

A Survey of Wavelet–domain Watermarking Algorithms

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motivation & classification

approximation image and detail subband
characteristics

relationship to compression and JPEG2000

Why wavelet-domain watermarking?

⇒ robustness

- allows to mark significant image components

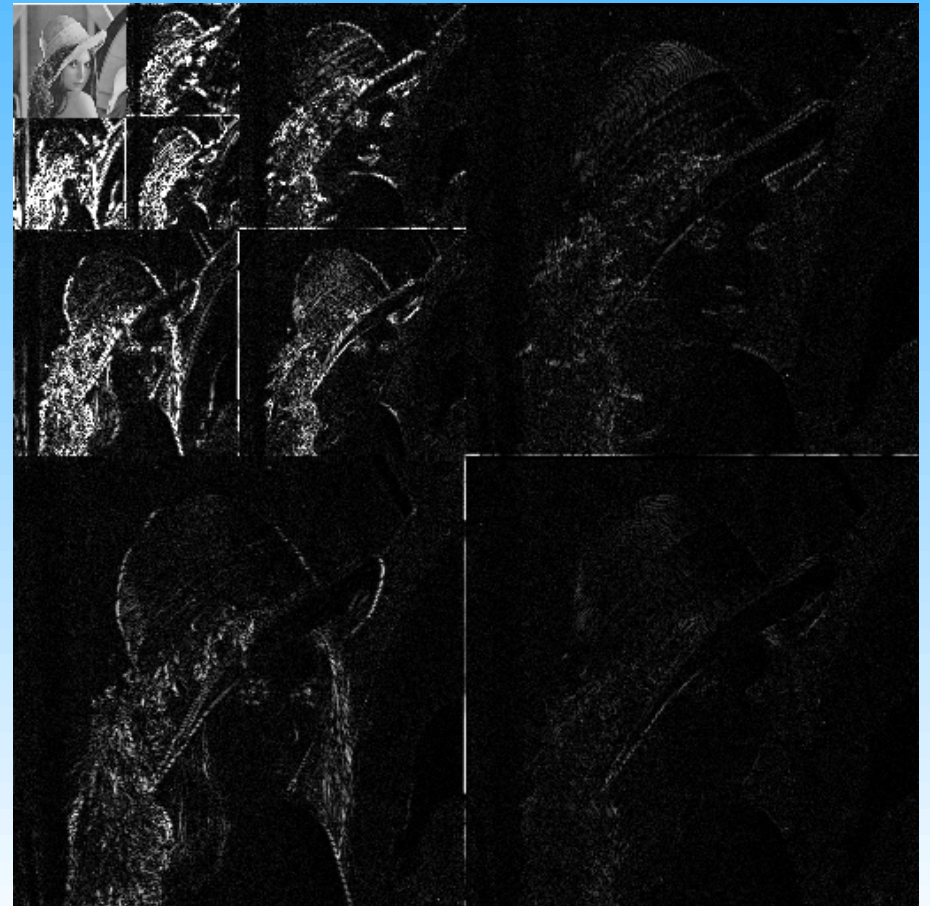
⇒ advantages due to transform structure

- space–frequency localization
- multi–resolution representation
- adaptivity

⇒ compatibility with JPEG2000 standard

The wavelet transform domain

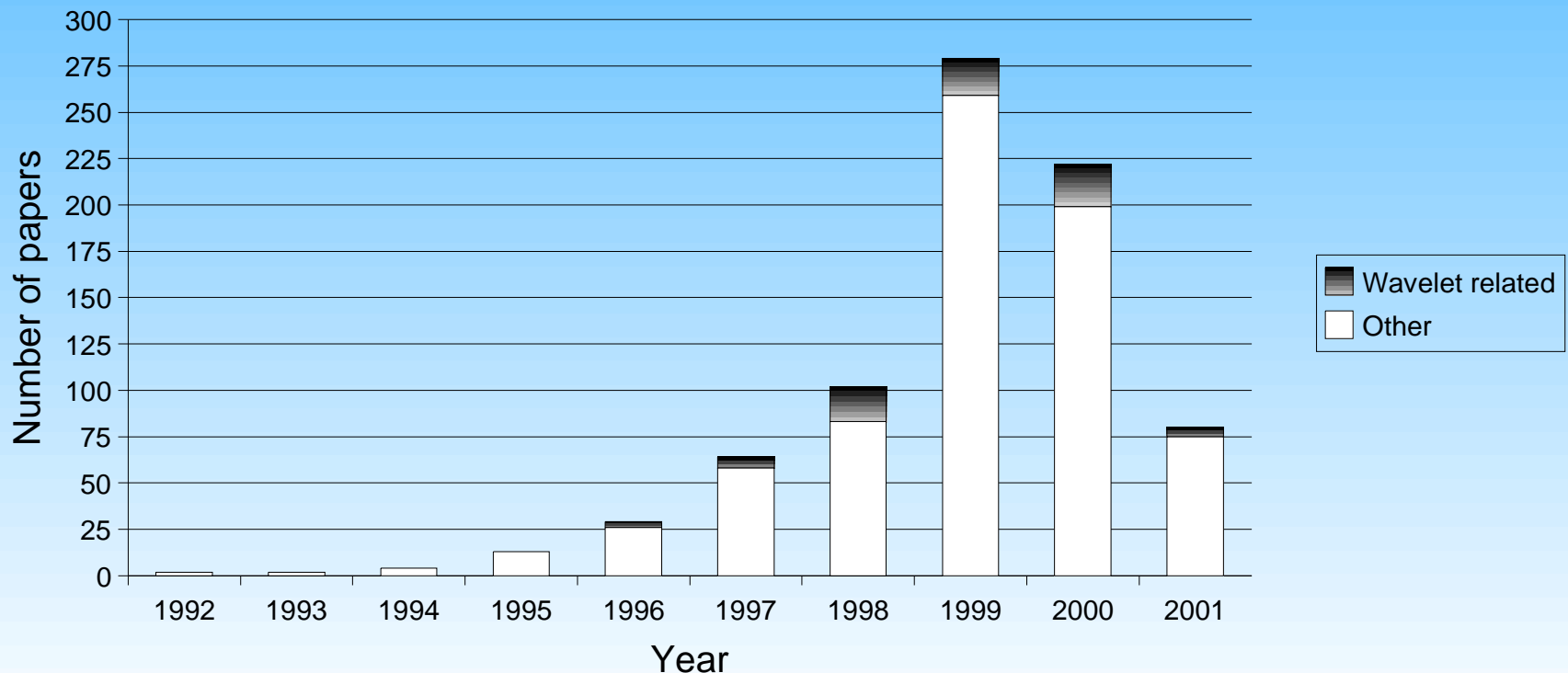
- ⇒ successive low-pass / high-pass filtering steps
- ⇒ approximation image
- ⇒ detail subbands
- ⇒ multi-resolution representation



Wavelet-domain watermarking

⇒ extensive research [Dugelay]

Watermarking publications



Classification of schemes

⇒ decomposition strategy

- number of levels, adaptivity, packet basis

⇒ coefficient selection

- approximation image or detail subbands?

⇒ embedding and extraction method

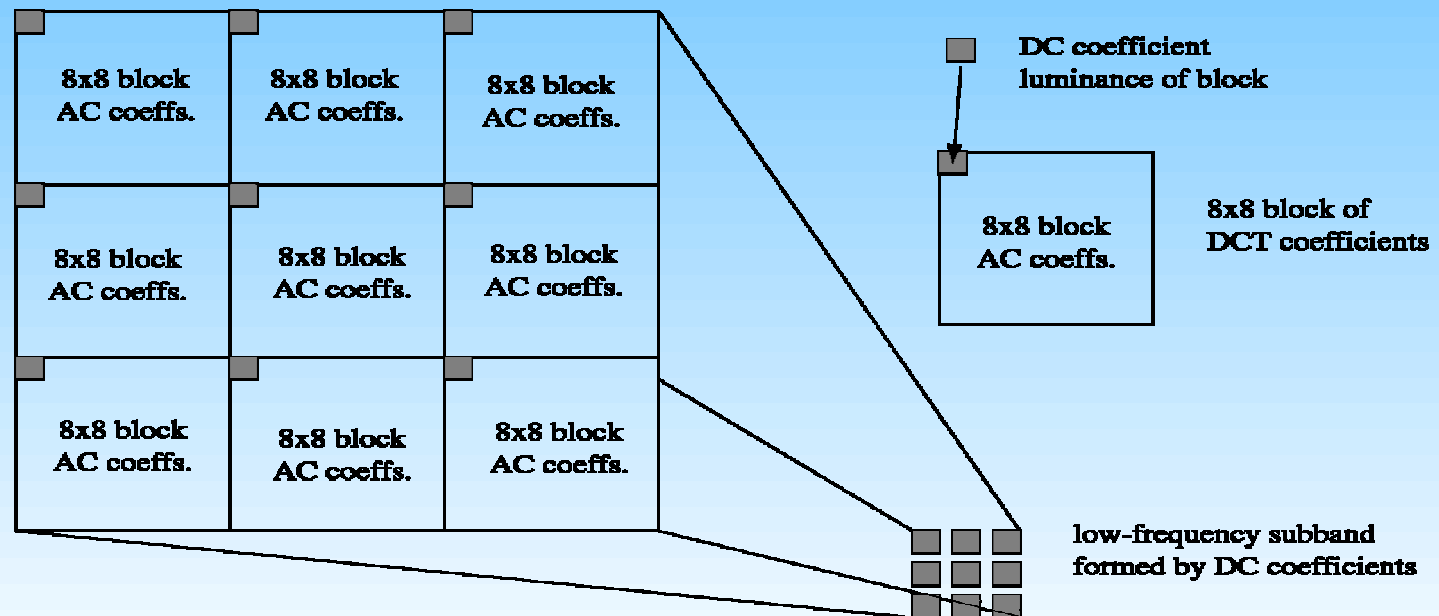
- additive or quantization strategy

⇒ HVS modelling

- implicit or explicit

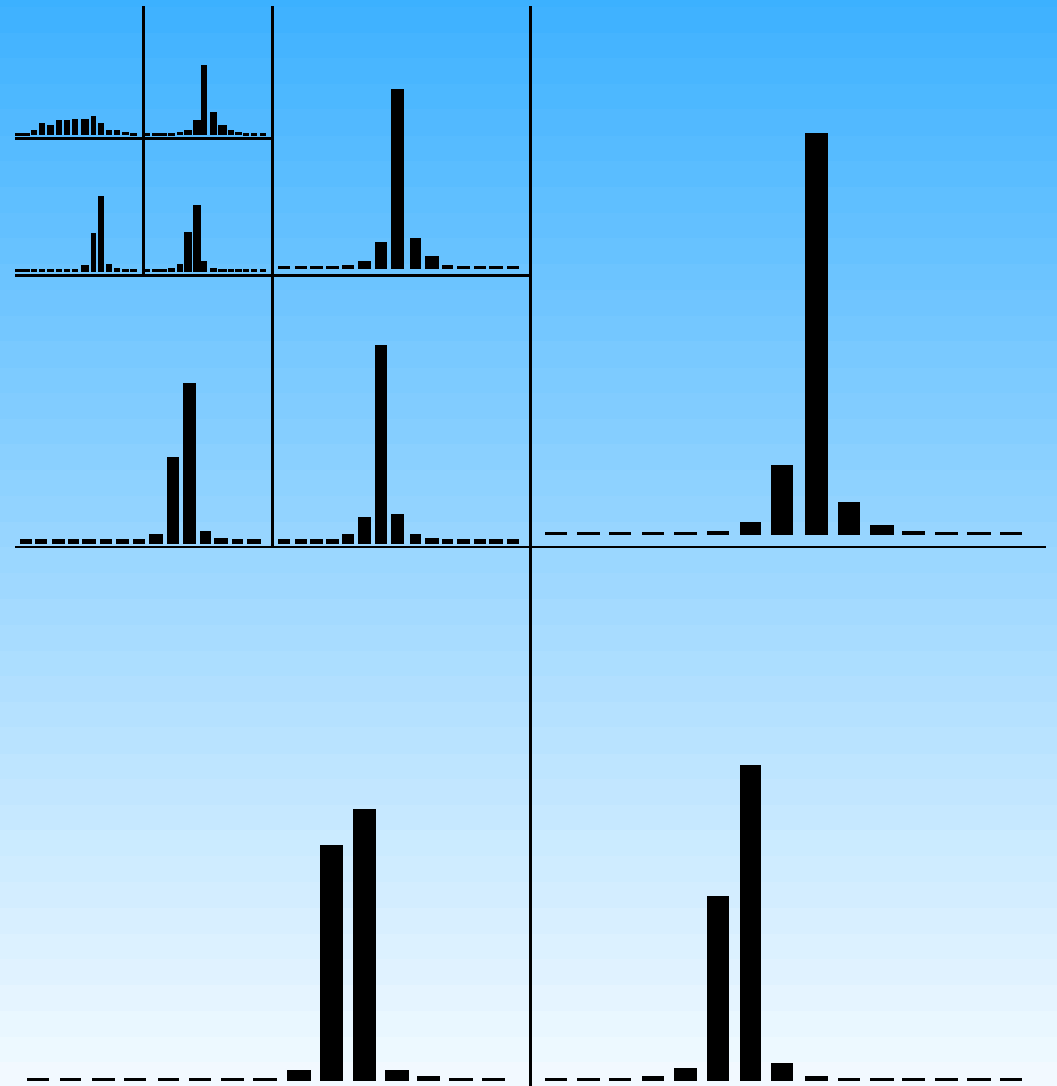
Approximation image watermarking

- first algorithm [ORuanaidh96] and early schemes, e.g. [Corvi97]
- general low–frequency marking, e.g. [Tzovaras98], [Liang]



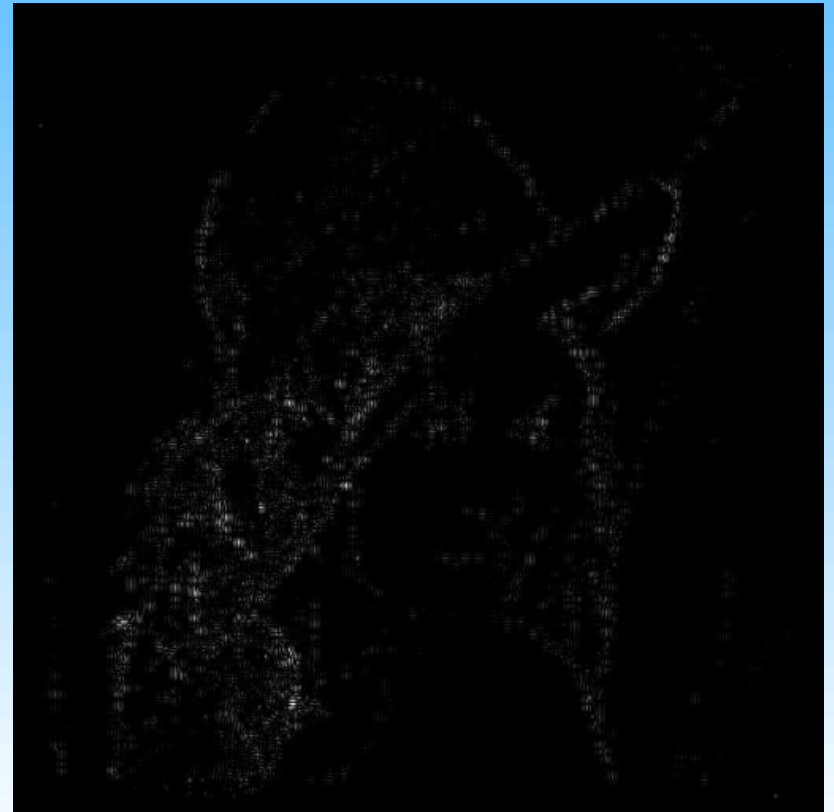
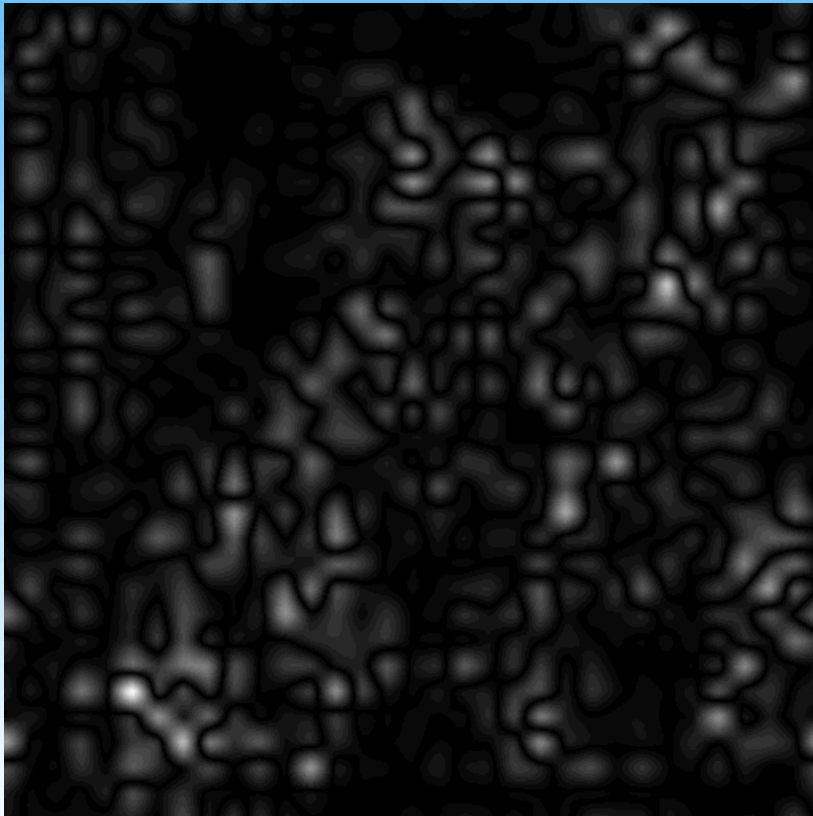
Detail subband embedding

- Laplacian coefficient distribution
- large coefficients correspond to edges, texture



Difference images

created with algorithms by [Corvi97] and [Xia98]

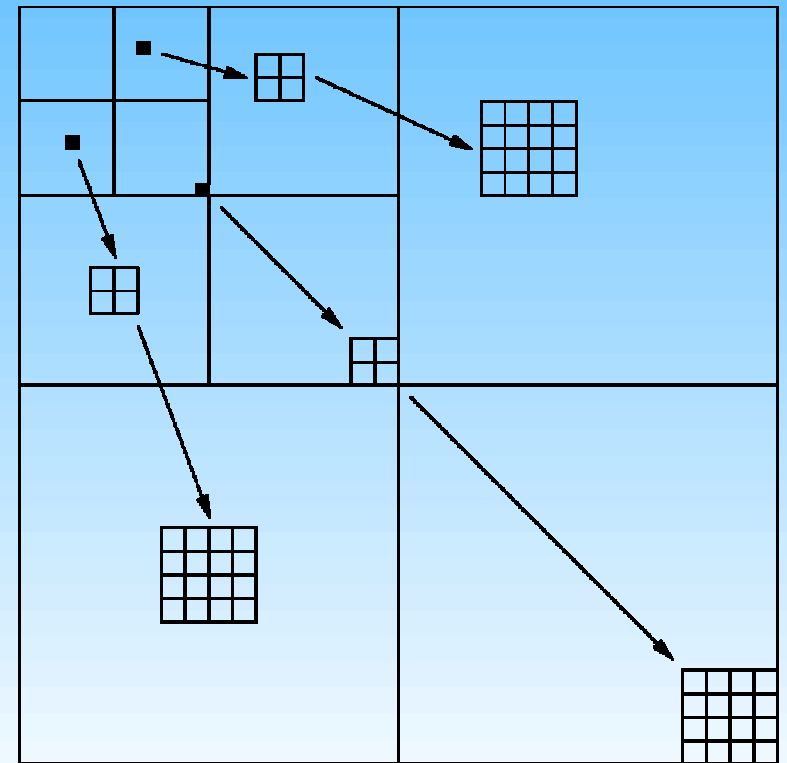


Relationship to image compression

- ⇒ duality between compression and watermarking
- ⇒ can use the same HVS model
- ⇒ just–noticeable difference (JND) paradigm
- ⇒ quantization visibility [Watson97]
- ⇒ watermarking can exploit visual masking

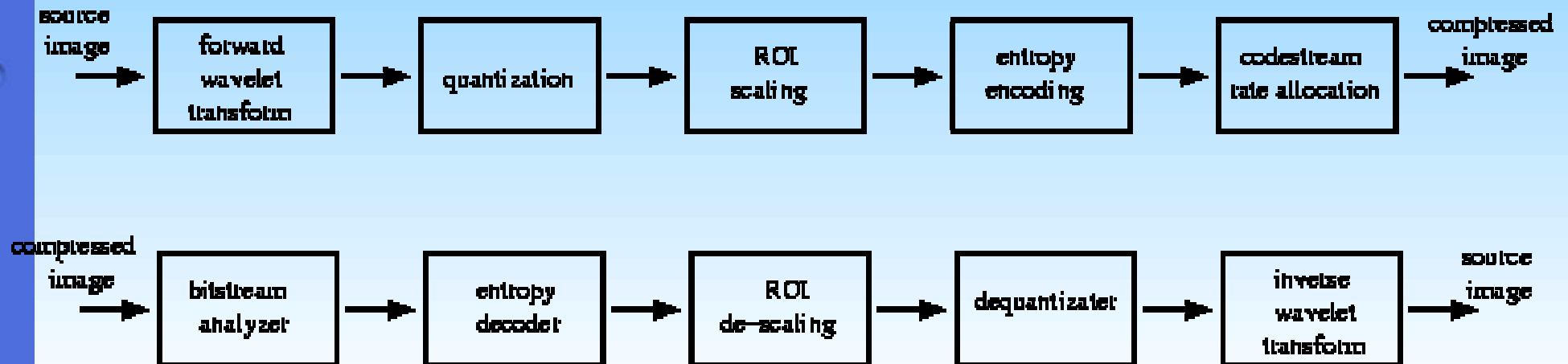
Relationship to image compression

- ⇒ similar coding techniques
- ⇒ MTWC [Wang98]
- ⇒ zero-tree coding [Inoue98]
- ⇒ EBCOT [Su99]

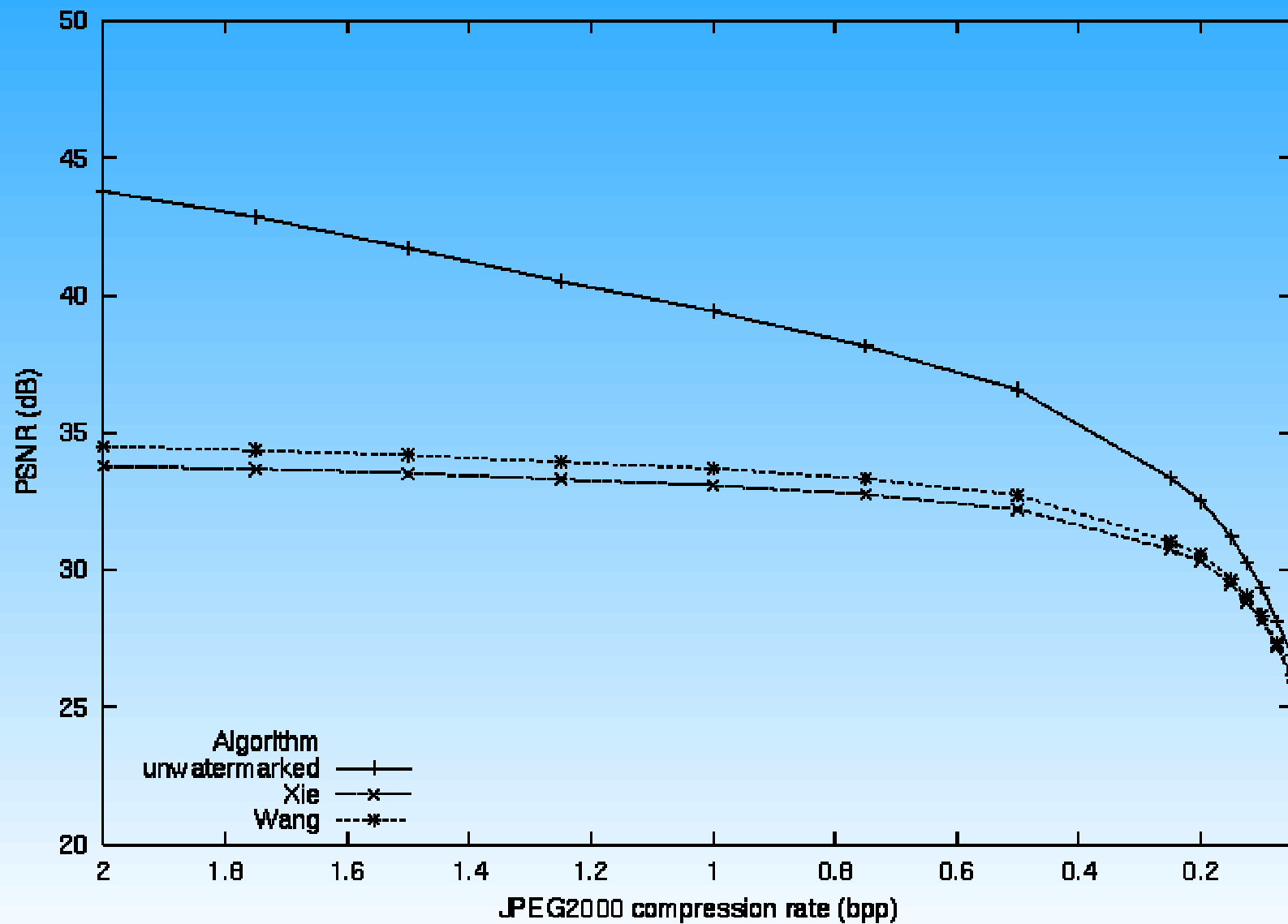


Compatibility with JPEG2000

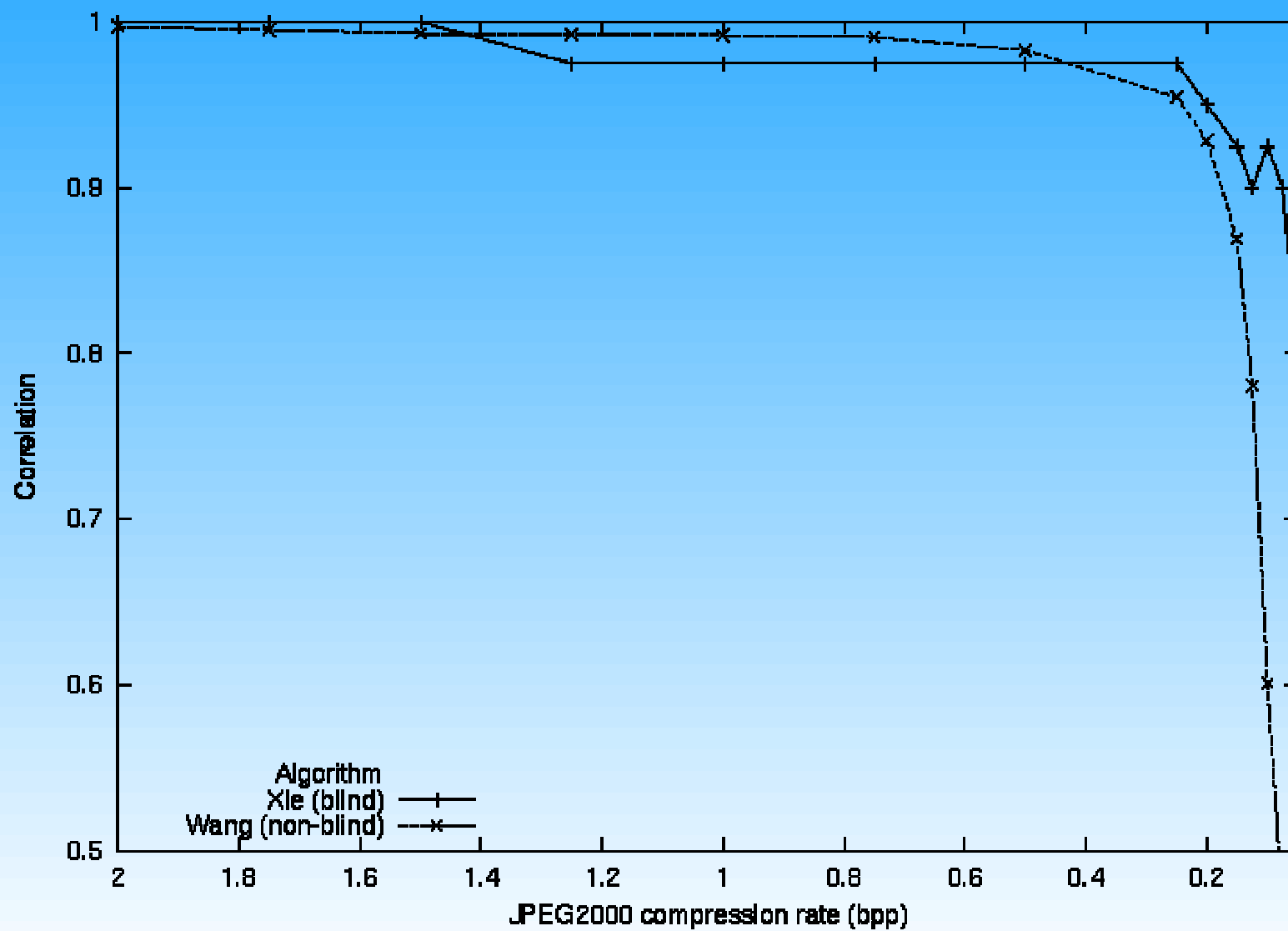
- ⇒ cheap devices require integrated coding and watermarking
- ⇒ versatile wavelet-based image coder
- ⇒ independent processing of image blocks, EBCOT [Taubman99]



PSNR gap



Correlation



Conclusion

- investigate JPEG2000 coding process for watermarking
- look at color images and HVS model
- applications & security