CCIT Report #622 May 2007

On a Probabilistic Approach to Rate Control for Optimal Color Image Compression and Video Transmission

Evgeny Gershikov * and Moshe Porat

Department of Electrical Engineering, Technion - Israel Institute of Technology, Haifa 32000, Israel

Abstract

Based on a recently introduced Rate-Distortion model for color image compression, optimal color coding and bit allocation are derived. We show that this Rate-Distortion model in conjunction with the probability distribution of subband coefficients can be used to develop an efficient algorithm for coding color images and video sequences. We demonstrate this approach for subband coding using Discrete Cosine Transform (DCT) and a Laplacian distribution as the probability model. We show how the model can be used for rate-control, applicable to still images and to controlling the bit-rate or bandwidth of video transmission. Visual and quantitative results are presented and discussed to support the efficiency of our algorithms, which outperform presently available compression systems.

Key words: Color image coding, Subband transforms, Rate-Distortion model, Discrete Cosine Transform, Laplacian distribution, Rate-control, Video Coding

1 Introduction

Color image and video compression has become a major task in today's communication environment. Usually color images are represented by the three RGB color components, which are highly correlated [4], [7], [10], [15], [22]. Naturally, it is a naive approach to compress each color component separately. To improve the information distribution in the image data, usually a color components transform (CCT) is used. The RGB to YUV transform is

* Corresponding author. Tel.: +972-4-8294725; Fax: 972-4-8294799.
Email addresses: eugeny@tx.technion.ac.il (Evgeny Gershikov), mp@ee.technion.ac.il (Moshe Porat).