Nghiên cứu và đề xuất một phương pháp bảo vệ bản quyền tài liệu số

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Introduction

A robust method to the ability of the watermark to resist against attacks is proposed for hiding information into images.

The robustness of the watermarking scheme is inspired by using a PJND (Pyramidal Just Noticeable Difference) model and the message is inserted into these DoG (Difference of Gaussians).

Our proposal takes into account three main characteristics of Human Visual System, namely: contrast sensitivity, luminance adaptation and contrast marking.

Therefore, it not only provides an invisible and robust watermarking but also optimizes watermarking capacity.
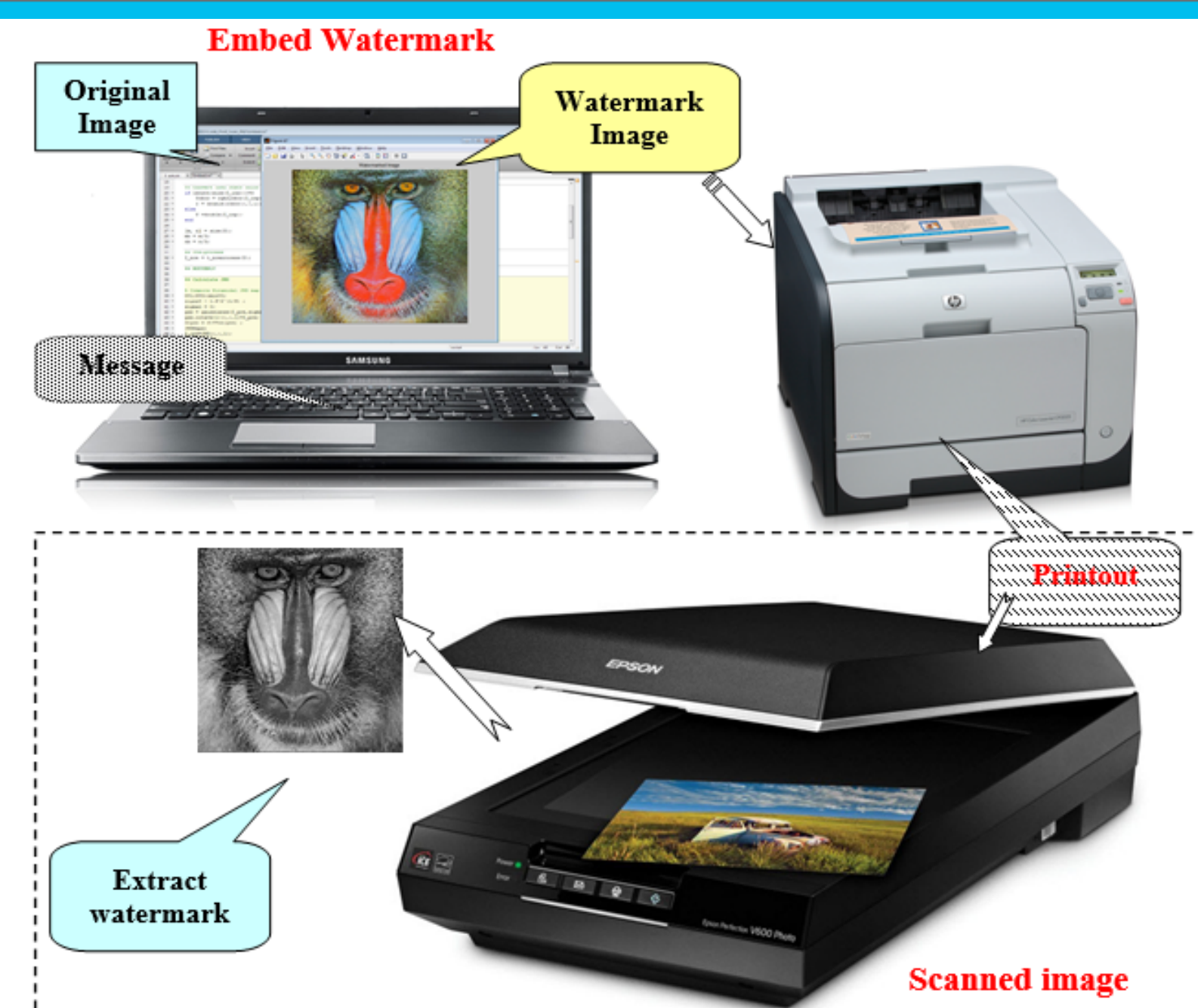
The performance of the proposed technique is evaluated by a series of experiments with different input images.

In terms of transparency, besides using the subjective experiments, eight objective metrics are calculated in comparison with other methods such as PSNR, MSSIM, SVDm, etc.
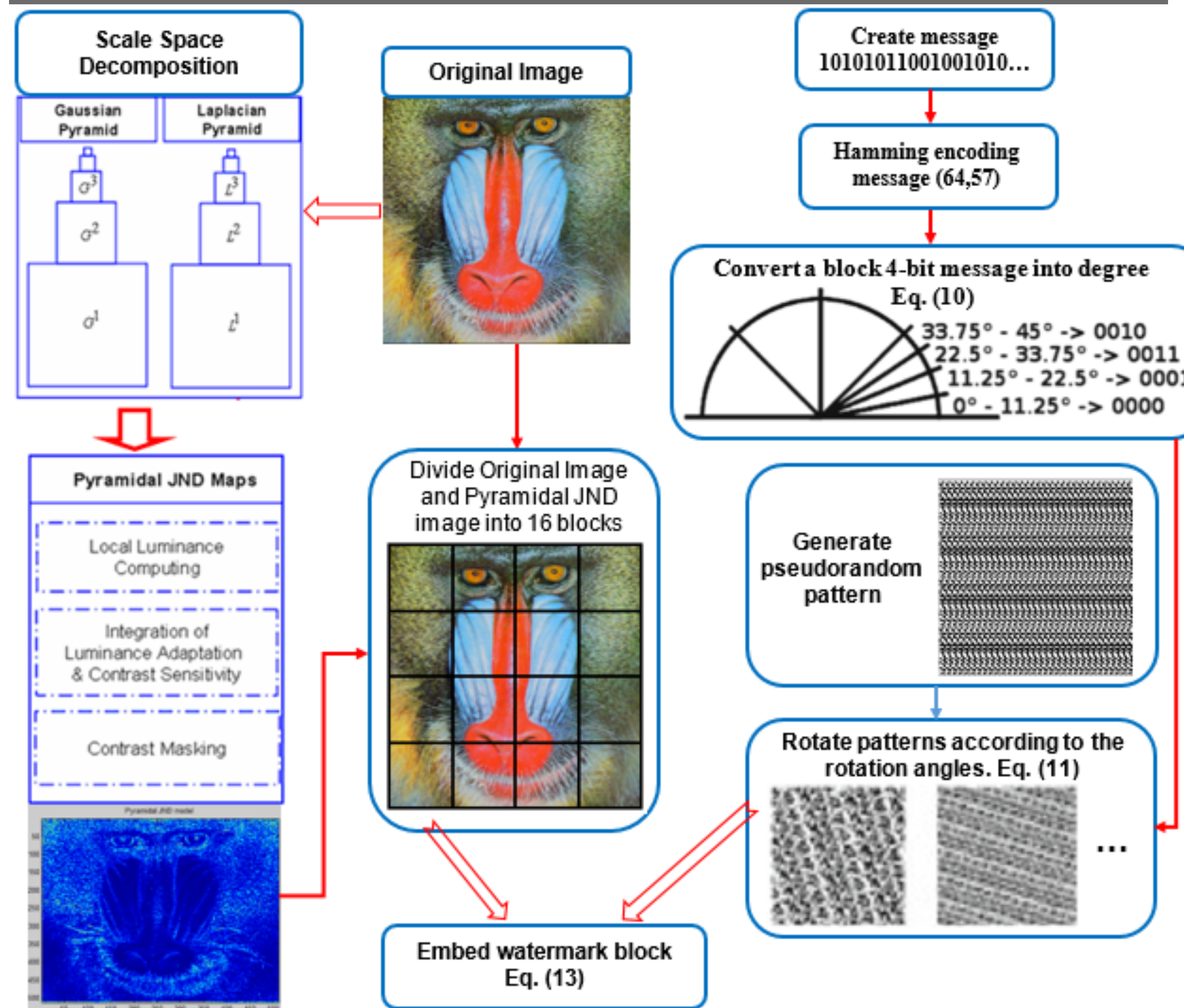
In terms of robustness, many kinds of attacks from global transformation (rotation, scaling, etc) to local transformation (stirmark, checkmark benchmarks, de-synchronization attacks) are implemented.

Many image processing tools are applied to simulate the attacks such as Print-Screen, Using Photo editing software, Camcorder, Print-Scan, etc.
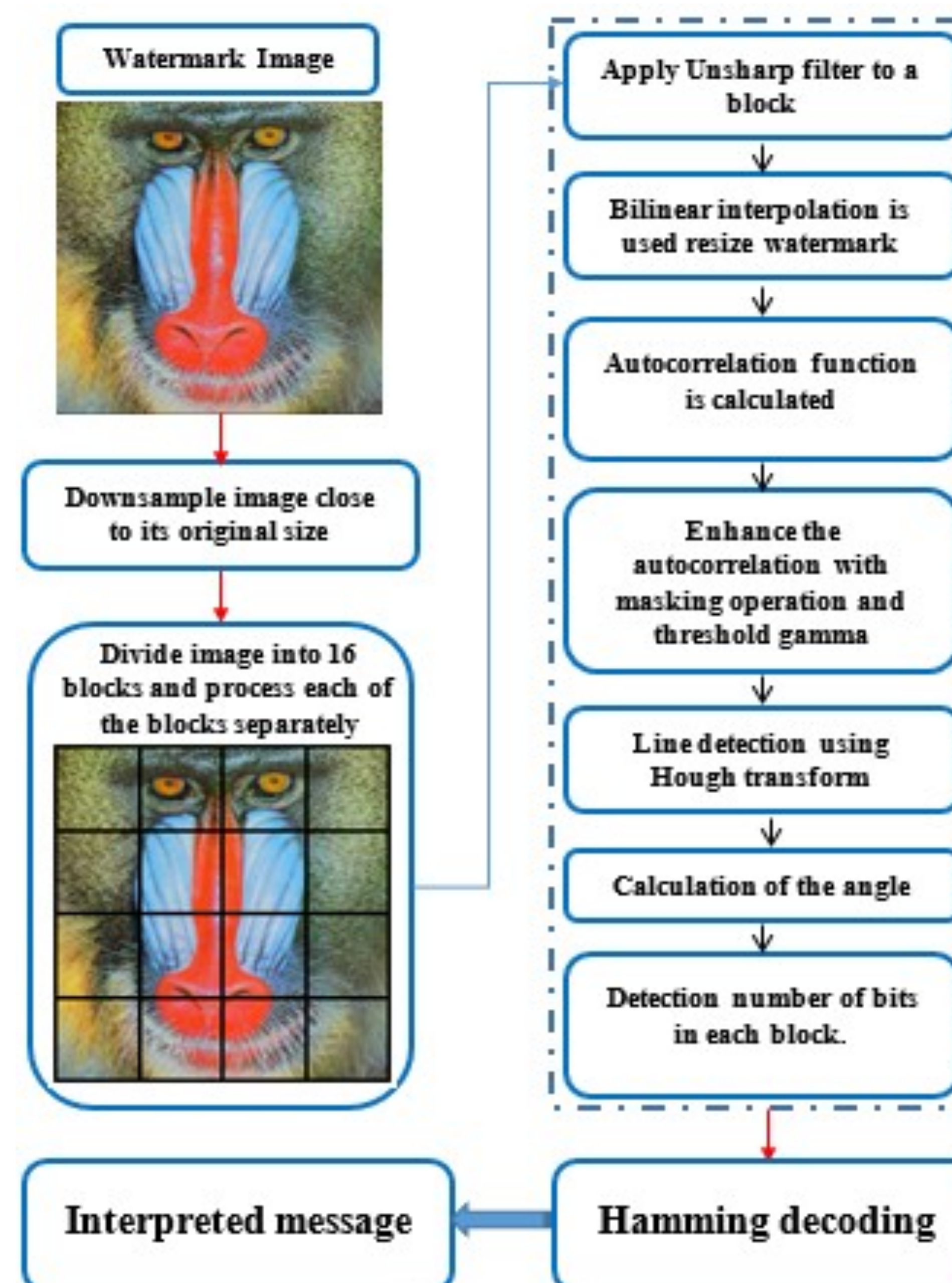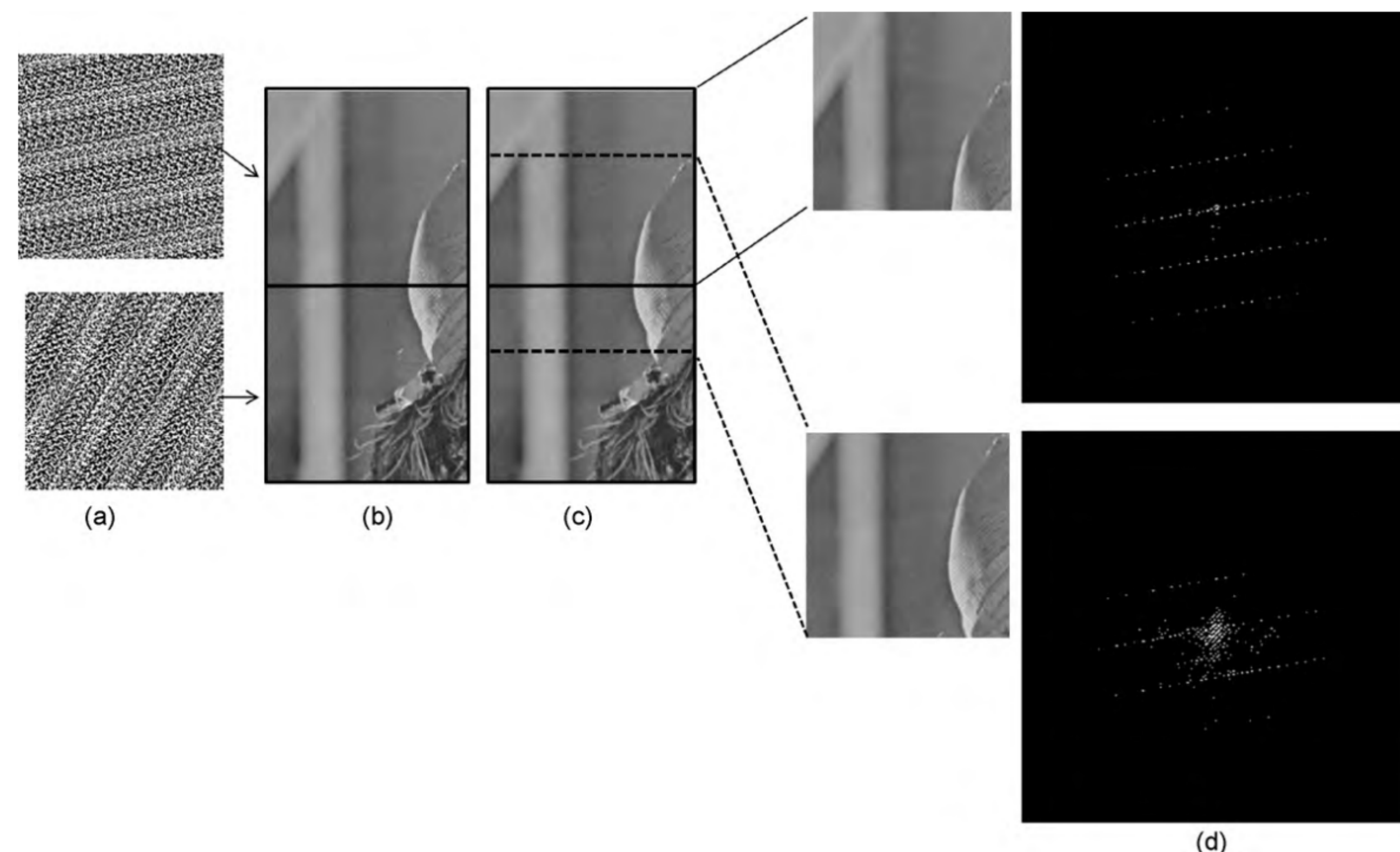
Project Overview

Detection of directed periodic patterns

(a) A directed periodic pattern with $\theta = 10^0$ and $\theta = 60^0$ generated using Eq. (11). (b) Two even sized blocks of the Lena image containing a different periodic pattern, upper block $\theta = 10^0$ and lower block $\theta = 60^0$. (c) The area of inspection shifted (dashed line). (d) Extracted autocorrelation peaks showing the effect of shifting the area of inspection.

Our Watermark Embedding Scheme

Watermark Detection Process

Results

Table 1. Robustness Evaluation (Stirmark [33] and Checkmark [34] benchmarks attack)

Attack Type	Explicit scheme	Method [7]
Random Cropping	1%	0.8%
Jpeg compression	QF=3%	QF=9%
Jpeg 2000 compression	0.08 bpp	0.1 bpp
Gaussian Noise	σ= 64%	σ= 67%
Wiener filtering	Ok	Ok
Median filtering	5x5	3x3
Sharpening	Ok	Failed
Blurring	Ok	Failed
Bit plan reduction	Ok	Failed
Histogram Equalization	Ok	Ok
Rescale (45%)	Ok	Ok
Affine Transform	Ok	Ok

Table 2. Imperceptibility Evaluation

Objective	Method	Image										
		Baboon	Barbara	Boat	Car	Clown	Fruit	Isabe	Lena	Peppers	Plane	AVG
PSNR	Keskinarkaus	25,79	28,41	33,01	32,80	33,66	36,68	36,18	35,45	35,51	35,82	33,33
	Proposed	26,10	27,88	32,46	31,98	32,98	34,84	35,25	34,47	34,35	33,61	32,39
PSNR wav1	Keskinarkaus	9,36	11,64	15,96	16,93	17,13	19,25	16,78	17,72	19,16	19,65	16,36
	Proposed	9,31	10,48	14,66	15,35	15,54	17,02	15,15	15,92	16,97	16,69	14,71
PSNR wav2	Keskinarkaus	10,08	12,43	16,33	17,69	18,13	19,68	18,56	19,11	19,99	20,03	17,20
	Proposed	9,88	10,87	14,87	15,95	16,45	17,53	16,90	17,14	17,75	17,08	15,44
SVDm	Keskinarkaus	37,82	34,82	16,47	17,35	12,51	9,74	9,28	10,70	8,07	11,10	16,79
	Proposed	33,36	29,64	13,94	15,20	11,18	9,65	8,27	9,88	7,87	10,82	14,98
TPE	Keskinarkaus	0,19	0,10	0,08	0,08	0,08	0,07	0,07	0,07	0,07	0,06	0,09
	Proposed	0,19	0,13	0,08	0,09	0,10	0,08	0,07	0,08	0,08	0,07	0,10
mssim	Keskinarkaus	0,82	0,88	0,93	0,94	0,93	0,97	0,94	0,94	0,91	0,96	0,92
	Proposed	0,85	0,89	0,94	0,94	0,94	0,97	0,95	0,94	0,93	0,96	0,93
wPSNR	Keskinarkaus	35,56	37,28	39,25	38,34	38,62	40,46	39,98	39,76	38,95	40,93	38,91
	Proposed	35,99	36,93	38,97	37,80	37,90	39,60	39,24	39,31	38,80	39,46	38,40
wsnr	Keskinarkaus	33,18	34,85	39,28	38,09	34,50	37,17	40,58	38,69	39,77	41,39	37,75
	Proposed	32,16	32,08	37,92	36,41	33,71	35,39	38,82	37,05	37,17	38,08	35,88

Table 3. Robustness Evaluation. For some type of attacks, the results showed: X/Y (bit error/bit encoded message) the parameters demonstrate the break-down limit of the method (the strongest attack to which the watermark still survives)

Attack	Method	Baboon	Fruit	Isabe	Lena	Peppers
Camcorder attack	Ours	Ok	Ok	2/64	1/64	3/64
	Keskinarkaus	-	-	-	-	-
Print scan Attack	Ours	Ok	3/64	Ok	2/64	Ok
	Keskinarkaus	Ok	2/48	3/48	Ok	Ok
Photo editing software	Ours	Ok	Ok	2/64	3/64	Ok
	Keskinarkaus	-	-	-	-	-
Print screen Attack	Ours	Ok	Ok	Ok	Ok	Ok
	Keskinarkaus	-	-	-	-	-
DA New	Ours	Ok	Ok	Ok	Ok	Ok
	Keskinarkaus	-	-	-	-	-

Conclusion