

Watermark Interference in Multiple Re-Watermarking

Daniel Mark

Team

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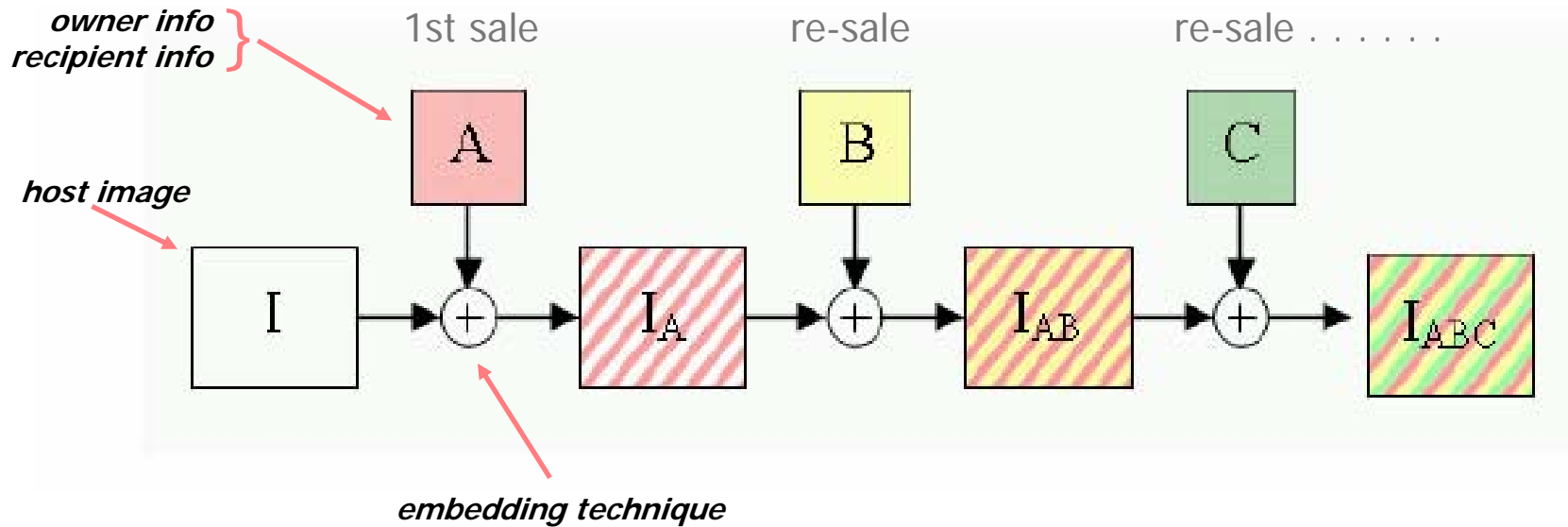
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Target Scenario

- Introduction
- Multiple Re- Watermarking
- Experimental Study
 - Settings & Methods
 - Results
- Conclusion / Perspectives



Scenario for reconstruction of the trading chain

Multiple Re-Watermarking

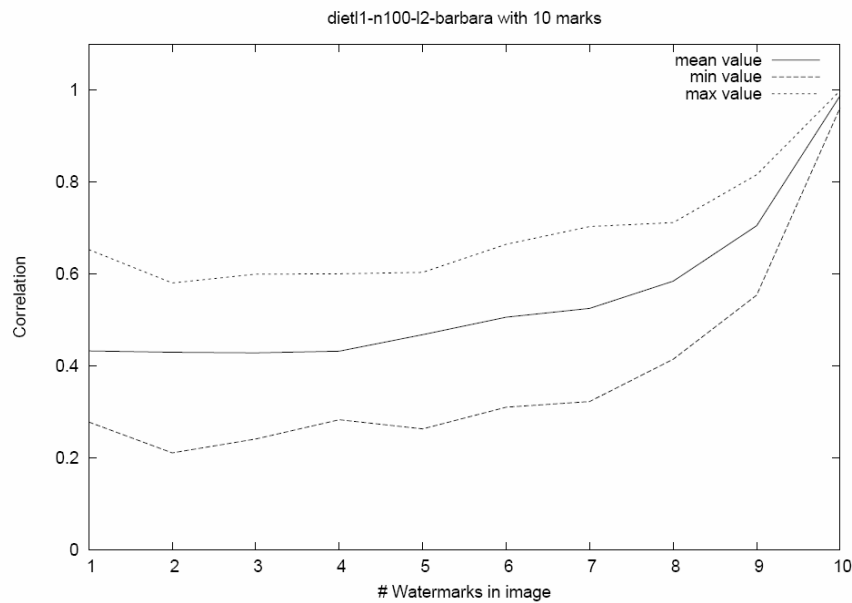
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- Multiple....
 - One application is addressed several times
- ...Re-Watermarking
 - Successive watermarking (Re-Watermarking)
(Embedding of one watermark after the other)
 - Composite watermarking (One single embedding process)
 - Segmented watermarking (Host data is partitioned)

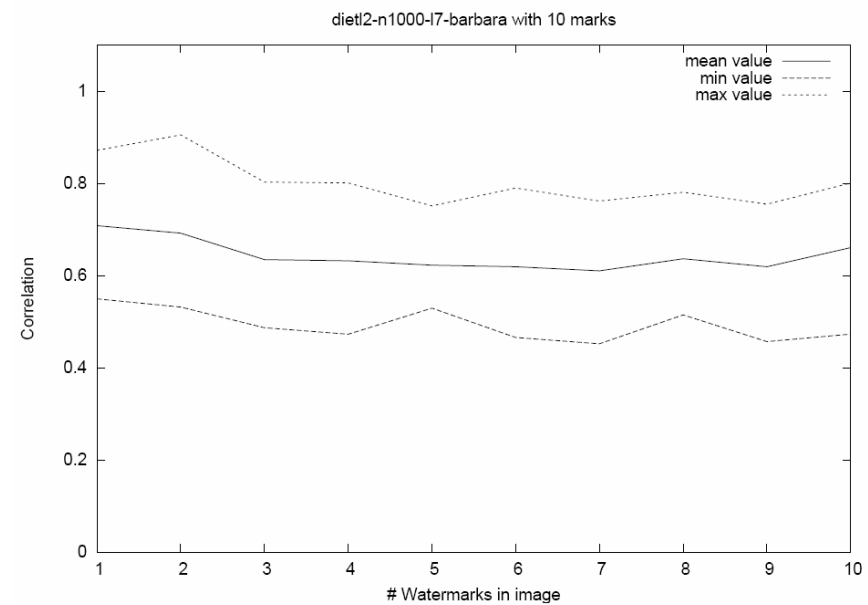
Watermark Interference

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■ Detection response for Wang & Dugad:



Wang (non blind)



Dugad (blind)

Multiple Re-Watermarking

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- Watermark Interference?
 - How much is a WM covered by an afterward embedded WM?
 - How many WMs can be embedded?
 - How to avoid WM- interference?

Avoiding Watermark Interference

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- Using different embedding domains (DCT, DWT, Spatial...)...

...OR...

- ...using different frequency bands for embedding

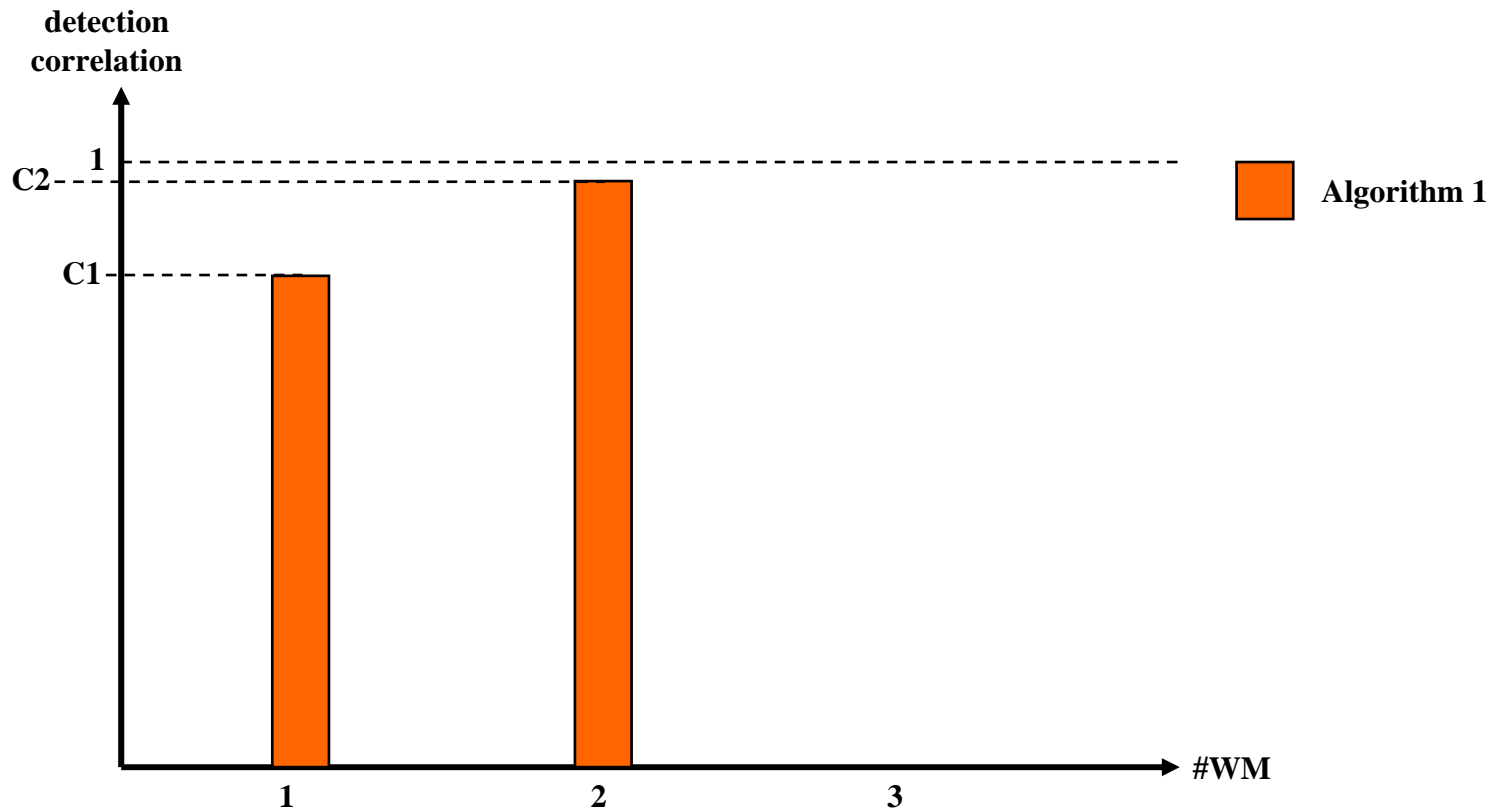
Experimental Study: Setting

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- 10 different host images (512 x 512 Px, 8 bpp)
- Freely available watermarking toolbox (Peter Meerwald)
- Algorithms:
 - Xie, Corvi, Wang, Kim, Zhu, Xia (waveletbased)
(LF.....MF.....HF)
 - Cox (DCT-based, LF)
 - Koch (DCT-based, MF - HF)
 - Bruyn (Spatial, MF - HF)
- Final PSNR \geq 38db

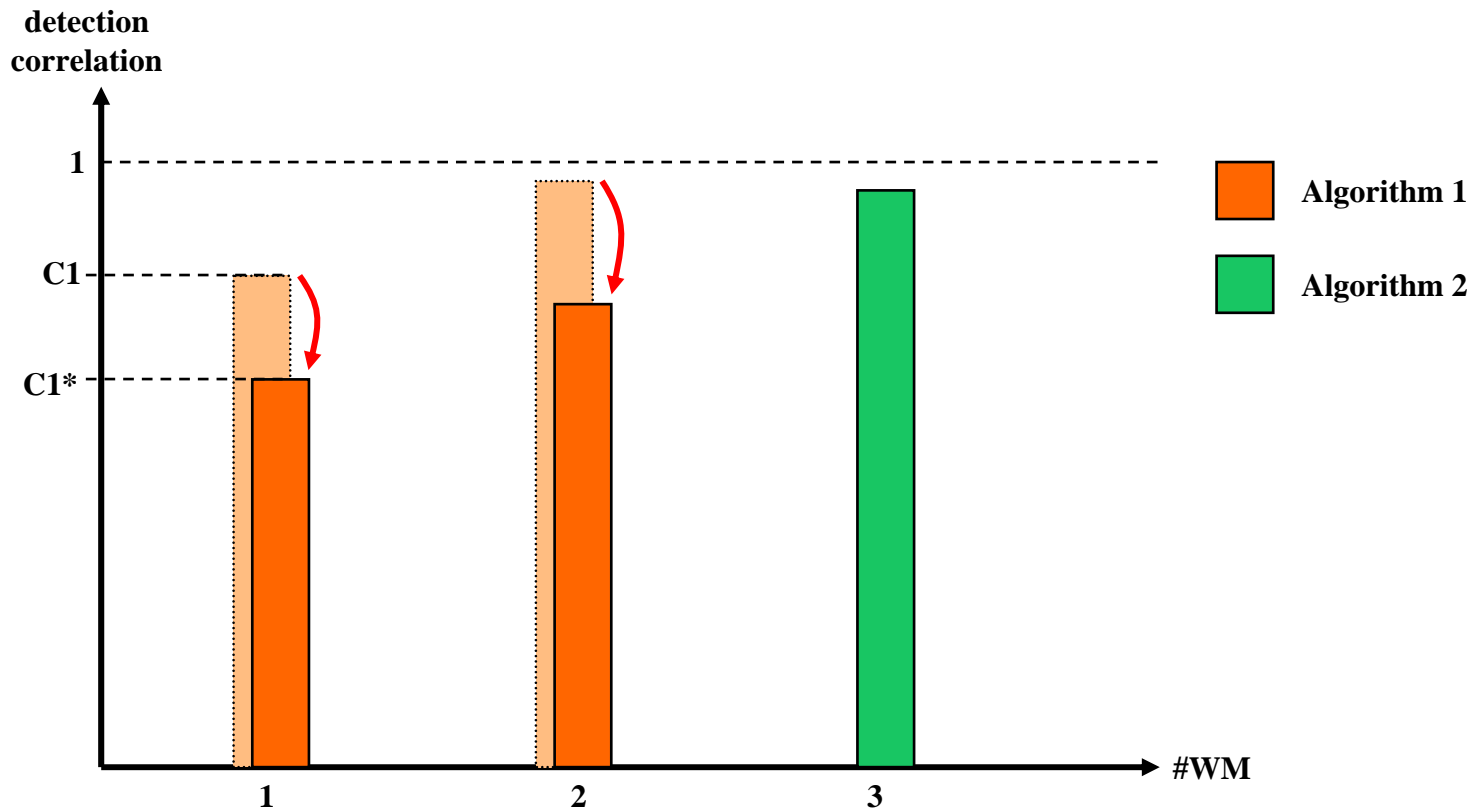
Experimental Study: Setting

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Experimental Study: Setting

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Results

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■ Cox (DCT-based, LF):

Image	DCT, MF-HF			DWT, LF				
	Koch	Bruyn	Xie	Corvi	Wang	Kim	Zhu	Xia
Lena (0.71)	0.69	0.72	0.57	0.67	0.67	0.62	0.72	0.71
Barbara (0.70)	0.70	0.70	0.46	0.65	0.63	0.68	0.72	0.73
Peppers (0.71)	0.74	0.70	0.57	0.67	0.67	0.65	0.67	0.70
Average (0.70)	0.71	0.71	0.56	0.66	0.67	0.64	0.70	0.71

Results

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■ Xia (DWT-based, HF):

Image	DCT, MF-HF				DWT, HF			
	Cox	Koch	Bruyn	Xie	Corvi	Wang	Kim	Zhu
Lena (0.92)	0.91	0.88	0.91	0.91	0.91	0.90	0.91	0.82
Barbara (0.97)	0.97	0.96	0.97	0.97	0.97	0.97	0.97	0.94
Peppers (0.87)	0.87	0.83	0.86	0.87	0.87	0.86	0.86	0.72
Average (0.96)	0.96	0.94	0.95	0.96	0.96	0.96	0.95	0.91

Results

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■ Kim (DWT-based, LF & HF):

Image	MF-HF			HF				
	Cox	Koch	Bruyn	Xie	Corvi	Wang	Zhu	Xia
Lena (0.71)	0.69	0.66	0.70	0.62	0.69	0.60	0.37	0.54
Barbara (0.72)	0.72	0.65	0.71	0.69	0.70	0.68	0.31	0.36
Peppers (0.72)	0.68	0.66	0.69	0.65	0.70	0.61	0.35	0.40
Average (0.74)	0.72	0.68	0.72	0.69	0.72	0.67	0.35	0.40

Conclusion

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- Limit watermark interference by using disjoint frequency bands
- Future work:
 - Parameterized transform domains

Thank you for your Attention!

Daniel Mark