Multimedia Data Security
University of Trento

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Iquartz

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Capture The Mark

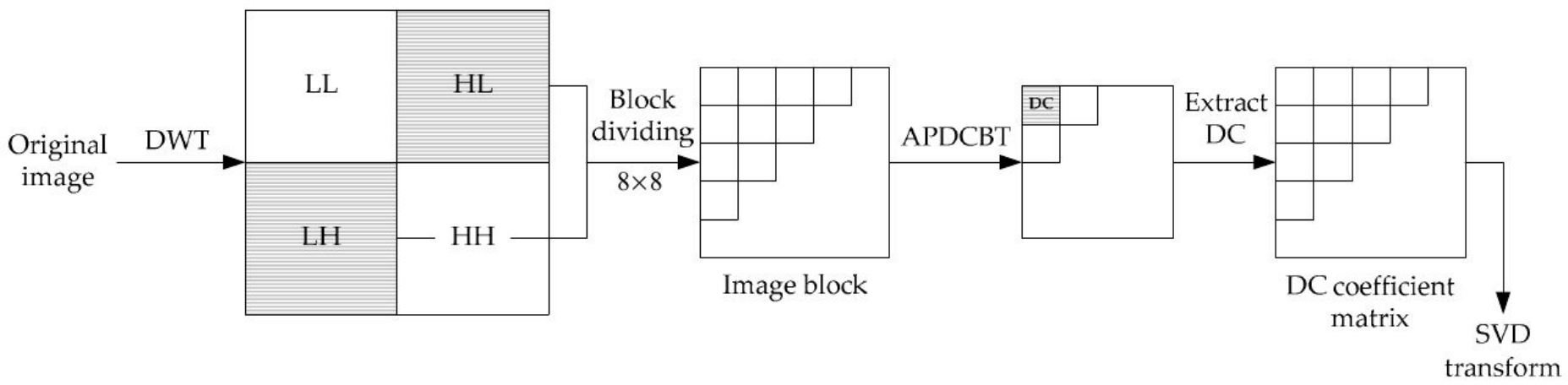
1. Defense strategy
2. Attack strategy
3. Results

Choosing our Strategy

“A Robust Image Watermarking Technique Based on DWT, APDCBT, and SVD”

- Explains the algorithm clearly
- Analyses and reports a high watermark robustness

Paper: Insertion Strategy



"A Robust Image Watermarking Technique Based on DWT, APDCBT, and SVD"

Example of embedding with paper algorithm

Lena, original

Lena, watermarked, alpha = 100

Implementation by Trial and Error

1. DWT + DCT full frame
2. DWT + APDCBT full frame
3. DWT + APDCBT on 8x8 blocks + DC extraction + SVD
4. DWT + APDCBT on 8x8 blocks

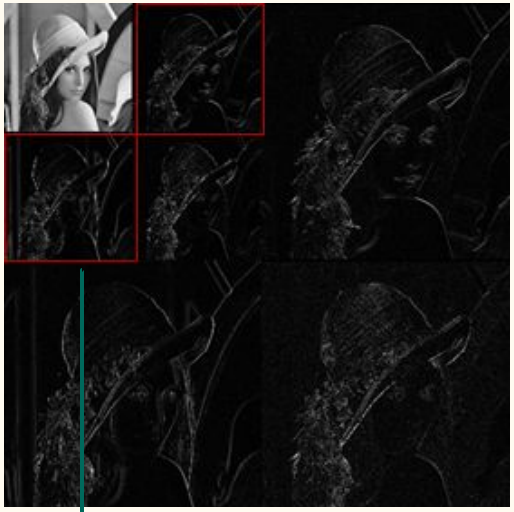
Final approach: Insertion

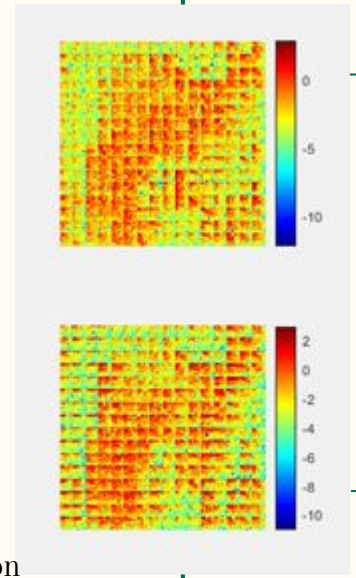
1 - Discrete Wavelet Transform, Level 2

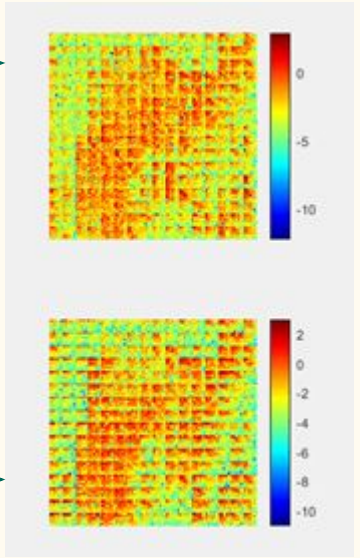
2.A - APDCBT on blocks on horizontal sub-band

3. Spread Spectrum additive in highest 1024 coefficients

watermarked = *original* + *1,2* x *watermark*





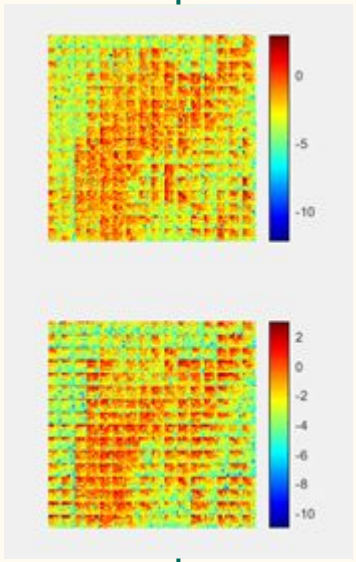


2.B - APDCBT on blocks on vertical sub-band

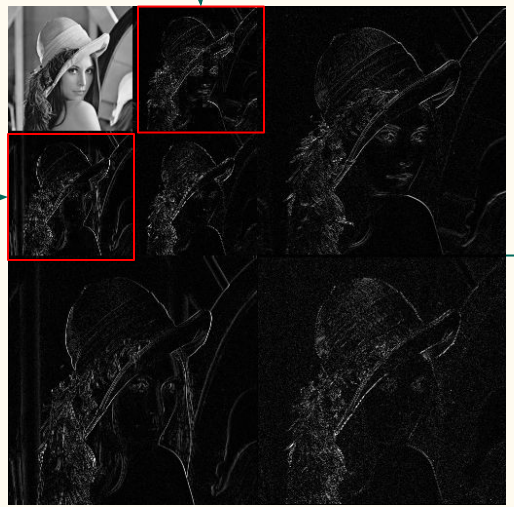
EXTRA: Change watermark to [-1, 1]

Insertion (continued)

3. Watermarked coefficients



4.A - IAPDCBT on horizontal sub-band

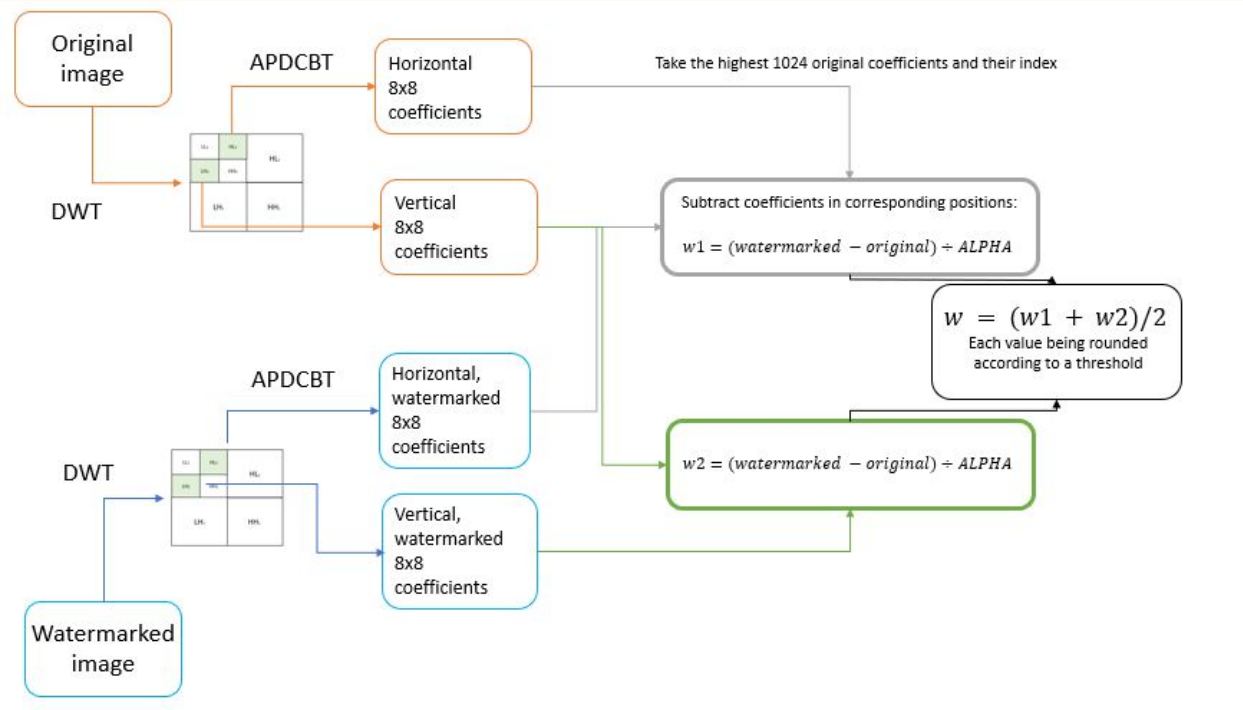


5 - Inverse DWT

Watermarked image

4.B - IAPDCBT on vertical sub-band

Detection



Extraction of original watermark w

Same procedure to extract attacked watermark w_a (change watermaked image with attacked one)

So when we have w and w_a we compare them based on a similarity measure

Embedding Results

- Average **embedding WPSNR**: 50.62 dB
- Average **robustness WPSNR**: 40.03 dB
  - Pretty good due to insertion in the **hybrid transform** domain and in the highest coefficients.
  - **Localisation** of the watermark in **textured areas**, **edges** and **surroundings.**

BUT

- Quite high visibility in the areas near the borders

Attacks: before the competition

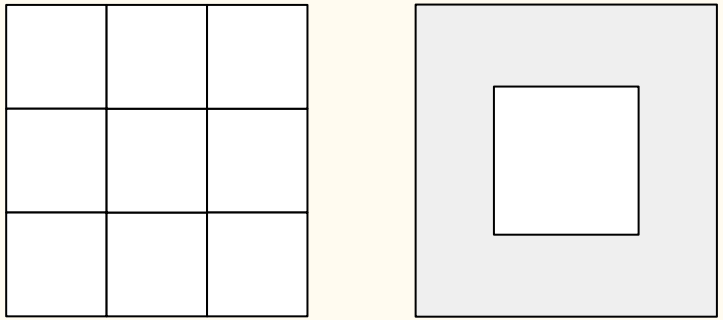
Attacks created

Standard

Combinations

AWGN + Median
AWGN + Median + jpeg
Median + jpeg
Resize + jpeg

Localized attacks
10 different zones



9 + 1

Attacks: before the competition

1. Python script for generating MATLAB attack scripts with different parameters
2. Automation script in MATLAB to automate the execution
3. R script to check the results table

Attacks: during the competition

1. Divide the groups to attack
2. Execute the automation script
3. Check the results of the attacks
4. Tune the most performing attacks to reach a higher WPSNR

Attacks Results

- **6 groups** attacked
- **16 images** attacked
- **Most effective:** AWGN & Median
  - 50% of successful attacks used awgn or median
- **Localization** played an important role in 6 attacks

Median filter on the upper half

References

MLA

Zhou, Xiao, Heng Zhang, and Chengyou Wang. "A robust image watermarking technique based on DWT, APDCBT, and SVD." Symmetry 10.3 (2018): 77.

Wang, C. Y., B. C. Jiang, and S. Z. Xie. "Properties of all phase biorthogonal transform matrix and its application in color image compression." *Journal of Computational Information Systems* 9.18 (2013): 7227-7234.