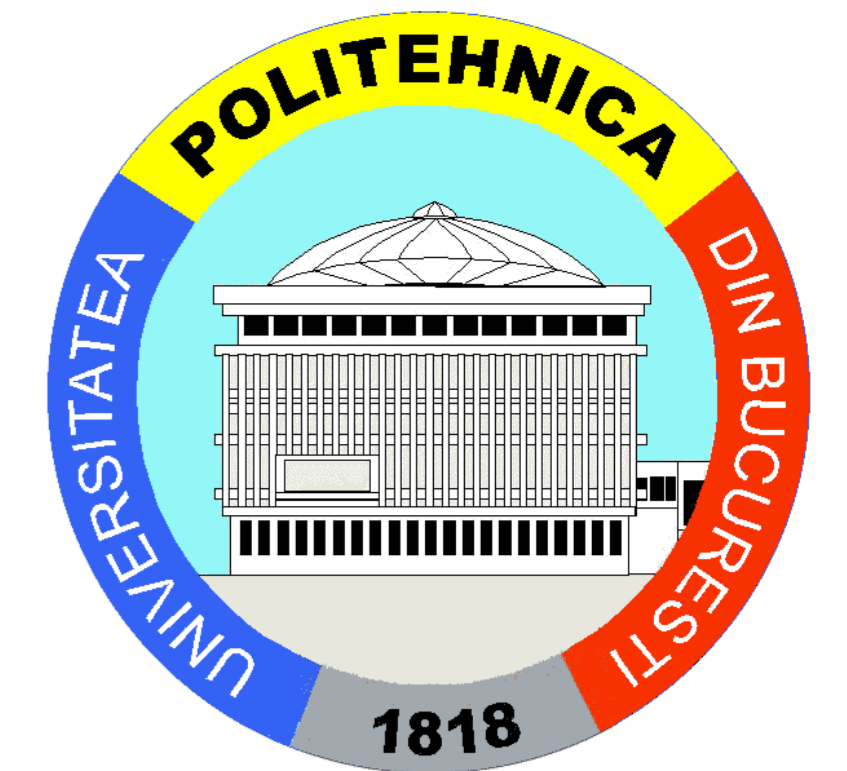


Direct Hologram Compression vs. Image Compression

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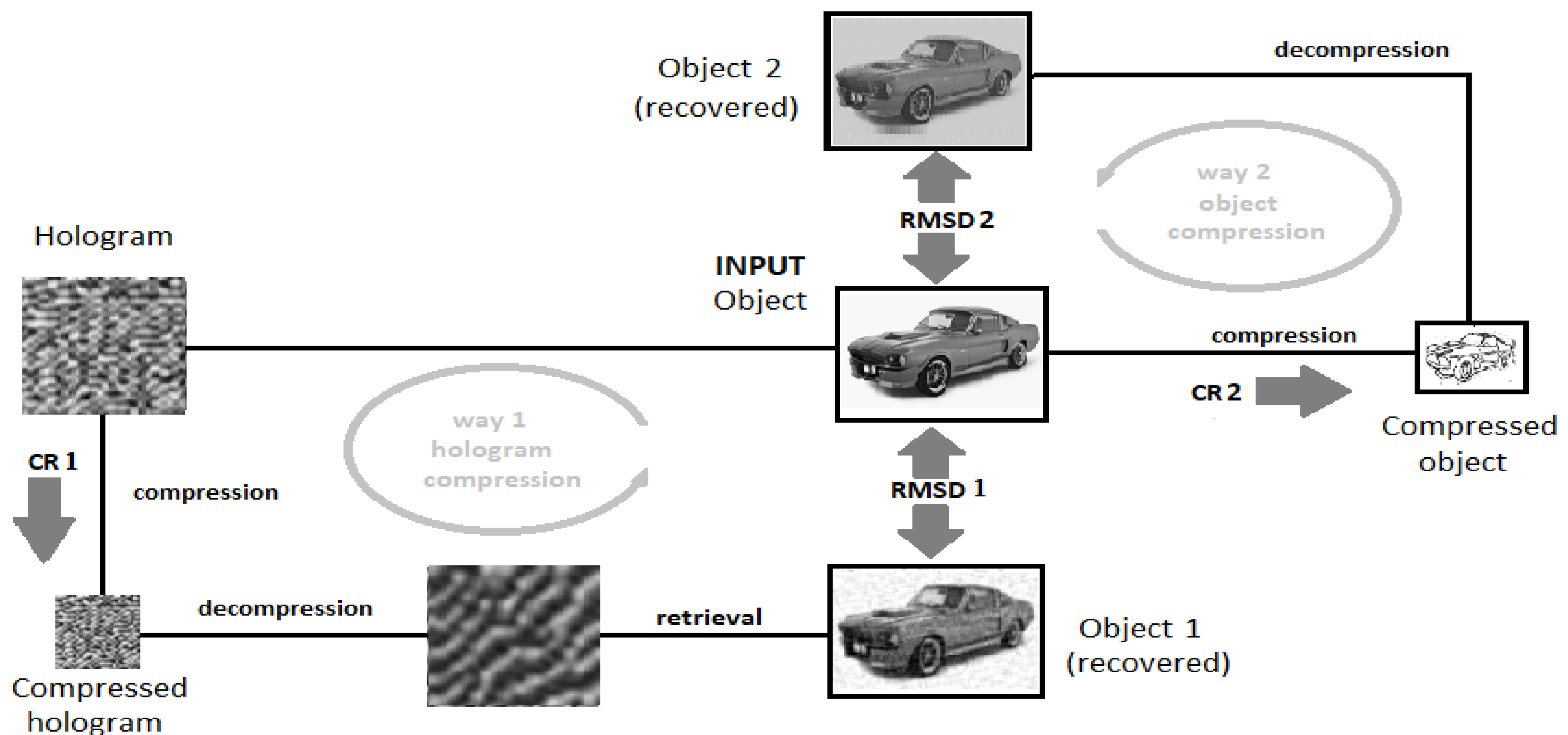
SCOPE

Comparison between a visual, complex object and two of its copies obtained via two different sequences: 1/ compression-decompression of the hologram of the object followed by object retrieval, and 2/ simple compression-decompression of the object itself.

NEW IN THE WORK

1/ Object/hologram compression, stages: i/ partition of each matrix into 8x8 pixels blocks, ii/ space transformation, iii/ quantization with quantization matrix (Q), iv/ rounding, using the multiplication coefficient associated to Q, v/ binary encoding. Hologram compression skips step ii/ and uses different coefficients.
 2/ Compression algorithm - Python based, run under a versatile interface with the following facilities: programmable steps i/-v/, the choices of transformation, quantization matrix, multiplication coefficient, and the representation of the complex form (real-imaginary or phase-amplitude).

SCHEME



PREQUISITES

1/ Visual objects, JPEG 2000 as benchmark with associated Q1, 2/ Compression ratio (CR), $RMSD_j = \sqrt{\frac{1}{L_x L_y} \sum_{x,y} |Obj(x',y',z') - Obj_j(x',y',z')|^2}$, $RMSD_{max}=255$.
 3/ Characterization of spatial frequencies

Object compression using DWT and Q1

Hologram compression with Q1 in real-imaginary representation

Genuine object ^o						
RDMS 2	0	94.7	123.5	144.4	169.5	176.5
CR 2	62.3	63.9	63.9	63.9	63.9	63.9

Genuine object ^o						
RDMS 1	0	62.9	65.3	63.8	52.5	51.4
CR 1	62.3	20.0	20.1	19.8	15.2	30.6

RESULTS

Comparison between the recovered versions of the object „vehicle” along way 1 and way 2

# gray levels		2	4	8	16	32	64	128	256
Way 1	RMSD 1	101.6	83.6	76.4	74.2	73.6	73.3	73.2	74.4
	CR 1	4.1	9.1	12.2	13.6	14.1	14.3	14.4	14.5
Way 2	RMSD 2	136.8	111.5	104.8	102.5	101.8	101.1	100.9	100.6
	CR 2	62.2	62.2	62.2	62.2	62.2	62.2	62.2	62.2



Genuine object «vehicle» 256 levels a), and reconstructed object way 1 b), and way 2 c).

Conclusions

- For visual objects the image compression (DWT-Q1) and hologram compression (_-Q1) are comparable . with advantage for object compression since JPEG 2000 was used as reference.
- Hologram compression offers a smaller global error. .
- Real-Imaginary representation is a better option than amplitude-phase. .
- Hologram compression remains an option for objects without visual significance. .

References

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- [2] R. Corda, "Digital Holography Data Compression", *Telfor Journal*, 11 (1), 52-57, 2019.