Signal Processing and Compression for Image Capturing Systems Using a Single-Chip Sensor

Dr. Y. Tim Tsai
Eastman Kodak Company
Rochester, NY 14650-2015

Abstract:
An electronic camera system using a single Charge Coupled Device (CCD) image sensor equipped with a color filter array (CFA) can be used to produce color images by the application of an appropriate color interpolation algorithm to the digitized image data. To minimize storage space and transmission time requirements, compression of the digitized image data is necessary. All previous methods of compression published so far have been applied to the interpolated image data. Recent research [1], shows that compressing the uninterpolated image data may not only save processing time but will also result in a higher level of compression efficiency. DCT is used as a core compression scheme in this work. Since DCT compression is a lossy algorithm which will generate noise on each of the reconstructed pixels, the total noise resulting from compressing and reconstructing an interpolated image is larger than the total noise resulting from compressing and reconstructing the corresponding uninterpolated image. The research also shows that direct compression of the unseparated image data is not efficient. An appropriate procedure for incorporating color interpolation and image compression should result in good image quality while maintaining compression efficiency. This paper will examine the interaction between signal processing and compression algorithms. Two images are used to demonstrate a step-by-step procedure from raw captured camera data to color hardcopies. The corresponding statistics of both images reveals the efficiency of compression and processing. Prints of intermediate results are included to demonstrate the observed effects of the processing at various steps of the procedure.

Reference: