1) **SUBMIT TO:** VCo3 (EBRAHIMI, SIKORA)

2) **SYMPOSIUM**
Visual Communications and Image Processing 2003

3) **ABSTRACT TITLE**
“Block based Embedded Color Image and Video Coding”

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5) **PRESENTATION**
ORAL PREFERRED, IF NOT, POSTER PRESENTATION acceptable.

6) **1.1 IMAGE/VIDEO CODING ALGORITHMS**

*Abstract*—In this paper, we propose a new embedded color coder based on the Set Partitioned Embedded Block coder (SPECK). SPECK has been found to perform comparable to the best-known still grayscale image coders like EZW, SPIHT, JPEG2000 etc. Color-SPECK (CSPECK) is a natural extension of SPECK to handle color images in the YUV 4:2:0 format. Results indicate that CSPECK performs comparable to SPIHT and JPEG2000 (0.1 – 2.7 dB for Y component). Extensions to other YUV formats are also possible. We then propose a moving picture based coding system called Motion-SPECK with CSPECK as the core algorithm in an intra-based setting. Results on well-known CIF sequences indicate that the PSNR for the Y-component for Motion-SPECK is comparable or better than Motion-JPEG2000 by 0.6 - 0.7 dB. As such, Motion-SPECK provides subjective image quality superior than Motion-JPEG2000. CSPECK and Motion-SPECK automatically inherit all the desirable features of SPECK, embeddedness, low computational complexity, highly efficient performance, fast decoding and low dynamic memory requirements. The intended applications of Motion-SPECK would be high-end and emerging video applications such as High Quality Digital Video Recording System, Internet Video, Medical Imaging etc.

7) **KEYWORDS**
color coding, embedded, Motion-JPEG2000, intra-based coding, moving picture coding

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1. **INTRODUCTION**

In the arena of still image compression, there has been a growing interest in wavelet based embedded image coders because of their desirable features, namely high quality at large compression ratios, very fast decoding, progressive transmission etc. In particular, set-partitioning schemes seems to have an edge due to their relatively low-complexity and high performance when compared to other coders, such as those employing vector quantization.
Recently, a number of hierarchical coding techniques have emerged which provide very good performance, apart from exhibiting the desirable properties characteristic of such coding techniques. All these coding techniques are based on the idea of partitioning the image into sets, and exploiting the hierarchical subband pyramidal structure of the transformed image. Shapiro’s Embedded Zero-tree Wavelet algorithm (EZW) was the one of the first of this kind. Said and Pearlman successfully improved the EZW algorithm by providing symbols for combination of parallel zerotrees. The implementation is based on set-partitioning sorting algorithm called Set-Partitioning in Hierarchical Trees (SPIHT). Of more recent is Islam and Pearlman’s Set Partitioned Embedded BloCK Coder (SPECK). SPECK has all the desirable properties of embeddeness, progressive transmission, low computational complexity, low dynamic memory requirements, fast decoding/encoding and provides excellent performance.

Inspired by the huge success of SPIHT & SPECK for still grayscale image coding, there has been extensive research on color image coding using the zerotree structure. A simple application of these grayscale algorithms on the individual components of a color image would result in losing embeddedness. We investigate a natural extension of SPECK to handle color images. By treating all color planes as one unit at the coding stage, we generate a single mixed bit-stream so that we can stop at any point of the bit-stream and reconstruct the color image with the best quality at that bit-rate. CSPECK (Color-SPECK) is found to perform comparable or superior to the best-known color coders like SPIHT, JPEG2000 etc. In general, CSPECK outperforms other codecs for the Y component with a gain of (0.1 - 2.7 dB). We also extend CSPECK for a moving picture based coding system, where we operate CSPECK in an intra-based setting on each frame of the video sequence. As such, we demonstrate its performance against Motion-JPEG2000. The intended applications of Motion-SPECK would be high-end and emerging video applications such as High Quality Digital Video Recording System, Internet Video, Medical Imaging etc.

This paper is divided as follows: In (II), we introduce color image coding and the extension of SPECK to color images (CSPECK) and comparing its performance with JPEG2000, SPIHT & Predictive Embedded Zero-tree Wavelet (PEZW), which is an improved version of the original EZW and is currently in the MPEG-4 verification model (VM) 6.0. In (III), we propose Motion-SPECK and compare its performance with Motion-JPEG2000 on standard CIF sequences (300 frames per sequence). (V) concludes with future research possibilities. Results of extensive simulations on various types of color test images are reported. Color images are YUV 4:2:0 chrominance downsampled versions from the first frames (intraframes) of standard MPEG-4 test sequences.

8) BRIEF BIOGRAPHY OF PRINCIPAL AUTHOR:

Nithin Nagaraj (M.S.) obtained his Bachelor's in Electrical & Electronics Engineer from REC Surathkal, India and Master's degree in Electrical Engineering from Rensselaer Polytechnic Institute, NY, USA. He is presently working at the G.E. John F. Welch Technology Center, Global Research Bangalore, INDIA. His research topics include image and video coding, medical image processing, entropy coding, wavelets.