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## **Discrete Cosine Transform (DCT)**

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- a) The images to be compressed are transformed into DCT coefficients. The DCT is an orthogonal transform. Check the quality of the reconstructed image (for instance for the "Lena256B" image) for different DCT sizes. How well does the theory correspond with the practical implementation?
- b) Load the "Lena256B" image. Select the 8x8 DCT transform, and select PCM compression for all DCT coefficients. Pick a reasonable value for the  $c$ -parameter (think of a way to find a  $c$ -value that matches best the pdf of the subband coefficients). Draw two SNR-bitrate curves, one with and one without entropy coding. How much additional compression or SNR does entropy-coding give?
- c) Repeat (b) for incorrect values of the  $c$ -parameter. Look closely at the difference between the selected bit rate, the bit rate predicted after bit allocation, and the actually obtained bit rate. Explain difference observed.
- d) Repeat (b) for the "Noise256B" image. Look at the variances of the DCT coefficients and the results of the bit allocation. Compare your results with PCM and DPCM compression of this noise image.
- e) Load the "Lena256B" image, and compute SNR-bitrate curves using different DCT block sizes, keeping the compression of the DCT coefficients fixed (for instance using DPCM for DCT coefficient 1 and PCM for the others, using a fixed prediction model, and using a fixed  $c$ -parameter).
- f) Examine the consequences of bit errors on DCT compression at different error probabilities and for different DCT block sizes and (DPCM) prediction models. Explain the structure of the degradations observed. Compare the effects of bit errors in the DCT coefficients with those in the reconstructed image.