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A Survey on Compound Image Classification and Compression Techniques

K.Kalpana^{*1}, G.Sophia Reena²

^{*1}Department of Computer Science, PSGR. Krishnammal College for women, Coimbatore – 004, India

²Department of Information Technology, PSGR. Krishnammal College for women, Coimbatore – 004, India

kalpanakans@gmail.com

Abstract

Compound images are combinations of text, graphics and natural images. This paper presents a review of recent developments in compound image segmentation and compression in the field of image processing.

Keywords: Compound images, layer based classification, and block based classification, segmentation, compression.

Introduction

Image compression represents the process of data reduction and at the same time retains image information. To compress the data, The key components are specified channel bandwidths or storage requirements and maintaining the highest possible quality. So efficient data compression techniques save storage space and accelerate the transmission time. Compound images are different kind of images that contain both palletized regions, which have text or graphics, and continuous tone regions. In compound image Compressing techniques, compression with the help of a single algorithm that simultaneously meets the requirements for text, image and graphics has been obscure and thus requires new algorithms that can competently reduce the file size without degrading the quality [1].

Classification Techniques in Compound Image

Mostly a compound image is a combination of text, graphics and pictures. Compound image can be classified and compressed based on the following categories.

- Object Based
- Layer Based and
- Block Based



(a)Computer Generated Image (CGI) (b) Document Image (DI)



(c) Text Image (TI) (d)Scanned Image(SI)

**Fig.1 Example images for compound images
Object Based Segmentation**

In this approach, a page is divided into regions and each region follows exact object boundaries. An object may be a photograph, a graphical object, a letter, etc. In principle, this method may provide the best compression, since it provides the best match between a data type and the compression method most suitable for this data type. In reality, the best compression may not be

achievable for the following reasons. Coding the object boundaries requires extra bits, and the typical algorithms, used for loss image compression, are designed to operate on rectangular objects. They can operate on objects with nonrectangular boundaries, but the compression performance will suffer. Complexity is another drawback of this method, since precise image segmentation may require the use of very sophisticated segmentation algorithms.

Layer Based Classification

In layer based classification method, The screen image page is divided into rectangular layers, which can have one or more objects, and “mask” planes. A mask plane generates which pixels of a particular layer should be included in the final composite page. Each layer is compressed with a particular compression method. The benefits of this approach are simplified, and an improved matches between layer boundaries and the compression algorithm. The disadvantages of this method are: mismatch between the compression method used for a particular layer and the data types (when several various objects are included in the same layer), mismatch between the object boundaries and the compressed region boundaries, and an essential redundancy, due to the fact that the same

parts of the original image appear in several layers.

Most layered coding algorithms use the standard three layers Mixed Raster Content (MRC) representation. There are three layers such as text, mask and graphics layers. Each layer is compressed using various compressors. The mask layer has the contours of text and other well image structures. JBIG (Joint Bi-level Image Experts Group) algorithm image is used to lossless compress the mask layer .The Text layer is compressed using token based coder[1], mask layer is compressed using JBIG coder and the graphics layer is compressed using the JPEG coder.

Block Based Classification

Block-based segmentation algorithms are developed mostly for grayscale or color compound images. In this technique the compound image is divided in blocks of a certain size (e.g. 16x16) and the block is classified using specific classification method to segment the image into blocks, and then it can be compressed using different techniques. The classification information is coded before coding the block pixels and usually it depends only on the values of the pixels inside a block and possibly the decision on the neighboring blocks.

AC coefficients introduced during DCT to segment the image into three blocks as back ground, text/graphic and image blocks [3]. The background block

has smooth regions of the image while the text / graphics block has high density of sharp edges regions and image block has the non-smooth part of the compound image. In existing [4] method a classification algorithm, uses the threshold of the number of colors in each block to find the threshold values.[3]In existing method contained a technique called the Run Length-Smoothing Algorithm (RLSA) to partition a binary compound image into blocks. Said et al. [2] proposed a simple blocked-based scheme, which compresses text blocks using JPEG-LS, picture blocks using JPEG. G. However, it fails to handle the hybrid blocks, which contains mixed text and pictures.

Block-based segmentation model is used a histogram-based threshold approach [6]. This model uses a series of decision rules to segment an image. The benefits of this approach are: simplified segmentation, good match between region boundaries and the compression algorithms, and The potential drawbacks are the potential loss in the compression performance compared to the true object-based segmentation, and the need to slightly modify the off-the-shelf algorithms to work on nonrectangular regions. Block-based approaches for compound images are also studied for their low complexity.

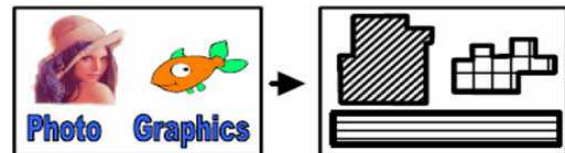


Fig.2 Block Based Segmentation

Hybrid Method of Layer based and Block-based Method

The two techniques layer-based and block based are combined to form a hybrid compound image compression technique. In this model the compound image is first divided into 16x16 blocks. Using the gradient values and a combination of decision rules, the block is classified into five different regions .such as background block, text block, picture block, graphics block and overlapping blocks. Here the overlapping block contained mixed contents. So the main challenge was faced with the overlapping block. For this purpose a wavelet packet-based compression technique is used. In the period of segmentation, there is two features are used such that the histogram and the gradient of the block. Using the gradient values, the histogram distribution for each pixel group is computed. Then the various compression schemes suiting the need of block or layer are applied. This model combines the advantages of both

layer-based and block-based approaches and hence can be considered as an improvement of both the approaches.

Conclusion

This paper provides a review of different classification method based on object based, layer based and block based methods and recent developments in compound image segmentation and compression in the field of image processing.

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