MMSP 2nd Module – Lab3

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Predictive coding
EXERCISE 1

POLITECNICO DI MILANO

1. Generate 10000 samples of the random process $x(n) = rho*x(n-1) + z(n)$, where rho=0.95 and $z(n) \sim N(0,0.1)$

2. Build a PCM codec. Quantize the signal with a uniform quantizer and R bits. Compute the R-D curve for R=1,2,...,8 bits

3. Build a predictive codec in open loop. Use the optimal MMSE predictor. Use PCM to initialize the codec.

4. Build a DPCM codec. Use the optimal MMSE predictor. Use PCM to initialize the codec.

5. Compare R-D curves for PCM, open-loop DPCM and closed-loop DPCM

1. Uniform quantization: x_q = delta * floor(x/delta) + delta/2

2. Optimal MMSE predictor for AR(1): x_hat(n) = rho*x(n-1)

3. Pay attention to difference between closed- and open-loop

Predictive coding
EXERCISE 2

POLITECNICO DI MILANO

1. Load the stereo file 'mso.wav' and define *xl* and *xr* as the left and right channels, respectively.

2. Build a DPCM codec. Quantize the signal with a uniform quantizer and R=1,2,...,8 bits. Use the left channel *xl* as the signal and
   1. xl(n-1)
   2. xr(n)
   3. dummy 5*xl(n)

   as the predictor. Use PCM to initialize the codec.

3. Compute the R-D curve for R=1,2,...,8 bits

EXERCISE 3

POLITECNICO DI MILANO

1. Load the stereo file 'ns.wav'.

2. Build a PCM codec. Quantize the signal with a uniform quantizer and R=1,2,...,8 bits. using *floor*, *ceil* and *round* in the quantizer rule.

3. Compute the R-D curve for R=1,2,...,8 bits. What's wrong?

Predictive coding
EXERCISE 4

POLITECNICO DI MILANO

1. Load the image 'lena512color.tiff'.

2. Let x be the red channel and y the green channel of the image. Quantize y with PCM and DPCM (R=1,2,...,8 bits) using:

    1. y_hat(n) = a*x(n)+b

    2. y_hat(n) = randn*x(n) + randn*100

    where 'a' and 'b' are obtained by linear regression (least squares on y=ax+b). Use PCM to initialize the codec.

3. Compute the R-D curve for R=1,2,...,8 bits