

Blur Kernel Estimation using Normalized Color-Line Priors

Supplementary Material

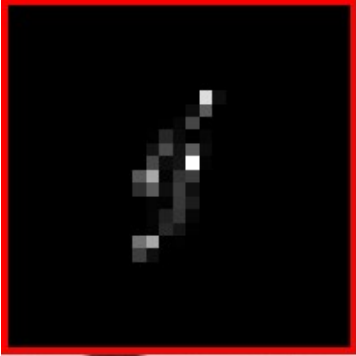
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Yung-Yu Chuang

CVPR 2015

Quantitative Experiment on Sun *et al.*'s synthetic dataset

- 80 images, 8 blur kernels, 1% Gaussian noise
- Zoran and Weiss's method is used as the final non-blind deconvolution method to restore latent images.
- We compare deblurred results using the ground truth kernel, estimated kernels from [Cho & Lee], [Xu & Jia], [Levin *et al.*], [Krishnan *et al.*], [Sun *et al.*], [Michaeli & Irani], and our method.

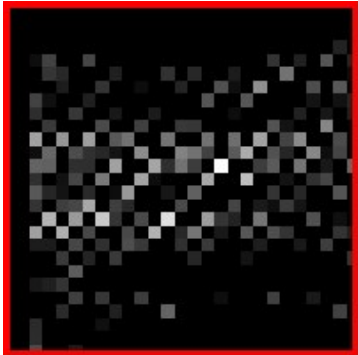
Blurred Input (1% noise) and the ground truth kernel



Error Ratio = 2.5242
PSNR = 30.7804
SSIM = 0.8979



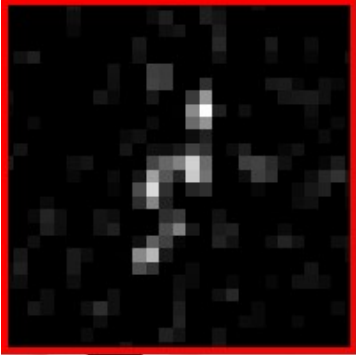
Cho & Lee (+ Zoran & Weiss)



Error Ratio = 39.3406
PSNR = 18.8533
SSIM = 0.4725



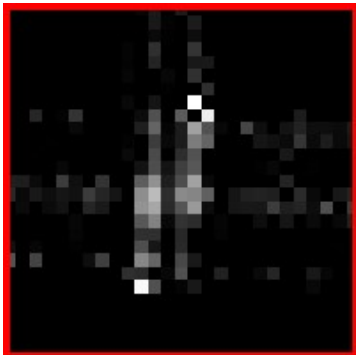
Xu & Jia (+ Zoran & Weiss)



Error Ratio = 14.3417
PSNR = 23.2357
SSIM = 0.7297



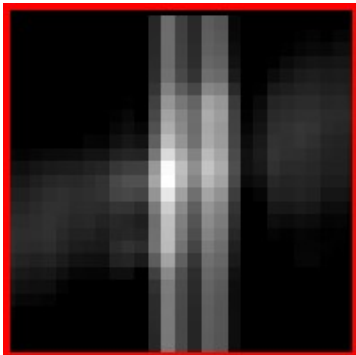
Levin *et al.* (+ Zoran & Weiss)



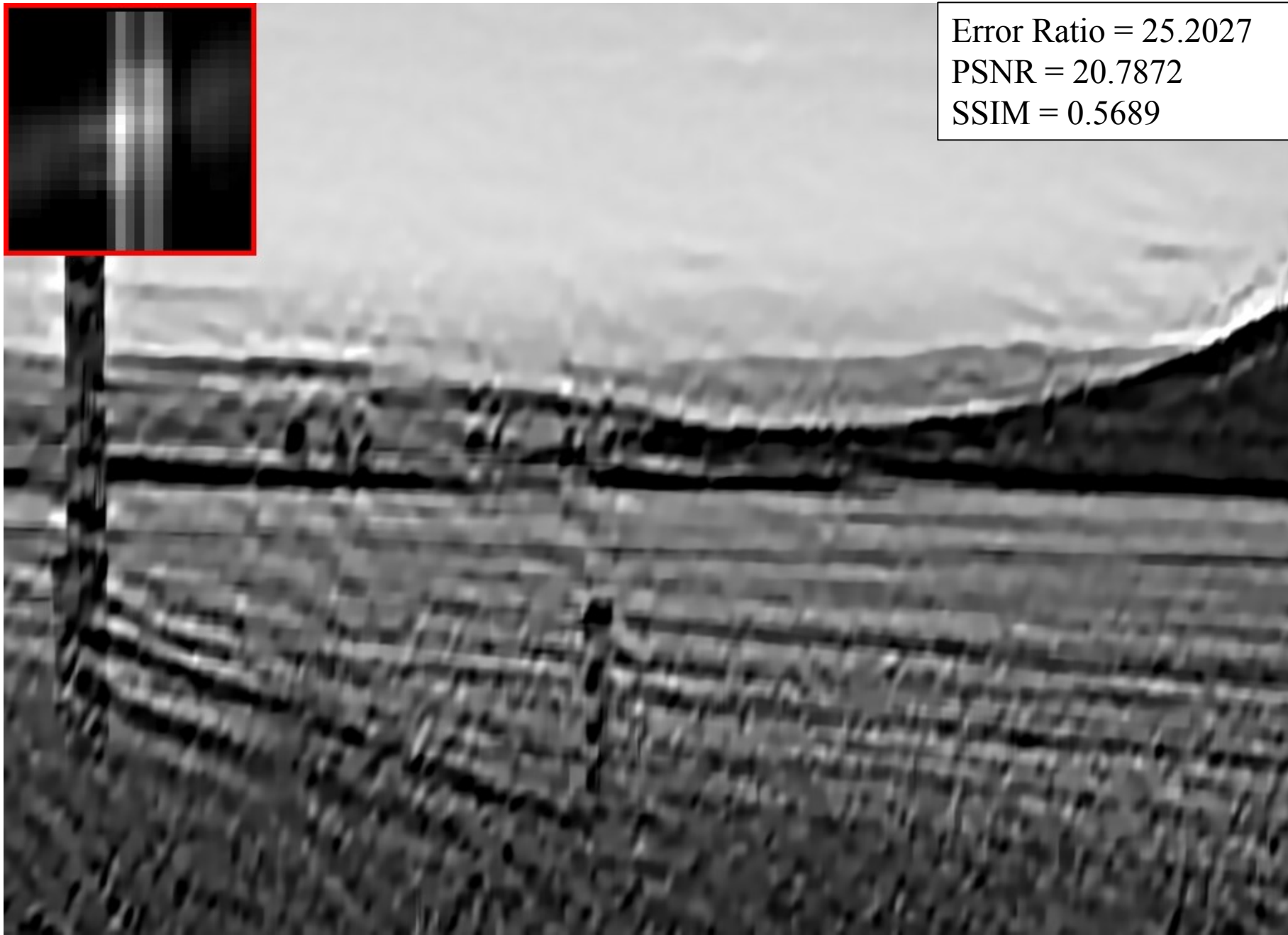
Error Ratio = 4.2065
PSNR = 28.5625
SSIM = 0.8581



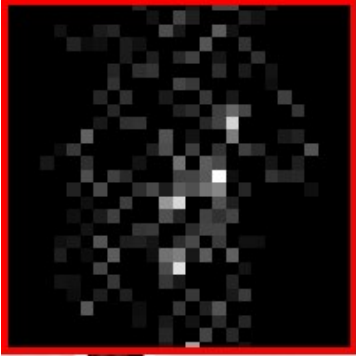
Krishnan *et al.* (+ Zoran & Weiss)



Error Ratio = 25.2027
PSNR = 20.7872
SSIM = 0.5689



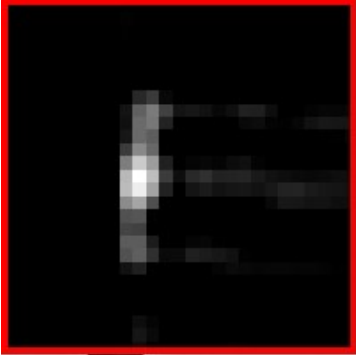
Sun *et al.* (+ Zoran & Weiss)



Error Ratio = 22.5350
PSNR = 21.2731
SSIM = 0.6150



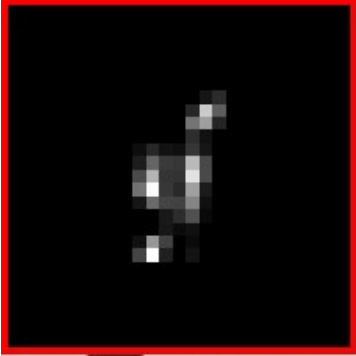
Michaeli & Irani (+ Zoran & Weiss)



Error Ratio = 2.6983
PSNR = 30.4908
SSIM = 0.9143



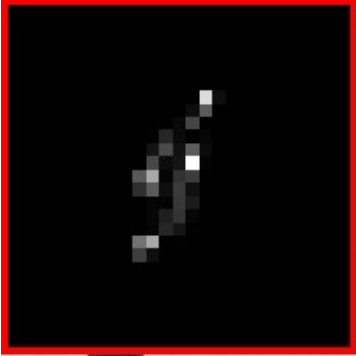
Our (+ Zoran & Weiss)



Error Ratio = 1.1302
PSNR = 34.2703
SSIM = 0.9516



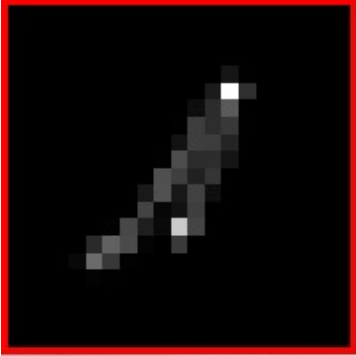
The ground truth kernel (+ Zoran & Weiss)



Error Ratio = 1.0000
PSNR = 34.7965
SSIM = 0.9253



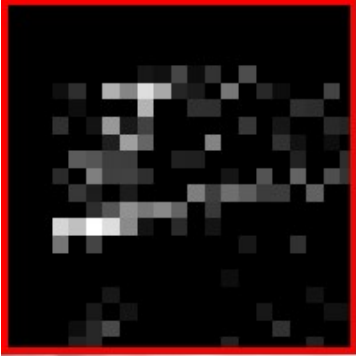
Blurred Input (1% noise) and the ground truth kernel



Error Ratio = 5.3914
PSNR = 30.5081
SSIM = 0.9199



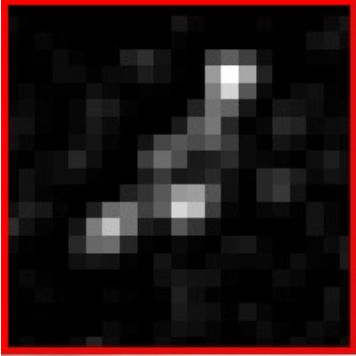
Cho & Lee (+ Zoran & Weiss)



Error Ratio = 37.8570
PSNR = 22.0437
SSIM = 0.7021



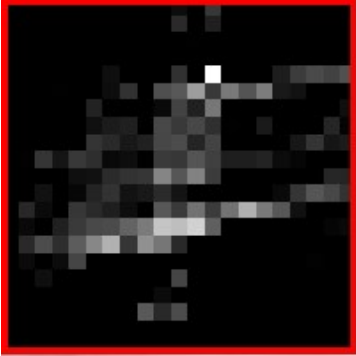
Xu & Jia (+ Zoran & Weiss)



Error Ratio = 34.9616
PSNR = 22.3893
SSIM = 0.7490



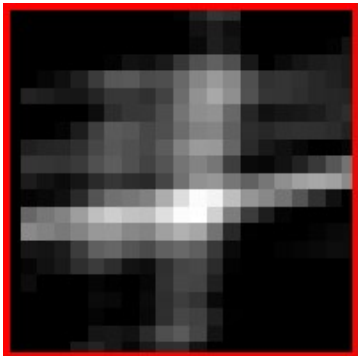
Levin *et al.* (+ Zoran & Weiss)



Error Ratio = 6.6032
PSNR = 29.6276
SSIM = 0.9032



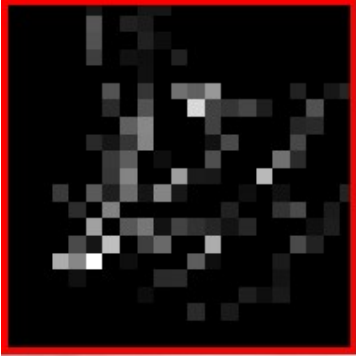
Krishnan *et al.* (+ Zoran & Weiss)



Error Ratio = 17.6013
PSNR = 25.3697
SSIM = 0.8091



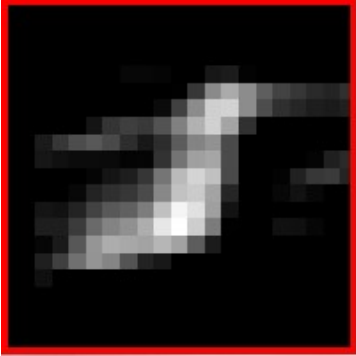
Sun *et al.* (+ Zoran & Weiss)



Error Ratio = 9.9046
PSNR = 27.8668
SSIM = 0.8946



Michaeli & Irani (+ Zoran & Weiss)



Error Ratio = 3.9415
PSNR = 31.8686
SSIM = 0.9519



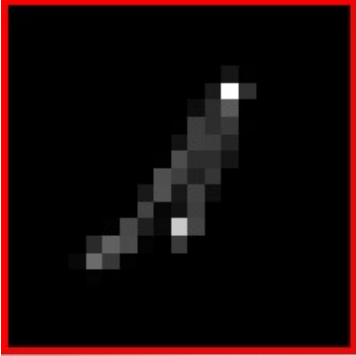
Our (+ Zoran & Weiss)



Error Ratio = 2.0401
PSNR = 34.7287
SSIM = 0.9677



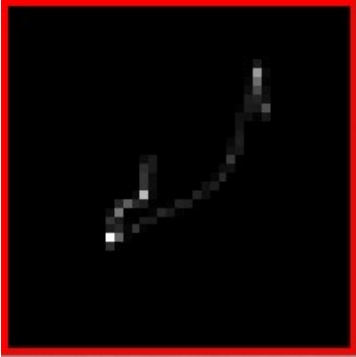
The ground truth kernel (+ Zoran & Weiss)



Error Ratio = 1.0000
PSNR = 37.8259
SSIM = 0.9532

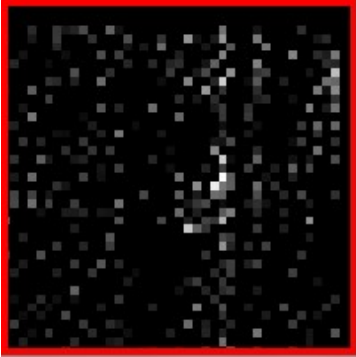


Blurred Input (1% noise) and the ground truth kernel



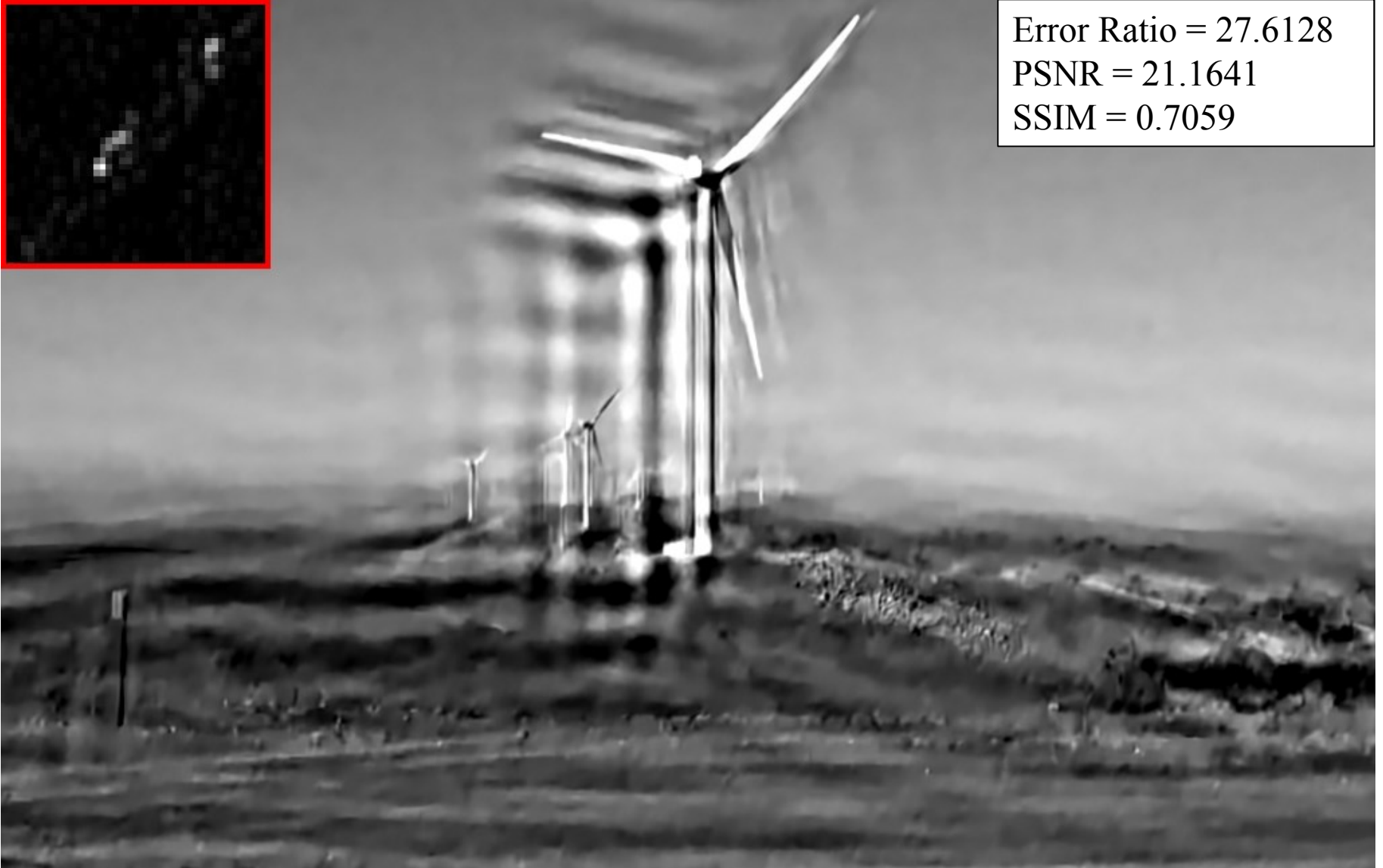
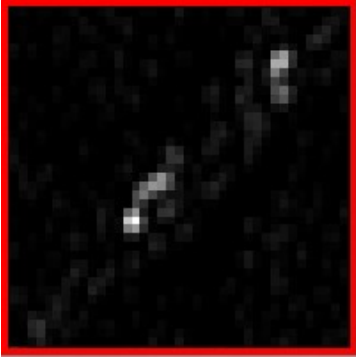
Error Ratio = 4.2506
PSNR = 29.2907
SSIM = 0.8376

Cho & Lee (+ Zoran & Weiss)



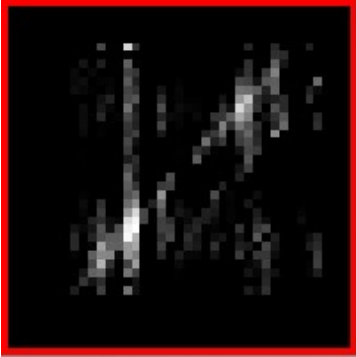
Error Ratio = 32.1649
PSNR = 20.5014
SSIM = 0.6774

Xu & Jia (+ Zoran & Weiss)



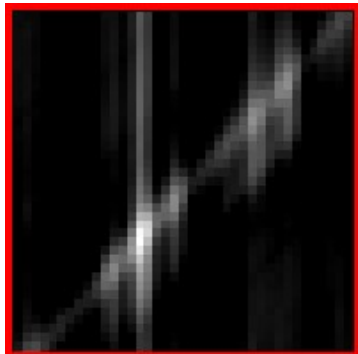
Error Ratio = 27.6128
PSNR = 21.1641
SSIM = 0.7059

Levin *et al.* (+ Zoran & Weiss)



Error Ratio = 4.6836
PSNR = 28.8694
SSIM = 0.8482

Krishnan *et al.* (+ Zoran & Weiss)

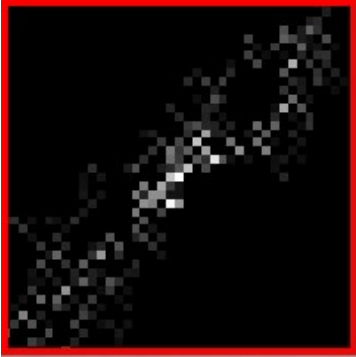


Error Ratio = 29.4693

PSNR = 20.8815

SSIM = 0.6466

Sun *et al.* (+ Zoran & Weiss)



Error Ratio = 18.5778

PSNR = 22.8852

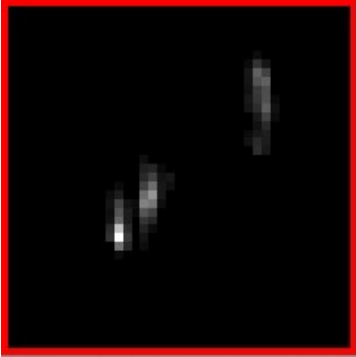
SSIM = 0.7467

Michaeli & Irani (+ Zoran & Weiss)



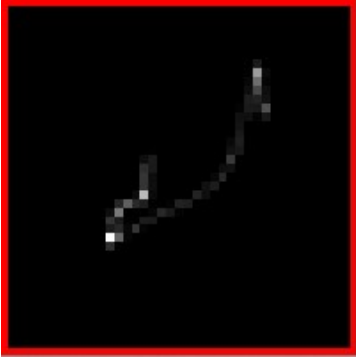
Error Ratio = 6.4726
PSNR = 27.4644
SSIM = 0.8499

Our (+ Zoran & Weiss)



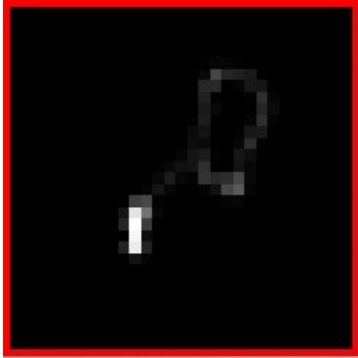
Error Ratio = 1.5447
PSNR = 33.6868
SSIM = 0.9182

The ground truth kernel (+ Zoran & Weiss)



Error Ratio = 1.0000
PSNR = 35.5818
SSIM = 0.9406

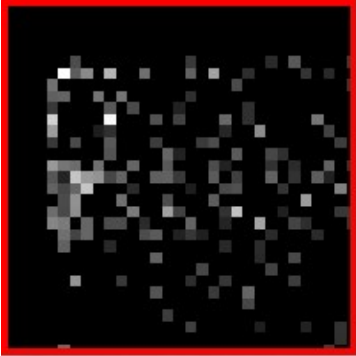
Blurred Input (1% noise) and the ground truth kernel



Error Ratio = 11.0195
PSNR = 27.0256
SSIM = 0.8700



Cho & Lee (+ Zoran & Weiss)

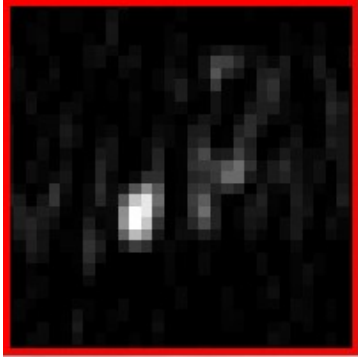


Error Ratio = 22.2858

PSNR = 23.9670

SSIM = 0.8534

Xu & Jia (+ Zoran & Weiss)

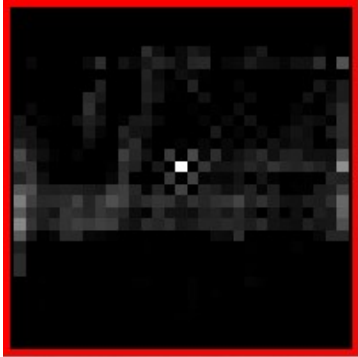


Error Ratio = 24.6973

PSNR = 23.5208

SSIM = 0.8457

Levin *et al.* (+ Zoran & Weiss)



Error Ratio = 23.2055
PSNR = 23.7914
SSIM = 0.7785



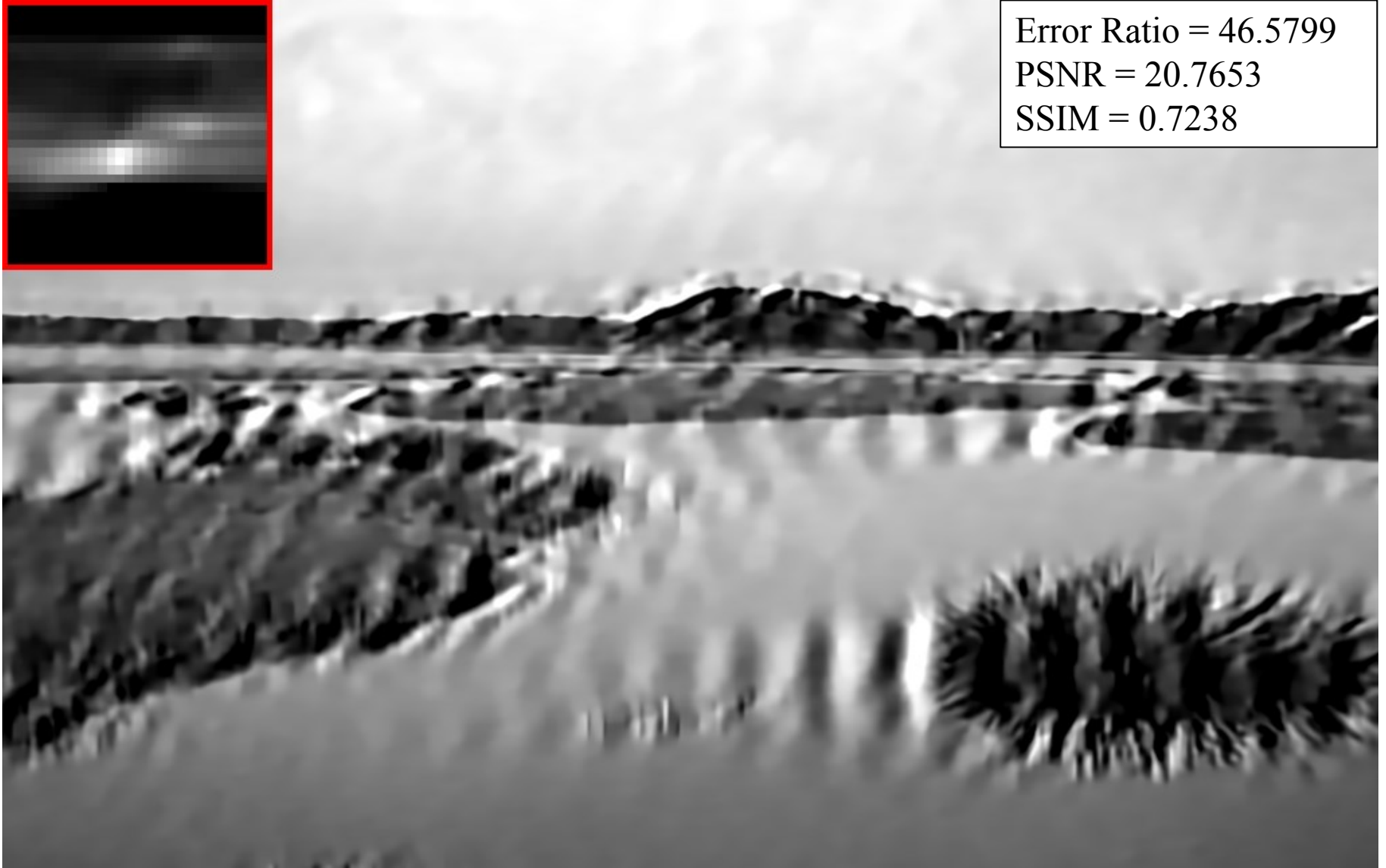
Krishnan *et al.* (+ Zoran & Weiss)



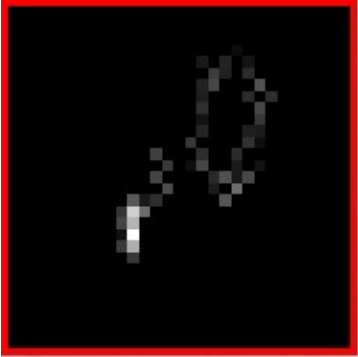
Error Ratio = 46.5799

PSNR = 20.7653

SSIM = 0.7238



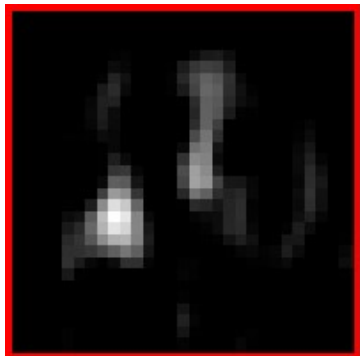
Sun *et al.* (+ Zoran & Weiss)



Error Ratio = 2.2536
PSNR = 33.9186
SSIM = 0.9629

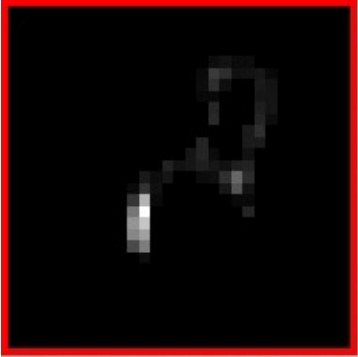


Michaeli & Irani (+ Zoran & Weiss)



Error Ratio = 6.2518
PSNR = 29.4872
SSIM = 0.9239

Our (+ Zoran & Weiss)



Error Ratio = 1.7062
PSNR = 35.1269
SSIM = 0.9650

The ground truth kernel (+ Zoran & Weiss)



Error Ratio = 1.0000
PSNR = 37.4404
SSIM = 0.9734



Comparison on Real-World Photos

- We compare deblurred results using Zoran & Weiss's non-blind deconvolution with the estimated kernels from [Cho & Lee], [Xu & Jia], [Krishnan *et al.*], [Levin *et al.*] [Sun *et al.*], [Michaeli & Irani], and our method.
- [Cho & Lee], [Xu & Jia], and [Michaeli & Irani] also estimate the latent images. For these methods, we show their deblurred images as well.

Blurred Input



Cho & Lee



Cho & Lee (+ Zoran & Weiss)



Xu & Jia



Xu & Jia (+ Zoran & Weiss)



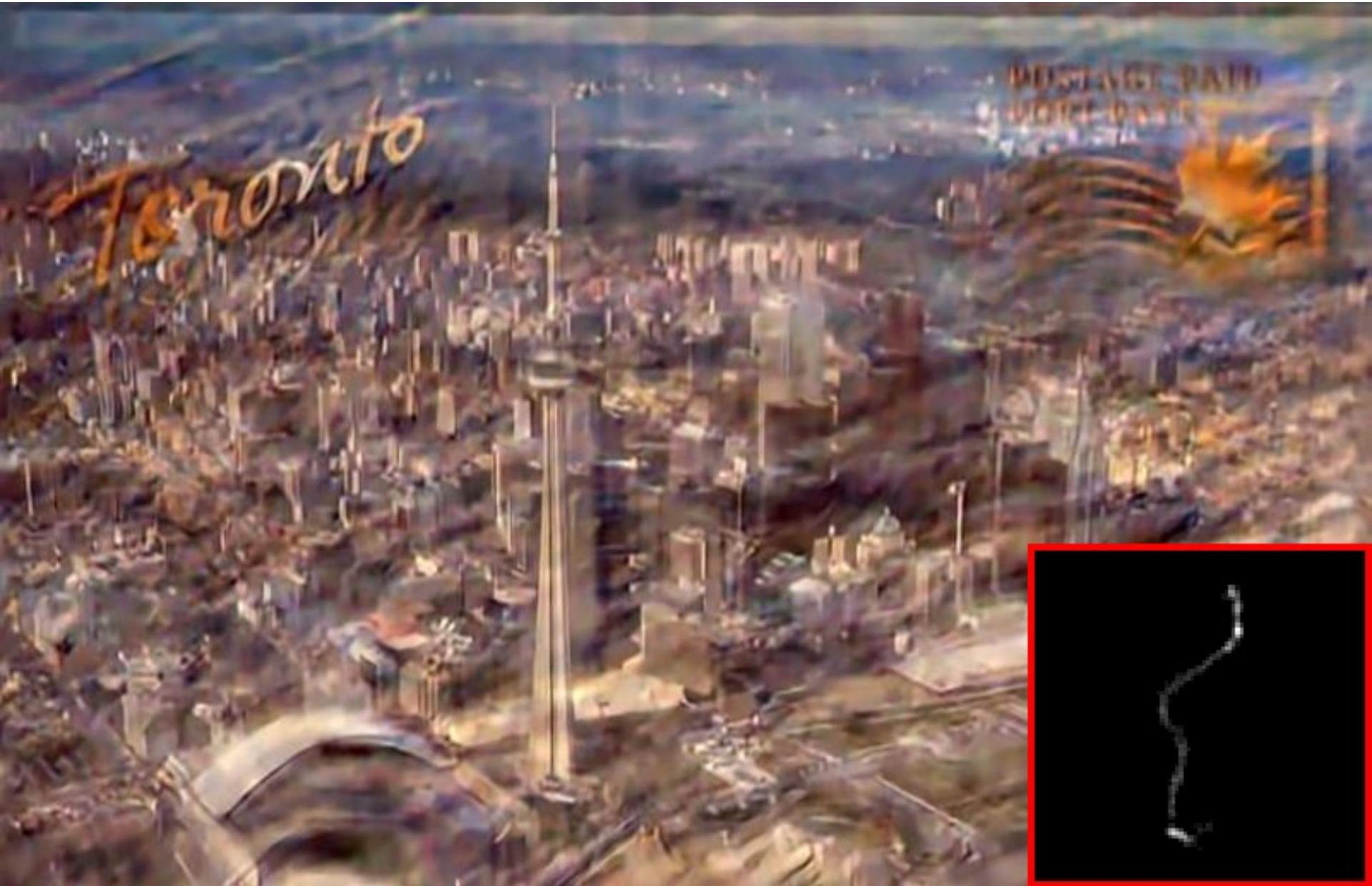
Krishnan *et al.* (+ Zoran & Weiss)



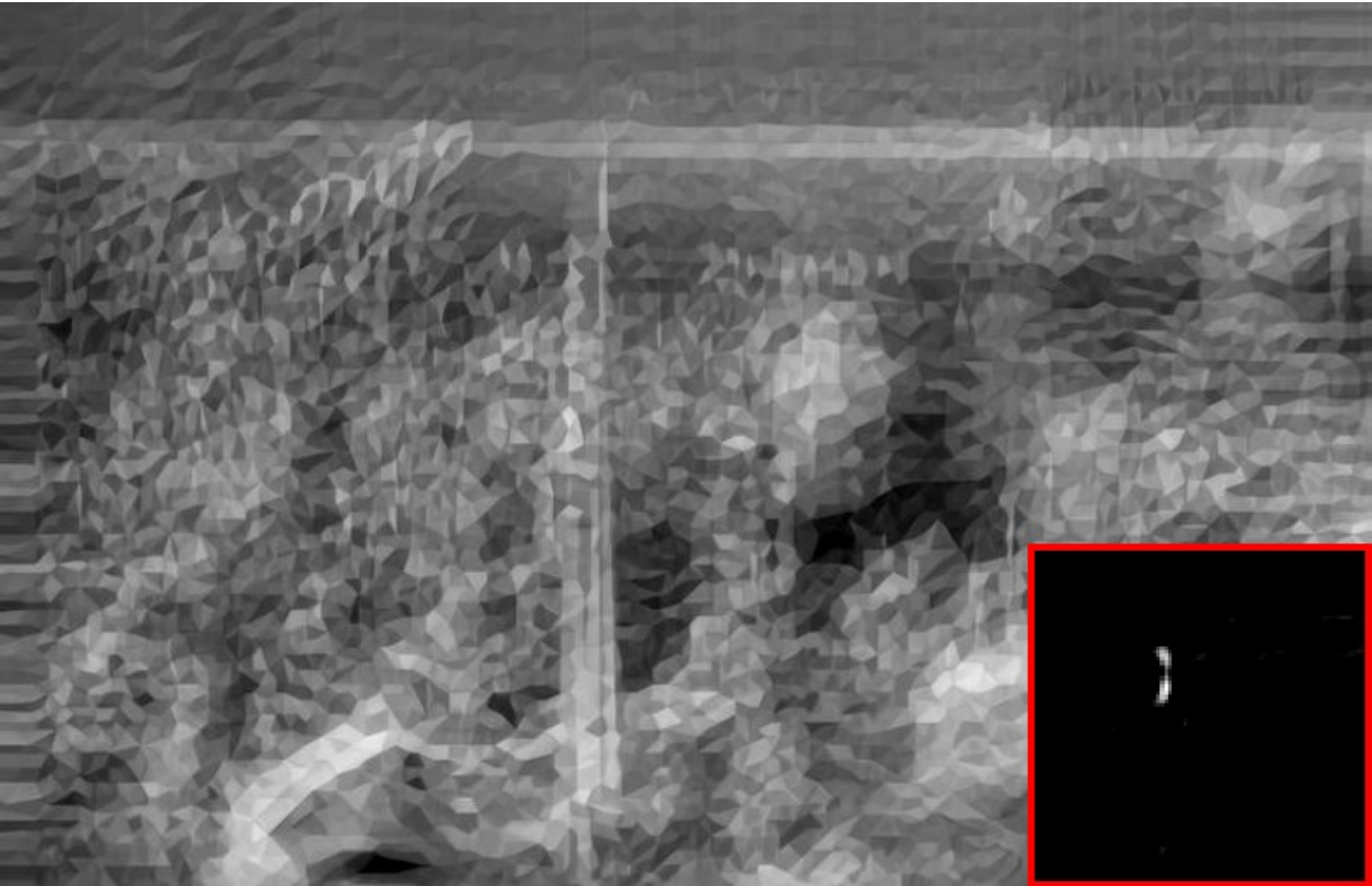
Levin *et al.* (+ Zoran & Weiss)



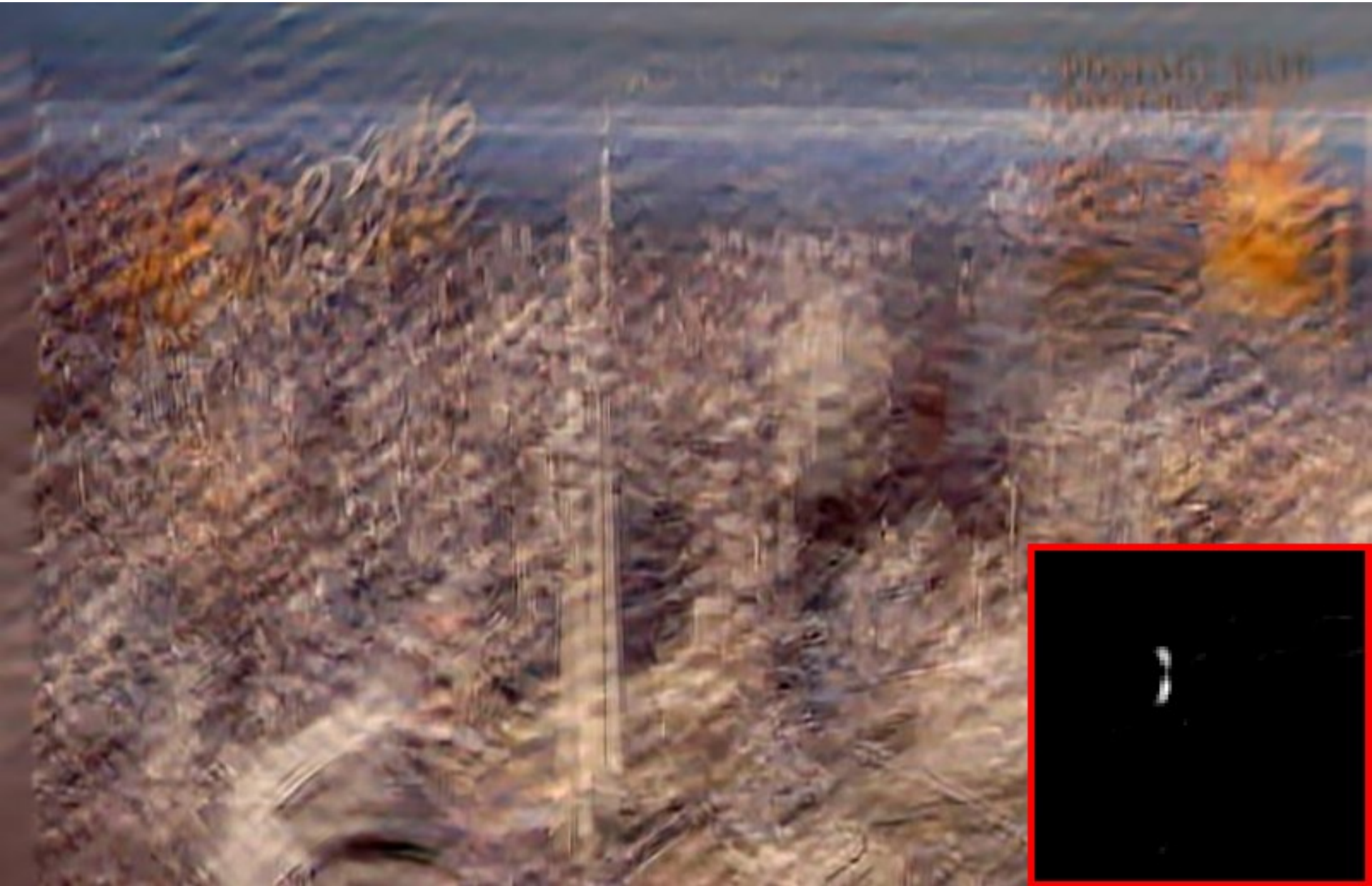
Sun *et al.* (+ Zoran & Weiss)



Michaeli & Irani



Michaeli & Irani (+ Zoran & Weiss)



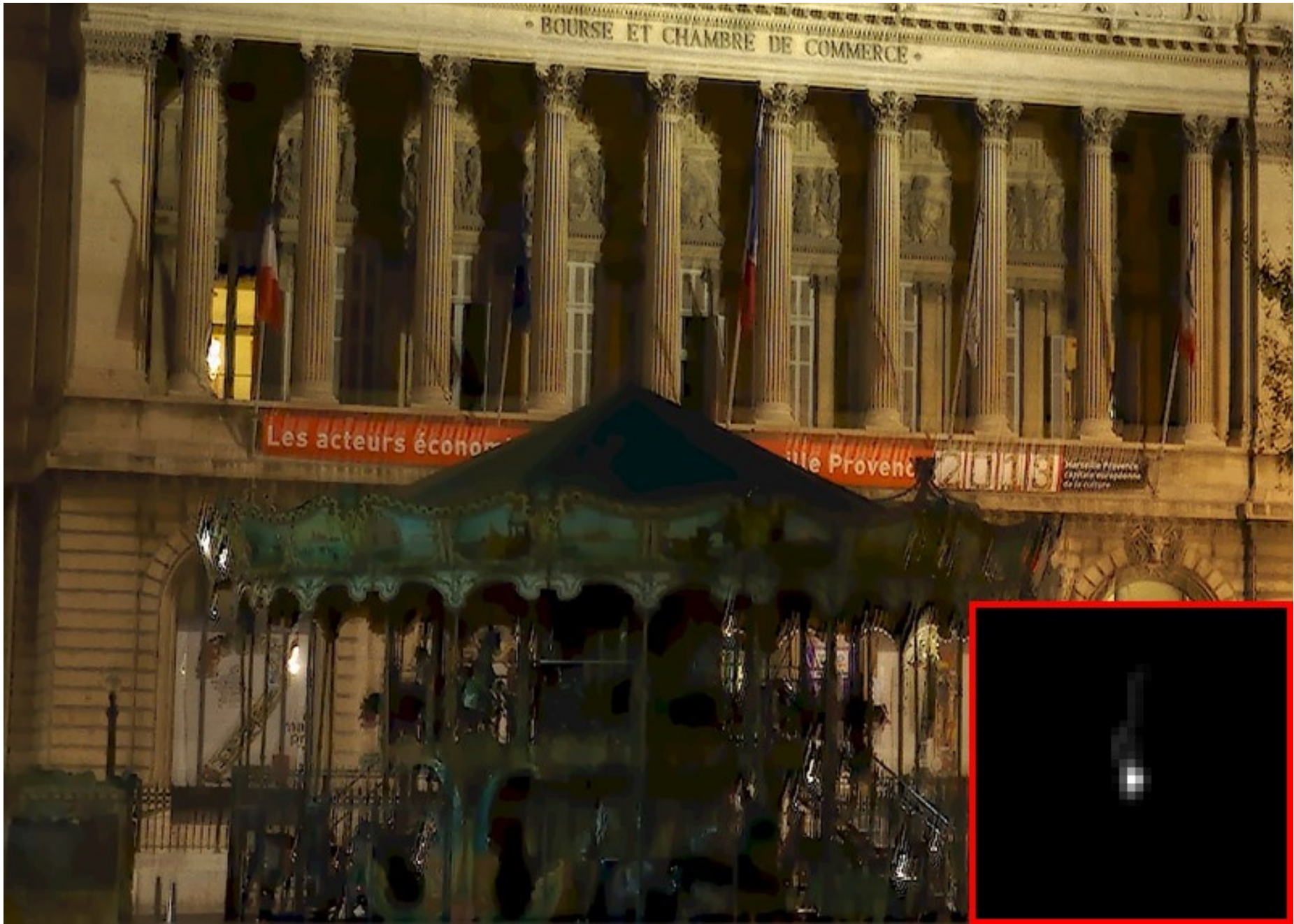
Our (+ Zoran & Weiss)



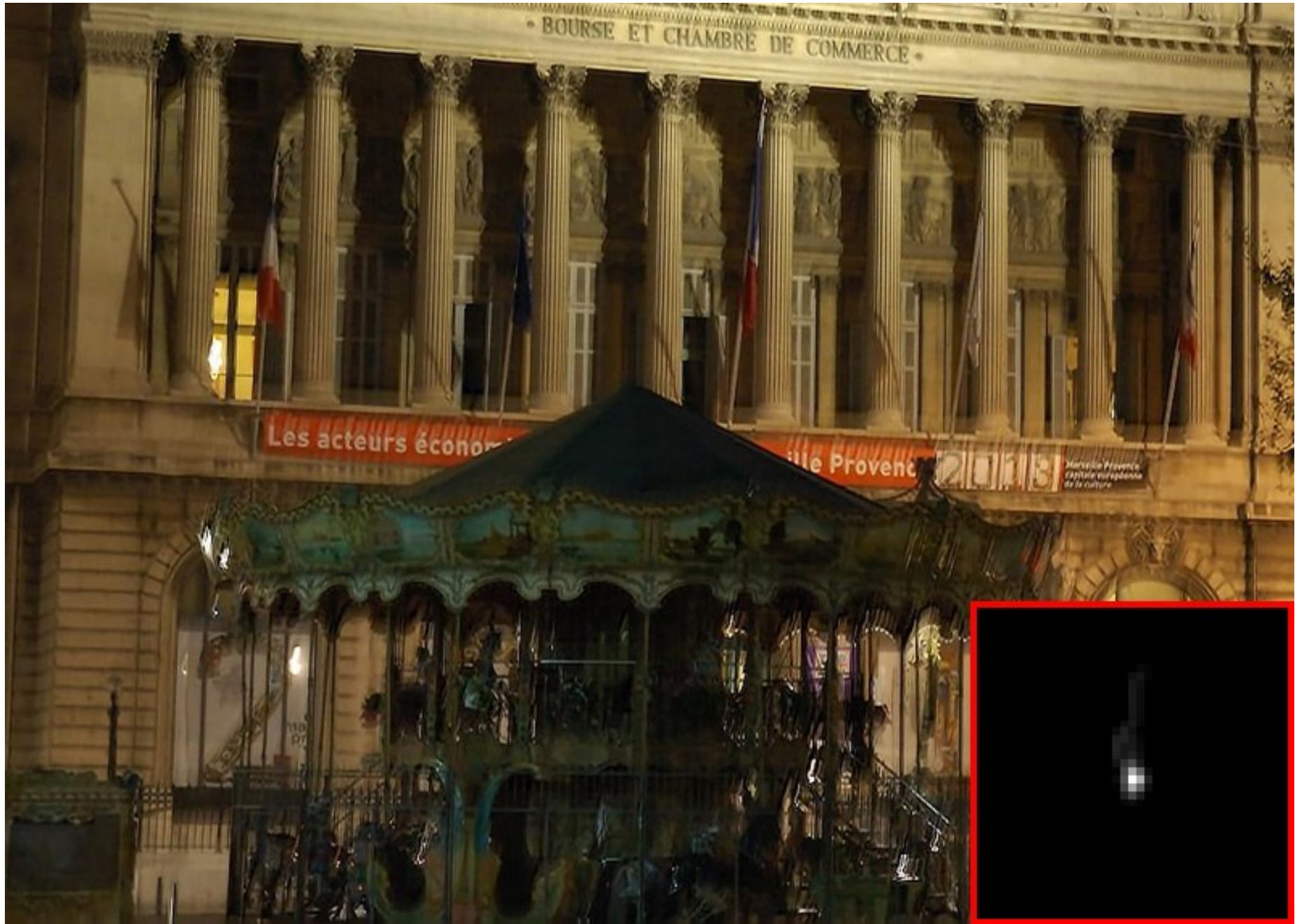
Blurred Input



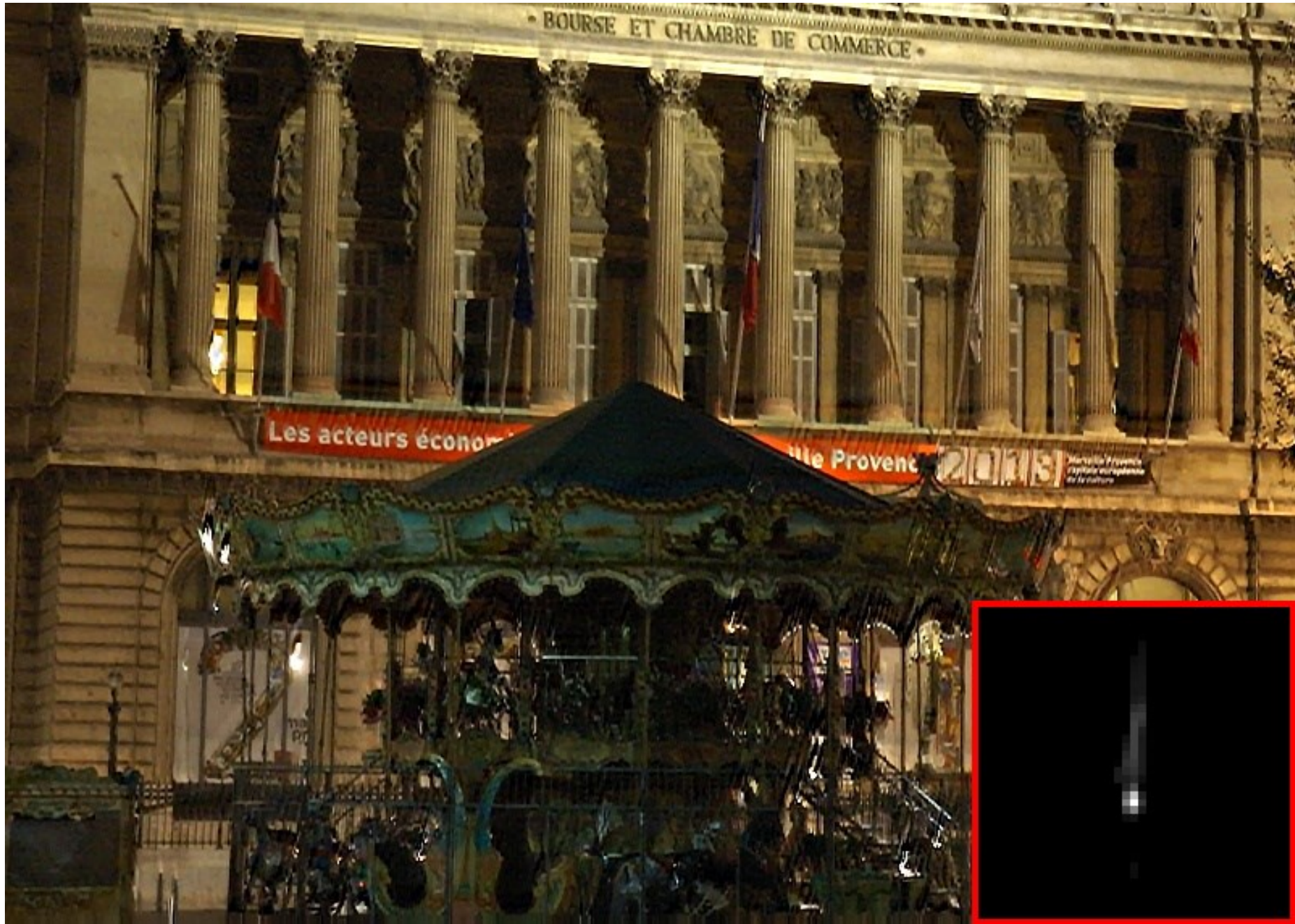
Cho & Lee



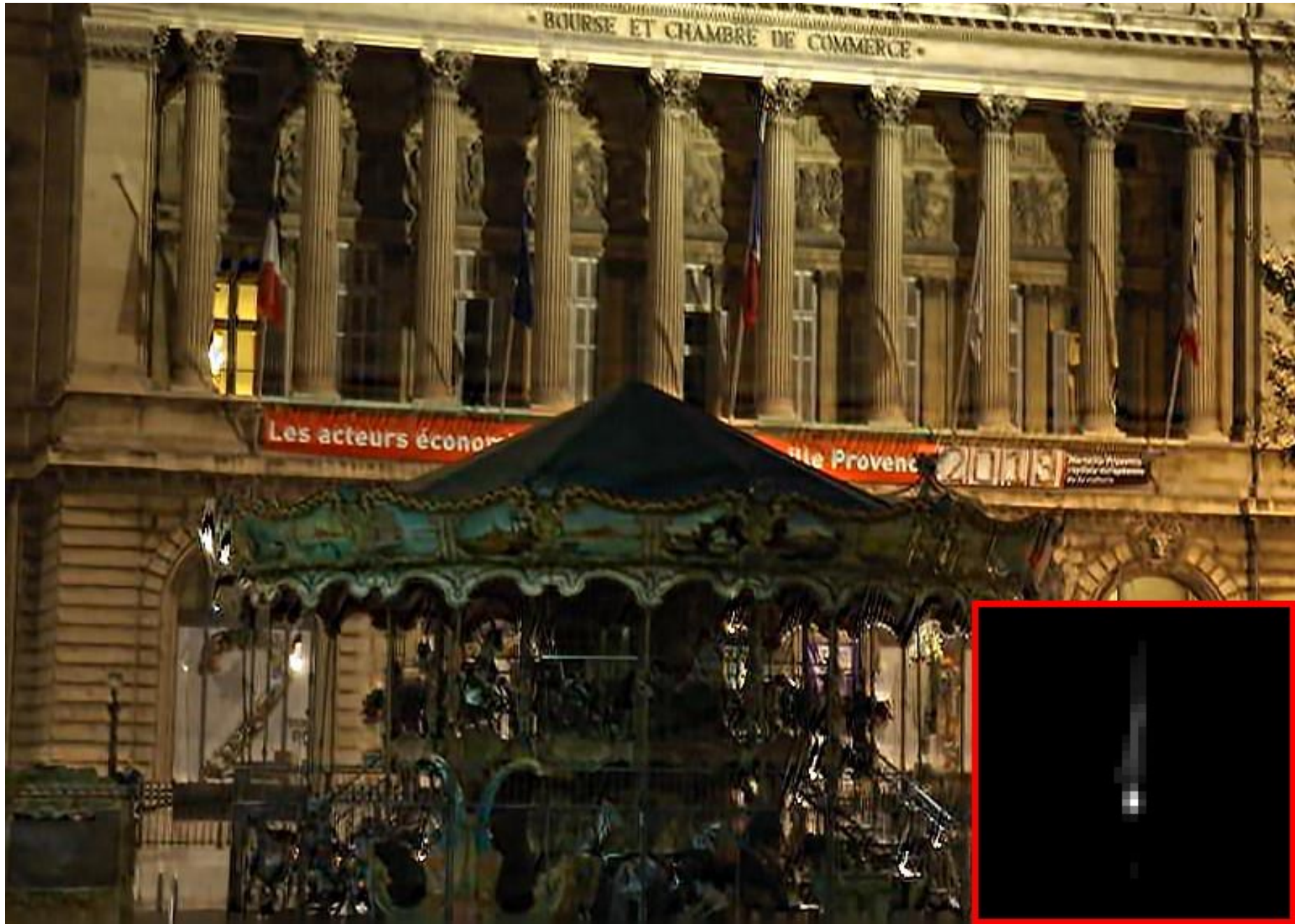
Cho & Lee (+ Zoran & Weiss)



Xu & Jia



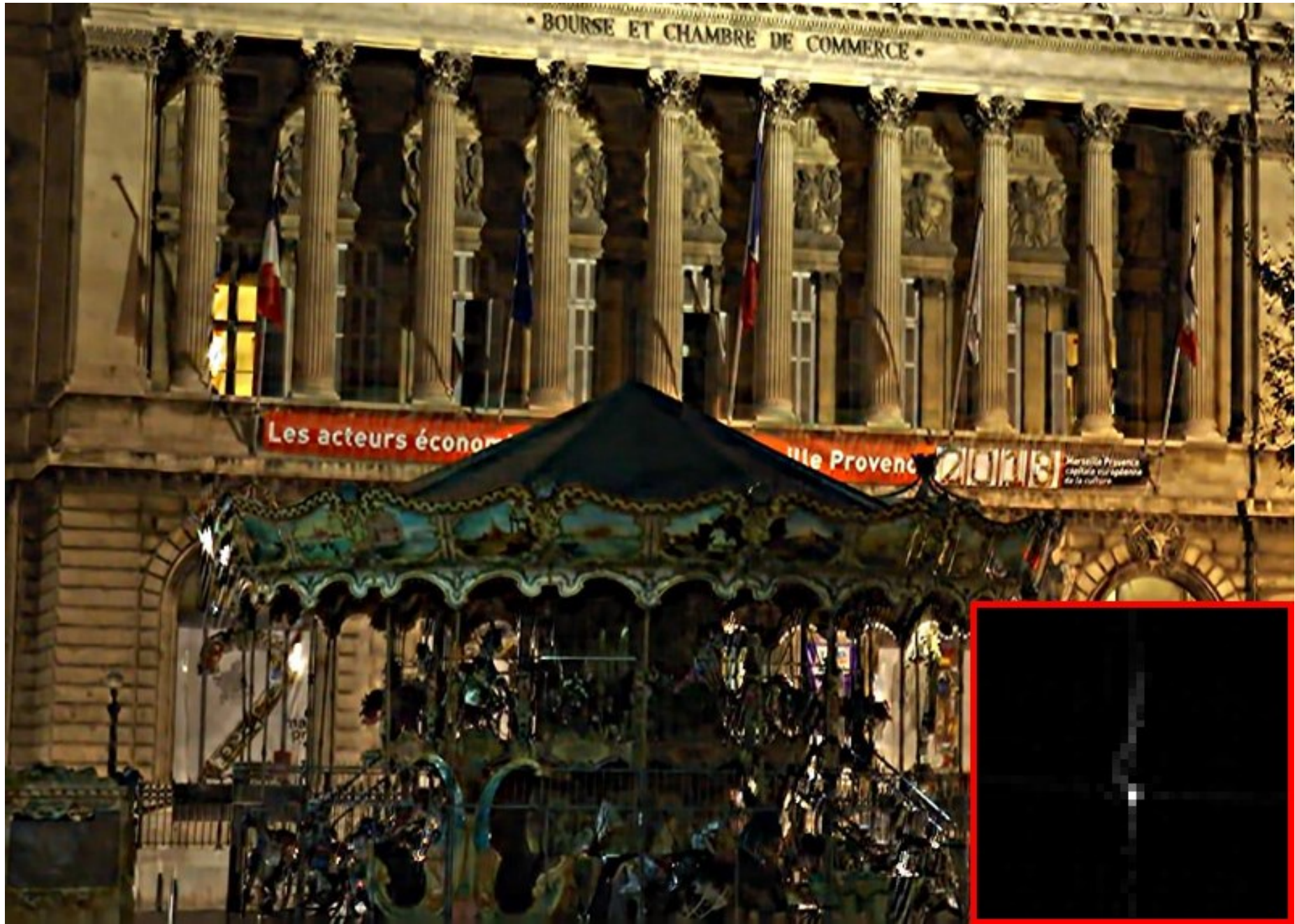
Xu & Jia (+ Zoran & Weiss)



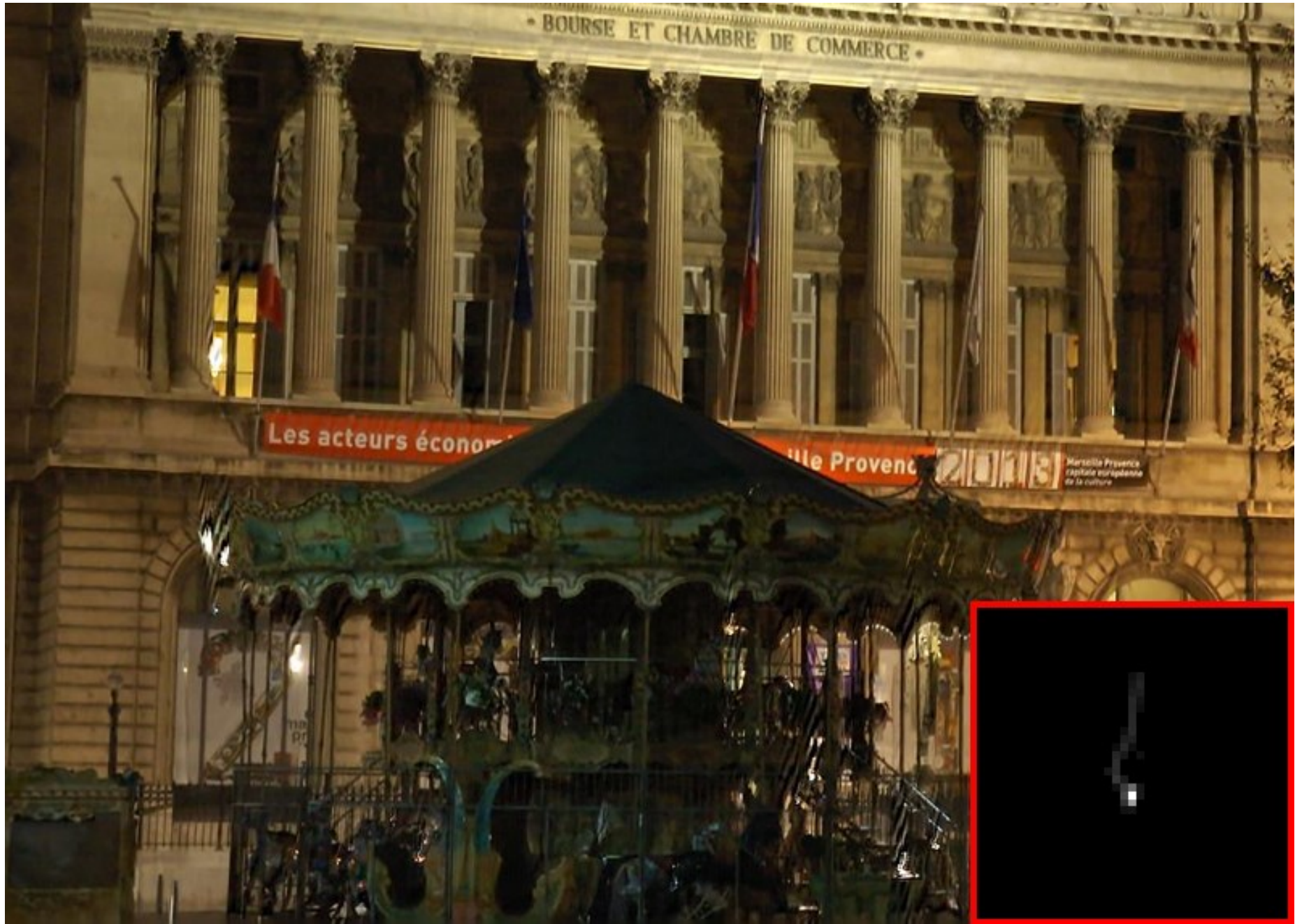
Krishnan *et al.* (+ Zoran & Weiss)



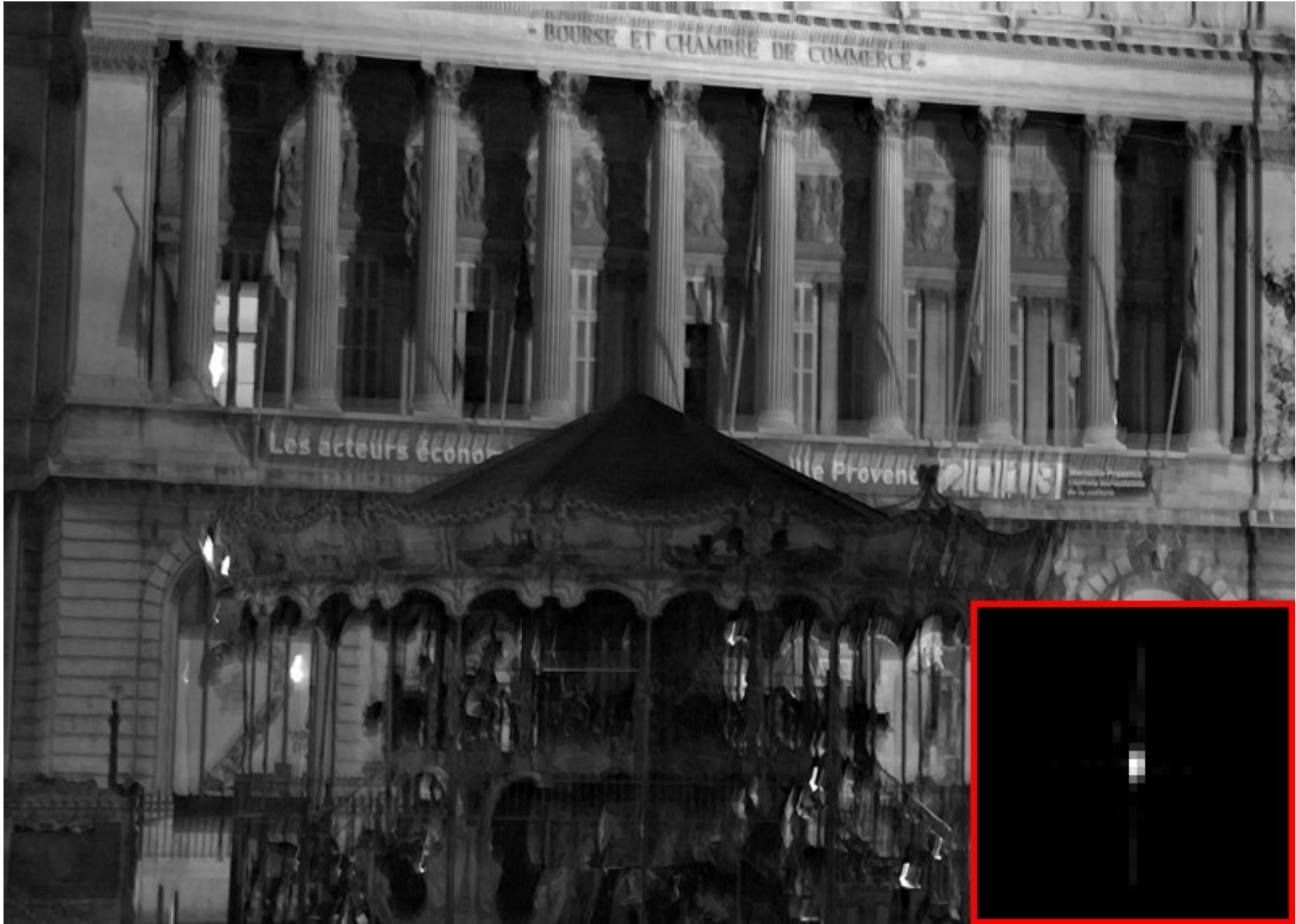
Levin *et al.* (+ Zoran & Weiss)



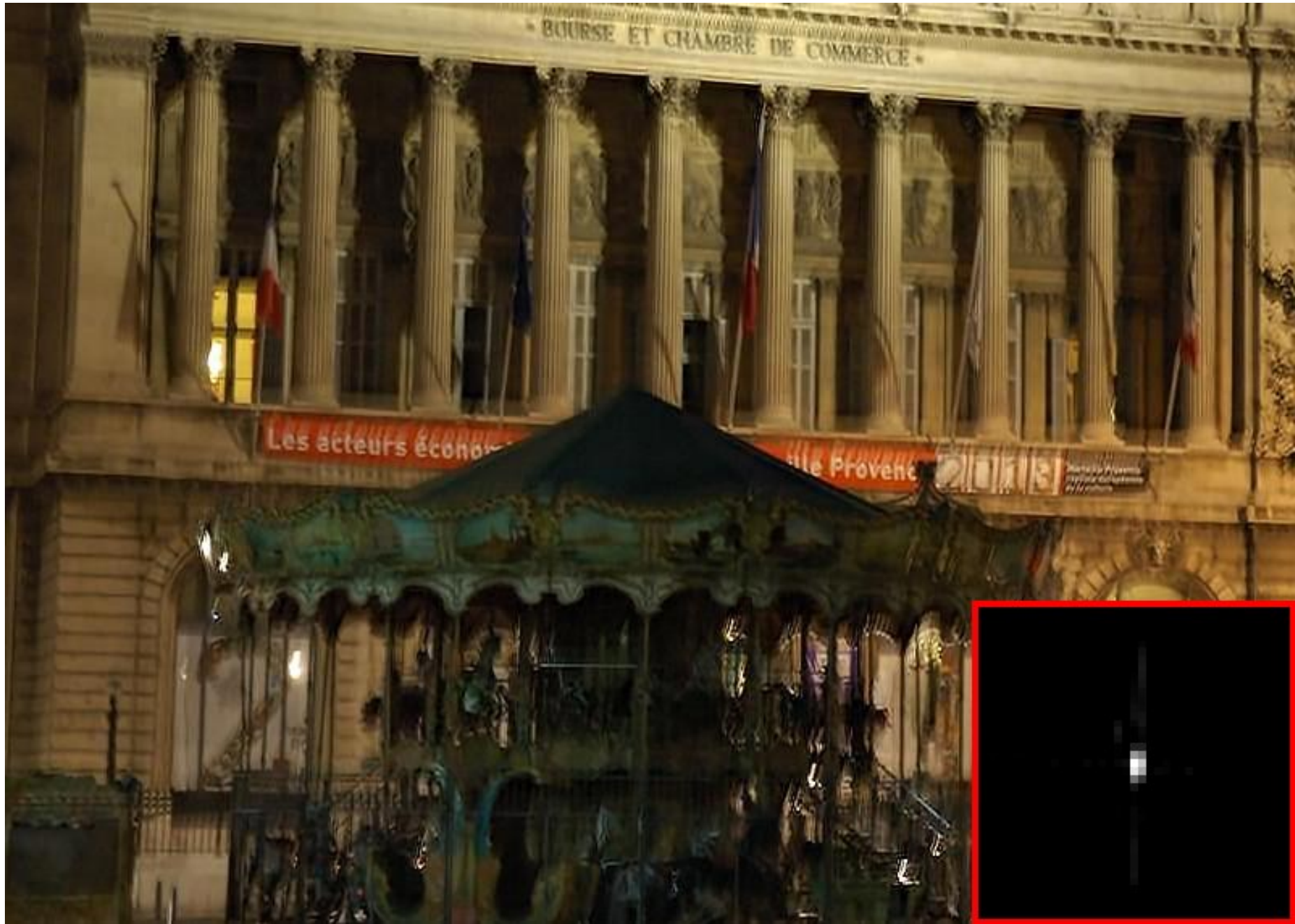
Sun *et al.* (+ Zoran & Weiss)



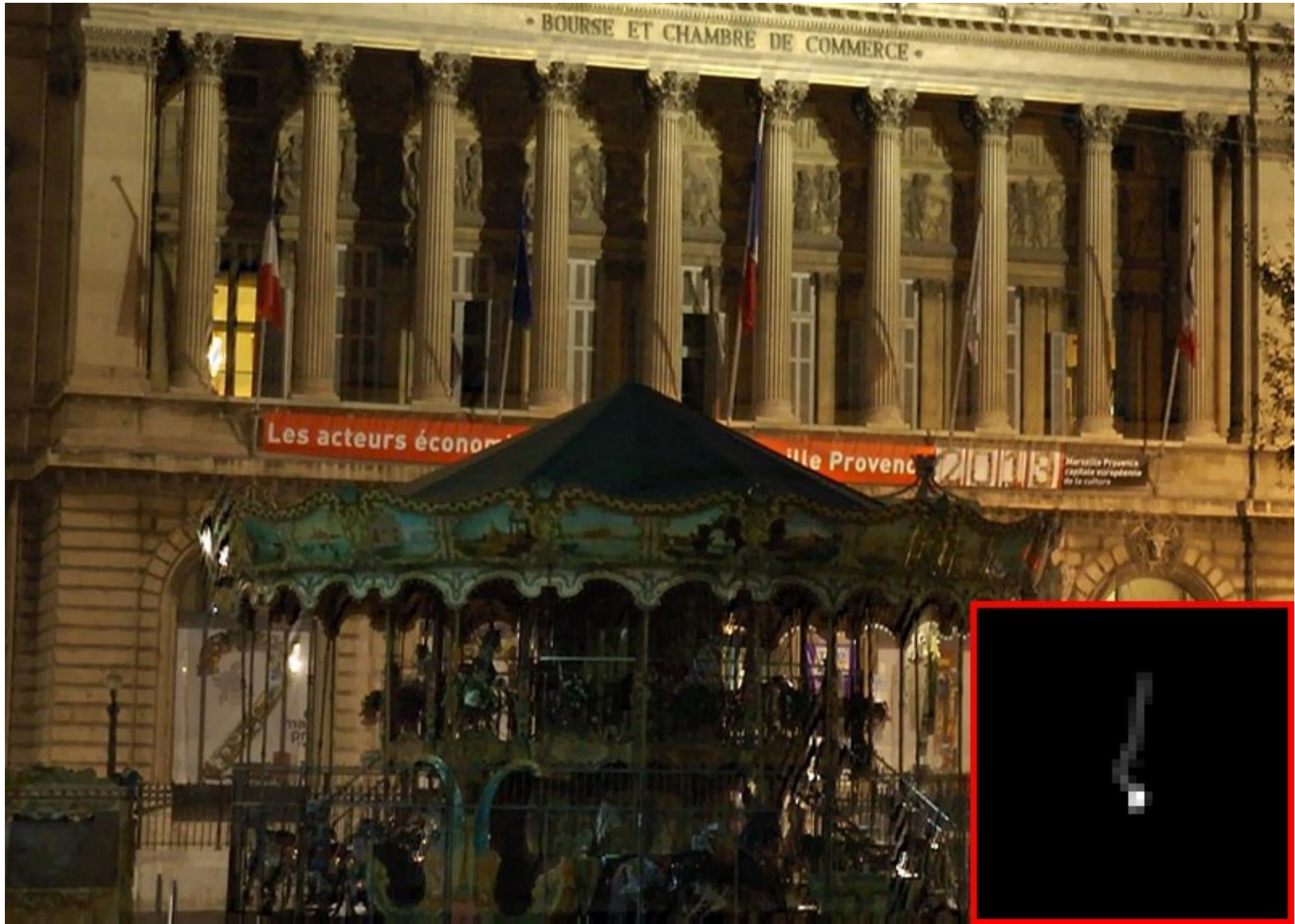
Michaeli & Irani



Michaeli & Irani (+ Zoran & Weiss)



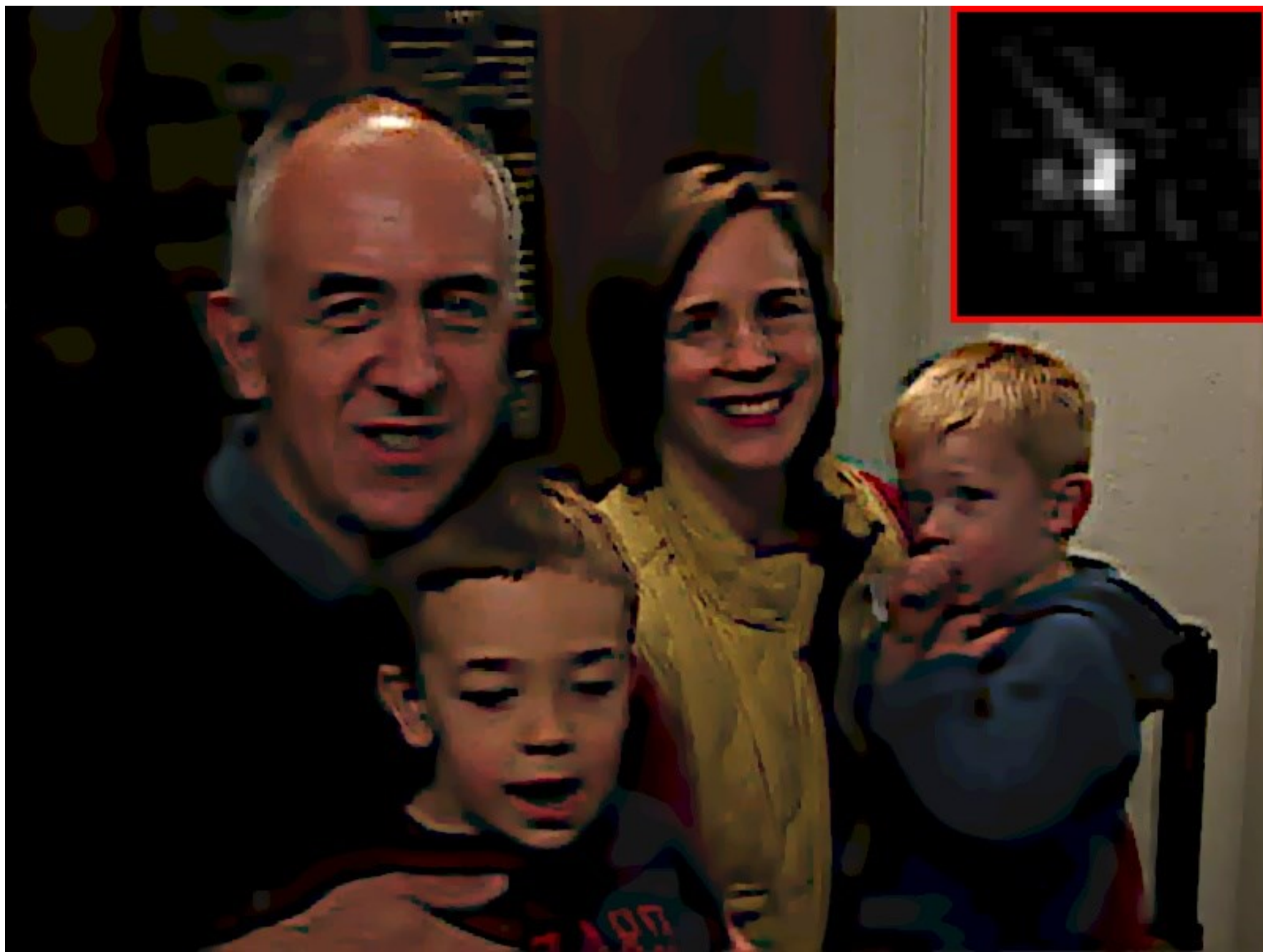
Our (+ Zoran & Weiss)



Blurred Input



Cho & Lee



Cho & Lee (+ Zoran & Weiss)



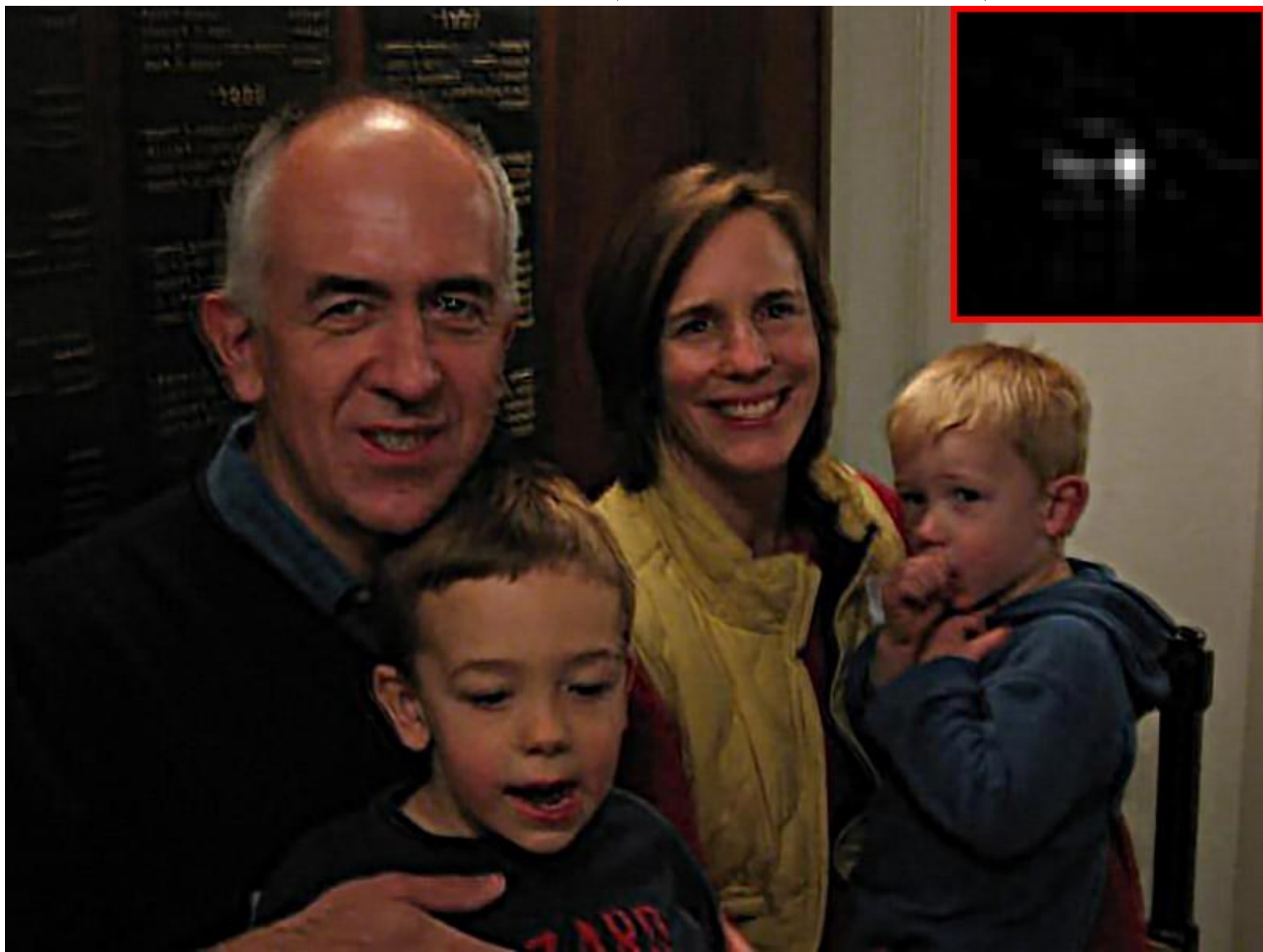
Xu & Jia



Xu & Jia (+ Zoran & Weiss)



Krishnan *et al.* (+ Zoran & Weiss)



Levin *et al.* (+ Zoran & Weiss)



Sun *et al.* (+ Zoran & Weiss)



Michaeli & Irani



Michaeli & Irani (+ Zoran & Weiss)



Our (+ Zoran & Weiss)



Blurred Input



Cho & Lee



Cho & Lee (+ Zoran & Weiss)



Xu & Jia



Xu & Jia (+ Zoran & Weiss)



Krishnan *et al.* (+ Zoran & Weiss)



Levin *et al.* (+ Zoran & Weiss)



Sun *et al.* (+ Zoran & Weiss)



Michaeli & Irani



Michaeli & Irani (+ Zoran & Weiss)



Our (+ Zoran & Weiss)



Blurred Input



Cho & Lee



Cho & Lee (+ Zoran & Weiss)



Xu & Jia



Xu & Jia (+ Zoran & Weiss)



Krishnan *et al.* (+ Zoran & Weiss)



Levin *et al.* (+ Zoran & Weiss)



Sun *et al.* (+ Zoran & Weiss)



Michaeli & Irani



Michaeli & Irani (+ Zoran & Weiss)



Our (+ Zoran & Weiss)

