LAB 2
Spread Spectrum

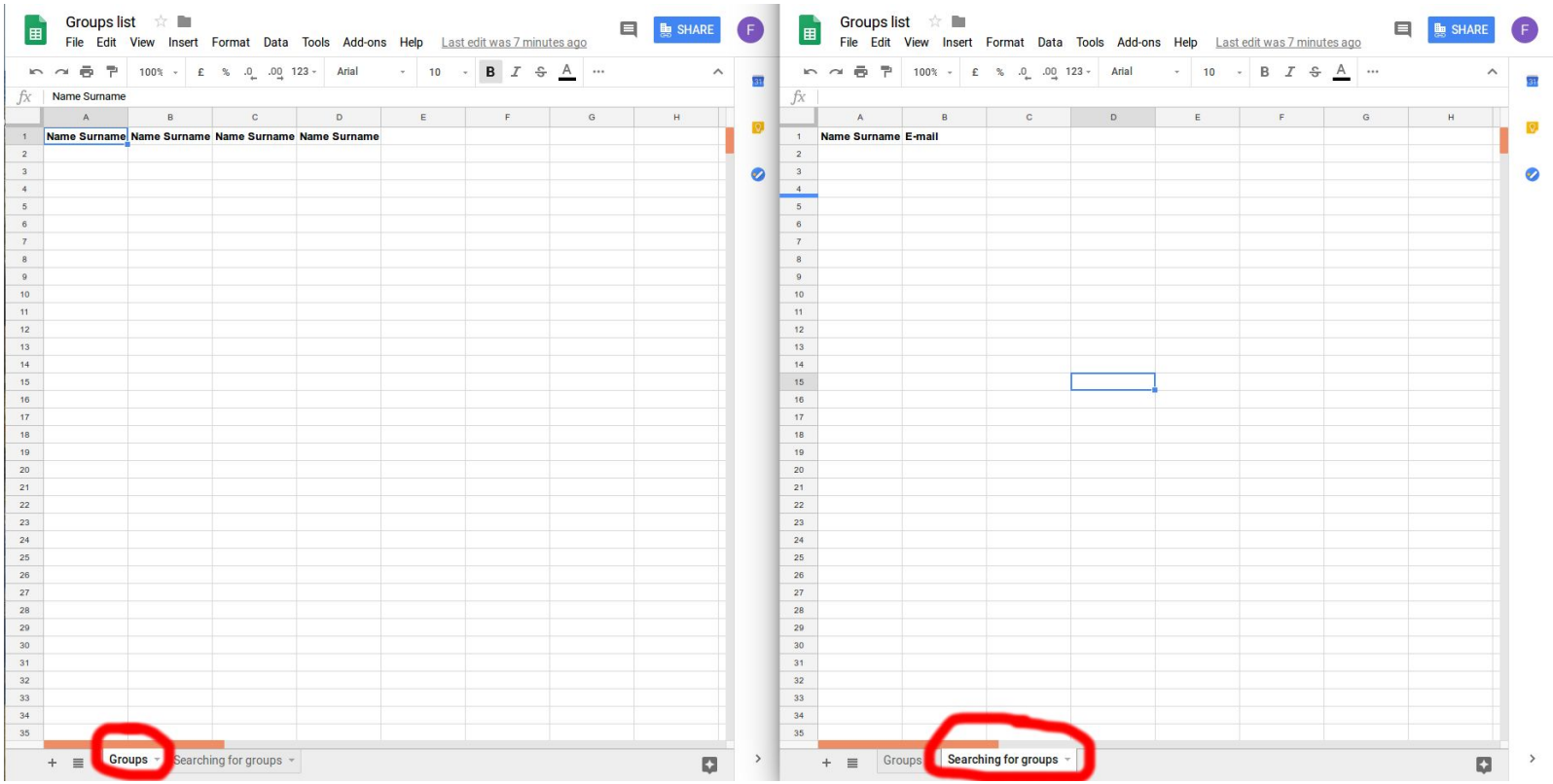
Federica Lago - federica.lago-1@alumni.unitn.it

Content

- Structure of lab
  - Recap last lab
  - Spread Spectrum Embedding
  - Spread Spectrum Detection Tutorial

Announcement

You can use this spreadsheet to organize groups.



Recap

Last time we have seen LSB

- embedding
- detection
- attack

Spread Spectrum - recap

An independent and identically distributed (i.i.d.) Gaussian random vector (the watermark) is imperceptibly inserted in a spread-spectrum-like fashion into the perceptually most significant spectral components of the data.

PSNR vs WPSNR

- Objective metrics that simulate the behavior of the Human Visual System, and thus can emulate the subjective evaluation.
- The PSNR measures the ratio between the maximum possible power of a signal (the original image) and the power of corrupting noise.
- WPSNR is based on the fact that human eye is less sensitive to changes in textured areas than in smooth areas. It uses as a weight factor a Noise Visibility Function (NVF) that estimates how much texture exists in any area of an image.

SS - Embedding

- Try to modify CoxEmebdding.m to embed a watermark using Spread Spectrum.

Generate watermark

Compute DCT → Coefficient selection → Embed watermark → Compute IDCT

Hint: sort the coefficients (sign is irrelevant)

Hint: use additive SS: $v'_i = v_i + \alpha x_i$

LSB - Embedding

- Try to modify CoxEmebdding.m to embed a watermark using Spread Spectrum.

Exercises:

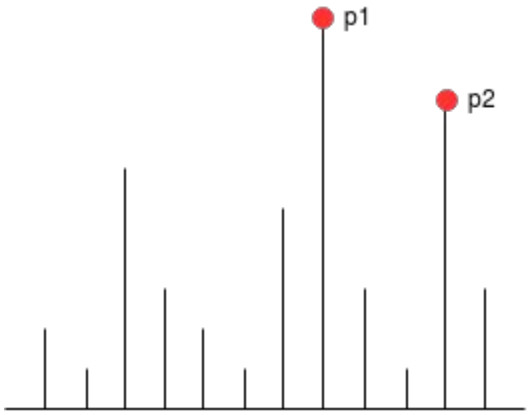
- Try to change the value of alpha.
- Try to use multiplicative Spread Spectrum: $v'_i = v_i * (1+\alpha x_i)$
- Try changing the size of the watermark

LSB - Detection

- Try to modify CoxDetection.m to retrieve the watermark using Spread Spectrum. Hint: similar to embedding

$$\text{sim}(X, X^*) = \frac{X^* \cdot X}{\sqrt{X^* \cdot X^*}}$$

- NB! We need to use a threshold to see if the watermark is present. The threshold is computed as follows:
  - Generate other 999 random watermakrs
  - Present the 999 + your mark to your detection system, and consider the 2nd highest correlation peak (p2)
  - Compute the threshold as T = p2 + 0.10*p2



LSB - Detection

- Try to modify CoxDetection.m to retrieve the watermark using Spread Spectrum.

Exercises:

- Try to see what happens if the image is attacked