

# Multimedia Communications

## Lab. Session 4

Name

First Name

### Exercise 1: Wavelet transform

For each of the following signals:

- Ramp + colored noise `cnislop`
- Sine + white noise
- Real signal `leleccum`
- Real EEG signal "test"

1. Perform the Stationary and the Discrete Wavelet transform with the parameters listed in the Table:

|                  |  |
|------------------|--|
| Number of levels | J=3                                    |
| Filters          | haar, orthogonal db2, biorthogonal 2.4 |

2. Choose one wavelet and set  $J = 3$ . Perform the following operations on the subband coefficients:
  - (a) Display the subbands for all levels and orientations;
  - (b) For each subband, display the histogram of the coefficients;
  - (c) Reconstruct the signal by performing the inverse transform and verify that it is indistinguishable from the original (the reconstruction error is zero);
  - (d) Successively set to zero the different subband coefficients (first subband by subband, and then level by level);
  - (e) Keep the absolute value of the coefficients (change each negative sign to positive);
  - (f) Keep the signs of the coefficients while setting the absolute value of each coefficient equal to  $(\sqrt{2})^j$ , where  $j$  represents the level;
  - (g) Quantize the coefficients by rounding to the nearest integer;
  - (h) Quantize the coefficients of the different subbands according to the rule  $\Delta_k = 2^{-j}$ , where  $\Delta_k$  is the size of the quantization bin.

Then, for each case, perform the inverse transform to reconstruct the signal. Save the corresponding image and comment the result.

3. In which case the signal is most deteriorated?
4. Calculate the SNR between the original the reconstructed signals; Comment the results.