Literature Survey on Color Image Compression

[1]Ranjodh Kaur, [2]Harbhag Singh, [3]Jagdeep Singh, [4]Sandeep Kaur
[1,2,3]Dept. of IT, Guru Nanak Dev Engineering College, Ludhiana, Punjab, India
[4]Dept. of CS, Baba Banda Singh Bahadur Engineering College, Fatehgarh, India

Abstract
The need for an efficient technique for compression of Images ever increasing because the raw images need large amounts of disk space seems to be a big disadvantage during transmission & storage. Even though there are so many compression technique which is faster, memory efficient and simple surely suits the requirements of the user. This paper consists of review of some of the color image compression techniques.

Keywords
DCT, Color Image Compression

I. Introduction

It is used specially for the compression of images where tolerable degradation is required. With the wide use of computers and consequently need for large-scale storage and transmission of data, efficient ways of storing of data have become necessary. With the growth of technology and entrance into the Digital Age, the world has found itself among a vast amount of information. Dealing with such huge information can often present difficulties. Image compression is minimizing the size in bytes of a graphics file without degrading the quality of the image to an unacceptable level. The reduction in file size allows more images to be stored in a given amount of disk or memory space. It also reduces the time required for images to be sent over the Internet or downloaded from Web pages. JPEG and JPEG 2000 are two important techniques used for image compression.

JPEG, image compression standard use DCT (DISCRETE COSINE TRANSFORM). The discrete cosine transform is a fast transform. It is a widely used and robust method for image compression. It has excellent compaction for highly correlated data. DCT has fixed basis images DCT gives good compromise between information packing ability and computational complexity.

JPEG 2000 image compression standard makes use of DWT (DISCRETE WAVELET TRANSFORM). DWT can be used to reduce the image size without losing much of the resolutions computed and values less than a pre-specified threshold are discarded. Thus it reduces the amount of memory required to represent given image. The literature survey in the chronological order is as follows:

According to Y. Tim Tsai, [1] in 1991-color image compression for Single-Chip Cameras Single-chip cameras could be incorporated a CFA (color filter array) on the sensor to obtain color information. Color interpolation could then needed to recover the color images. Color-coding was conventionally implemented after the interpolation process. Two drawbacks inherited are a long processing time, and a requirement for a large memory buffer. Direct coding of the sensor data before color interpolation results in enormous artifacts and poor compression efficiency. Four new ideas for compressing color images obtained from single-chip CFA imagers have been presented. Be- cause of the special characteristics of the input, perceptually weighted coefficient quantization should be modified or removed. The color data should be separated in 3 colors. The best method was selected by comparing the compression efficiency and final image quality. The suggested method has the advantage of low processing time and low bit rate.

Takio Kurita [2] in 1993 proposed a Method of Block Truncation Coding for Color Image Compression. A BTC algorithm for color image compression and its mod- ification were presented. The algorithms require a significantly small computational load and little memory and preserve sharp edges as well as the ordinary monochrome BTC. Further improvements of performance of bit rate reduction will be achieved by using the same techniques proposed for the monochrome BTC. The quality of reconstructed images also will be improved by adaptively combining a spatial coding technique and the color BTC method like the hybrid image compression method for medical images.

Gaurav Sharma [3] in 1997 proposed a Digital Color Imaging, procedure that provide, research in the area of digital color imaging. In order to establish the background and lay down terminology, fundamental concepts of color perception and measurement are first presented using vector-space notation and terminology. Present-day color recording and reproduction systems are reviewed along with the common mathematical models used for representing these devices. Algorithms for processing color images for display and communication surveyed, and a forecast of research trends are attempted.

Method proposed by A.N. Skodras [4] in 2001 was JPEG2000: The upcoming still image compression standard With the increasing use of multimedia technologies, image compression requires higher performance as well as new features. To address this need in the specific area of still image encoding, a new standard is currently being developed, the JPEG2000. This intended to provide rate-distortion and subjective image quality performance superior to existing standards, but also to provide functionality that, current standards can either not address efficiently or not address at all. It provided a new framework and an integrated toolbox to better address in- creasing needs for compression and functionalities for still image applications, like Internet, color facsimile, printing, scanning, digital photography, remote sensing, mobile applications, medical imagery, digital library and E-commerce. Lossless and lossy coding, embedded lossy to lossless, progressive by resolution and quality, high compression efficiency, error resilience and lossless color transformations are some of its features. Comparative results shown that JPEG2000 was indeed superior to existing still image compression standards.

S. Makrogiannis [5] in 2002 suggested Region oriented compression of color images using fuzzy inference and fast merging. The new region based lossy compression scheme for color images was proposed. The segmentation method belonged to the split and merge category. The compression part was based on the Shape Adaptive DCT with delta DC correction method. The quantization matrices had been designed according to the properties of the employed transform. A generic, fuzzy segmentation based, compression method for color images has been proposed. The compression efficiency of the proposed method may be further improved if an adaptive content-based coding method is employed subsequent to the SA-DCT approximation, which represented as one of our future goals.

According to Larisa Goffman [6] in 2002, proposed a color

image Compression using Inter-color Correlation Natural images were characterized by high correlation between their RGB color components. Most representation and compression techniques reduce the redundancies between color components by transforming the color primaries into a decor related color space, such as YIQ or YUV. And proposed a different approach to color information analysis. Since the high correlation of color channels implicitly suggests a localized functional relation between the components, it could be used in an alternative framework, by approximating subordinate colors as functions of a base color. This way, only a reduced number of parameters were required for coding the color information. Compression results were presented and compared with JPEG, and the parameters that affect the coding quality studied and discussed and the conclusion was searched in color representation, a correlation-based approach superior to the traditional decor relation methods.

Li Tao and Vijayan Asari [7] in 2004 described as an Integrated Neighborhood Dependent Approach for Nonlinear Enhancement of Color Images. Proposed a new image enhancement algorithm INDANE (Integrated Neighborhood Dependent Approach for Nonlinear Enhancement of Color Images), which was applied to improve the visibility of the dark regions in digital images. INDANE was a combination of two independent processes: luminance enhancement and contrast enhancement. The luminance enhancement, also regarded as a process of dynamic range compression, is essentially an intensity transformation based on a specifically designed nonlinear transfer function. Finally implemented with nonlinear transfer function and multi-scale convolutions. The enhanced images' good quality has been confirmed.

Chun-Hsien Chou [8] in 2004 presented a color image compression using adaptive color quantization. The objective of perceptual compression scheme was to remove the visual redundancy of images and maintain the perceptual quality of decoding result. In this paper, he designed a perceptually adaptive color quantized for color image compression in wavelet domain. The quantization step sizes of three-color components, for each coefficient, were adaptively adjusted by the estimated error, visibility thresholds for achieving transparent coding at low bit rate. Based on the proposed color visual model, the error visibility thresholds were estimated by quantifying the perceptual redundancy in color spaces. The visual model built on defining a perceptually indistinguishable region for each color in a color space by mapping colors, which were barely distinguishable from the target color in a perceptually uniform color space (PUCS), to the target color space. The simulation results showed that the proposed scheme was able to achieve the perceptually lossless color image compression at low entropies.

Z.-M. Lu [9] in 2005 suggested a Color image retrieval based on DCT-domain vector quantization index histograms A new kind of feature for color image retrieval based on DCT-domain vector quantization (VQ) index histograms (DCTVQIH) is proposed. For each color image in the database, 12 histograms (four for each color component) were calculated from 12 DCT-VQ index sequences, respectively. The retrieval simulation results showed that, compared with the traditional spatial-domain color-histogram-based features, the proposed features can largely improved the recall and precision performance.

Subramania Sudharsanan [10] in 2005 considered shared key encryption of JPEG Color Images Several methods have been proposed for encrypting images by shared key encryption mechanisms since the work of Naor and Shamir. All the existing techniques were applicable to primarily non-compressed images in either monochrome or color domains. However, most imaging applications including digital photography, archiving, and Internet communications nowadays use images in the JPEG compressed format. Application of the existing shared key cryptographic schemes for these images requires conversion back into spatial domain. Proposed a shared key algorithm that works directly in the JPEG domain, thus enabling shared key image encryption for a variety of applications. A new {2,2} shared encryption method for JPEG images were proposed. The proposed method can take in JPEG or other image formatted and created the two shares in the JPEG format. The proposed method were extended to any other transform or wavelet domain techniques for image coding.

Ashutosh Dwivedi [11] in 2006 suggested a color image compression using 2-dimensional principal component analysis (2DPCA) technique for face representation and recognition. The standard PCA works on 1-dimensional vectors which has inherent problem of dealing with high dimensional vector space data such as images, whereas 2DPCA directly works on matrices i.e. in 2DPCA, PCA technique was applied directly on original image without transforming into 1 dimensional vector. This feature of 2DPCA has advantage over standard PCA in terms of dealing with high dimensional vector space data. The other performance measures, such as computational time, compression ratio were upgraded. The results obtained by using the proposed working method for color image compression were found impressive on account of both compression ratio and quality of reconstructed image. This methodology can be further applied with other compression algorithm to increase the compression ratio.

Ramesh (Neelsh) Neelamani [12] in 2006 suggested the JPEG Compression History Estimation for Color Images encounter digital color images that were previously compressed using the Joint Photographic Experts Group (JPEG) standard. En route to the image's current representation, the previous JPEG compression's various settings termed its JPEG compression history (CH) often discarded after the JPEG decompression step. Given a JPEG-decompressed color image, this paper aimed to estimate its lost JPEG CH. We observed that the previous JPEG compression's quantization step introduced a lattice structure in the discrete cosine transform (DCT) domain. This paper proposed two approaches that exploit this structure to solve the JPEG Compression History Estimation (CHEst) problem. First, designed a statistical dictionary-based CHEst algorithm that tests the various CHs in a dictionary and selects the maximum a posteriori estimate. Second, for cases where the DCT coefficients closely conform to a 3-D parallelepiped lattice, designed a blind lattice-based CHEst algorithm. JPEG CHEst could also help us uncover proprietary compres- sion settings used by imaging devices. It could contribute to applications such as covert message passing and image authentication. In summary, we envision that JPEG CHEst would enable a variety of intriguing applications.

A. Alkholidi [13] in 2007 considered a new approach for optical colored image compression using the JPEG standards. Image compression consists in reducing information volume representing an image. Elimination of redundancies and non-pertinent information enables memory space minimization and thus faster data transmission. The present work aims to improve the quality of the compressed image while minimizing the time required for compression by using the principle of coherent optics. They presented an optical adaptation of the method of JPEG compression technique for binary, gray-level and color images. They presented simulation as well as experimental results of the optical implementation of the JPEG compression

and decompression. Optical JPEG compression shows advantages when compared to the digital JPEG compression. The image quality was compared for binary, gray level and color images for the same compression ratios. Optical JPEG compression has shown to be a good compression alternative for all types of images.

Bibhas Chandra Dhara [14] in 2007 proposed a color image compression based on block truncation coding using pattern fitting principle This paper described a color image compression technique based on block truncation coding using pattern fitting (BTC-PF). High degree of correlation between the RGB planes, of a color image is reduced, by transforming them to O1O2O3 planes. As the proposed method requires negligible decoding time compared to JPEG, the former were preferred over the latter in those cases. A color image compression technique based on BTC with pattern fitting was presented. In the proposed CBTC-PF method, to reduce inter-plane, redundancy, (R,G,B) is transformed to (O1 O2 O3) using lossless transformation as it was seemed that the algorithm performs better in O1 ,O2 ,O3 domain compared to other well-known color domain, e.g., YIQ. They have selected the size of the blocks, size of pattern books and the number of levels in pattern depending on the entropy of Oi plane. Progressive transmission was possible as low-resolution image can be obtained from only the block means available in the compressed data stream of proposed method. Various image processing and feature extraction algorithm can be applied directly on the compressed data as the spatial correspondence is retained in it.

According to Stefano Andriani [15] in 2008 presented a Lossless Compression of Color Sequences Using Optimal Linear Prediction Theory that uses the optimal linear prediction theory to exploit all the existing redundancies in a color video sequence for lossless compression purposes. The main idea was to introduce the spatial, the spectral, and the temporal correlations in the autocorrelation matrix estimate. In this way, we calculate the cross correlations between adjacent frames and adjacent color components to improve the prediction, i.e., reduce the prediction error energy, focusing on investigations on an improved error modeling, testing temporal contextualization solutions which take into account the temporal correlation for prediction error modeling.

King-Hong Chung [16] in 2008 planned a Lossless Compression Scheme for Bayer Color Filter Array Images In most digital cameras, Bayer color filter array (CFA) images were captured and demos icing is generally carried out before compression. Recently, it was found that compression-first schemes outperform the conventional demos icing-first schemes in terms of output image quality. An efficient prediction-based lossless compression scheme for Bayer CFA images was proposed in this paper. It exploits a context matching technique to rank the neighboring pixels when predicting a pixel, an adaptive color difference estimation scheme to remove the color spectral redundancy when handling red and blue samples, and an adaptive code word generation technique to adjust the divisor of Rice code for encoding the prediction residues. Simulation results showed that the proposed compression scheme can achieve a better compression performance than conventional lossless CFA image coding schemes provided the best average compression ratio as compared with the latest lossless Bayer image compression schemes.

Andriy Bazhyna [17] in 2008 in his work Lossless and Near Lossless Compression of Real Color Filter Array were described the Data Compression of Bayer pattern Color Filter Array (CFA) data has gained a lot of attention during past years. Numerous algorithms have been proposed for lossless, near-lossless and lossy compression. The performance evaluation of compression methods was typically done only for artificial CFA data, obtained by sub-sampling full color images according to CFA pattern, without taking into account that CFA data are heavily processed before obtaining full color images. In his work the compression of real Bayer pattern CFA data was reviewed. The differences of real CFA data from artificial CFA data, obtained by sub-sampling of full color images according to CFA pattern were emphasized. Only the later one was typically used for evaluation of methods for CFA compression. In this paper, performance comparison of the same lossless methods for both artificial and real CFA was made.

Tak-Shing Wong [18] in 2009 described a Document Image Model and Estimation Algorithm for Optimized JPEG Decompression. The JPEG standard was the one of the most prevalent image compression schemes in use today. While JPEG was de- signed for use with natural images, it is also widely used for the encoding of raster documents. Unfortunately, JPEG's characteristic blocking and ringing artifacts can severely degrade the quality of text and graphics in complex documents. We proposed a JPEG decompression algorithm, which were designed to produce substantially higher quality images from the same standard JPEG encodings. The method worked by incorporating a document image model into the decoding process, which accounts for the wide variety of content in modern complex color documents. We focused on the class of document images, and proposed a JPEG decoding scheme based on image segmentation. A major contribution of our research is on the use of a novel text model to improve the decoding quality of the text regions.

Shengyang Dai [19] in 2009 designed a Soft Edge Smoothness Prior for Color Image Super-Resolution Designing effective image priors was of great interest to image super-resolution (SR), which is a severely under determined problem. An edge smoothness prior was favored since it is able to suppress the jagged edge artifact effectively. However, for soft image edges with gradual intensity transitions, it was generally difficult to obtain analytical forms for evaluating their smoothness. This paper characterizes soft edge smoothness based on a novel SoftCuts metric by generalizing the Geocuts method. To extend this method to natural color image SR, an adaptive Soft Cuts method is proposed based on a novel.

Yuji Itoh [20] in 2009 suggested Up-sampling of YCbCr 4:2:0 Image Exploiting Inter-color Correlation in RGB Domain and introduced a practical inter-color up-sampling algorithm for images with decimated chrominance components. Most of the existing and emerging image and video compression coding standards such as JPEG, MPEG and H.26x families employ YCbCr 4:2:0 chrominance format. After reconstructing the YCbCr 4:2:0 image at a decoder, one must up-sample the decoded chrominance signals by a factor of two in both horizontal and vertical directions to generate the YCbCr 4:4:4 format image, which is eventually transformed to RGB color space especially for displaying the reconstructed image. And proposed an innovative up-sampling algorithm that exploits the RGB inter-channel correlation.

Fouzi Douak [21] in 2009 designed a Color image compression algorithm based on the DCT transform combined to an adaptive block scanning and considered the design of a lossy image compression algorithm dedicated to color still images. After a preprocessing step (mean removing and RGB to YCbCr transformation), the DCT transform is applied and followed by an iterative phase (using the bisection method) including the thresholding, the quantization, DE quantization, the inverse DCT, YCbCr to RGB transform and the mean recovering. The last step was the application of a modified systematic lossless encoder.

The efficiency of the proposed scheme demonstrated by results, especially, when faced to the method presented in the recently published paper based on the block truncation coding using pattern fitting principle. And proposed a new efficient algorithm for color images compression.

Chulhee Lee [22] in 2009 suggested Efficient Compression for Sampled Color Images Single image sensors with color filter arrays have been widely used in color imaging systems. In typical applications, sampled color images obtained using a single sensor were first interpolated and then compressed. In this paper, they proposed an efficient compression method for such images. Instead of encoding full color image data obtained by DE mosaicking, the proposed method divides sampled color images into sub-images. In this paper, we proposed a color compression method that directly encoded sampled color images obtained by a CFA without color DE mosaicking. By encoding the difference sub- images instead of the sub-images themselves using the JPEG2000 compression method, they aimed to improve overall coding efficiency. Along with a good DE mosaicking algorithm, the proposed methods can substantially improve coding efficiency.

Karthik S. Gurumoorthy [23] in 2010 proposed a Method for Compact Image Representation Using Sparse Matrix and Tensor Projections Onto Exemplar Orthonormal Bases. They presented a new method for compact representation of large image datasets and presented a new technique for sparse representation of image patches, which was based on the notion of treating an image as a 2-D entity. Directions for future work include: (1) investigation of alternative matrix representations tuned for specific applications (as opposed to using the default rows and columns of the image), (2) application of our technique for compression of gray-scale and color video (represented as 3-D and 4-D matrices, respectively), or for de-noising, and (3) a theoretical study of the method in the context of natural image statistics.

Tae-Hyun Kim, [24] in 2010 presented a Backlight Power Reduction Using Efficient Image Compensation for Mobile Devices Since backlight dimming widely used for power reduction of mobile devices degrades the image quality in brightness and contrast; image enhancement is exploited to compensate the degradation. In this paper, proposed a novel backlight power reduction scheme using an efficient image compensation algorithm that scales discrete cosine transform (DCT) coefficients of image in the compressed domain. To reduce the computational burden of the conventional backlight dimming method where decompression was performed prior to image compensation in the spatial domain, and introduced a computationally efficient image compensation algorithm that processes only dominant DCT coefficients of images using a mapping function in the DCT domain. By scaling the DC and AC coefficients in each DCT block based on the mapping function, an enhanced image can be displayed under a low backlight level without increase of the power consumption for the display.

Zhiwei Xiong [25] in 2010 suggested a Block-Based Image Compression With Parameter-Assistant In painting. This correspondence presented an image compression approach that integrates a proposed parameter-assistant in painting (PAI) to exploit visual redundancy in color images. In this scheme, we studded different distributions of image regions and represent them with a model class. Based on that, an input image at the encoder side was divided into featured and non-featured regions at block level. First, assistant parameters may be described and compressed into the bit stream in a more condensed manner. Second, extraction of distinctive features could be more flexible and adaptable. Besides gradated and structural regions, other types, such as textural regions, could also be involved in the future work.

Ji Won Lee [26] in 2010 presented a Tone Mapping Using Color Correction Function and Image Decomposition in High Dynamic Range Imaging and proposed a tone mapping (TM) method using color correction function (CCF) and image decomposition in high dynamic range (HDR) imaging. The CCF in the proposed TM was derived from the luminance compression function with the color constraint under which the color ratios, between the three-color channels of the radiance map and dynamic range compression term, were preserved and color saturation controlled. And presented a TM algorithm using the proposed CCF and image decomposition. The CCF in the proposed TM is derived from the LCF with the color constraint under which the color ratios are preserved and color saturation is controlled in local TM. The method using subband decomposition was to be investigated for local/global contrast and detail enhancement and artifact suppression.

J. Christopher Clement [27] in 2010 presented a Color Image Enhancement in Compressed DCT Domain Novel algorithm for image enhancement in compressed (DCT) domain were presented. Despite, few algorithms have been reported to enhance images in DCT domain; proposed algorithm differs from previous algorithms in such a way that it enhances both dark and bright regions of an image equally well.

Presented an algorithm to enhance images in the compressed domain. Proposed Algorithm was less complex and it outperforms in enhancing chromatic and luminance components equally well. The values from JPQM and PSNR metrics insist that quality after enhancement was improved.

S. Ebenezer Juliet [28] in 2011 represented an efficient block prediction-based coding of computer screen images with precise block classification. This study presents a precise, one-pass block classification algorithm for efficient coding of computer screen images like power-point presentations, webpages and wallpapers. The objective was to minimize the loss of visual quality of text during compression by separating text information, which needs high spatial resolution than the pictures and background. It segments computer screen images into text/graphic, picture/ background blocks by computing the statistical feature based on discrete wavelet transforms coefficients in the detail sub-bands of each 8×8 block, and then compresses the text/graphics pixels losslessly with a two-mode block prediction coding and the background pixels with the lossy JPEG algorithm. The proposed scheme performs accurate block classification of text information with different fonts, sizes and ways of arrangement from the background image, so that text/graphics blocks are compressed at higher quality than background image blocks. They proposed two- mode block prediction-based entropy coding improves compression ratio of the lossless coding of text/graphics regions by 2% over Huffman coding for the similar PSN and the proposed compound image compression algorithm can be embedded in the mobile equipment to access and store multimedia documents in an effective manner.

Sung Hee Park [29] considered the Analysis on Color Filter Array Image Compression Methods. In most imaging systems, image compression was carried out after demos icing process and compression algorithms usually have focused on compressing three- channel color images. Recently, several image compression methods were proposed to directly handle CFA images that captured before color interpolation. These CFA compression schemes exploit the fact that CFA images do not contain the redundant information introduced by de-mosaicing. Compared the performance of various CFA compression methods and describe

how visual qualities were affected by the choice of de-mosaic algorithm. Another interesting direction of future works will be considering de-noising, de-mosaicing, de-blocking and image compression at the same time. There are several are taken into account. All four operations are closely related and strongly affect the performance each other. We believe there is room for big improvement in this direction.

References

[1] Iain Richardson,"Video Codec Design - Developing Image and Video Compression Systems", Copyright by John Wiley & Sons Ltd. 2002.

[2] Y. Tim Tsai,"Color Image Compression for Single-Chip Came", lEEE Transactions on electron devices. Vol. 38. No 5. MAY 1991.

[3] Takio Kurita, Nobuyuki Otsu,"A Method of Block Truncation Coding for Color Image Compression", IEEE Transactions on image processing, Vol. 41, No. 9, September 1993

[4] Gaurav Sharma, H. Joel Trussell, Digital,"Color Imaging", IEEE Transactions on image processing, VOL. 6, NO. 7, July 1997.

[5] A.N. Skodras, C.A. Christopoulos, T. Ebrahimi, "JPEG2000: The upcoming still image compression", standard Pattern Recognition Letters 22, 2001.

[6] S. Makrogiannis, G. Economou, S. Fotopoulos,"Region oriented compression of color images using fuzzy inference and fast merging", Pattern Recognition 35 2002, pp. 1807–1820

[7] Larisa Goffman-Vinopal and Moshe Porat, "Color Image Compression using Inter-color Correlation", IEEE ICIP 2002

[8] Li Tao and Vijayan Asari," An Integrated Neighborhood Dependent Approach for Nonlinear Enhancement of Color Images", Proceedings of the International Conference on Information Technology: Coding and Computing (ITCC'04) © 2004 IEEE.

[9] Chun-Hsien Chou, Kuo-Cheng Liu,"COLOR IMAGE COMPRESSION USING ADAPTIVE COLOR QUANTIZATION", 2004 International Conference on Image Processing (UP)

[10] Z.-M. Lu, H. Burkhardt,"Colour image retrieval based on DCT-domain vector quantisation index histograms", ELECTRONICS LETTERS 18th August 2005 Vol. 41 No. 17

[11] Subramania Sudharsanan,"Shared Key Encryption of JPEG Color Images", IEEE Transactions on Consumer Electronics, Vol. 51, No. 4, NOVEMBER 2005

[12] Ashutosh Dwivedi, Arvind Tolambiya, Prabhanjan Kandula, N Subhash Chandra Bose, Ashiwani Kumar, Prem K Kalra,"Ashutosh Dwivedi, Arvind Tolambiya, Prabhanjan Kandula, N Subhash Chandra Bose, Ashiwani Kumar, Prem K Kalra," Color Image Compression Using 2-Dimensional Principal Component Analysis (2DPCA)", Proc. of ASID '06, 8-12 Oct, New Delhi

[13] Ramesh (Neelsh) Neelamani, Ricardo de Queiroz, Zhigang Fan, Sanjeeb Dash, Richard G. Baraniuk,"JPEG Compression History Estimation for Color Images", IEEE Transactions on image processing, Vol. 15, No. 6, June 2006

[14] A. Alkholidia, A. Alfaloua, H. Hamama, " A new approach for optical colored image compression using the JPEG standards", Signal Processing 87, 2007, pp. 569–583

[15] Stefano Andriani, Giancarlo Calvagno,"Lossless Compression of Color Sequences Using Optimal Linear Prediction Theory", IEEE Transactions on image processing, Vol. 17, No. 11, November 2008.

[16] Bibhas Chandra Dharaa, Bhabatosh Chandab,"Color image compression based on block truncation coding using pattern fitting principle", Pattern Recognition 40, 2007, pp. 2408–2417

[17] King-Hong Chung, Yuk-Hee Chan,"A Lossless Compression Scheme for Bayer Color Filter Array Images", IEEE Transactions on image processing, Vol. 17, No. 2, February 2008.

[18] Tak-Shing Wong, Charles A. Bouman, Ilya Pollak, Zhigang Fan,"A Document Image Model and Estimation Algorithm for Optimized JPEG Decompression", IEEE Transactions on image processing, Vol. 18, No. 11, November 2009.

[19] Shengyang Dai, Mei Han, Wei Xu, Ying Wu, Yihong Gong, Aggelos K. Katsaggelos,"SoftCuts: A Soft Edge Smoothness Prior for Color Image Super-Resolution",IEEE Transactions on image processing, Vol. 18, No. 5, May 2009.

[20] Yuji Itoh, Tsukasa Ono,"Up-sampling of YCbCr4:2:0 Image Exploiting Inter-color Correlation in RGB Domain", IEEE Transactions on Consumer Electronics, Vol. 55, No. 4, NOVEMBER 2009.

[21] Fouzi Douak, Redha Benzid, Nabil Benoudjit,"Color image compression algorithm based on the DCT transform combined to an adaptive block scanning", Int. J. Electron. Commun. (AEU˙) 65, 2011, pp. 16–26.

[22] Chulhee Lee, Jonghwa Lee,"Efficient Compression for Sampled Color Images", IEEE Transactions on Consumer Electronics, Vol. 55, No. 4, November 2009.

[23] Karthik S. Gurumoorthy, Ajit Rajwade, Arunava Banerjee, Anand Rangarajan,"A Method for Compact Image Representation Using Sparse Matrix and Tensor Projections Onto Exemplar Orthonormal Bases", IEEE Transactions on image processing, Vol. 19, No. 2, February 2010.

[24] Tae-Hyun Kim, Kang-Sun Choi, Sung-Jea Ko, Senior Member, IEEE," Backlight Power Reduction Using Efficient Image Compensation for Mobile Devices," IEEE Transactions on Consumer Electronics, Vol. 56, No. 3, August 2010

[25] Zhiwei Xiong, Xiaoyan Sun, Feng Wu,"Block-Based Image Compression With Parameter-Assistant Inpainting", IEEE Transactions on image processing, Vol. 19, No. 6, June 2010.

[26] Ji Won Lee, Rae-Hong Park, SoonKeun Chang, "Tone Mapping Using Color Correction Function and Image Decomposition in High Dynamic Range Imaging", IEEE Transactions on Consumer Electronics, Vol. 56, No. 4, November 2010.

[27] J. Christopher Clement, M. Prabukumar, A. Baskar," Color Image Enhancement in Compressed DCT Domain", ICGST - GVIP Journal, Vol. 10, Issue 1, February 2010

[28] S. Ebenezer Juliet, D. Jemi Florinabel,"Efficient block prediction-based coding of computer screen images with precise block classification", IET Image Process., 2011, Vol. 5.

[29] Sung Hee Park, Albert No,"Analysis on Color Filter Array Image Compression Methods", Electrical Engineering Stanford University.



Harbhag Singh received his B.Tech. degree in Information Technology from Punjab Technical University, Jalandhar, Punjab, India in 2011. He is currently pursuing M.Tech. In Information Technology from Punjab Technical University, Jalandhar, Punjab, India.



Jagdeep Singh received his B.Tech. degree in Information Technology from Punjab Technical University, Jalandhar, Punjab, India in 2011. He is currently pursuing M.Tech. In Information Technology from Punjab Technical University, Jalandhar, Punjab, India.



Sandeep Kaur received her diploma in CSE(Computer Science), B.Tech. Degree in CSE (Computer Science) from Punjab Technical University, Jalandhar, Punjab, India in 2009. She received her M.Tech. degree In ICT (Information and Communication Technology) from Punjabi University, Patiala, Punjab, India in 2011.



Ranjodh Kaur received her diploma in CSE, B.Tech. degree in Information Technology from Punjab Technical University, Jalandhar, Punjab, India in 2009. She received her M.Tech. degree In Computer Science from Punjabi University, Patiala, Punjab, India in 2011.