Client Server based Image Enhancement in Android Phones

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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

Figure 2: Client 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 benchmarking 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 \( \{X_0, X_1, \ldots, X_{L-1}\} \), where \( X(i,j) \) represents an intensity of the image at the spatial location \((i,j)\) and \( X(i,j) \in \{X_0, X_1, \ldots, X_{L-1}\} \). For a given image \( X \), the probability density function \( p(X_k) \) is defined as

\[
p(X_k) = \frac{n_k}{n}
\]

for \( k = 0, 1, \ldots, L - 1 \), 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 \( x_k = x \), for \( k = 0, 1, \ldots, L - 1 \). Note that \( C(X_{L-1}) = 1 \) by definition. Histogram equalization is a scheme that maps the input image into the entire dynamic range, \( (X_0, X_{L-1}) \), 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

\[
Y = f(X) = \{f(X(i,j))| \in X\}
\]
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.

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

![Flowchart of ALWHE](image)

Figure 6: Flowchart of ALWHE

4. RESULTS

![Front End Design](image)

Figure 5: BBHE Processed image

**b) Android phone Gallery(SD Card)**

![Android phone Gallery](image)

Figure 7: ALWHE Processed image

![Display the selected image](image)

**c) Display the selected image**
Enter Server IP address

Retrieve enhanced image

**Figure 8: Input and Output Images**

Histogram Equalization is rarely used in some of the consumer electronic products like Televisions due to the flattening property. This disadvantage is overcome by using the BBHE which is a 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


