

A Survey of Wavelet-domain Watermarking Algorithms

Dept. of Scientific Computing, University of
Salzburg, Austria

motivation & classification

approximation image and detail subband
characteristics

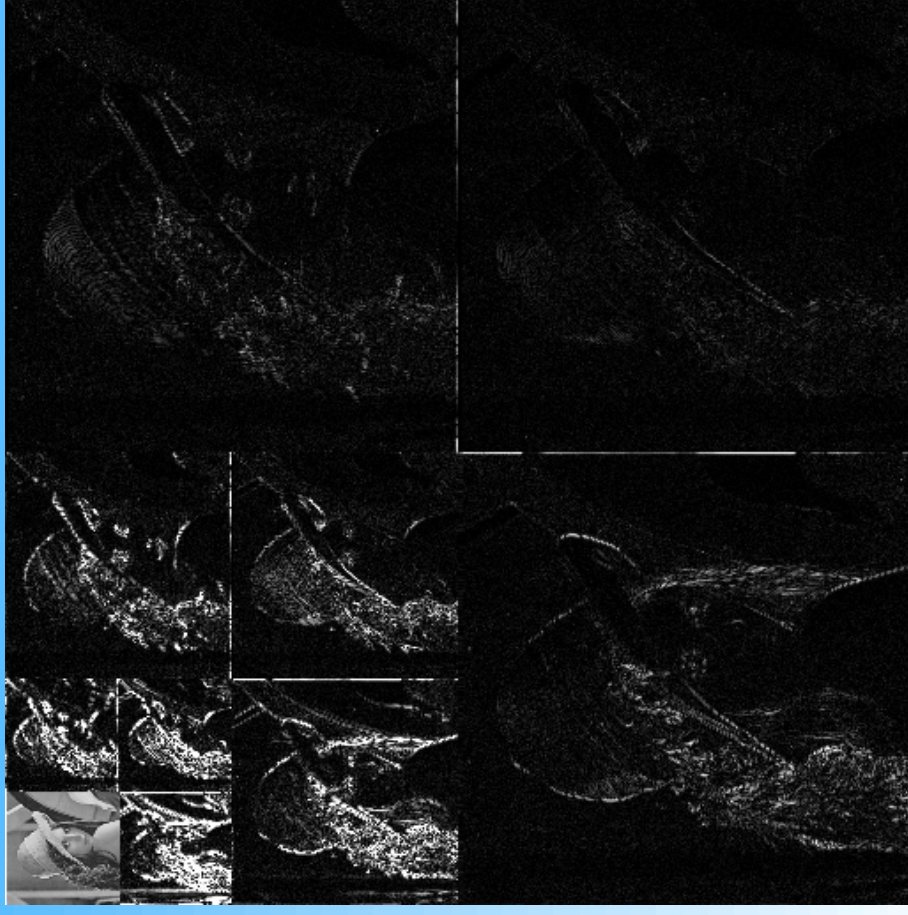
relationship to compression and JPEG2000

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

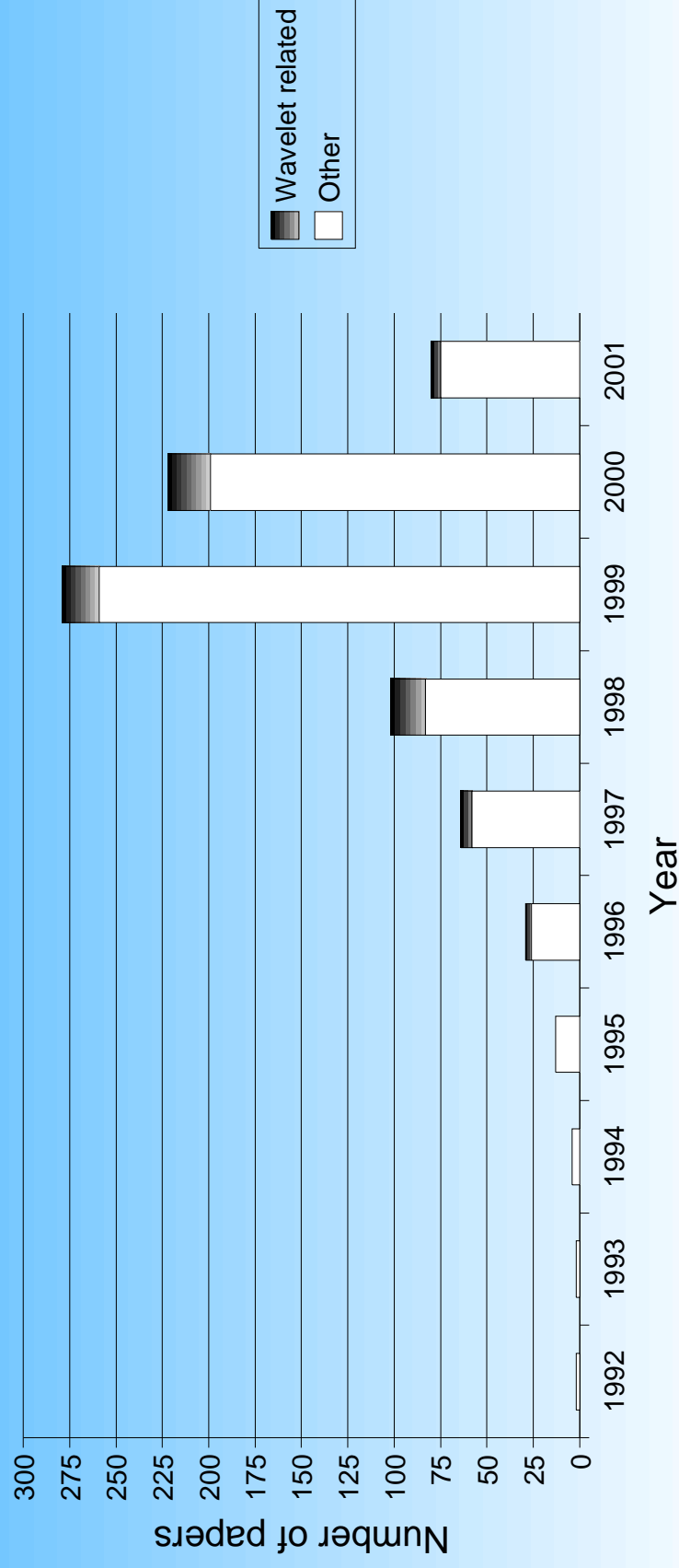
- ⇒ successive low-pass / high-pass filtering steps
- ⇒ approximation image
- ⇒ detail subbands
- ⇒ multi-resolution representation



Wavelet-domain watermarking

⇒ extensive research [Dugelay]

Watermarking publications

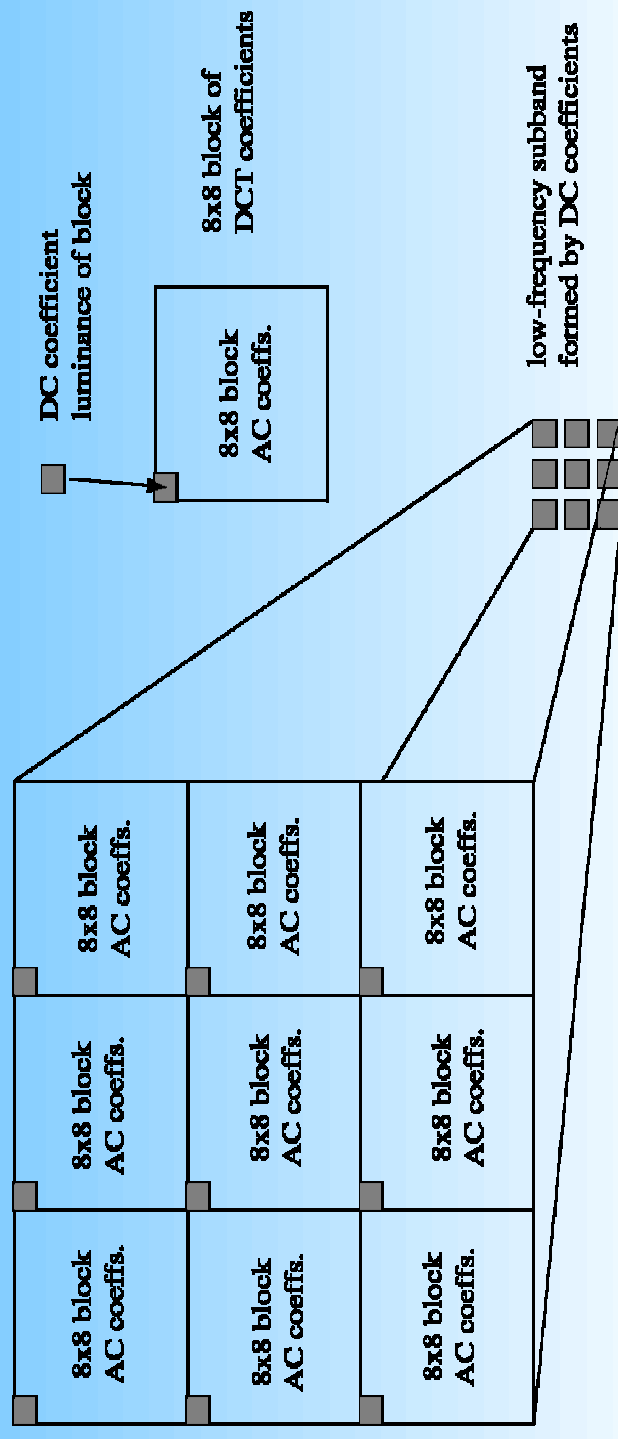


Classification of schemes

- ⇒ 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

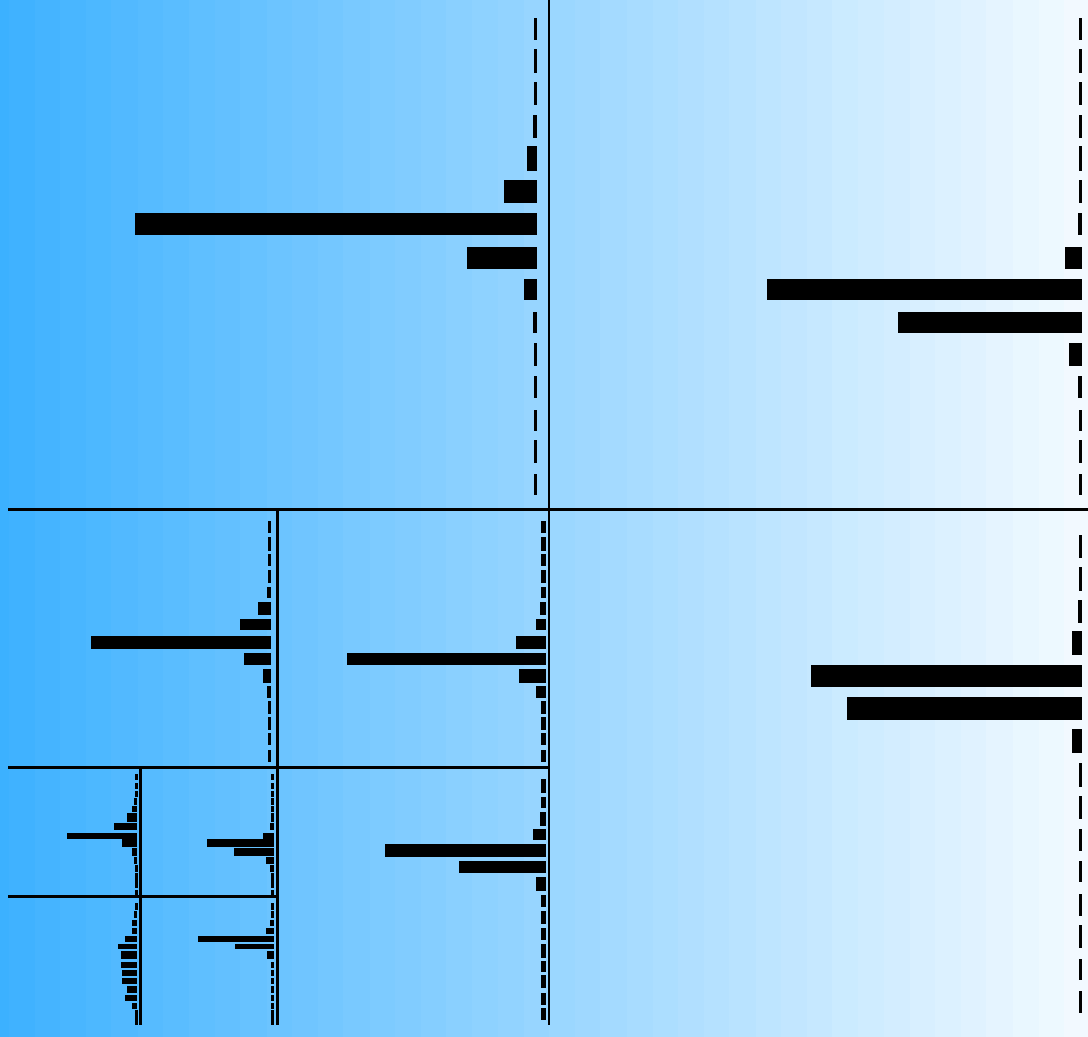
Approximation image watermarking

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



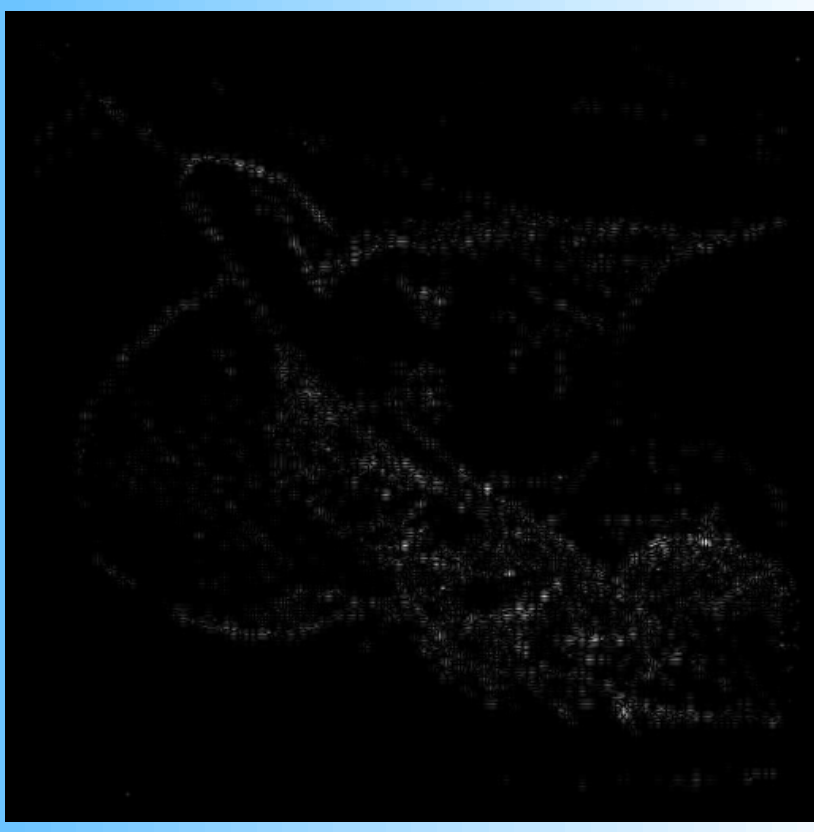
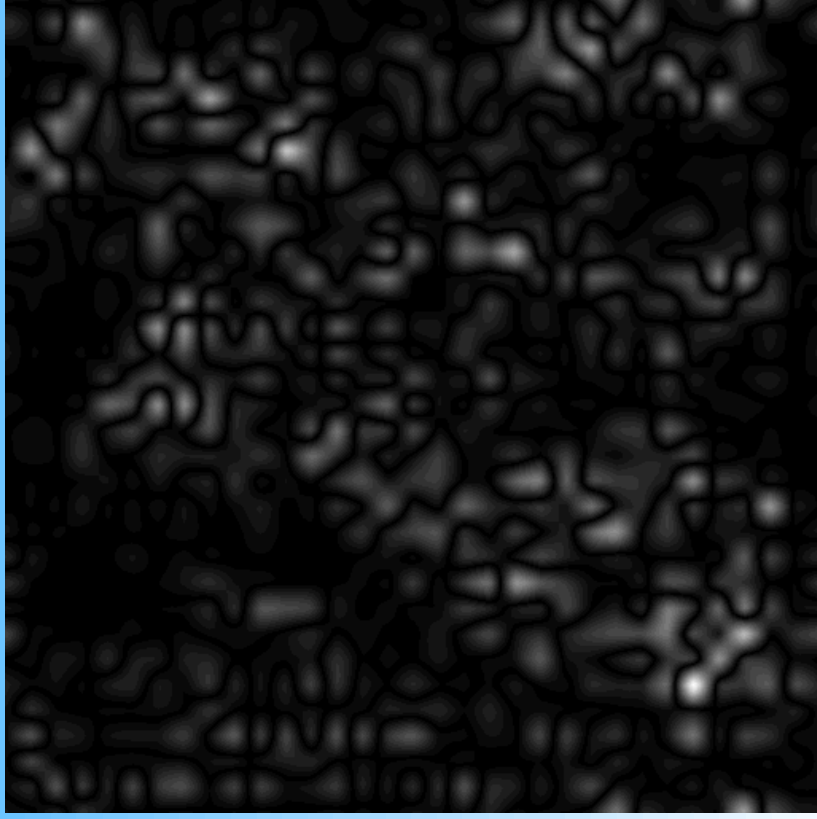
Detail subband embedding

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



Difference images

created with algorithms by [Corvi97] and [Xia98]

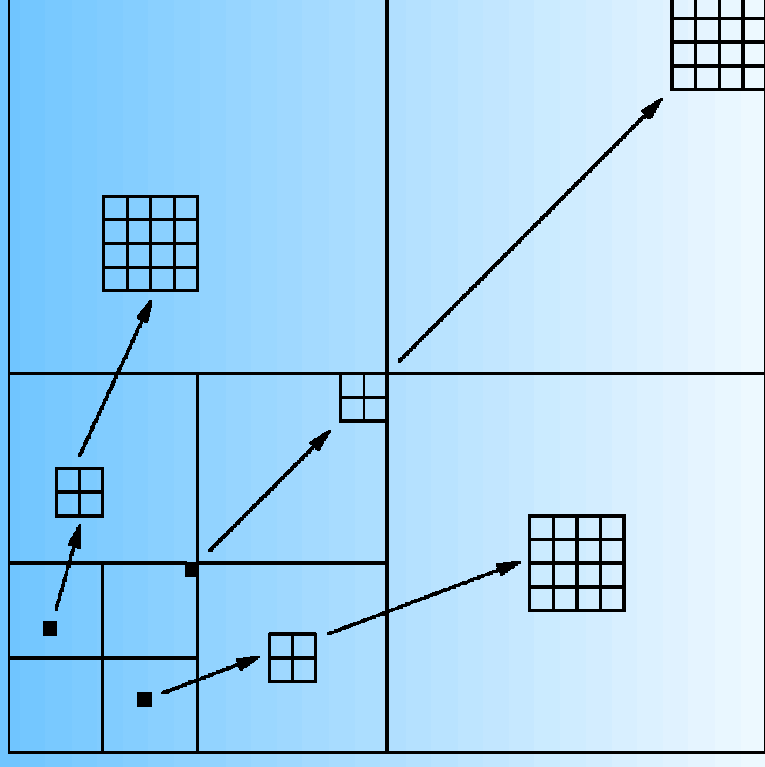


Relationship to image compression

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

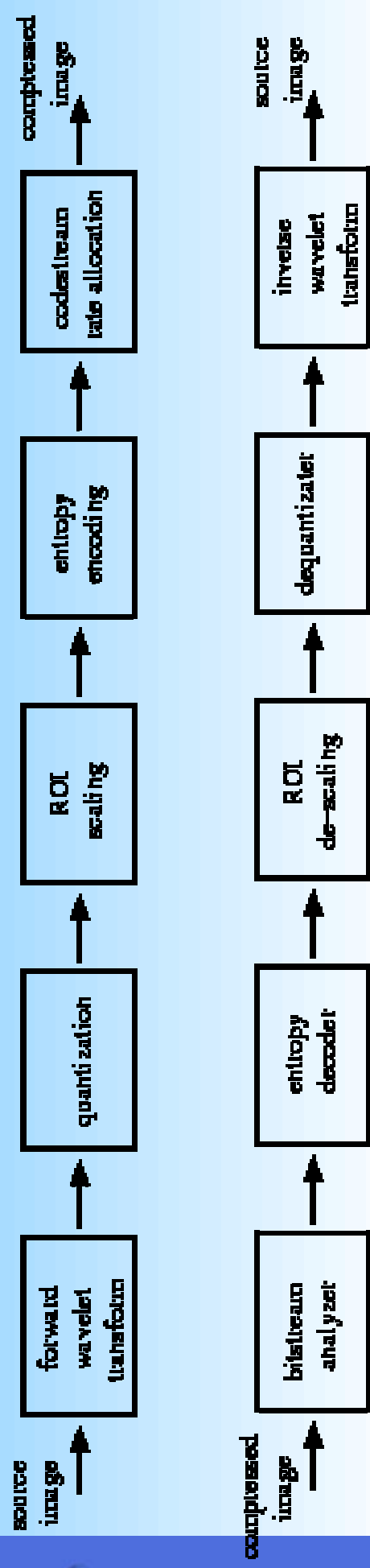
Relationship to image compression

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

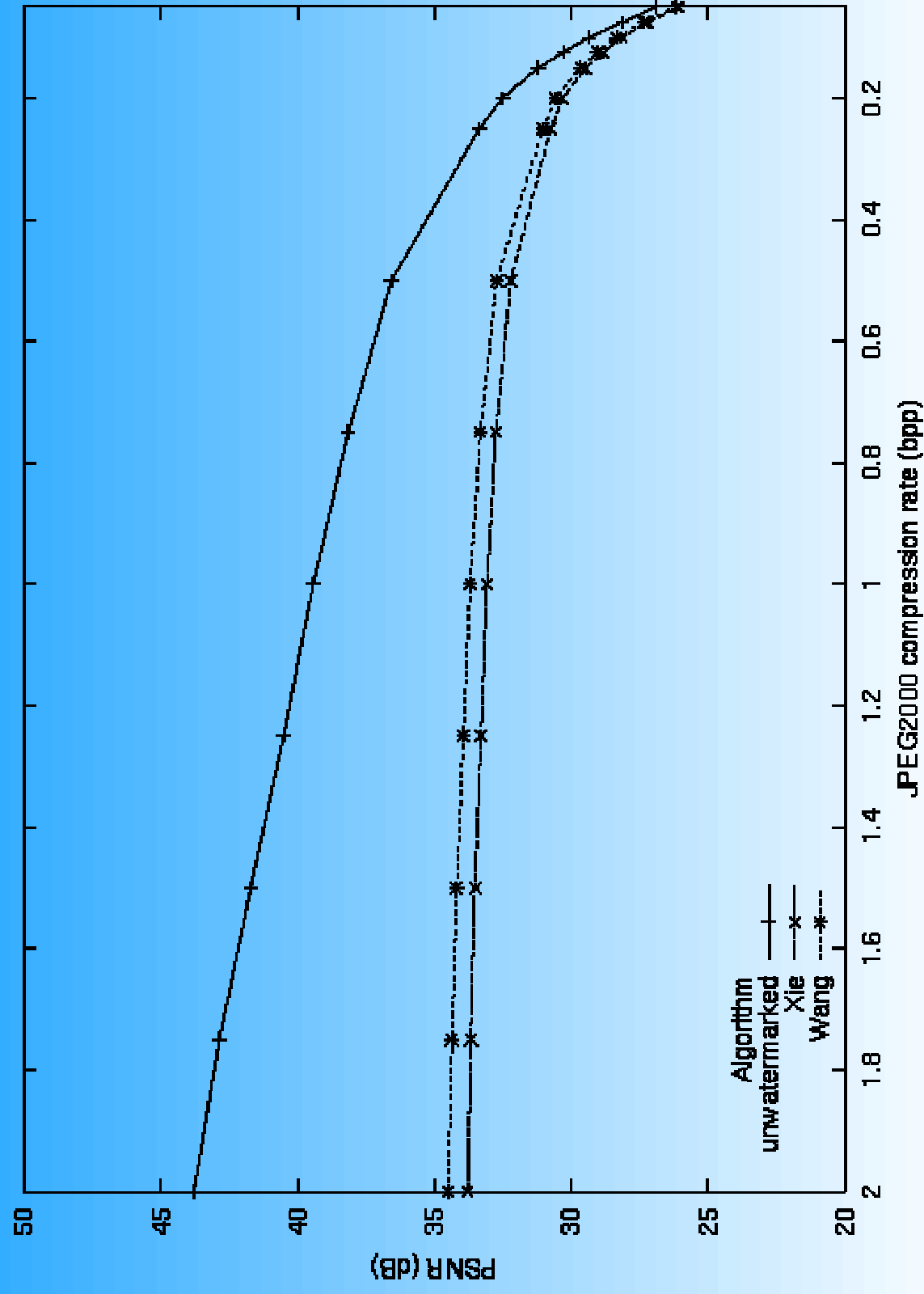


Compatibility with JPEG2000

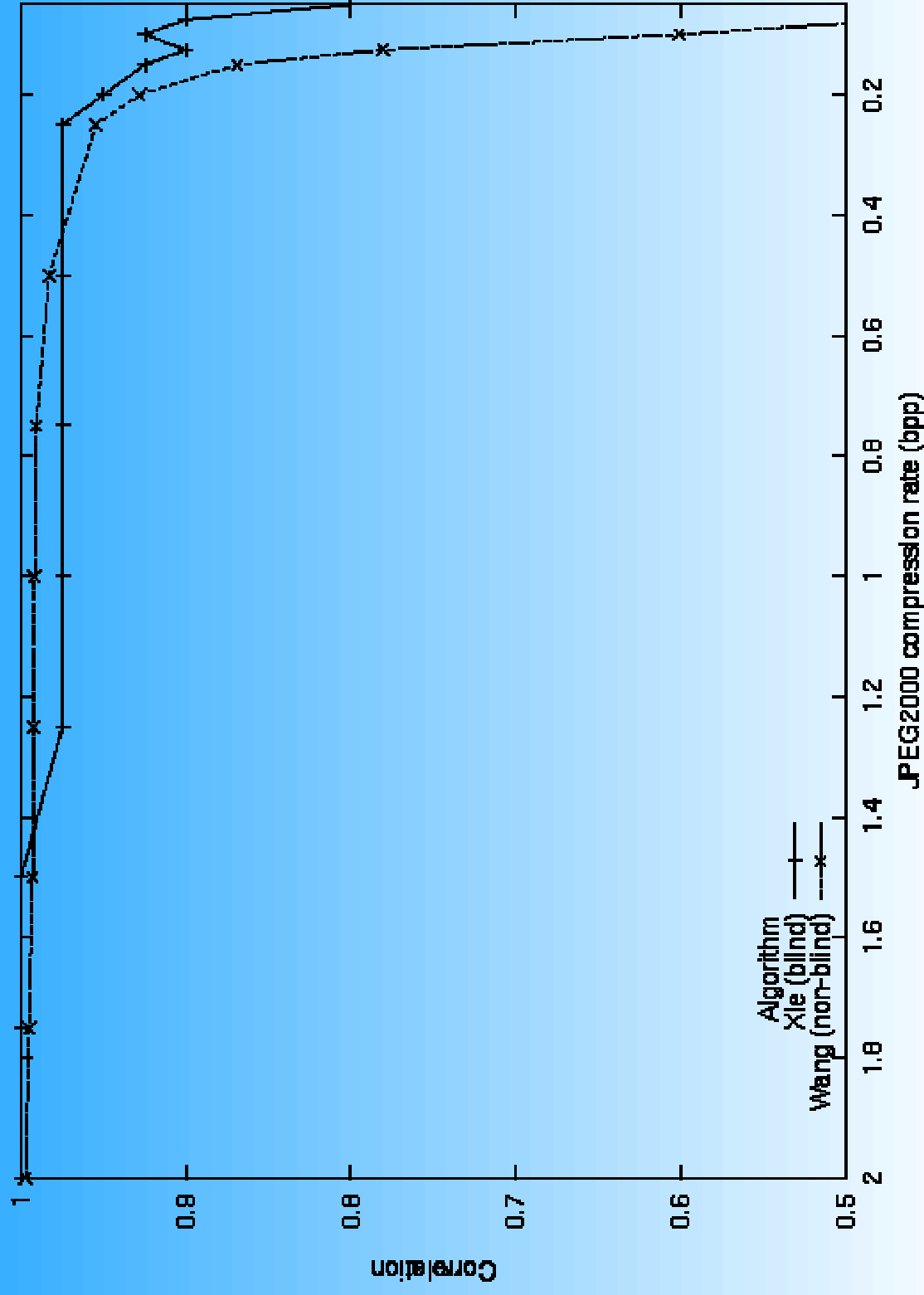
- ⇒ cheap devices require integrated coding and watermarking
- ⇒ versatile wavelet-based image coder
- ⇒ independent processing of image blocks, EBCOT [Taubman99]



PSNR gap



Correlation



Conclusion

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