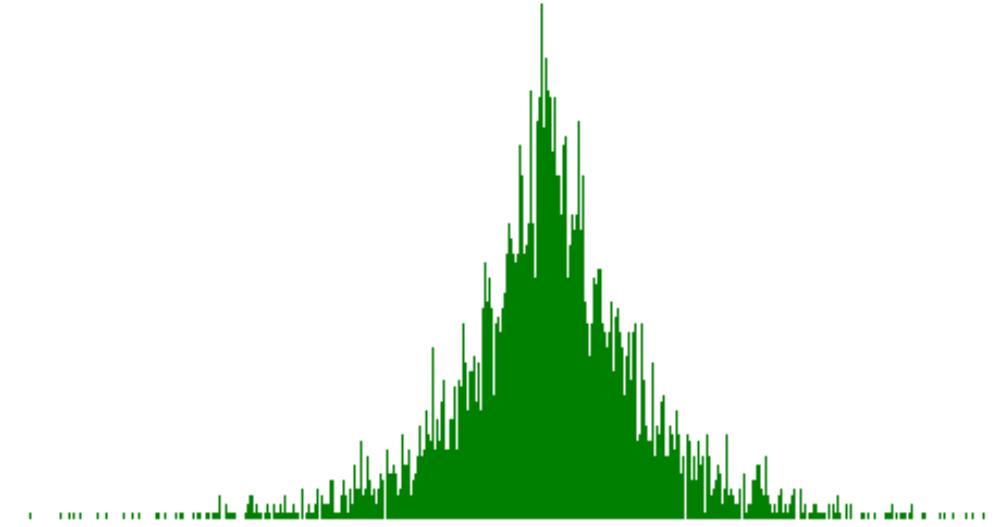
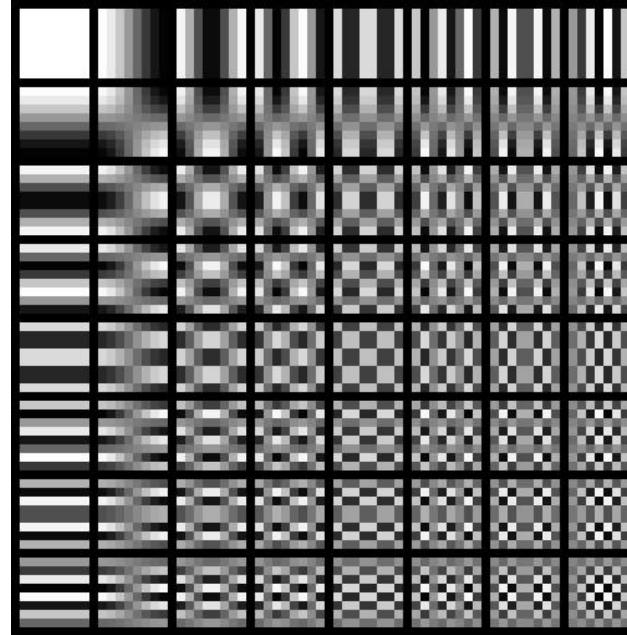
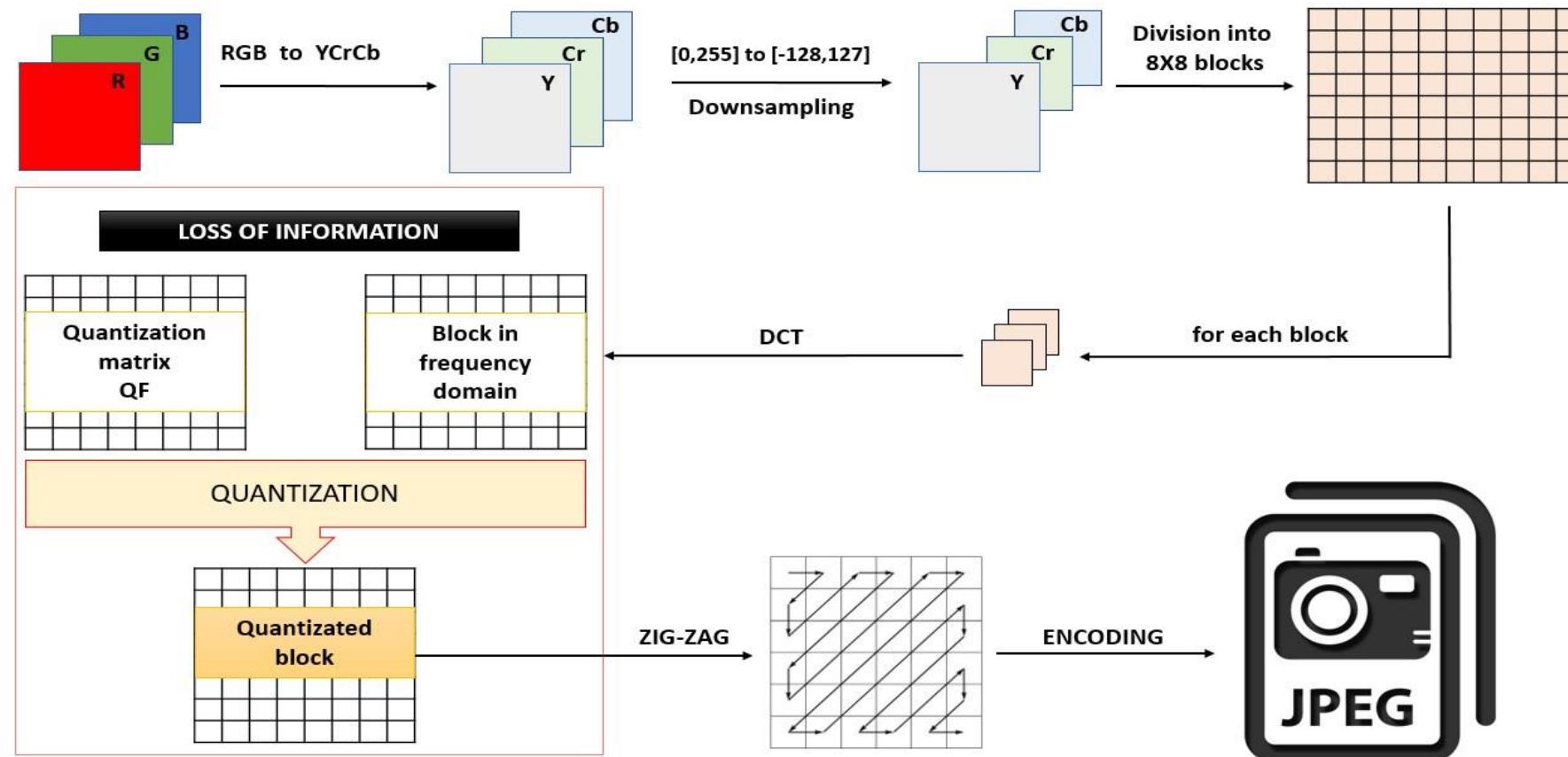


Computational Data Analysis for First Quantization Estimation on JPEG Double Compressed Images



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*University of Catania, [≈]University of Cagliari

The JPEG algorithm



Digital image life-cycle



FQE

DQD

FQE: First Quantization Estimation

RAW IMAGE



JPEG COMPRESSED



JPEG COMPRESSED

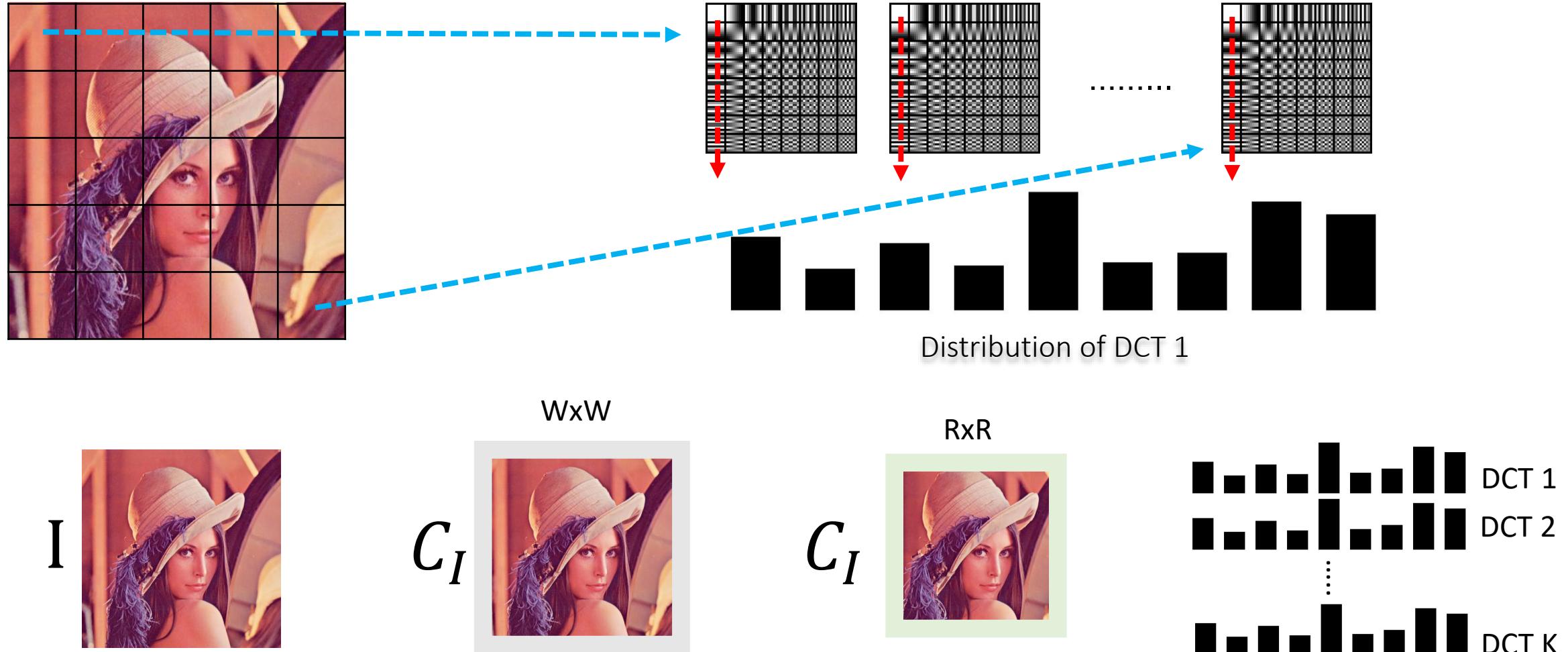


REFERENCE WORKS

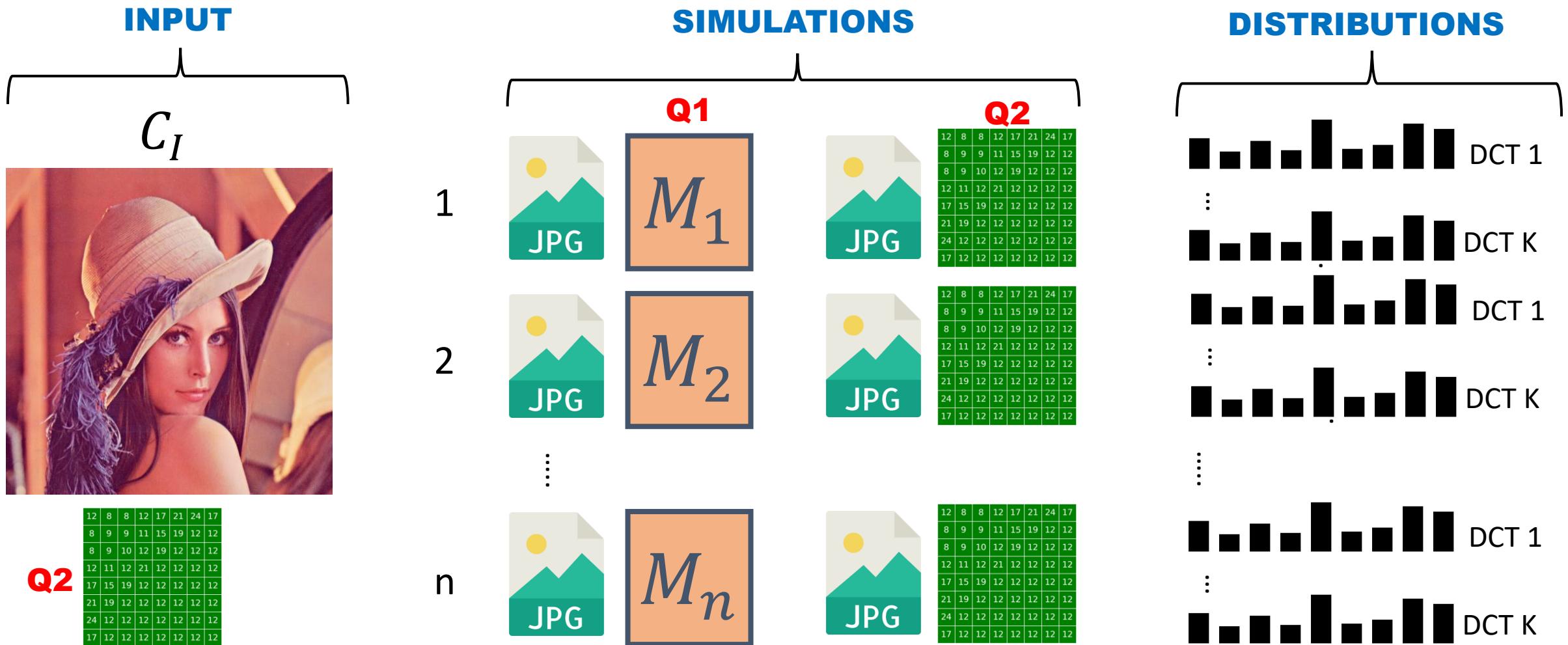
T. Bianchi and A. Piva, “Image forgery localization via block-grained analysis of JPEG artifacts,” 2012.

Y. Niu, B. Tondi, Y. Zhao, and M. Barni, “Primary quantization matrix estimation of double compressed JPEG images via CNN” ,2020.

The Method (1/4)

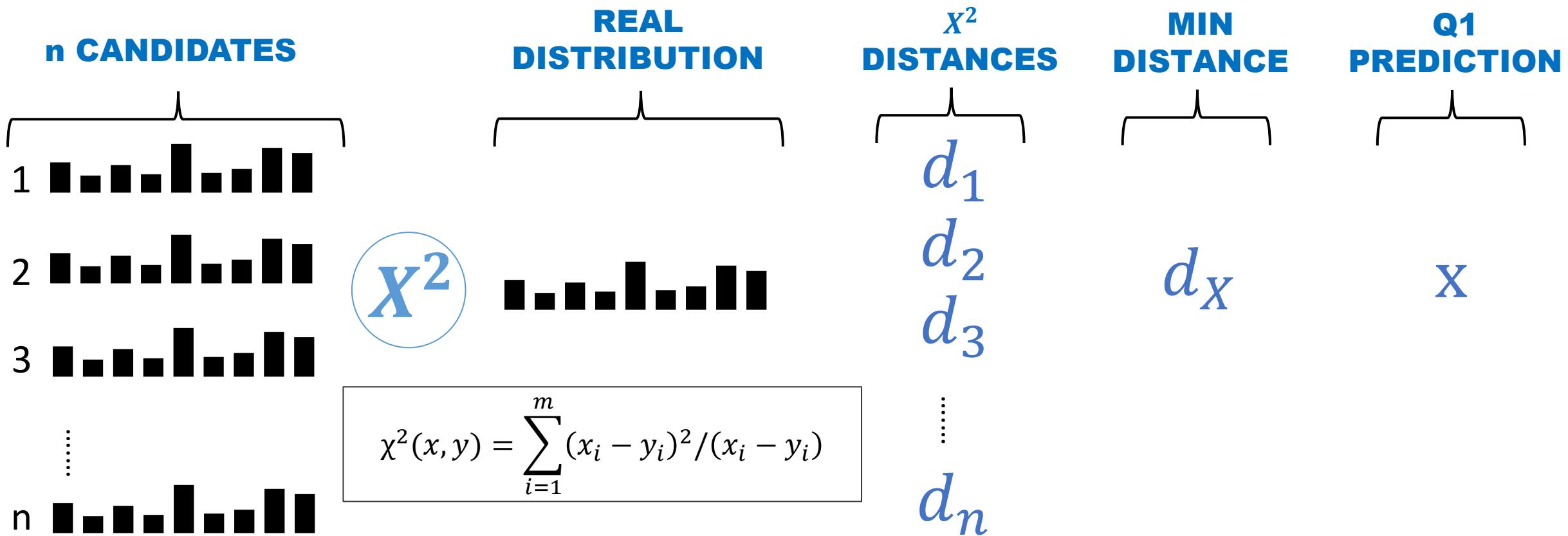


The Method (2/4)

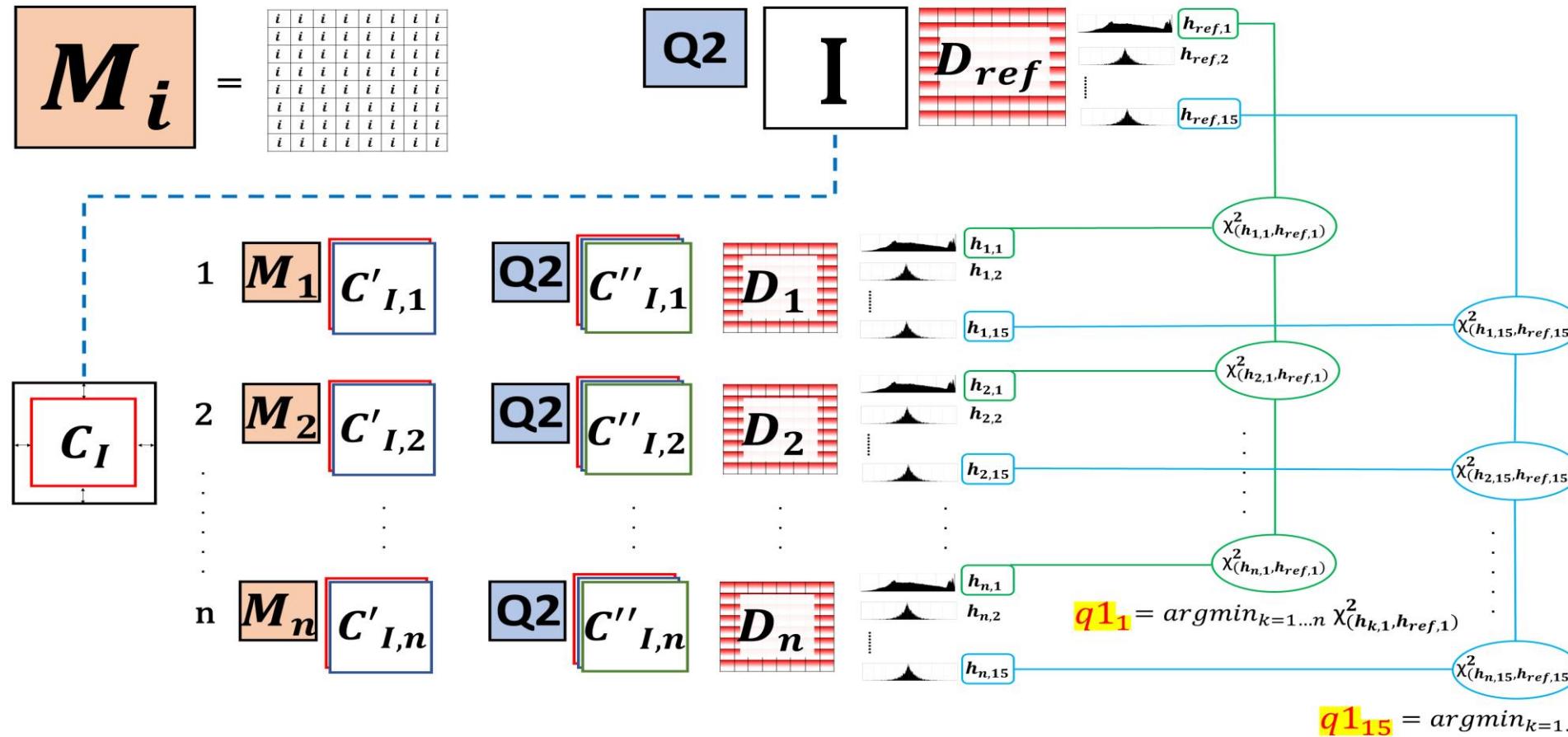


The Method (3/4)

For every DCT from 1 to K ...



The Method (4/4)



Dataset

STANDARD DATASET

- Patch size: {64x64, 128x128, 256x256}
- QF1: {50,55,60,65,70,75,80,85,90,95,98}
- QF2: {80,90}



CUSTOM DATASET

- Patch size: {64x64}
- QF1: {5,6,7,8,9,10,11,12}
- QF2: {80,90}

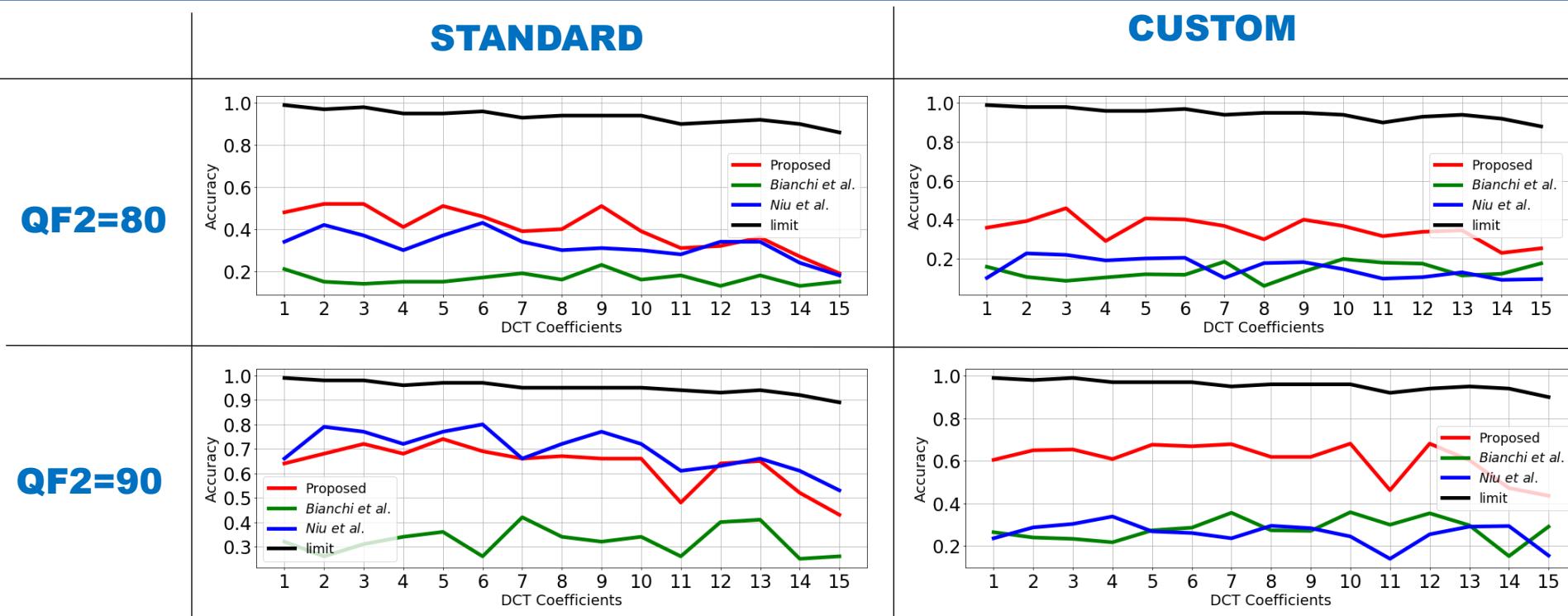


Adobe Photoshop CC
version 20.0.4

12	8	8	12	17	21	24	17
8	9	9	11	15	19	12	12
8	9	10	12	19	12	12	12
12	11	12	21	12	12	12	12
17	15	19	12	12	12	12	12
21	19	12	12	12	12	12	12
24	12	12	12	12	12	12	12
17	12	12	12	12	12	12	12

Photoshop QF=5

Experimental results



REFERENCE WORKS

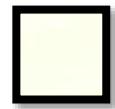
T. Bianchi and A. Piva, "Image forgery localization via block-grained analysis of JPEG artifacts," 2012.

Y. Niu, B. Tondi, Y. Zhao, and M. Barni, "Primary quantization matrix estimation of double compressed JPEG images via CNN" ,2020.

The theoretical limit



256x256



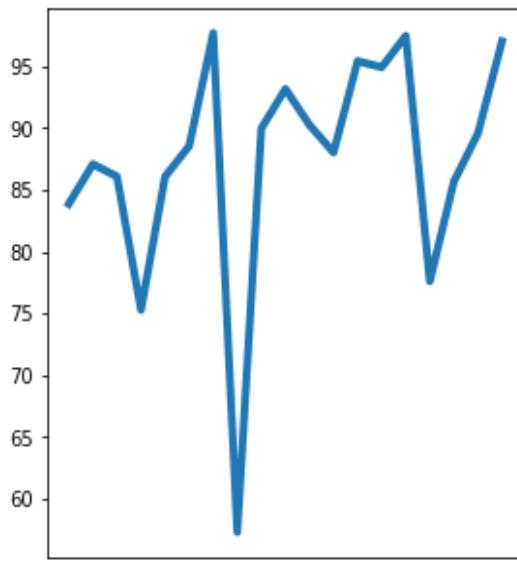
128 x 128



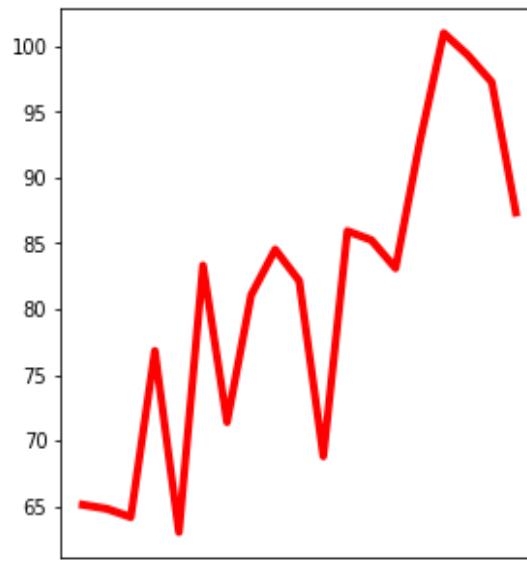
64 x 64

$$\text{limit} = 1 - (\text{np}/\text{t})$$

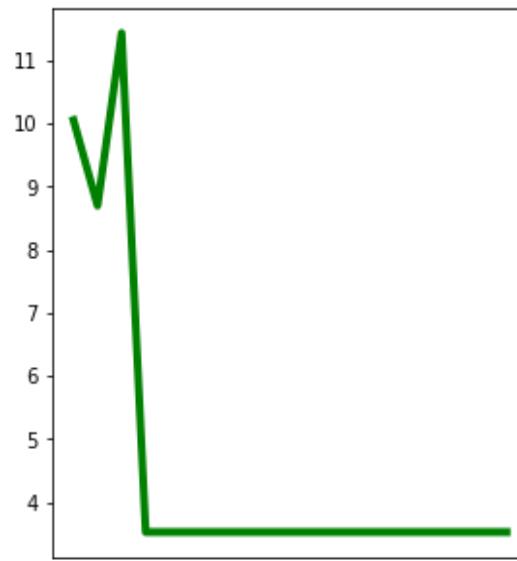
Reliability of the estimation



(a)



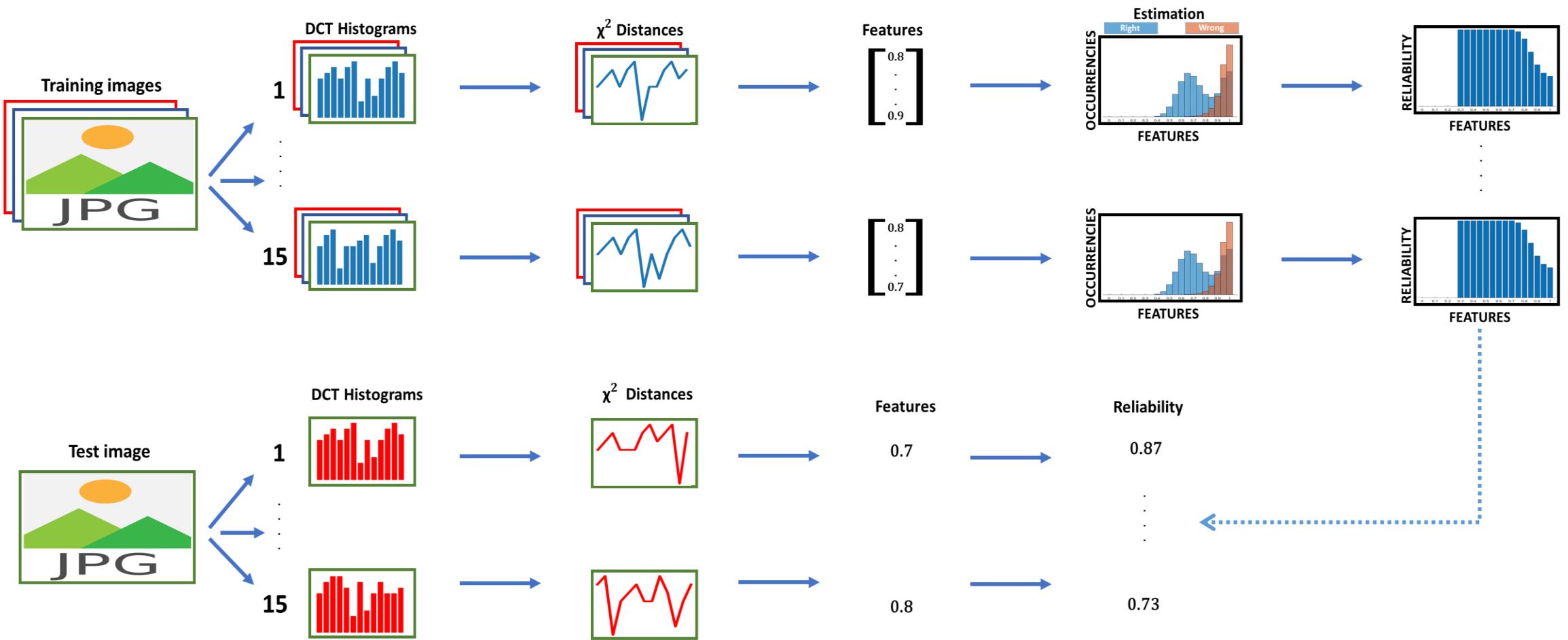
(b)



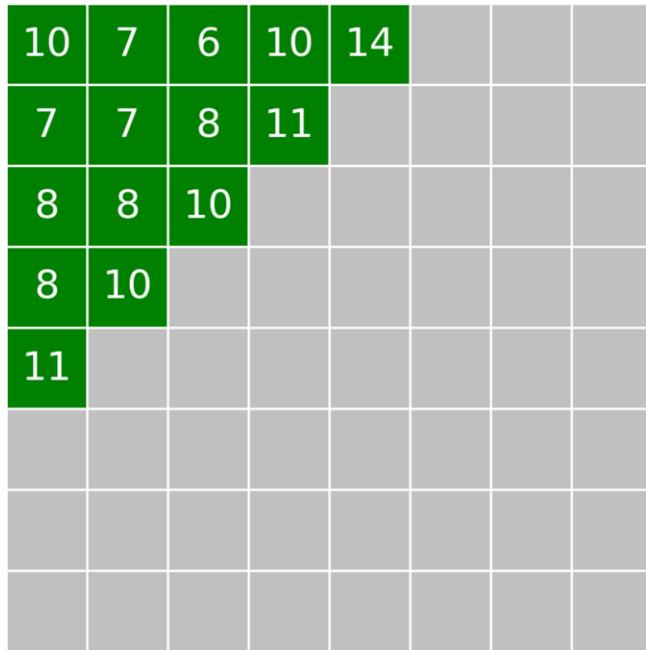
(c)

$$r_{21} = \frac{\min_1}{\min_2}$$

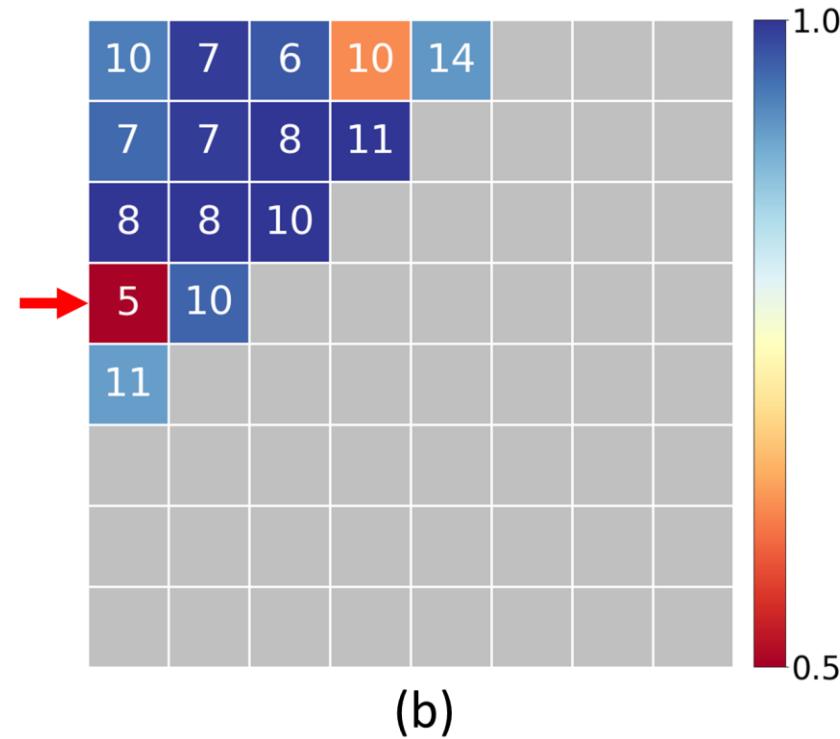
Reliability of the estimation



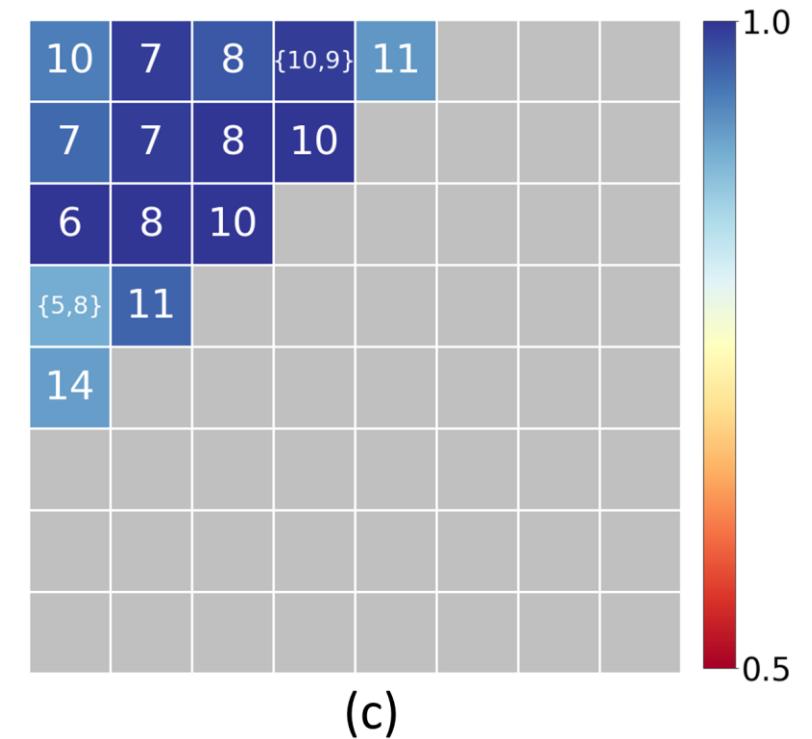
Reliability of the estimation



(a)



(b)



(c)

Future Work

- FQE in JPEG multiple compression
 - “Estimating Previous Quantization Factorson Multiple JPEG Compressed Images”. Submitted in Eurasip Journal on Information Security, Special Issue “Facing emerging challenges in multimedia forensics”
- Mixed statistical/learning techniques and images predictability
 - “In-depth DCT coefficient distribution analysis for first quantization estimation”. To appear in MMForWild2020 - Workshop of International Conference on Pattern Recognition(ICPR), 2020
- Not-aligned/resized scenario
- Tampering



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A large central red word "thank you" is surrounded by various international words for "thank you" in different colors. The surrounding words include: danke (German), 謝謝 (Chinese), teşekkür ederim (Turkish), спасибо (Russian), hyah (Korean), dziękuje (Polish), Maururu (Fijian), obrigado (Portuguese), sagolun (Ukrainian), Sukriya (Malay), kop khun krap (Thai), terima kasih (Indonesian), 감사합니다 (Korean), ngiyabonga (Zulu), grazie (Italian), arigatō (Japanese), grazie (Italian), takk (Norwegian), dakujem (Croatian), merci (French), mochchakkeram (Burmese), go raibh maith agat (Irish), and merci (French). The background features a faint grid pattern.

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<https://iplab.dmi.unict.it/mfs/publications>



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