# Modified Patchwork Algorithm: Anovel Audio Watermarking Scheme

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# What is Audio  Watermarking ?

- Embed Data into an Audio File

- Quality required
  - Not be perceivable by a listener
  - Robust again manipulation
  - Rely to a key to ensure security
  - Statistically undetectable

# Application of Audio Watermarking

- Monitoring a file
- Fingerprinting
- Can indicate content manipulation

# Exemple of Patchwork Algorithm for Image

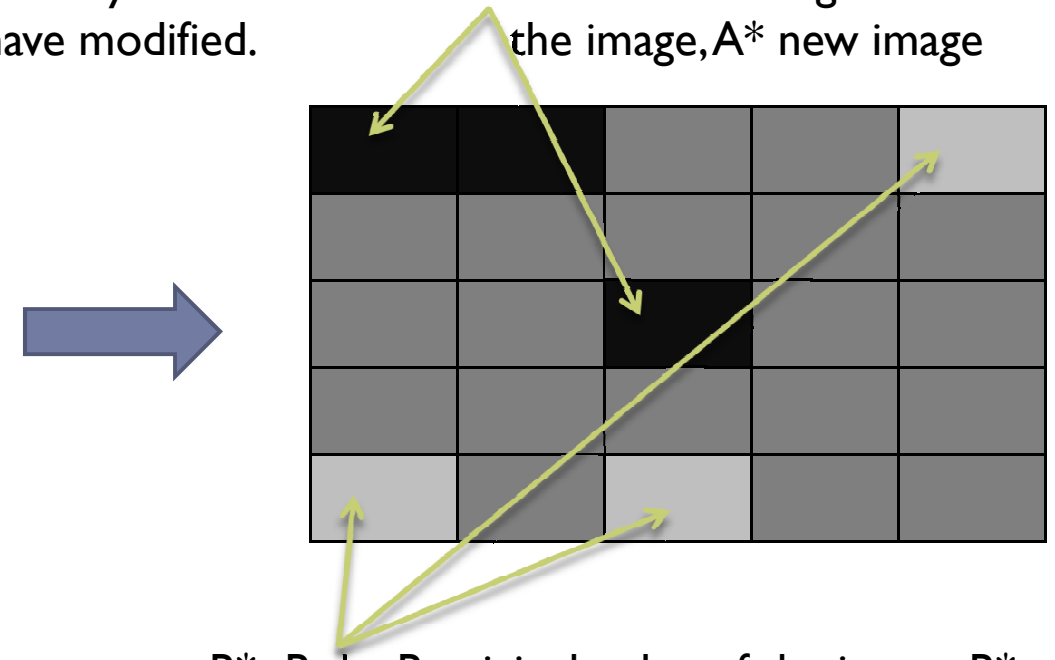
We darken some part, and light up some others part of the image

We keep in memory the Position of the pixel we have modified.

A*=A+d : A original color of the image, A* new image

| | | | | |
|---|---|---|---|---|
| A | A | | | B |
| | | | | |
| | | A | | |
| | | | | |
| B | | B | | |

Original Image

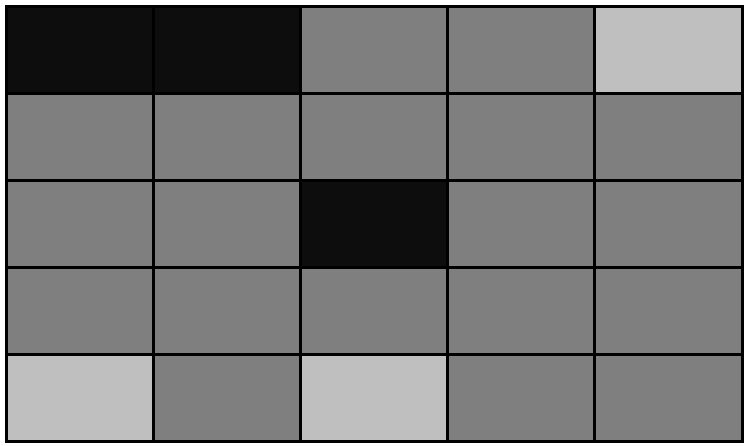


We assume that E[A-B]=0:

B*=B-d : B original color of the image, B* new image. We have decreased the darkness

# Exemple of Patchwork Algorithm for Image

The image has been modified and we try to retrieve the original information.
Keep in mind: We know the location of the original modified pixel.



E[A*-B* ]= E [(A+d) – (A-d)] = E[A-B] + 2d
And E[A-B]=0 as assumed. Thus we get :
E[A*-B* ]= 2d
So we can retrieve d, and thus the embeded information.

# Audio watermarking = same ideas but differencies

- Patchwork algorithm applicated to the frequency domain
- We use mean and variance to detect the watermarks
- Assume that the Distribution of the sample is gaussian
- We use A*=A(1+d) instead of A*=A+d
- d is decided adaptively.

# Implemented Algorithm for embedding

- Apply a DFT, or DCT of size N on an audio frame an store the coefficients F.
- From a secret key, generate 2 Index with  2 n values pseudo-randomly chosen between 1 and N. Each index will represented 0 or 1.
- Define the subset A and B, with A=[ F coefficients with subset equals to the first n elements of the Index of the desired values] . Same for B with the last n elements.

# Implemented Algorithm for embedding (cont'd)

- Calculate the mean and the pooled sample standard error S of elements of A and B.
- Replace them by Ai*=Ai + sign(average(A-B))* C * S/2
  - C is a constant
- Apply the inverse DCT. The signal is watermarked.

# Implemented Algorithm for deembedding

- Retrieve the modified DFT,DCT coefficient for the Index representing 0, and 1. A0 and B0 and A1 and B1.
- Compute the sample means and pooled sample error (S0,S1) for A0,B0…
- See what for what set we get the biggest values T:
  - $T0 = (ave(A0)-ave(B0))^2 / S^20$ or $T1 = (ave(A1)-ave(B1))^2 / S^21$.
- If T is bigger than a predecided threshold then we assume that the signal is watermarked.

# Summarize: What I Have done so far ?

- Understanding globally what a Watermark is. Uses and Applications.
- Understand MPA Algorithm.
- Try to understand deeply the paper.
- Implemented the embedding algorithm
- Implemented the deembedding algorithm