A universal orthogonal System of functions for still colour Image compression and results in reconstruction

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After describing some preliminary experiments on picture compression, the paper deals with the construction of a system of orthogonal functions which provides the best mean square reconstruction of still coloured images by means of a finite (or in general truncated) linear expansion of its tessels. Such an orthogonal system is obtained by solving a Fredholm integral equation whos kernel is the Covariance function of the "Random field" "IMAGE TESSEL". The equations are solved in discrete form because of the discrete representation of images on computers. One can see that whichever is the size S of the tessel, the eigenfunctions do not change shape (some remarks are necessary here) nor they change shape even if one evaluates the Covariance function from a reduced subset of the Universal set describing the Random field. Moreover the set of functions is invariant under the group that maps a square onto itself since this property is a peculiar one of the Random Field which must then be built with this property. The space of such functions can be described as a Kronecker product of a 3-dimensional space (Colour space) and an n^2 dimensional euclidean space, where n is the tessel size; the overall set of functions can be constructed from a considerably smaller lower number. Such functions allow image compression with large compression coefficients and hence we give several examples of compression and reconstruction and show the results together with the set of eigenfunctions (Universal Eigenfunctions).

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