International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169
Volume: 4 Issue: 11 271 – 273

Decompression of JPEG Document Images: A Survey Paper

Miss. Punam N. Kamble
Computer Science and Technology,
Department of Technology, Shivaji University,
Kolhapur, India
poonamkamble28@gmail.com

Mr.C. J. Awati
Computer Science and Technology,
Department of Technology, Shivaji University,
Kolhapur, India
chetan.awati@gmail.com

Abstract — JPEG Decompression techniques are very useful in 3G/4G based markets, handheld devices and infrastructures. There are many challenging issues in previously proposed decompression methods, like very high computational cost, and heavy distortion in ringing and blocking artifacts which makes the image invisible. To improve the visual quality of the JPEG document images at low bit rate and at low computational cost, we are going to implement the decompression technique for JPEG document images. We first divide the JPEG document image into smooth and non-smooth blocks with the help of Discrete Cosine Transform (DCT). Then the smooth blocks (background , uniform region) are decoded in the transform domain by minimizing the Total Block Boundary Variation(TBBV). In this we propose to compute the block variation directly in the DCT domain at the super pixel level. The super pixel have size n*n, each super pixel is assigned with an average intensity value. The smooth blocks are then reconstructed by using the Newton's method. The implementation of the smooth block decompression will be done here. The non-smooth blocks of the document image contains the text and graphics/line drawing objects. The post processing algorithm will be introduced which takes into consideration the specificities of document content. The inverse DCT is applied to represent the image in spatial domain. So the implementation of the non-smooth block decompression will be done here. Finally, we design different experimental results and analyze that our system is better than the existing. And it will show the quality improvement of decompressed JPEG document image.

Keywords—*Document decompression, JPEG decoding, total variation, soft classification*

*****

I. Introduction

The JPEG document arranges has been around for a long time, and is support by each image editor and web browser available. The JPEG is one of the most popular file format used to save images. JPEG is also termed as picture compression standard. It is also supported by every digital camera, and any video camcorder that can also take pictures. Every computerized photograph print shop likewise bolsters the JPEG standard. If you want a universal image format, the JPEG format is the one to choose. Today, digital cameras that are set to save JPEGs can save them much faster than when using the Raw format since their smaller size means cameras can write the JPEG to the memory card much quicker than Raw files.

For as far back as couple of years, an institutionalization exertion known as JPEG, for Joint Photographic Experts Group, has been moving in the direction of building up the international digital image compression standard for continuous-tone (multilevel) still images, both grayscale and color.

Currently, due to the quickly expanding variety of portable digital imaging devices (e.g., cameras, smartphones, electronic camera-pen systems), the use of document images has become much more convenient, thus to the huge expansion of document data. In this expeditious evolution, the real challenges in document image analysis (DIA) have shifted toward effective pervasive computing, storage, sharing and browsing of mass digitized documents. A promising and efficient approach is to exploit the benefits of very low bit rate compression technologies. Lossless compression algorithms allow the encoded images to be correctly reconstructed, but the gain of the compression ratio is not sufficiently high. In contrast, lossy compression algorithms provide very low bit rates at the cost of losing a certain degree of image quality. In addition, the level of image quality reduction can be easily controlled by pre-determined parameters. For these reasons, the multimedia data, in their current form, are mostly compressed using a lossy compression scheme.

II. Brief Literature Survey

Following are the some research paper analysed on the basis of block classification and decompression technique.

a) *Block Classification*

The-Anh, Mathieu Delalandre proposed a model of "effective decompression of JPEG document images". In this system the JPEG encoded image is first classified into smooth and non-smooth blocks. The smooth blocks are fully decoded into transform domain and the non-smooth blocks are decoded in spatial domain.[1]

In paper "A document image model and estimation algorithm for optimized JPEG decompression" the blocks are classified into three blocks, background blocks, text blocks and picture

blocks which are used with different characteristics and they suffer differently from JPEG artifacts. The background blocks correspond to the background of the document and smooth regions of natural images. A major contribution of this research is on the use of a novel text model to improve the decoding quality of the text regions. The regions corresponding to text and background are then decoded using maximum a posteriori (MAP) estimation. Most importantly, the MAP reconstruction of the text regions uses a model which accounts for the spatial characteristics of text and graphicsIn particular, the text regions decoded are essentially free from ringing artifacts even when images are compressed with relatively low bit rate. The adaptive nature of the text model allows the foreground color and the background color to be estimated accurately without obvious color shift.[2]

b) *Decompression*

In the paper "The jpeg still picture compression standard": JPEG(Joint Photographic Experts Group)is a picture compression technique of both grayscale and color images. JPEG's decompression technique also works for the improvement of the visual quality of JPEG document images. To meet the different needs of many applications, the JPEG standard includes two basic compression methods, each of which with various modes of operation. A DCT-based method is specified for "lossy" compression, and a predictive method for "lossless" compression. JPEG features a simple lossy technique known as the Baseline method, a subset of the other DCT-based modes of operation. The Baseline method is most widely implemented JPEG method, and is very helpful for large number of applications[3].

In the paper "Removal of artifacts from jpeg compressed document images": the segmentation-based method is used to reduce the compression artifacts in JPEG document image. JPEG compressed images generally exhibit ringing and blocking artifacts. The ringing artifacts are more dominant around textual regions where the blocking artifacts are more visible in natural images. This work concentrates on low computational cost methods to reduce ringing and blocking artifacts for segmented document images. It performs simple image processing techniques to clean out ringing and blocking artifacts. The method significantly reduces the artifacts with simple computation. The technique can be applied both to grayscale and color images.[4]

A Total Variation–Based JPEG Decompression Model: In this paper DCT-based zooming and artifact-free JPEG decompression of digital image is performed. The analytical treatment of the infinite dimensional problem formulation provides a basis for further research on qualitative properties of solutions and usage of more sophisticated numerical algorithms, possibly for applications in a different context. The number of existing publications related to artifact-free JPEG decompression indicates that the resolution of this issue is of high interest to the digital imaging community. The numerical solutions obtained with the TV-based model and algorithm confirms effectivity of TV regularization in reducing noise without over-smoothing sharp boundaries. The observation that optimal solutions to the minimization problem often expose typical staircasing artifacts indicates that there is still a need for a better regularization functional. Total generalized variation (TGV), proposed, seems to resolve this issue.[5]

Reducing artifact in jpeg decompression via a learned dictionary: The JPEG compression method is among the most successful compression schemes since it readily provides good compressed results at a rather high compression ratio. However, the decompressed result of the standard JPEG decompression scheme usually contains some visible artifacts, such as blocking artifacts and Gibbs artifacts (ringing), especially when the compression ratio is rather high. In this paper, a novel artifact reducing approach for the JPEG decompression is proposed via sparse and redundant representations over a learned dictionary. Indeed, an effective two-step algorithm is developed. The first step involves dictionary learning and the second step involves the total variation regularization for decompressed images. Numerical experiments are performed to demonstrate that the proposed method outperforms the total variation and weighted total variation decompression methods in the measure of peak of signal to noise ratio, and structural similarity.[6].

Image Denoising Via Sparse and Redundant Representations Over Learned Dictionaries: This work has presented a simple method for image denoising. The method is based on local operations and involves sparse decompositions of each image block under one fixed over-complete dictionary, and a simple average calculations. The content of the dictionary is of prime importance for the denoising process, proposed method shown that a dictionary trained for natural real images, as well as an adaptive dictionary trained on patches of the noisy image itself, both perform very well. There are several research directions that are currently considered, such as using several dictionaries and switching between them by content, optimizing the parameters, replacing the OMP by a better pursuit technique. This work concentrated on small image patches, completely overlooking the global structure of the image, and the multiscale analysis that other techniques have exploited rather well.[7]

III. Comparison between Existing algorithm

A. Comparison of Various decompression techniques

Parameters	**JPEG**	**EDJPEG**	**Proposed System**
Block classification	Yes	Yes	Yes
Computational cost	Low	Low	Very Low

Bit Rate	Low	Low	Very Low
Visual Quality	Normal	High	High
Supports to	Both color and grayscale images	Only grayscale images	Both color and grayscale images

B. Drawbacks of various decompression techniques

1.JPEG: Virtual perceprion of JPEG decompression is annoying.

2.EDJPEG: Does not supports for color images.

3.Proposed System: High compression rate.

IV. Proposed work

The proposed system consists of classification of the image blocks, smooth block decompression and non-smooth blocks decompression. The block classification model consists of classification of the image block with the help of discrete cosine transform (DCT) in smooth blocks and non-smooth blocks. The smooth block decompression model consists of fast extracting the total block boundary variation (TBBV) and minimizes the TBBV-based objective function. Non-smooth decompression model consists of construction of text document that consists of specific characteristics of text document content, followed by the optimization process for decoding the text blocks.

The system have the following modules along with functional requirements.

a. Block classification

b. Smooth block decompression

c. Non-smooth block decompression

d. Color image decompression

a) ***Block Classification:***

1) Given image is classified into 8*8 DCT blocks.

2) 8*8 DCT blocks are classified into smooth and non-smooth

blocks.

b) B. Smooth block decompression:

1) Extracting Total block boundary variation.

2) Minimization of TBBV-based objective function.

c) c. Non-smooth block decompression:

1)Non-smooth block decompression consists of construction of a text document model that contains specific characteristics of document contents and reconstruction of text block.

d) d. color image decompression:

1)color images are converted from RGB to YCrCb and then decompression will done.

V. Conclusion

Earlier decompression technique has some limitations that is high computational cost that makes the images inapplicable for time critical applications. Also the existing system have problem with the large number of constraints created to reconstruct the original image, so the method may become computationally intensive. In proposed system the visual quality of the document image is improved at low bandwidth and low computational cost. This system is useful in 3G/4G based market or handheld devices and infrastructures. The extensive use of document image becomes fast needs for mobile users. Customers want to access and retrieve good quality images while expecting a low bandwidth, and needs fast response time and memory-efficient usage. So the decompression technique for JPEG document is going to be established for improving the visual quality of the image with low computational cost.

References

[1] The-Anh Pham, Mathieu Delalandre, IEEE Transaction on "Effective Decompression of JPEG document images", Aug. 2016.

[2] K. Bredies, K. Kunisch, and T. Pock, "Total generalized variation," SIAM Journal on Imaging Sciences, vol. 3, no. 3, pp. 492–526, 2010.

[3] H. Chang, M. Ng, and T. Zeng, "Reducing artifact in jpeg decompression via a learned dictionary," Transactions on Signal Processing (TSP), vol. 62, no. 3, pp. 718–728, 2013.

[4] T. Wong, C. Bouman, I. Pollak, and Z. Fan, "A document image model and estimation algorithm for optimized jpeg decompression," Transactions on Image Processing (TIP), vol. 18, no. 11, pp. 2518–2535, 2009.

[5] M. Elad and M. Aharon, "Image denoising via sparse and redundant representations over learned dictionaries," IEEE Transactions on Image Processing, vol. 15, no. 12, pp. 3736–3745, 2006.

[6] K. Bredies and M. Holler, "A total variation-based jpeg decompression model," SIAM Journal on Scientific Computing, vol. 5, no. 1, pp. 366– 393, 2012.

[7] B. Oztan, A. Malik, Z. Fan, and R. Eschbach, "Removal of artifacts from jpeg compressed document images," in Society of Photo-Optical Instrumentation Engineers (SPIE) Conference Series, vol. 6493, Jan 2007, pp. 1–9.

[8] E. Y. Lam, "Compound document compression with model-based biased reconstruction," Journal of Electronic Imaging, vol. 13, no. 1, pp. 191– 197, 2004

[9] A. Chambolle, "An algorithm for total variation minimization and applications," Journal of Mathematical Imaging and Vision, vol. 20, no.1-2, pp. 89–97, 2004

[10] G. K. Wallace, "The jpeg still picture compression standard," Communications of the ACM, vol. 34, no. 4, pp. 30–44, 1991.