

Non Uniform Quantization Functions

Optimal Output Alphabets and Levels

LLOYDS: Optimize quantization parameters using the Lloyd algorithm. [PARTITION, CODEBOOK] = LLOYDS(TRAINING_SET, INI_CODEBOOK) optimizes the scalar quantization PARTITION and CODEBOOK based on the provided training vector TRAINING_SET using the Lloyd algorithm. The data in the variable TRAINING_SET should be typical data for the message source to be quantized. INI_CODEBOOK is the initial guess of the codebook values. The optimized CODEBOOK has the same vector size as INI_CODEBOOK. When INI_CODEBOOK is a scalar integer instead of vector, it is the length of the desired CODEBOOK vector. PARTITION is a vector with the vector length being the CODEBOOK vector length minus 1. The optimization will be terminated if the relative distortion is less than 10^{-7} .

[PARTITION, CODEBOOK] = LLOYDS(TRAINING_SET, INI_CODEBOOK, TOL) provides the tolerance in the optimization.

[PARTITION, CODEBOOK, DISTORTION] = LLOYDS(...) outputs the final distortion value.

[PARTITION, CODEBOOK, DISTORTION, REL_DISTORTION] = LLOYDS(...) outputs the relative distortion value in terminating the computation.

See also QUANTIZ, DPCMOPT.

Non-Uniform Quantization

QUANTIZ: Produce a quantization index and a quantized output value. INDX = QUANTIZ(SIG, PARTITION) produces a quantization index INDX of the input signal SIG based on the decision points PARTITION. Each element in INDX is one of the N integers in range [0 : N-1]. PARTITION is a strict ascending ordered N-1 vector that specifies the boundaries. Elements of INDX = 0, 1, 2, ..., N-1 represent SIG in the range of (-Inf, PARTITION(1)], (PARTITION(1), PARTITION(2)], (PARTITION(2), PARTITION(3)], ..., (PARTITION(N-1), Inf).

[INDX, QUANT] = QUANTIZ(SIG, PARTITION, CODEBOOK) produces the output value of the quantizer in QUANT. CODEBOOK is a length N vector that contains the output set.

[INDX, QUANT, DISTOR] = QUANTIZ(SIG, PARTITION, CODEBOOK) outputs DISTOR, the estimated distortion value of the quantization. There is no decode quantizer function in this toolbox. The decode computation can be done using the command Y = CODEBOOK(INDX+1).

See also LLOYDS, DPCMENCO, DPCMDECO.

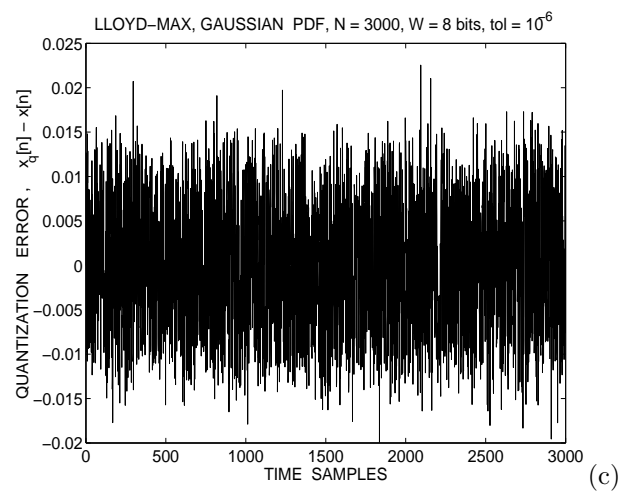
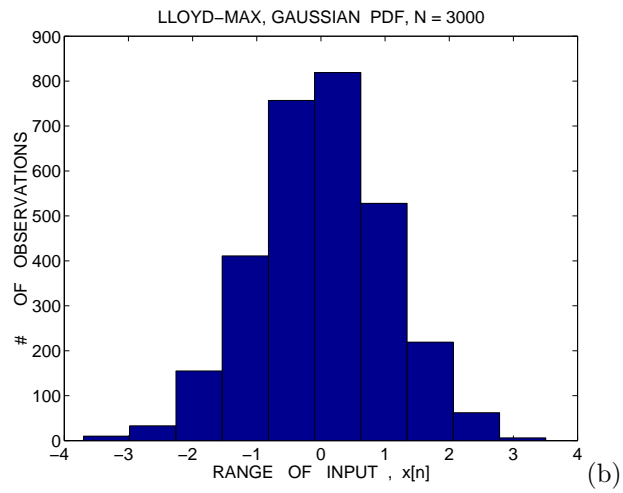
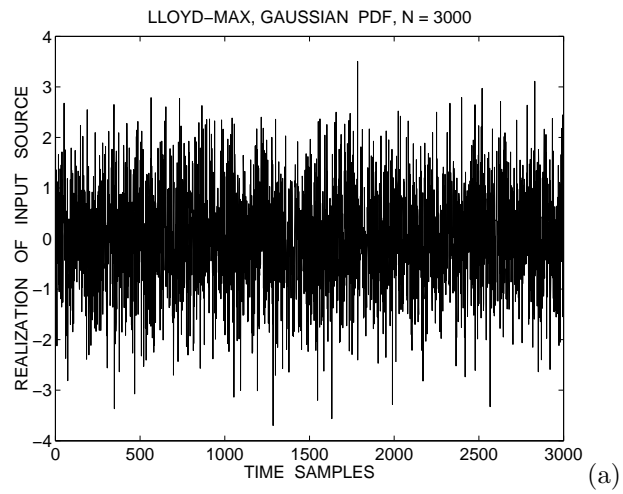


Figure 1: Lloyd Max quantization: (a) sample realization of standard Gaussian distributed input, (b) histogram of Gaussian distributed input, and (c) quantization error of the non uniform quantizer for a word-length of 8 bits.