Construct Smartphone Application to Produce Photo-Mosaic Using Client-Server Model

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ABSTRACT

A smartphone is a cellular telephone with an advanced mobile operating system , that combines a cell phone with a handheld computer, typically offering Internet access, data storage, email capability, etc. Photo mosaic is an image composed of a large number of one-size images. In this paper it has been proposed an application to generate photo mosaic on smartphones run with the Android operating system using (Client-Server Model). This application considered an entertaining, servicing, scientific application. The proposed application works to generate photo mosaic based on (CBIR) content based image retrieval (color features). The images are retrieving from the database to generate photo mosaic based on two methods: K-means clustering and the Patterns recognition network. The results showed that the best performance of the proposed application was through using k-means clustering and the pattern recognition neural network which merged with the K-means clustering using statistical extracted color features of image histogram with tiles size (16×16) pixels. The average time required to produce a mosaic photo with correcting colors was (26 seconds) and the mean of peak signal to noise ratio was (39.56594).

Keywords: *Smartphone, Photo-Mosaic, Client-Server Model, CBIR, Color Correction.*

1 INTRODUCTION

In the past few years the mobile device and mobile services markets have been affected by a strong emergence of smartphones. Smartphones are mobile phones that offer advanced computing abilities and connectivity options. Smartphones are programmable mobile devices, running complete operating systems in a manner similar to traditional computers. These features enable new kinds of mobile services that in turn shape the usage habits of smartphone users [1].

There are many operating systems work with smart phones: RIM (Research In Motion) of Blackberry, Windows Mobile, iPhone, Symbian and Android. Android is a comprehensive open source platform designed for mobile devices. It is championed by Google and owned by Open Handset Alliance. Android is revolutionizing the mobile space. For the first time, it is a truly open platform that separates the hardware from the software that runs on it. This allows for a much larger number of devices to run the same applications and creates a much richer ecosystem for developers and consumer [2] [3].

The mobile phone applications have been developed to run on mobile devices. These applications are generally available in stores that applications developers being platform applications such as Apple, Google, and Microsoft. Today, there are hundreds of thousands of mobile applications stores in various applications, and this number is increasing dramatically [4][5].

The client/server model, one process, called the server; provide services and other processes, called clients, request services from the server. The client/server model can be easily implemented by using send and receive constructs or remote procedure calls [6].

In this paper a smart phone Application has been proposed to produce a photo- mosaic on Android operating system using server and client model (Client-Server Model). This application has been built in order to contribute to the reduction of restrictions on memory space and the ability of low-processing that have important effects on the device on the art of generating images mosaic.

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2   RELATED WORK

There are many researches and studies there dealt with the production of photo mosaics based on different algorithms and methods, depending on the properties of the images, some researchers relied on the properties of color, others on the properties of color, and others relied on the properties of color and size, each according to his point of view, and some researchers use artificial intelligence techniques to generate images mosaic. Here are some studies on the production of photo mosaic:

Sang-Hun Lee et al presented a new recipes for images to be used in the generation of photo mosaics and these properties are the properties of vector Approximate total part of the image (Piecewise Aggregate Approximation) IMAGE-PAA using server and client model. The server divides the original image into tiles and extracted recipes of tile images and then sent to a server, compares these recipes with pre stored images data base recipes to get to the nearest image to produce an photo mosaic then be sent to a mobile phone[7].

Michihiro Mikamo et al. proposed three algorithms to produce photo-mosaic algorithm,first (greedy-based procedural algorithm) and the second algorithm (simulated annealing driven solution) and third algorithm (SoftAssign-based). These algorithms are used in the images retrieval processes based on the properties of color. The matching processing between the images and data bases tile images by using Euclidean distance measure (Euclidian distance)[8].

Ms Sonali Nakade and Prof. P.T. Karule suggested a new methodology for the production of photo mosaics based on the retrieval of images based on a runway local color histogram of images database and images tiles (Tiles) and through point distance rate scale to the point Average Pixel-to-Pixel Distance (APP Distance) calculated where the nearest form of databases to image tiles and compensate in the original image[9].

3   PROPOSED WORK

The application works on client-server model by this model the production process of the photo-mosaic is done. The first side (client) represents application interface which have been used to deal with the source image and the resulting photo-mosaic. The production of photo-mosaic has done through the server-side.
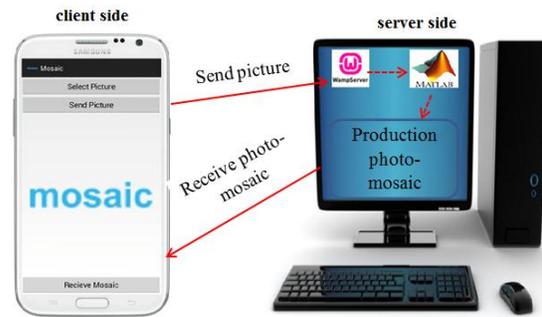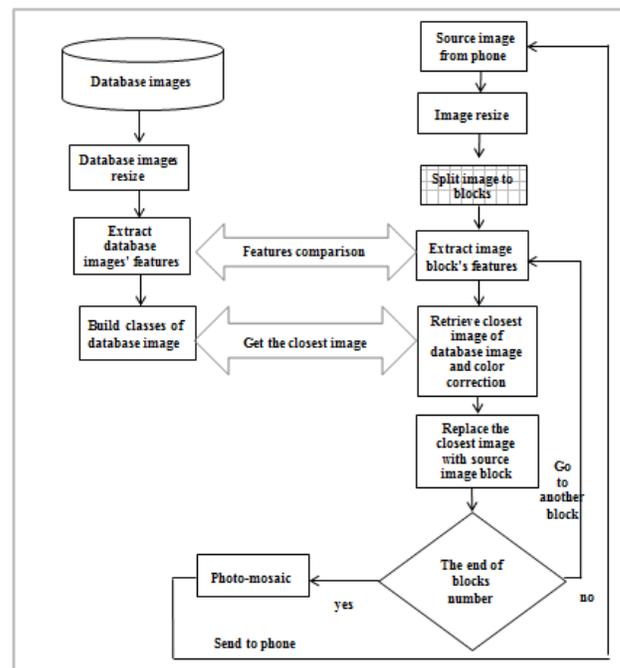

Fig. 1. proposed application

Fig. 2. planner of proposed work

3.1   CLIENT-SIDE

The client-side and Representative smartphone device management and control of the proposed application through interface designed using the working language (JAVA) through the work environment (Eclipse) to produce images mosaics. The client-side tasks:

1. Selection of the source image (the image you want to produce a mosaic).
2. Send the selected image to the server to produce a photo mosaic of her.
3. Reception image mosaics resulting from the server side and displayed on the smartphone screen.

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Table 1 summarizes the smartphone properties as well as environmental properties used for the construction of the proposed application.

Table 1: smartphone and environment properties

Smartphone: properties
*Type***:** Samsung Galaxy Note II N7100
Operating system: Android OS, v4.3
*Cpu***:** Quard-core 1.6 GHz Cortex-A9
*Camera***:** 8MP, 3264 × 2448 pixels
*Internal Memory***:** 16 GB storage
*RAM***:** 2GB
Environment: properties
Eclipse with JAVA language work with windows-64 bits

3.2 SERVER-SIDE

Reception the source image from client is the first server functions that assisted by wamp server program, after the client's request to upload the source image to the server by php code. This code programmed to get the image from client as well as is giving a prompt to run MATLAB environment and the implementation of the code to produce an image mosaic.

3.2.1   PHOTO-MOSAIC GENERATION

Photo mosaics production needs to a large database used in image retrieval operations to select the closest image to the block of photo-mosaic. The image database has selected from the images databases that available on the Internet's networks. The selected image database consist of 2000 picture that have different color properties.

The photo mosaic generation can be summarize by this steps:

STEP 1:

The resizing images database first step process for the production of mosaic images using the nearest-neighbor interpolation algorithm [7]. This process product three sizes (16X16,32X32,64X64) pixels also the same algorithm used in resizing the source image to three sizes (640X640, 320X320, 192X192).

STEP 2:

The second step represent by extracting the color properties of each block of the source image that we want to produce photo-mosaic for it. Where extracted properties of the color histogram with 16 colors by using the statistical characteristics (Mean, variance, Standard deviation, Skewness, Kurtosis) of the color histogram for each channel of color channels of the picture depending on space (RGB). vector color properties consist of 15 attributes for each image (block). Extracted color properties of images databases in an earlier period and are stored on the server to be used later in the production of images mosaic [10][11].

After it has been extracted color properties of images database it is necessary to classification database images to five classes in order to facilitate image retrieval process where used K-means clustering algorithm [12].

STEP 3:

Images retrieval: The process of finding the closest image for each block of the source image blocks one of the most important operations to produce photo-mosaic because it is responsible for giving the appearance. Where it used pattern recognition network[13] in image retrieval and k-means clustering, this operations with this network consist of two phases first training phase and the second phase the test phase, which the results of the second phase are used in the retrieval of the best image.

STEP 4:

This step is to correct the colors of the resulting photo-mosaic. This process applies to edit the retrieve image colors depending on the block of the source image and this process applied to the closest image selected. The colors are corrected by use color histogram for each channel of the retrieve image comparing with color histogram for all channel of the block of the source image by using histogram matching algorithm[14][15].
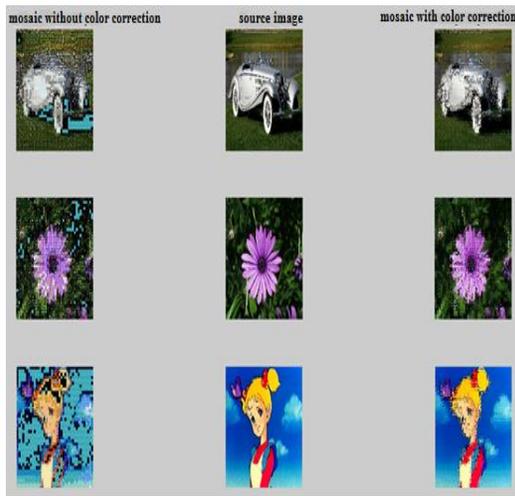
4 RESULTS

Fig. 3. photo-mosaic using k-means clustering (block(16X16pixel)),(image (640X640 pixel))
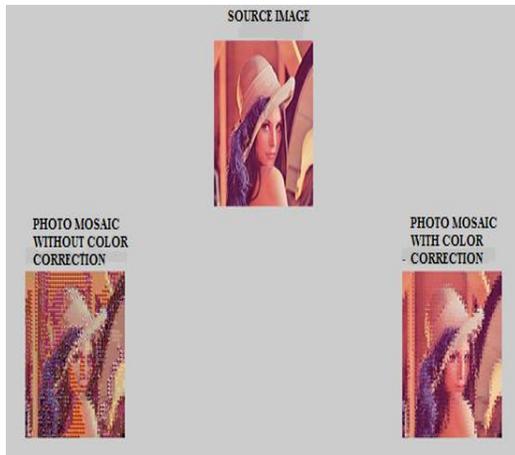

Fig. 4. photo-mosaic using pattern recognition network(block(16X16pixel)),(image (640X640 pixel))

Table 2: Quality Measurement of the produced mosaic image with and without color correction using k-means clustering

Image	PSNR With color correction	PSNR Without color correction
1	43.6859	37.5748
2	36.2785	30.2245
3	37.4515	31.7275
4	41.6281	33.1841
5	39.1279	24.7209

Table 3: Quality Measurement of the produced mosaic image with and without color correction using pattern recognition network

Image	PSNR With color correction	PSNR Without color correction
1	43.6626	34.5552
2	36.0683	29.2478
3	37.5189	31.313
4	41.1463	30.8422
5	39.4336	27.7209

Table 4: The time Of Producing Photo Mosaic using k-means clustering

Image	Time with color correction	Time without color correction
1	114.8/sec	81.3/sec
2	117.9/sec	86.4/sec
3	116.4/sec	81.5/sec
4	117.1/sec	80.6/sec
5	117/sec	81.7/sec

Table 5: The time Of Producing Photo Mosaic using pattern recognition network

Image	Time with color correction	Time without color correction
1	28.00/sec	19.99/sec
2	28.1/sec	20.35/sec
3	27.22/sec	19.77/sec
4	23.18/sec	14.74/sec
5	25.51/sec	16.12/sec

5 CONCLUSION

This paper suggests an application to produce photo-mosaic on smart phones running on Android operating system and depending on the client-server model.

JavaScript is a program language, which has the potential to build a smartphone application that runs on the Android operating system through the environment (Eclipse). There is the possibility to recovery images depending on content base(color features) by using artificial intelligent technique (pattern recognition network). These techniques has importance to reducing the time factor and improve the quality of the resulting photo-mosaic.

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