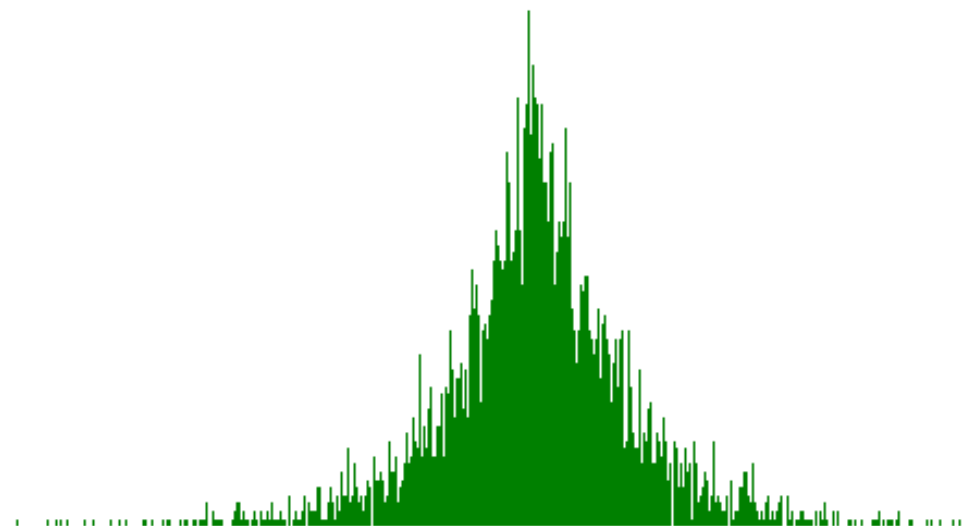
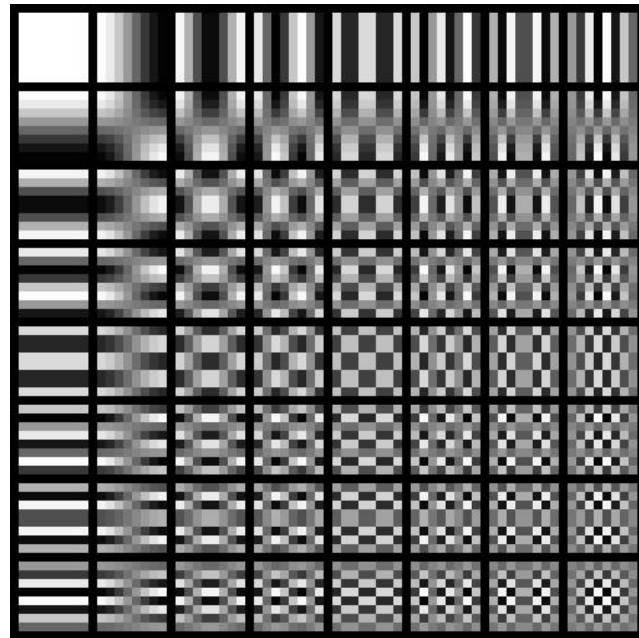
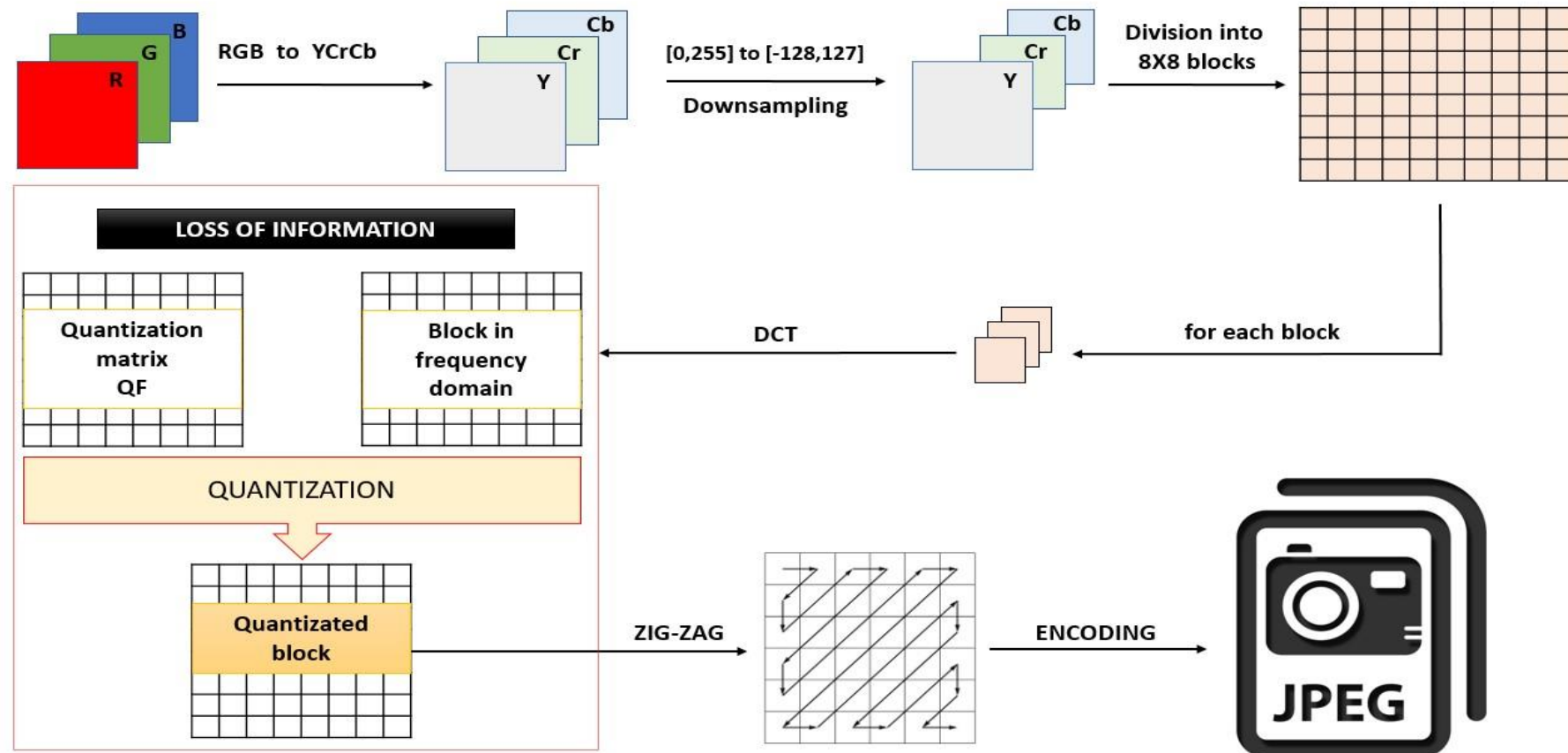


Computational Data Analysis for First Quantization Estimation on JPEG Double Compressed Images

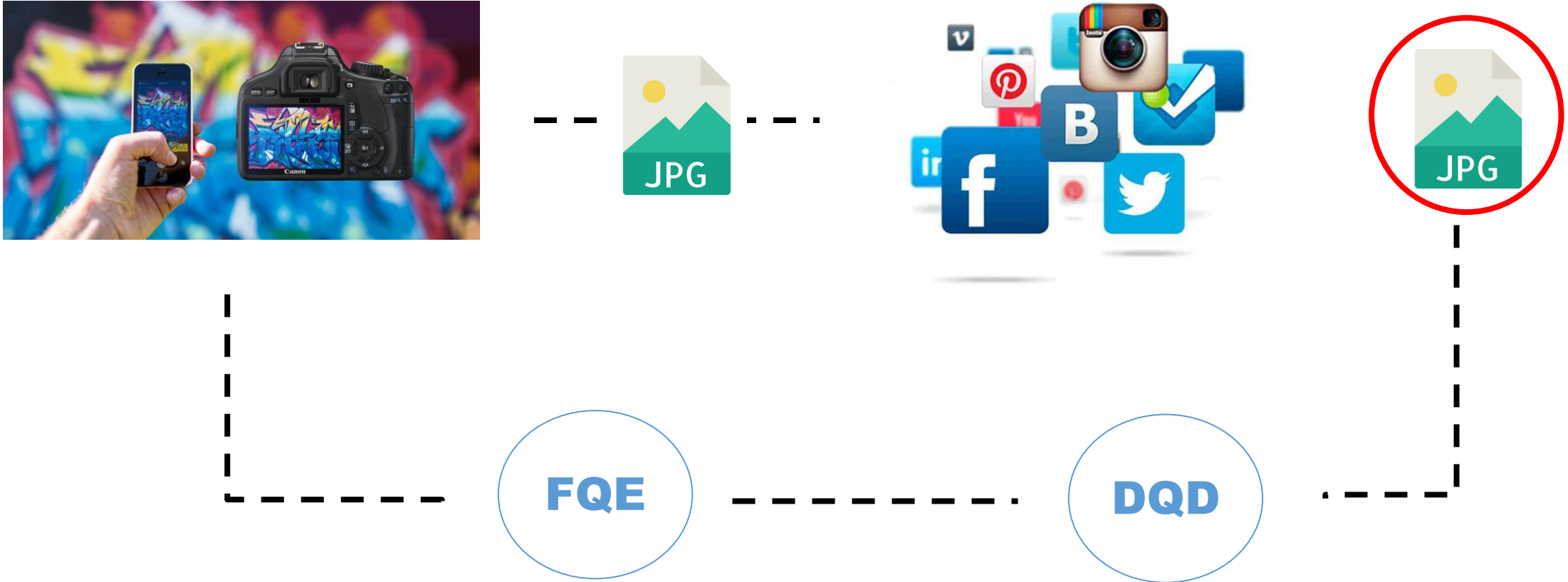


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The JPEG algorithm



Digital image life-cycle



FQE: First Quantization Estimation

RAW IMAGE



Q1

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

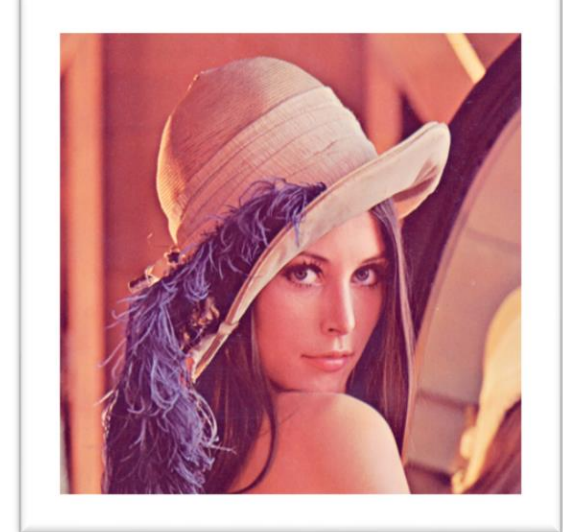
JPEG COMPRESSED



Q2

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

JPEG COMPRESSED



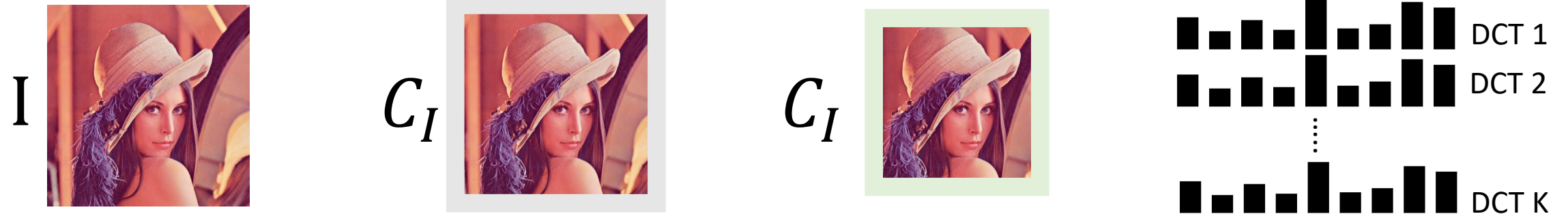
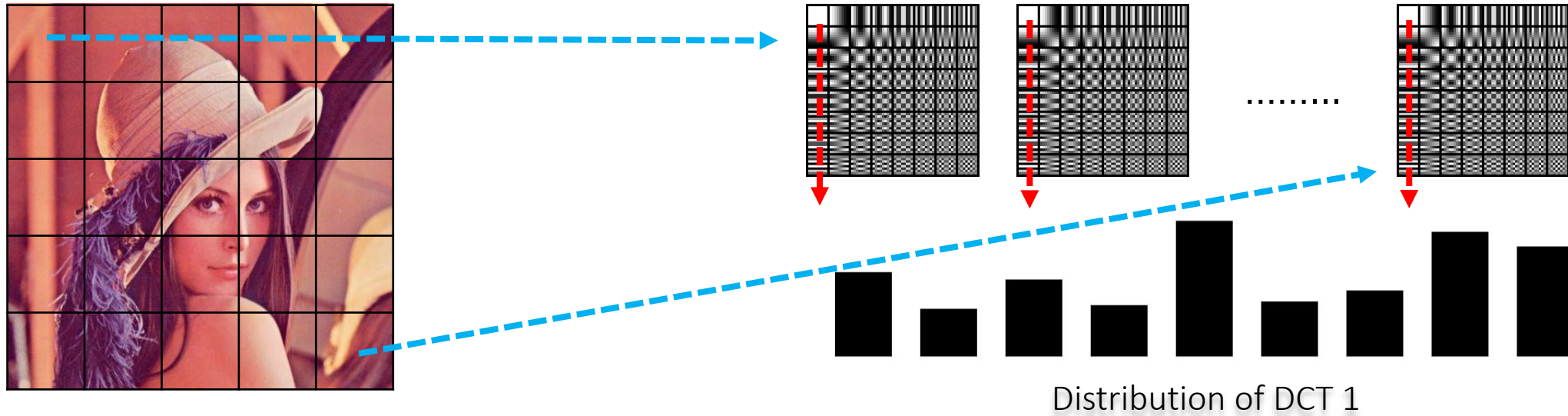
FQE

REFERENCE WORKS

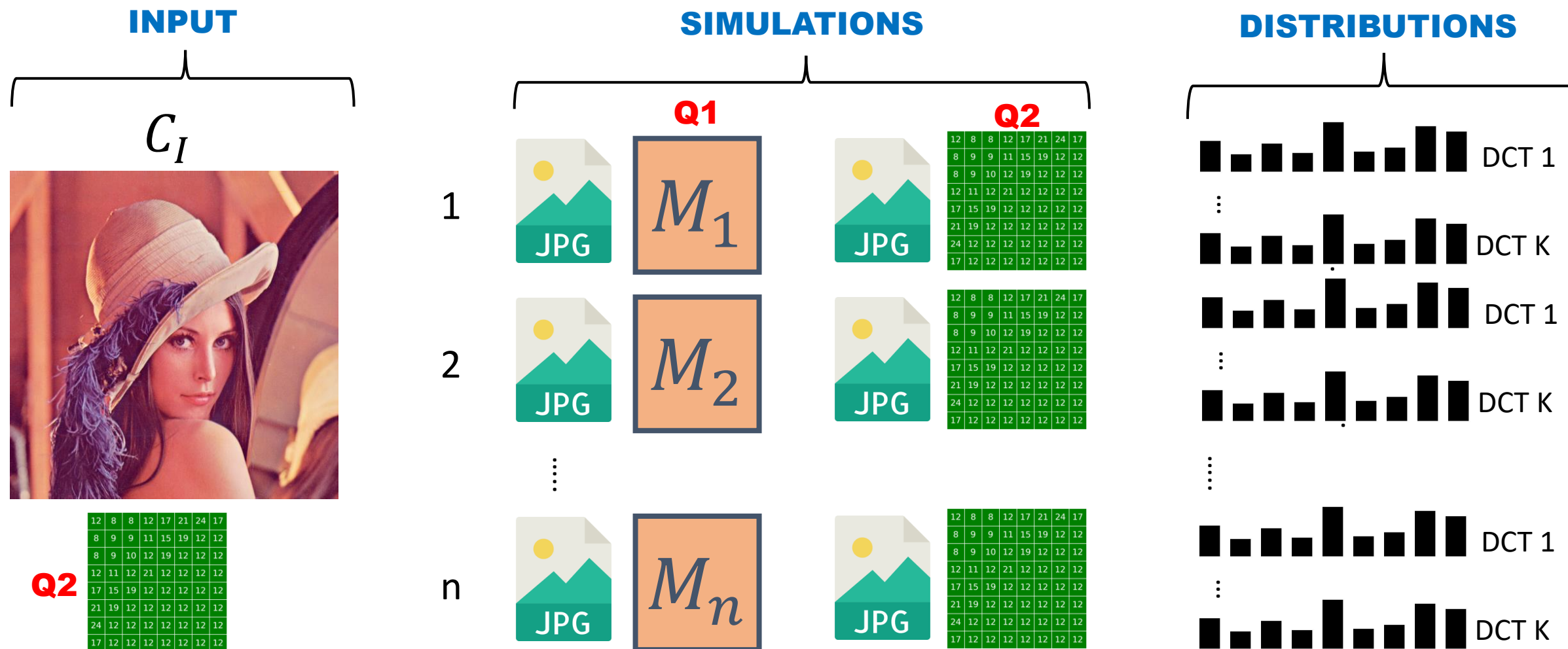
T. Bianchi and A. Piva, "Image forgery localization via block-grained analysis of JPEG artifacts," 2012.

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)

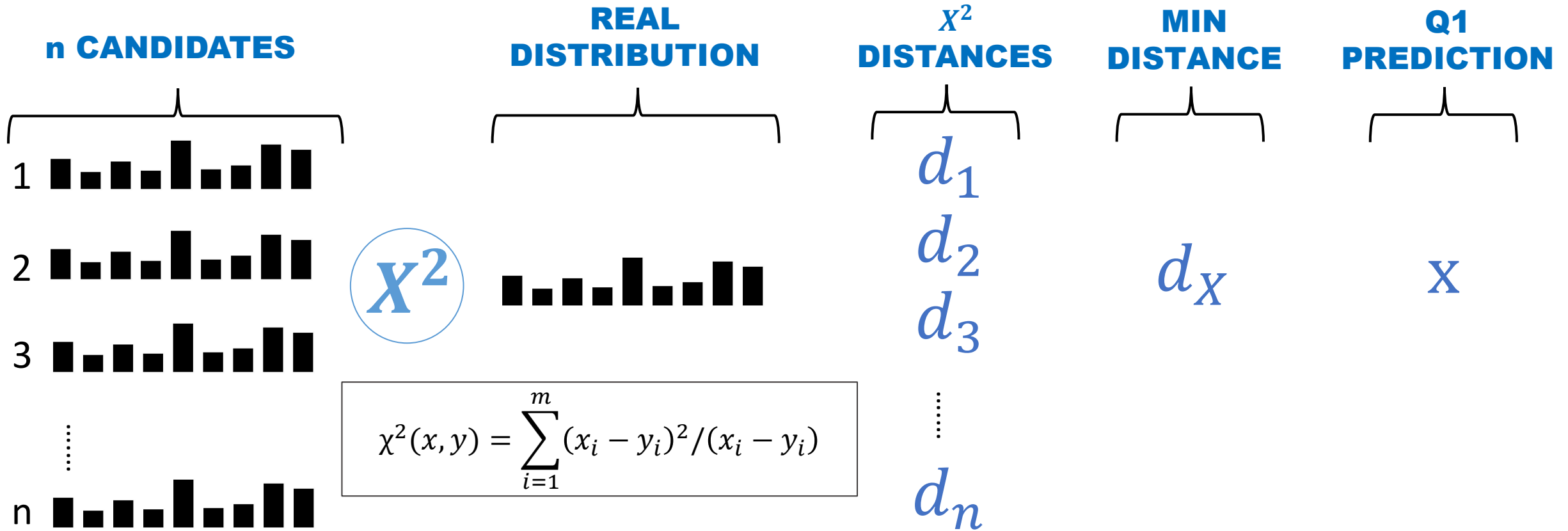


The Method (2/4)

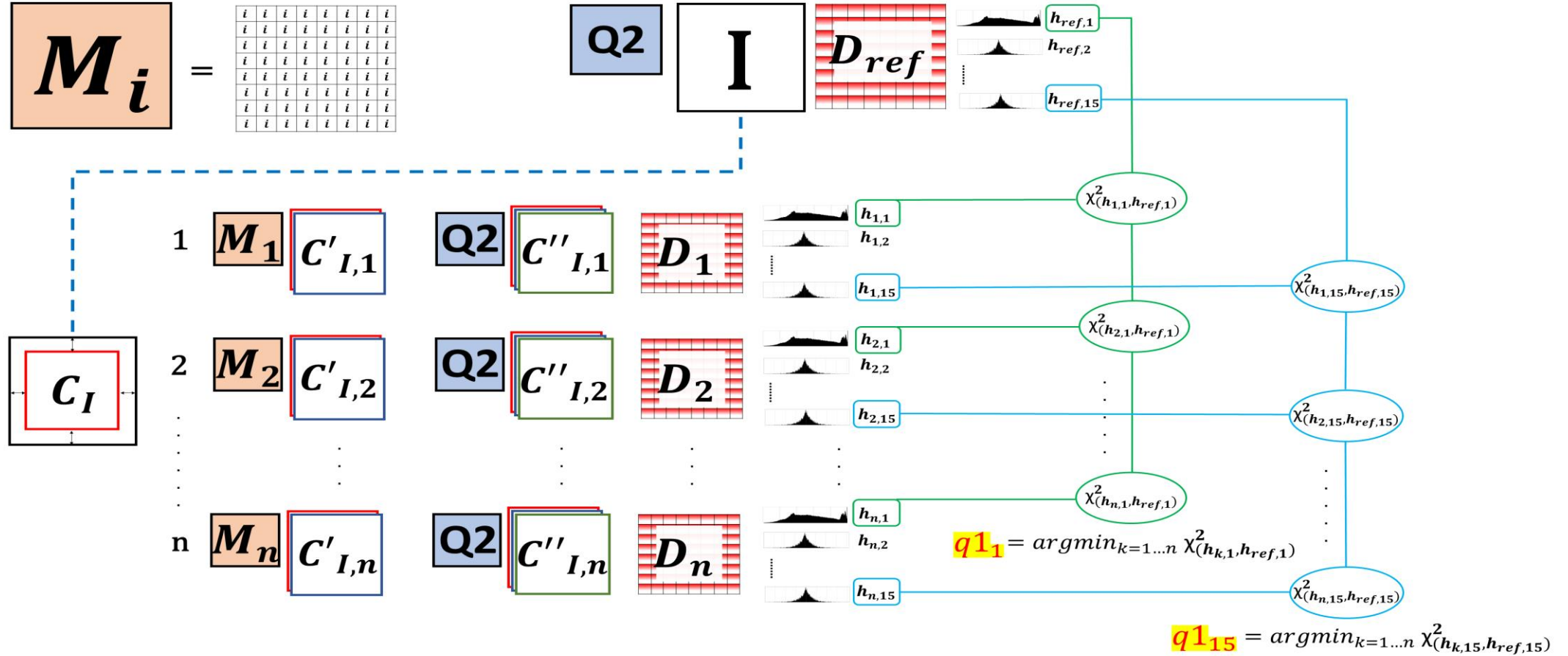


The Method (3/4)

For every DCT from 1 to K ...



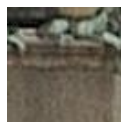
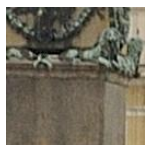
The Method (4/4)



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}

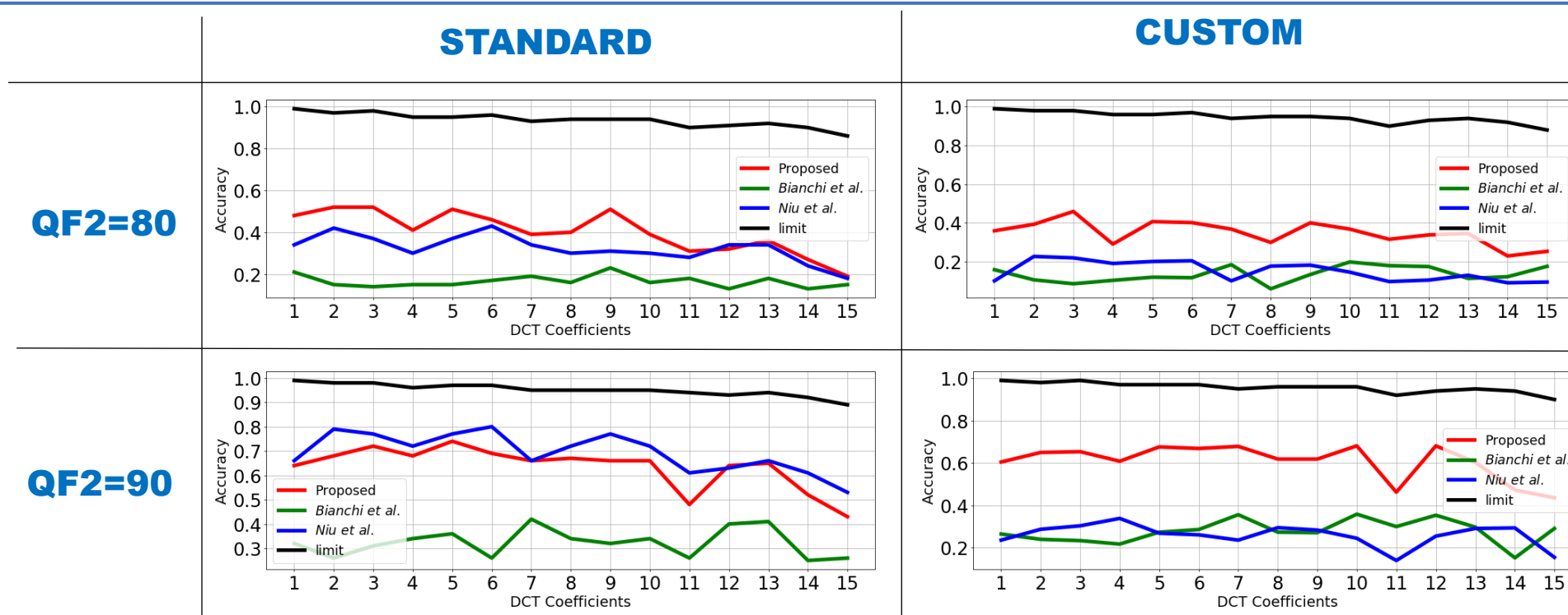


Adobe Photoshop CC
version 20.0.4

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.

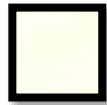
The theoretical limit



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



256x256

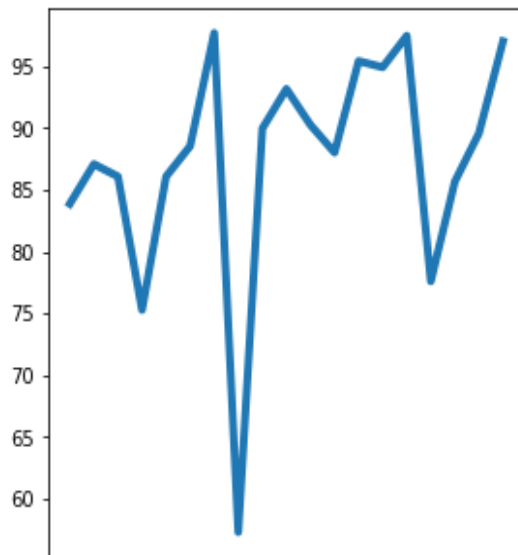


128 x 128

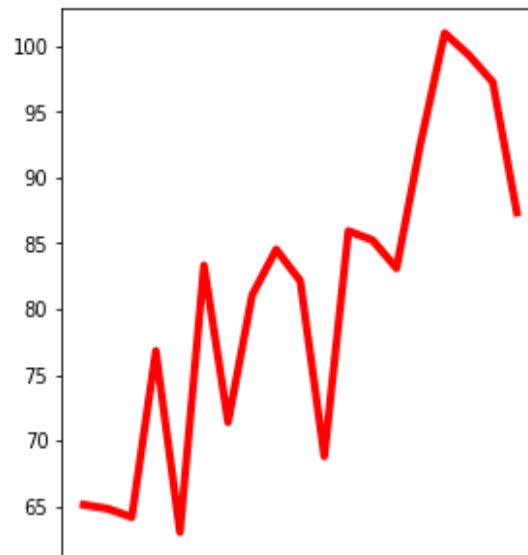


64 x 64

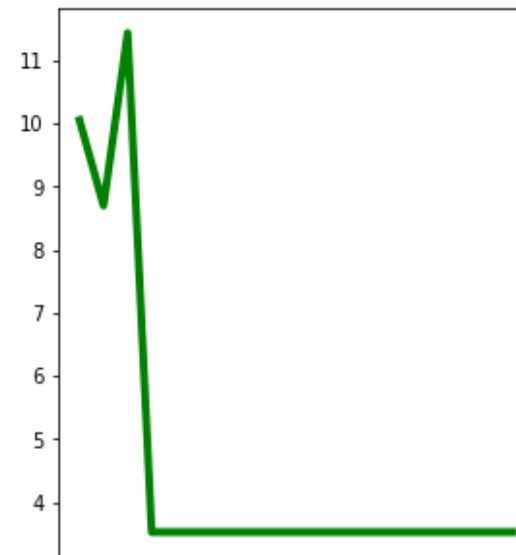
Reliability of the estimation



(a)



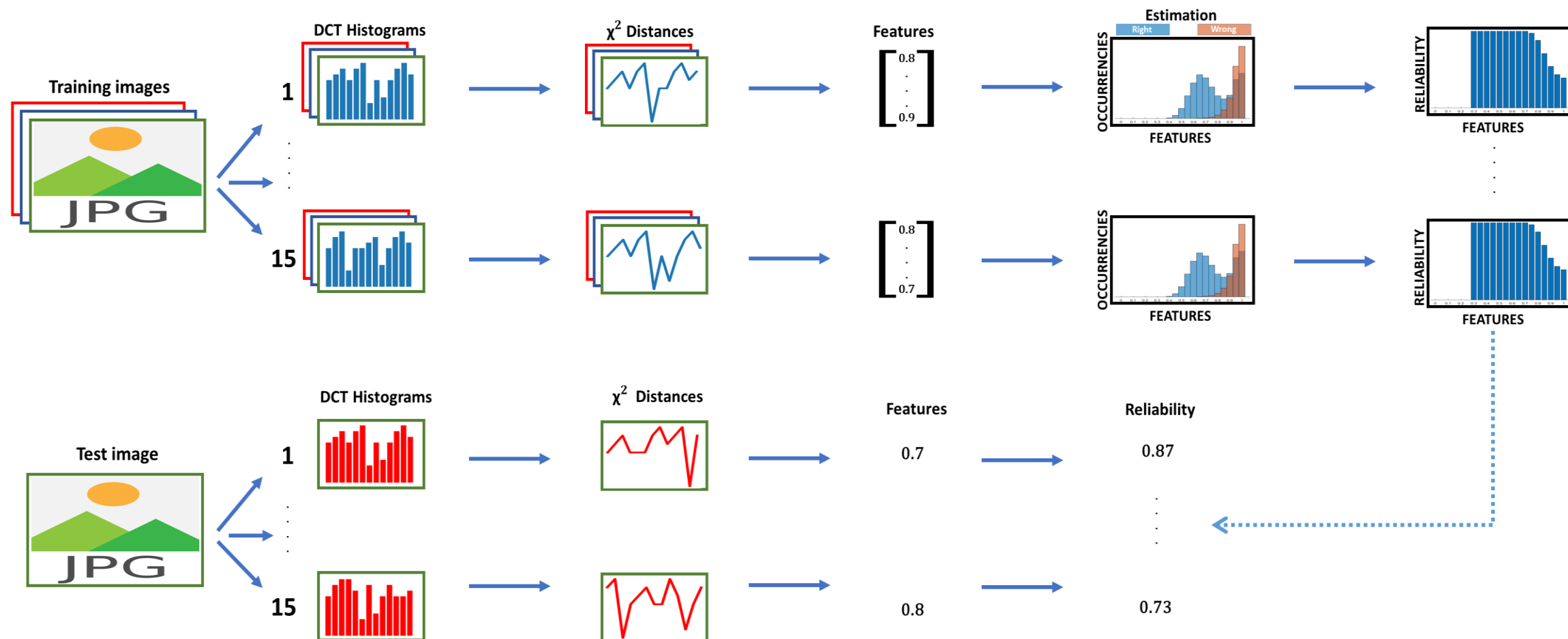
(b)



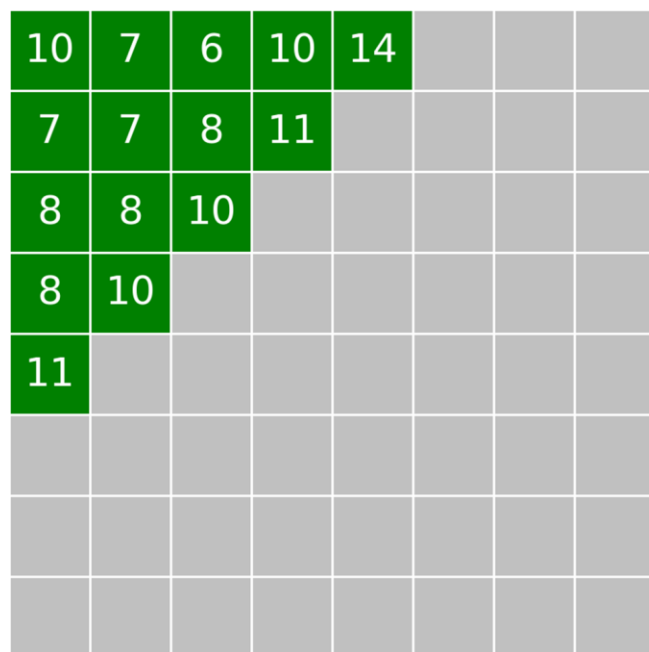
(c)

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

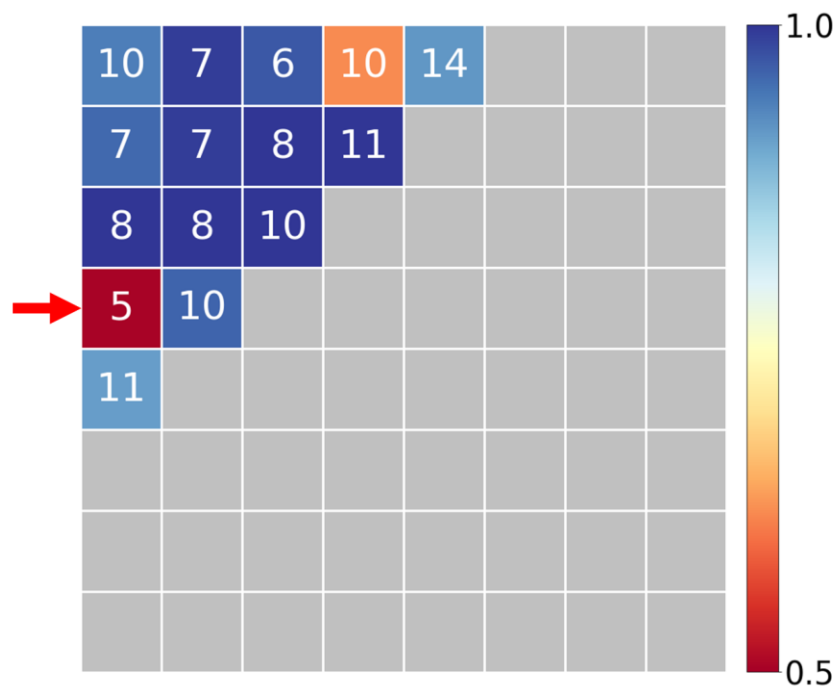
Reliability of the estimation



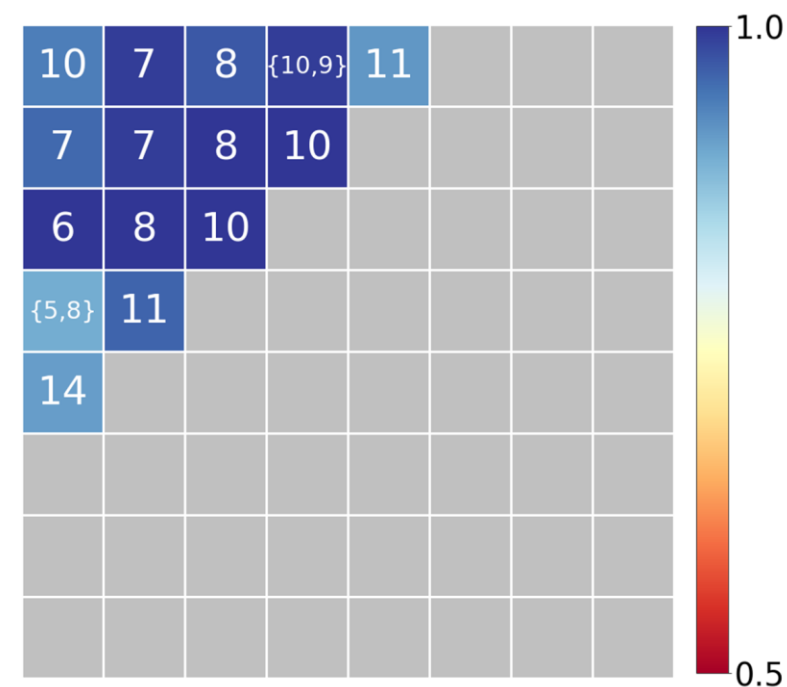
Reliability of the estimation



(a)



(b)



(c)

Future Work

- FQE in JPEG multiple compression
 - “Estimating Previous Quantization Factor on 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



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

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