concept of client-server, where the image Enhancement task is performed by the Server and android mobile acts as the client. Enhancement is an image processing technique which is used to increase the visibility of the image. Here the contrast of the image is enhanced while preserving the original brightness of the image.

6. REFERENCES

[1]. J.S Lim, Two-Dimensional Signal and Image processing, Prentice Hall, Englewood Cliffs, New Jersey 1990.

[2]. Y. Li, Wang, and D. Y. Yu, Application of adaptive histogram equalization to x-ray chest image," Proc of the SPIE, pp. 513-514

[3]. Y.T. Kim, "Contrast Enhancement using Brightness Preserving Bi–Histogram Equalization". IEEE Transactions on Consumer Electronics, Volume 43, No.1, 1997

[4] Tutorial on Using Android for Image Processing Projects, EE368 Digital Image Processing, Spring 2010, Linux Version

[5] Android Development Tools (ADT) Plug-in. http://dlssl.google.com/android/eclipse.

[6] K. C. lyer and A. Subramanya, "Image Encryption by Pixel Property Separation," http://eprint.iacr.org/2009/043.pdf, Cryptology ePrint Archive, 2009.

[7] M. Yang, N. Bourbakis, and S. Li, "Data-image-video Encryption," potential, IEEE, vol. 23, no. 3, pp. 28-34, 2004

[8] Y. Zhou, S. Again, V. M. Joyner, and K. Panetta, "Two Fibonacci p-code based image scrambling algorithms," in Image Processing: Algorithms and Systems VI, San Jose, CA, USA, 2008, pp. 681215-12.

[9]. R.C Gonzalez and P. Wints, Digital Image Processing, 3rd Edition, Addison-Wesley Publishing Co., Reading, Massachusetts.