A unique integral imaging system is employed as part of a three dimensional television system, allowing the display of a full colour 3D images with continuous parallax within a wide viewing zone. Unidirectional integral imaging is a special case of Integral 3D Image, where cylindrical lenses are used instead of a 2D array of microlenses, thus providing parallax in the horizontal direction only. A significant quantity of digital data is required to represent captured Integral 3D Images.

In this study, an adaptive 3D DCT based compression algorithm for use with full colour unidirectional Integral 3D Images based on sub-sampling of the chrominance components is presented. The planar intensity distribution representing an Integral Image is comprised of 8 pixels for each cylindrical lens in the horizontal direction. The structure of recorded unidirectional Integral Image intensity distribution is such that a high cross correlation in a third domain, i.e. between the bands produced by the recording 1D cylindrical microlens array, is present. This is due to the small angular disparity between adjacent cylindrical microlenses. To facilitate development of a compression scheme, the unidirectional 3D Integral Image is split into sections of 8 pixels on the vertical direction thus forming a 2D array of 8x8 sub-images. A 3D DCT is used to de-correlates a group of adjacent sub-images from the source intensity distribution data in both inter-sub-image and intra-sub-image dimensions simultaneously.

In this paper, the number of sub-images involved in a single 3D DCT computation, N, is made variable based on the cross correlation between the sub-images. The group length N is a parameter of the system and is chosen to provide maximally efficient de-correlation of all sub-images from the full source intensity distribution. The higher the cross correlation between the sub-images within a single group, the more efficient is the de-correlation process. Hence, N is varied based on the information from the segmented planar mean image, which gives an indication of the inter sub-image cross correlation. The planar mean image is formed by the mean values of the sub-images and it is segmented into regions with high cross correlation between the sub-images using a split merge algorithm. N is chosen as the number of consecutive pixels in the horizontal direction within the same homogeneous region of the segmented mean image.

The algorithm has been applied separately to the three colour components i.e. the luminance, Y, and the two chrominance components C_r and C_b. The chroma components C_r and C_b have been sub-sampled using several types of filters, such as: Box, Tent, filter-Support, Bell, Mitchell, B-spline and Lanczos3. It was observed that the use of a 3D DCT technique performed better than JPEG with respect to rate distortion performance. This occurs due to increasing overall effectiveness of de-correlation of all sub-image groups in the source intensity distribution; higher cross-correlated sub-images are included in a single 3D DCT computation. Different graphical measures on the image quality conduct to similar conclusions about the filter influence in the proposed compression scheme. It was noticed that the Box filter is more appropriate for C_b component while the Tent filter is more suited to C_r component.