

# IMAGE COMPRESSION WITH WAVELETS

Presented by Artur Sahakyan

# 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

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

- **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)



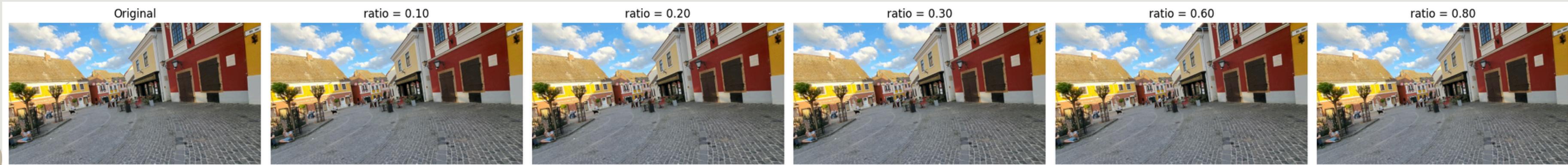
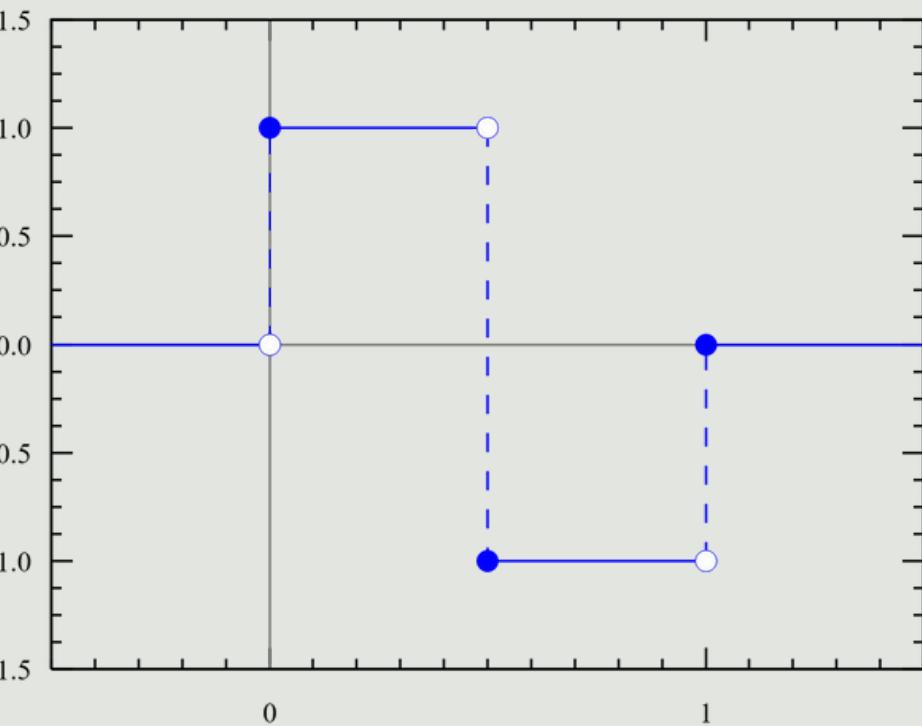
Grayscale

223	150	91
39	71	150
221	150	221

RGB

255	79	42
79	255	42
42	79	255
102	80	63
102	255	29
63	105	105

# EXPERIMENT WITH HAAR FUNCTIONS



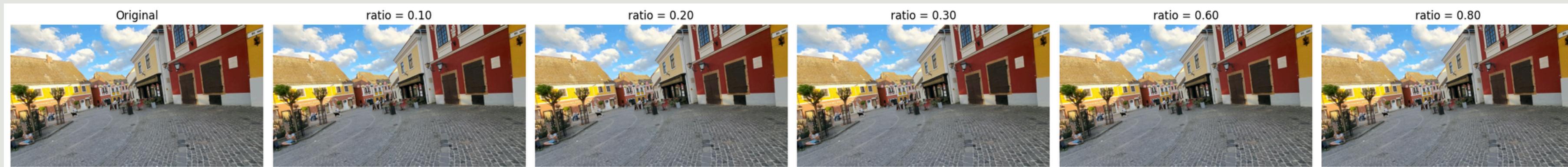
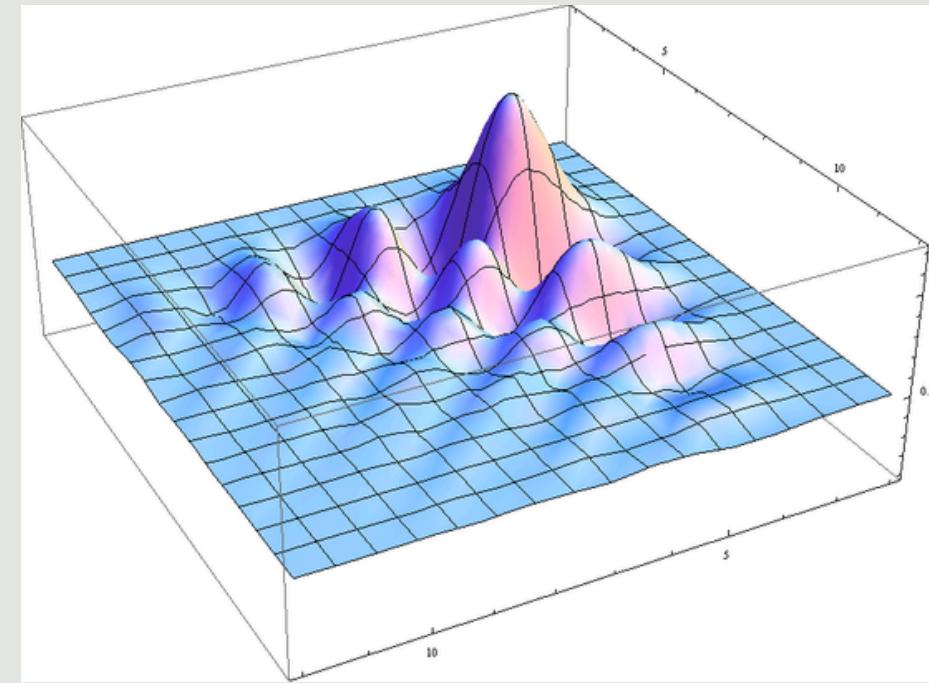
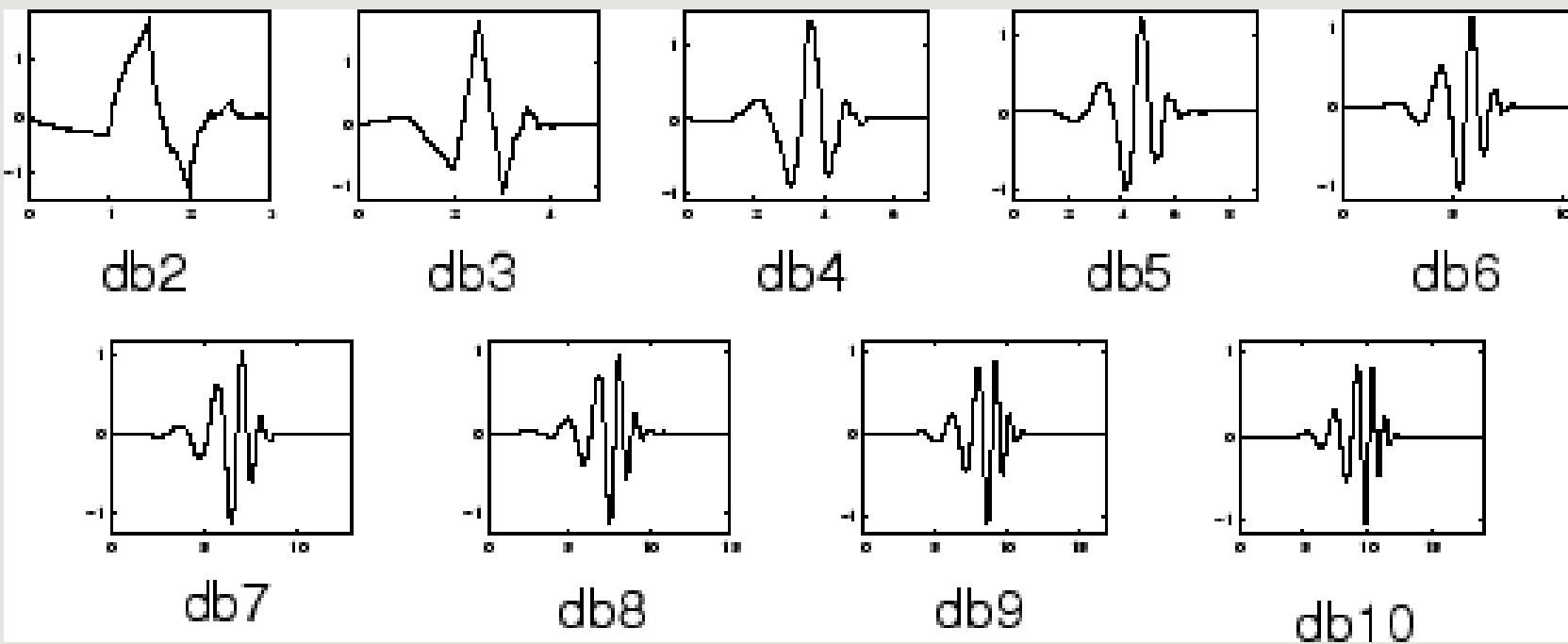
# RESULT WITH HAAR FUNCTIONS

- **RATIO = 0.10 | KEPT 10.00% COEFFS | FILE = 940.7 KB ( 27.2% OF ORIGINAL)**
- **RATIO = 0.20 | KEPT 20.02% COEFFS | FILE = 1019.6 KB ( 29.5% OF ORIGINAL)**
- **RATIO = 0.30 | KEPT 30.01% COEFFS | FILE = 1071.3 KB ( 31.0% OF ORIGINAL)**
- **RATIO = 0.60 | KEPT 60.45% COEFFS | FILE = 1127.5 KB ( 32.6% OF ORIGINAL)**
- **RATIO = 0.80 | KEPT 80.17% COEFFS | FILE = 1134.2 KB ( 32.8% OF ORIGINAL)**

NOTE: ORIGINAL FILE SIZE: 3454.7 KB



# EXPERIMENT WITH DAUBECHIES



# RESULT WITH DAUBECHIES

Ratio	Kept Coefficients	File Size (KB)	File Size (% of Original)	Output File Name
0,10	10,00%	1008,0	29,2 %	szentendre_ratio_10.jpg
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_60.jpg
0,80	80,00%	1134,4	32,8 %	szentendre_ratio_80.jpg

NOTE: ORIGINAL FILE SIZE: 3454.7 KB

# DIFFERENCES?





# **THANK YOU!**