IMAGE COMPRESSION WITH WAVELETS

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WAVELET TRANSFORM

$$W(a,b) = \int_{-\infty}^{\infty} x(t) \cdot \psi^* \left(\frac{t-b}{a} \right) dt$$

The **wavelet coefficients** c_{jk} are then given by

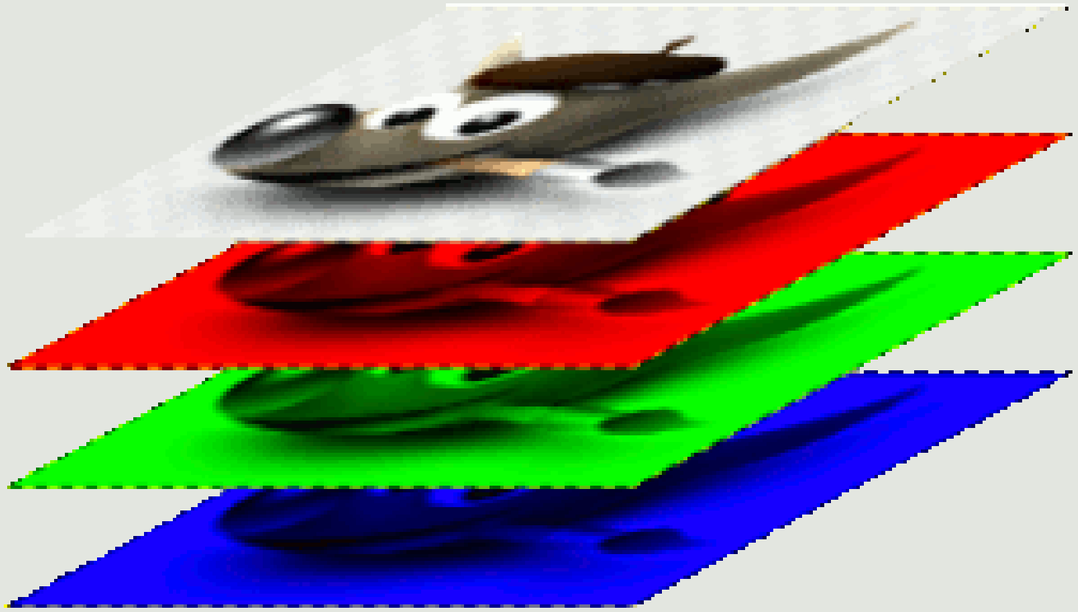
$$c_{jk} = [W_\psi f]\left(2^{-j}, k2^{-j}\right)$$

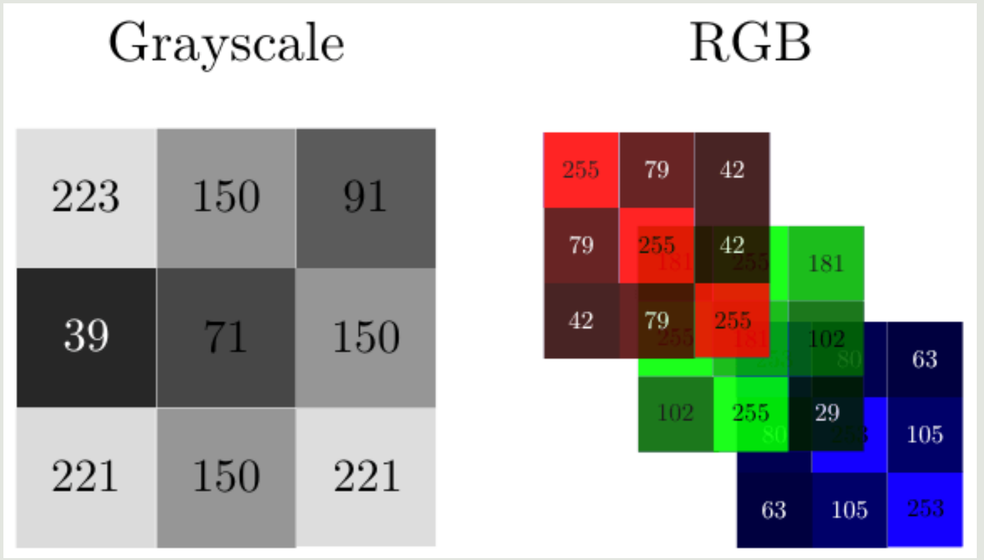
- **a**: The scaling factor **a** stretches or compresses the wavelet. Large values of **a** correspond to low-frequency components (coarse details), while small values correspond to high-frequency components (fine details).
- **b**: The translation factor **b** shifts the wavelet in time, allowing us to localize where specific frequency components occur in the signal.
- **Wavelet function**: The wavelet is analogous to the sinusoid in **Fourier analysis**, but unlike sinusoids, wavelets are **localized in time**.

COEFFICIENTS MATTER

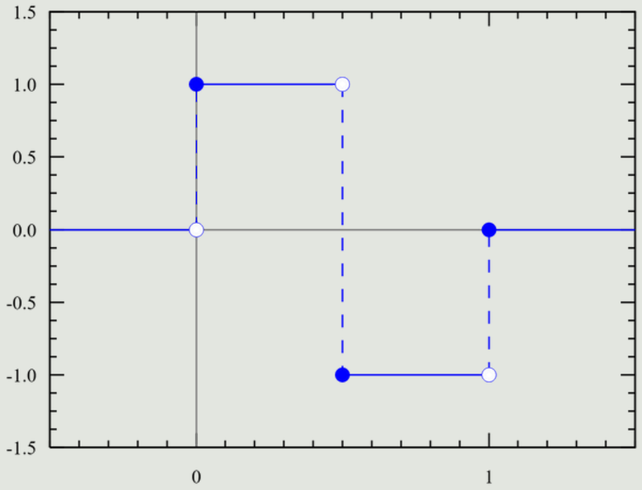
- “First a wavelet transform is applied. This produces as many coefficients as there are pixels in the image (i.e., there is no compression yet since it is only a transform).
- These coefficients can then be compressed more easily as the information is statistically concentrated in just a few coefficients. This principle is called transform coding.
- After that, the coefficients are quantized and the quantized values are entropy encoded and/or run length encoded.”

IMAGE LAYERS (RGB)





EXPERIMENT WITH HAAR FUNCTIONS



RESULT WITH HAAR FUNCTIONS

Ratio	Kept Coefficients	File Size (KB)	File Size (% of Original)	Output File Name
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0,20	20,11%	1707,0	84,3%	canyon_ratio_
0,30	30,02%	1848,6	91,3%	canyon_ratio_
0,60	60,85%	1933,3	95,4%	canyon_ratio_
0,80	100,00%	1932,1	95,4%	canyon_ratio_

NOTE: ORIGINAL FILE SIZE: 3454.7 KB


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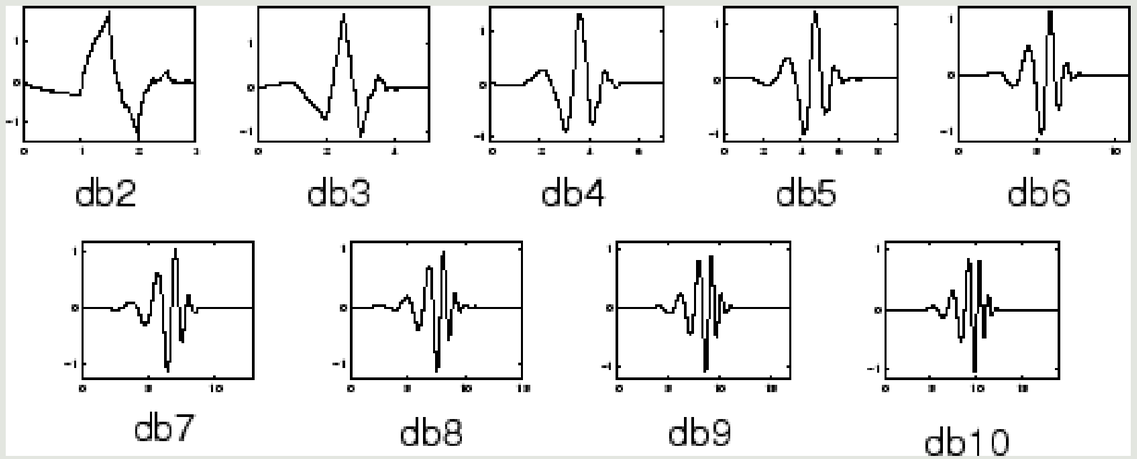
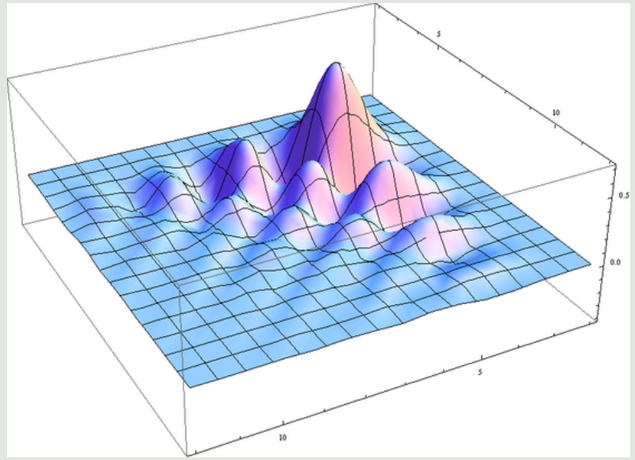
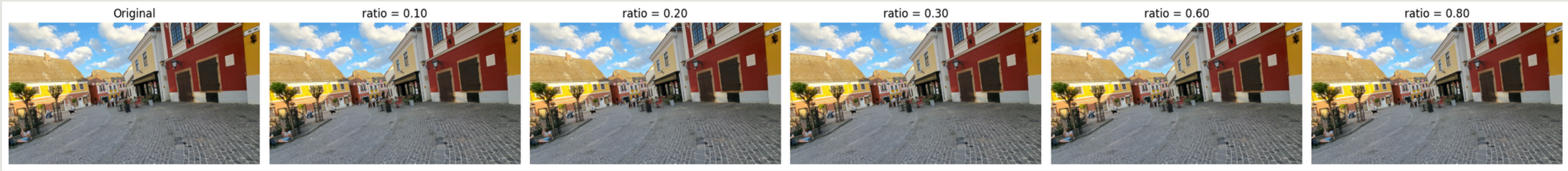
EXPERIMENT WITH DAUBECHIES







RESULT WITH DAUBECHIES

Ratio	Kept Coefficients	File Size (KB)	File Size (% of Original)	Output File Name
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0,20	20,00%	1059,3	30,7%	szentendre_ratio_20.jpg
0,30	30,00%	1093,3	31,6%	szentendre_ratio_30.jpg
0,60	60,00%	1129,7	32,7%	szentendre_ratio_80.jpg
0,80	80,00%	1134,4	32,8%	

NOTE: ORIGINAL FILE SIZE: 3454.7 KB

DIFFERENCES?

THANK YOU!