

A BASIC IMAGE COMPRESSION EXAMPLE*

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Abstract

This module gives a basic image compression example.

We shall represent a monochrome (luminance) image by a matrix x whose elements are $x(n)$, where $n = \begin{pmatrix} n_1 & n_2 \end{pmatrix}$ is the integer vector of row and column indexes. The energy of x is defined as

$$\text{Energy of } x = \sum_n x^2(n) \quad (1)$$

where the sum is performed over all n in x .

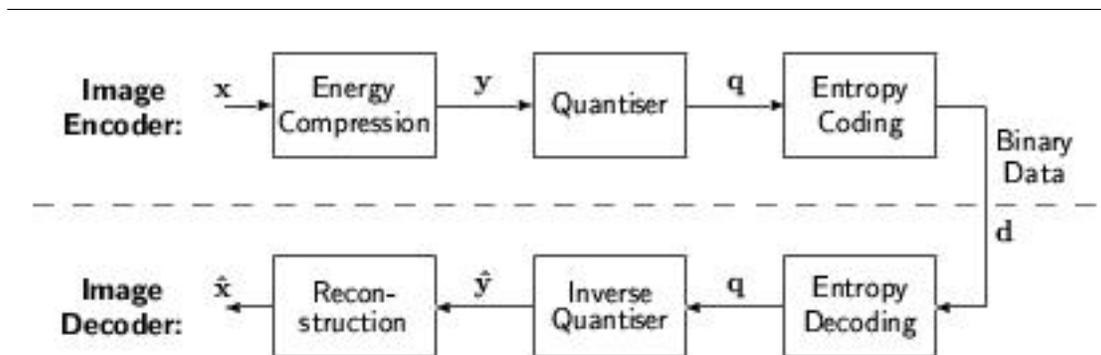


Figure 1: The basic block diagram of an image coding system.

Figure 1 shows the main blocks in any image coding system. The decoder is the inverse of the encoder. The three encoder blocks perform the following tasks:

- **Energy compression** - This is usually a transformation or filtering process which aims to concentrate a high proportion of the energy of the image x into as few samples (coefficients) of y as possible while preserving the total energy of x in y . This minimises the number of non-zero samples of y which need to be transmitted for a given level of distortion in the reconstructed image \hat{x} .

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- **Quantisation** - This represents the samples of y to a given level of accuracy in the integer matrix q . The quantiser step size controls the tradeoff between distortion and bit rate and may be adapted to take account of human visual sensitivities. The inverse quantiser reconstructs \hat{y} , the best estimate of y from q .
- **Entropy coding** - This encodes the integers in q into a serial bit stream d , using variable-length entropy codes which attempt to minimise the total number of bits in d , based on the statistics (PDFs) of various classes of samples in q .

The energy compression / reconstruction and the entropy coding / decoding processes are normally all lossless. Only the quantiser introduces loss and distortion: \hat{y} is a distorted version of y , and hence \hat{x} is a distorted version of x . In the absence of quantisation, if $\hat{y} = y$, then $\hat{x} = x$.