MOSAIC IMAGE GENERATOR

PROJECT REPORT

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BONAFIDE

This is to certify that **18CSE390T – COMPUTER VISION project report** titled "**MOSAIC IMAGE GENERATOR"** is the bonafide work of **Bobbili Yogendra (RA2011026010323), Vempatapu Koushik (RA2011026010326), Syed Yousuf (RA2011026010337)** who undertook the task of completing the project within the allotted time.

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ABSTRACT

Photo-mosaic (mosaic-image) generation is the process of dividing an input image into equal rectangular blocks (image blocks), each of which is replaced with another image (tile image) that matches the features of a corresponding image block. When the produced photo mosaic is seen from a distance, it seemingly forms the input image. Photo mosaic is not a new concept; however, only a few publications on this subject are available because of its commercial nature. The quality of the produced photo mosaic depends on the size of the database and the variety of images. In addition to process time, a bottleneck occurs because of the discrepancy in the match rate between the input image and the produced photo mosaic. This research proposes three intelligence-based approaches for producing photo mosaics in less time:

(1) k-means clustering with Manhattan distance,

(2) back propagation neural network with Manhattan distance,

(3) hybrid fuzzy logic with Elman neural network.

Three groups of features are extracted and then used to find the best matching tile image for each corresponding image block within the container image. The first group comprises statistical features extracted from a 64-gray level quantized histogram. These features are variance, mean, skewness, kurtosis, and energy.

Finally, experimental results show that hybrid fuzzy logic with Elman neural network is the best among the three approaches used. This technique needs 10.0 seconds to produce photo mosaics, with a correlation rate of 0.82 between the container image and the produced photo mosaics, Alaa Yaseen Taqa 71 using mean-based color correction. By contrast, this approach needs 42.33 seconds to produce photo mosaics, with a correlation rate of 0.86, using histogram specification-based color correction

MODULE DESCRIPTION

Photo-mosaic generation is a technique that transforms an input image into a rectangular grid of thumbnail images. It uses small photos in the same manner that a conventional graphic image uses pixels. A photo mosaic has a visual content as a whole, and each of its building images also has a meaningful content. A photo mosaic needs to be viewed from a distance to see the overall effect.

Classified image mosaics into four main types:

1)Crystallization mosaic

2)Ancient mosaic

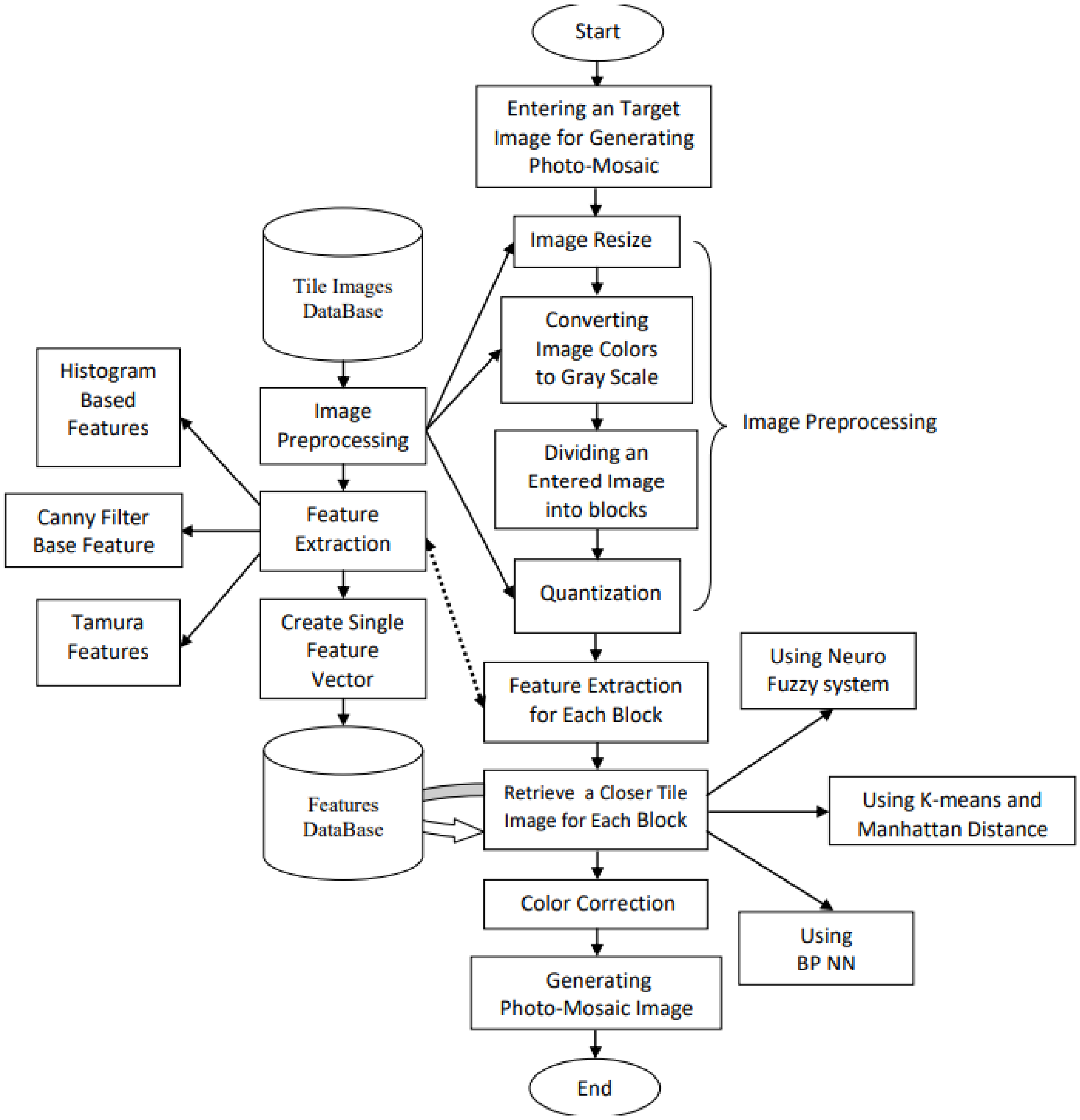
3)Photo mosaic

4)Puzzle-image mosaic

The first two types are obtained by decomposing a source image into tiles (with different colors, sizes, and rotations), and then, reconstructing the image by properly painting the tiles. As such, images under the first two classifications may be called tile mosaics. The last two types of mosaics are obtained by fitting images from a database to cover an assigned source image; thus, images under these types may be called multipicture mosaics. A different kind of mosaic, called Jigsaw Image Mosaic (JIM), is created using image tiles with arbitrary shapes to compose the final picture. Another type of mosaic, called artificial mosaic, was presented by Blasi and Gallo. This type of image mosaic is created based on reproducing colors of the original image and emphasizing relevant boundaries by placing tiles along edge directions.

System Architecture with Explanation

The proposed photo-mosaic system consists of two main phases: creating a database for features and generating a photo mosaic. The database for features is created through two main processes: preprocessing and feature extraction. The overall working architecture of the proposed photo-mosaic generator is shown in Figure.



The only appropriate manner with regard to collecting an image database for a photo-mosaic generator is to use a large number of images drawn from a wide variety of internet sources and with various subjects

The first step in preprocessing is size normalization, in which all tile images are resized (scaling) to a fixed size (64 × 64; 32 × 32, or 16 × 16 pixels, depending on the image block size) using a bicubic interpolation algorithm [35]. The second step is converting all color tile images into gray-scale images. The last step is quantization.

Feature Extraction of Tile Images

Three groups of features are extracted. The first group is composed of statistical features computed based on a 64-gray-scale quantized histogram. These features are variance, mean, skewness, kurtosis, and energy. The second group of features consists of Tamura features which are composed of six texture features (coarseness, contrast, directionality, line likeness, regularity, and roughness).

The last group of features includes edge rate, which is computed as the percentage of edge pixels in the image.

In the proposed photo-mosaic generator, feature extraction plays a major role. Extracted features are used to find a tile image similar to an image block. When the image block is given, features are extracted in the same manner in which a tile image is extracted. Then, a tile image resembling an image block is found based on one of the following approaches: (1) k-means clustering with Manhattan distance, (2) "back propagation neural network with Manhattan distance and (3) a hybrid approach combining Elman neural network and fuzzy logic.

Dataset Description

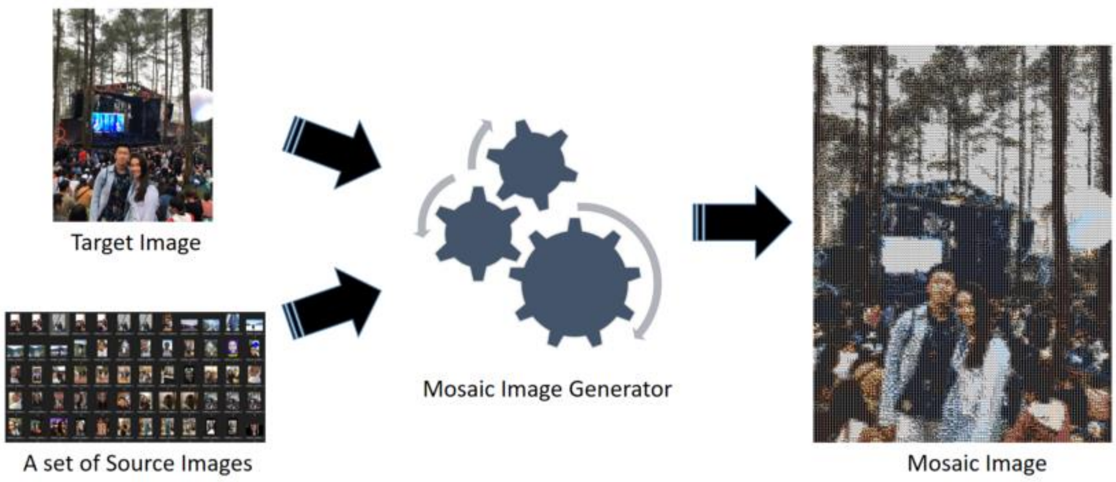
Think mosaic image generator as an engine that takes input a target image and a set of source images, and outputs a mosaic image. The aim of the engine is to generate a similar image like the target image by using one of the source images for each of the pixels.

1. All feature vectors being clustered into the space are placed. These vectors represent initial group centroids. The number of clusters nc is chosen a priori. nc centers are selected by randomly picking feature vectors from the database.

2. For each feature vector in the database, the similarity measure between the feature vector and the cluster centers are computed, and the vector is assigned to the cluster in which it exhibits the largest similarity measure. As such, each feature vector is assigned to the cluster with the closest centroid.

3. New cluster centers are computed as the centroids of the clusters.

4. Steps 2 and 3 are repeated until no further change is observed in the cluster centers.

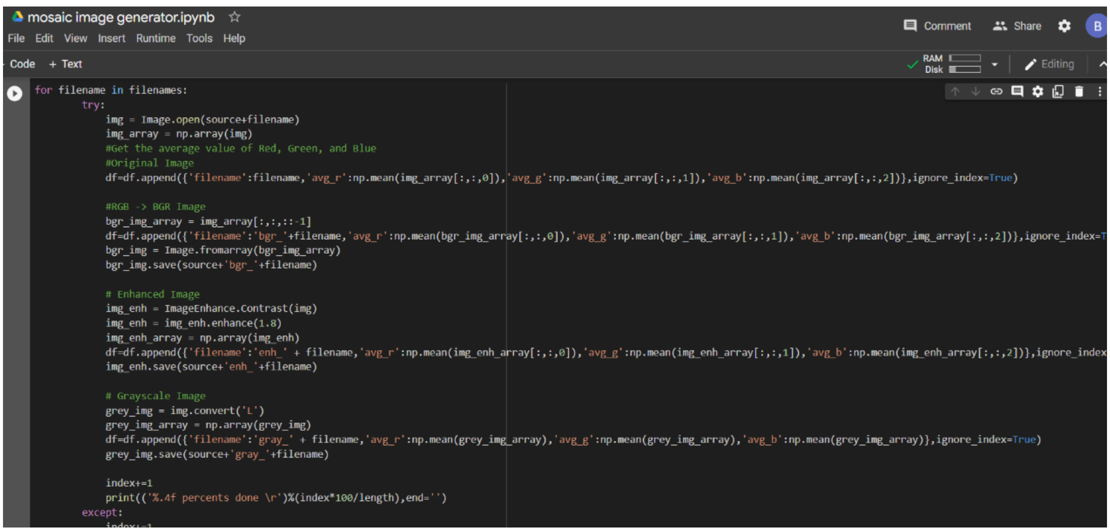


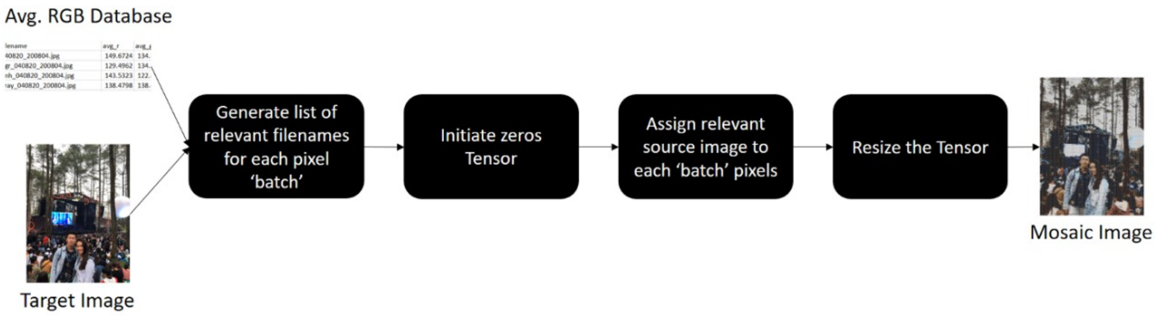
Results and Discussion

We propose three approaches for producing photo mosaics: (1) kmeans clustering with Manhattan distance, (2) BPNN with Manhattan distance, and (3) hybrid fuzzy logic with Elman neural network. Three input images and three different scales of tile images: 16 × 16, 32 × 32, and 64 × 64 pixels are used to test the proposed approaches for generating photo mosaics

A total time required among different photo mosaic generations are summarized in. The total mean time of the fast photo-mosaic generator proposed in is 19.058 seconds for an origin image measuring 800 × 600 pixels without a color correction step. In comparison, the total mean time of the artificial-mosaic generator proposed in is 14.091 seconds for an origin image measuring 800 × 600 pixels without a color-correction step. The total time of the puzzle image-mosaic generator proposed in is 267.131 seconds for an origin image measuring 600 × 600 pixels.

Experimental results show that the hybrid fuzzy logic with Elman neural network approach exhibits the best performance evaluation over kmeans clustering with Manhattan distance and BPNN with Manhattan distance approaches.





Conclusion

In this research, three different approaches to produce photo-mosaics are presented: (1) k-means clustering with Manhattan distance, (2) BPNN with Manhattan distance, and (3) hybrid fuzzy logic with Elman neural network. These approaches use three types of features to find the corresponding tile image of an image block. The first group of features includes statistical features extracted from a 64-gray-level quantized histogram. These features are variance, mean, skewness, kurtosis, and energy. The second group of features includes Tamura features such as coarseness, contrast, and directionality. The last feature is edge rate, which is computed as the percentage of edge pixels within an image detected using a Canny filter. Timing results (Table (2)) show that the third is the fastest among the three approaches, needing only 10.0 s and 42.33 s to produce a photo mosaic using mean- and histogram specification-based color correction, respectively. Correlation rate results (Table (3)) demonstrates the soundness of the third approach, which achieves good visual impact. The third approach provides the highest correlation rates between the input image and the produced photo mosaic, which are 0.82 and 0.86 when using mean- and histogram specification-based color correction, respectively.

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