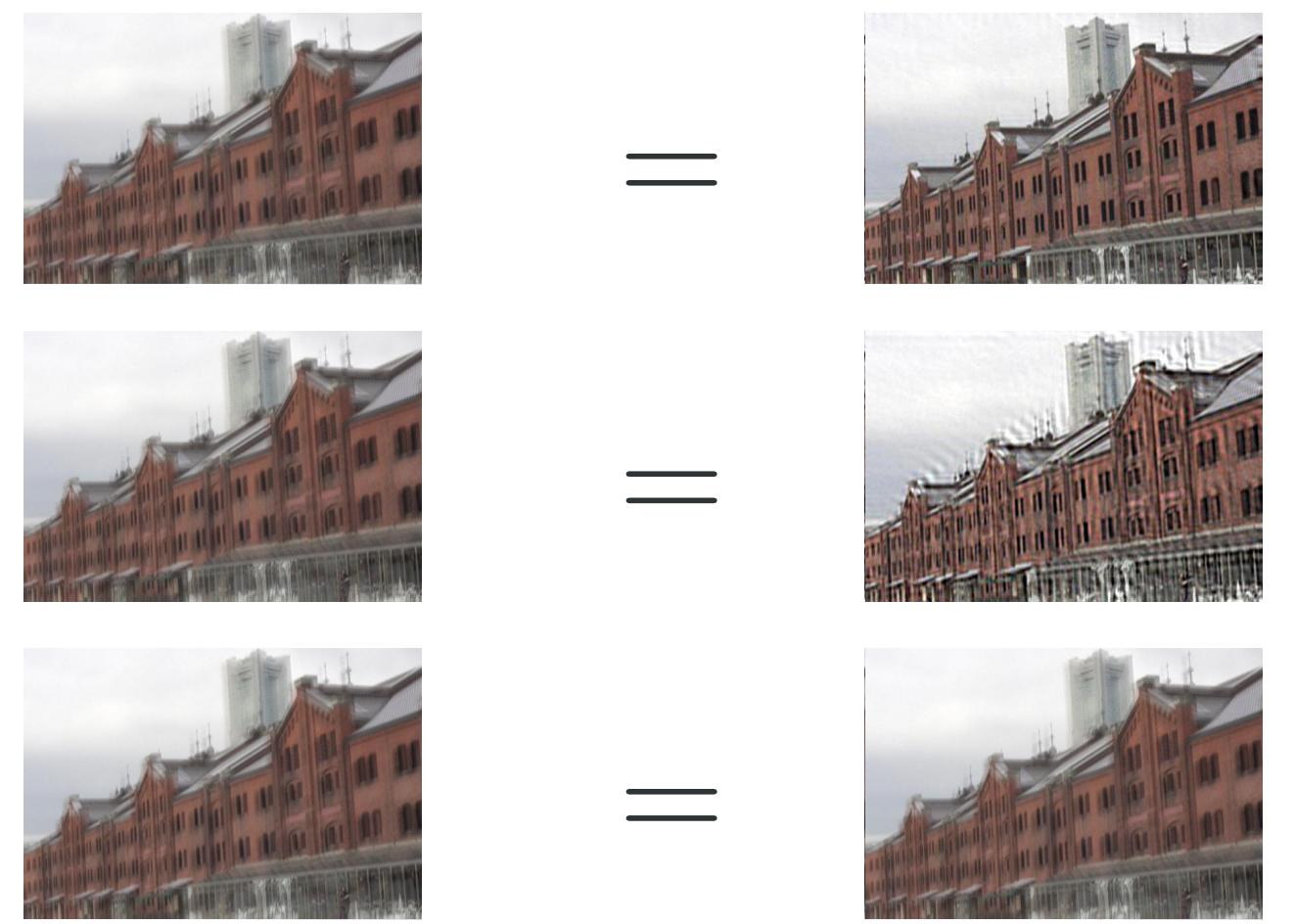


## Ill-posed problem

- Single-image, shift-invariant motion deblurring.

$$B = I \otimes K + N$$


## Workflow



Light streak image patch given by user.

Blur kernel extraction from light streak.

Image deblurring.

## Light streaks

- Smeared illumination from distant point lights, which are often close to the blur kernel.



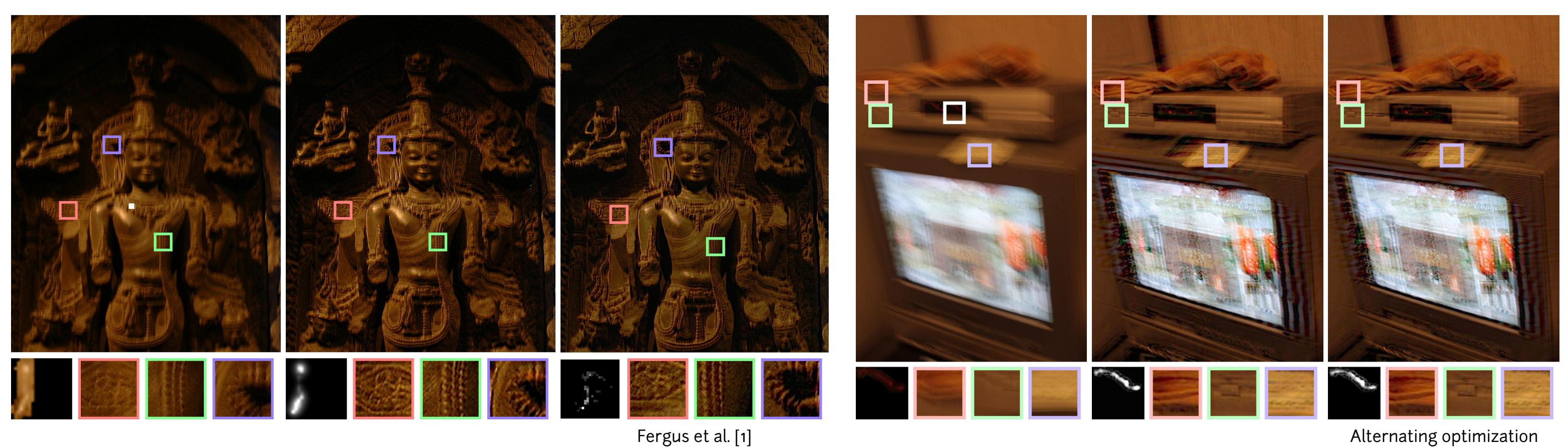
## Kernel extraction

- Find a sparse kernel that is close to the light streak:

$$\min_K \|\Delta K - \Delta P\|^2 + \lambda \|K\|_1$$

- Optimize using interior-point method or Bregman iteration.

## Examples



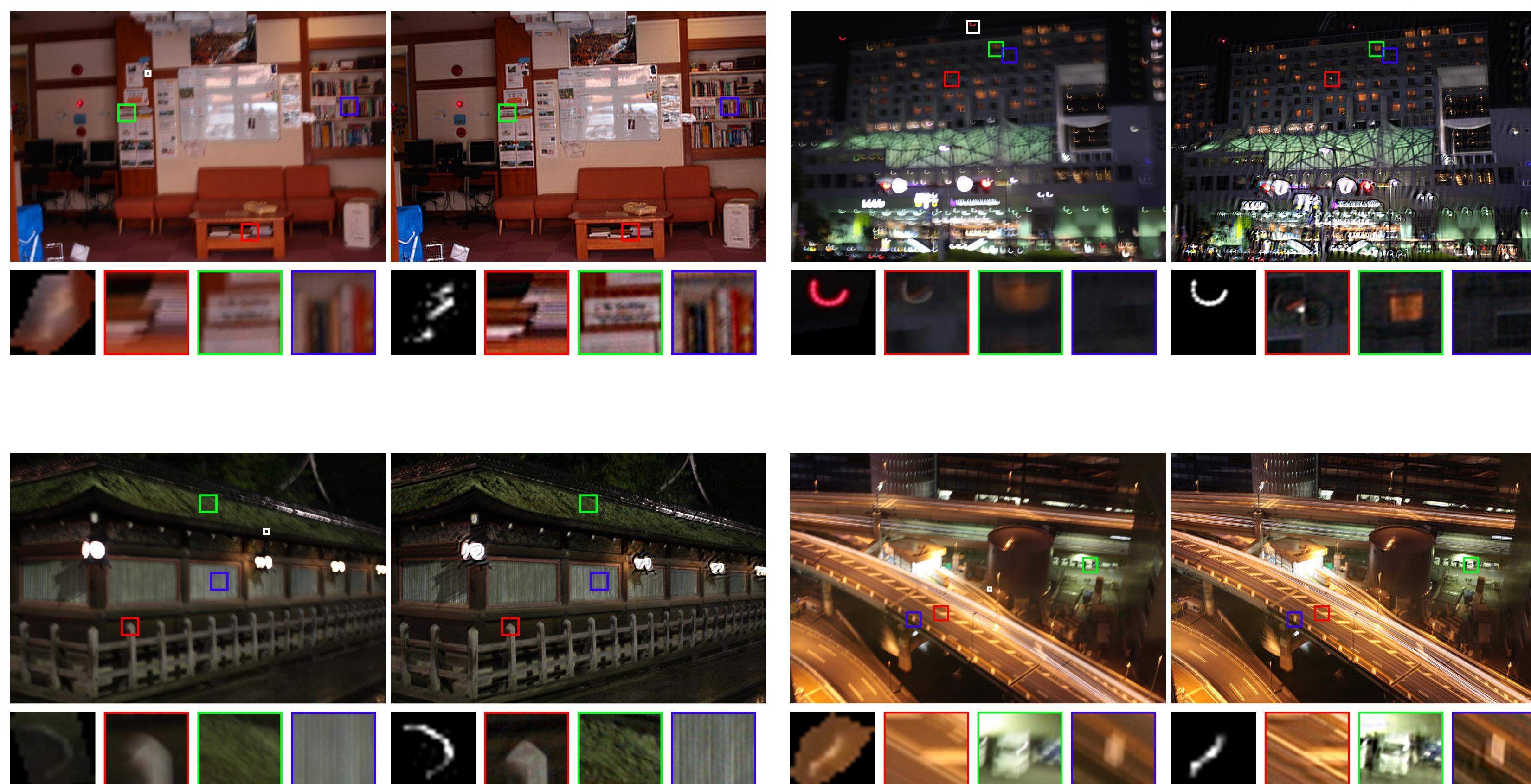
## Image deblurring

- Compute the FFT closed-form solution of the following minimization problem:

$$\min_I \sum_i \|\partial_i I \otimes K - \partial_i B\|^2 + \lambda \|\partial_i I\|^2$$

- Alternating optimization can be applied to refine the kernel and the latent sharp image.

$$\min_K \|I \otimes K - B\|^2 + \lambda \|K\|_1$$



## Performance

Figure	Image	Kernel	Time (sec.)		
			A	B	Total
1. chek-jawa	1600 × 1067	31 × 31	11.58	21.98	33.56
2. frame2	1024 × 683	33 × 33	1.75	10.89	12.64
3. lyndsey2	1024 × 1280	21 × 21	5.90	22.03	27.93
4. tv	683 × 1024	67 × 67	12.20	10.55	22.75
5. bus	1024 × 683	27 × 27	1.98	10.83	12.81
		35 × 35	2.76	11.26	14.02

Table 1: A: kernel extraction time. B: latent image estimation time.

## Spatially-varying blur

- Apply to reveal details in different parts of the scene when the image is spatially-varying blurred.

