

The Overlooked Importance of HVS Spectral Sensitivity and Full Colour Perception in Visually Lossless Compression Applications

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Abstract — There exists an inextricable relationship between the spectral sensitivity of the Human Visual System (HVS) and full colour perception; these vital components are typically overlooked in visually lossless coding (perceptual compression) research. In the vast majority of cases, previously proposed methods focus on luminance (luma) masking including luma spatiotemporal masking, luma contrast masking and luma texture/edge masking; in other words, authors typically focus only on the perceptual importance of brightness, contrast and luma sample structure in an image. The perceptual relevance of saturation, hue and chrominance in a picture is often overlooked entirely. A vast number published papers in perceptual coding research fail to make the distinction between physical luminance in the universe and "brightness" (brightness is a HVS-based perceptual phenomenon). Moreover, it is important to note that photon energies (which are perceived by the HVS as colour) and physical luminance — which is perceived by the HVS as the brightness of colour — exist in the universe irrespective of human perception. That is, it is the combined human interpretation of photon energies and physical luminance, via the HVS, that gives rise to the full perceptual experience of colour. This includes the perception of the brightness of colour, the saturation and hue of colour and also the perception of the contrast between two colours (or two shades of the same colour). The main contribution to knowledge in this paper is a conceptual framework that pertains to the spectral sensitivity of the HVS, full colour perception and visually lossless compression. A proof of concept perceptual quantisation algorithm — employed with the HEVC x265 codec — is presented in order to highlight the considerable bitrate reductions that can be achieved by fully accounting for HVS spectral sensitivity.