

# From local to global: Edge profiles to camera motion in blurred images Subeesh Vasu and A.N. Rajagopalan, Indian Institute of Technology Madras, INDIA

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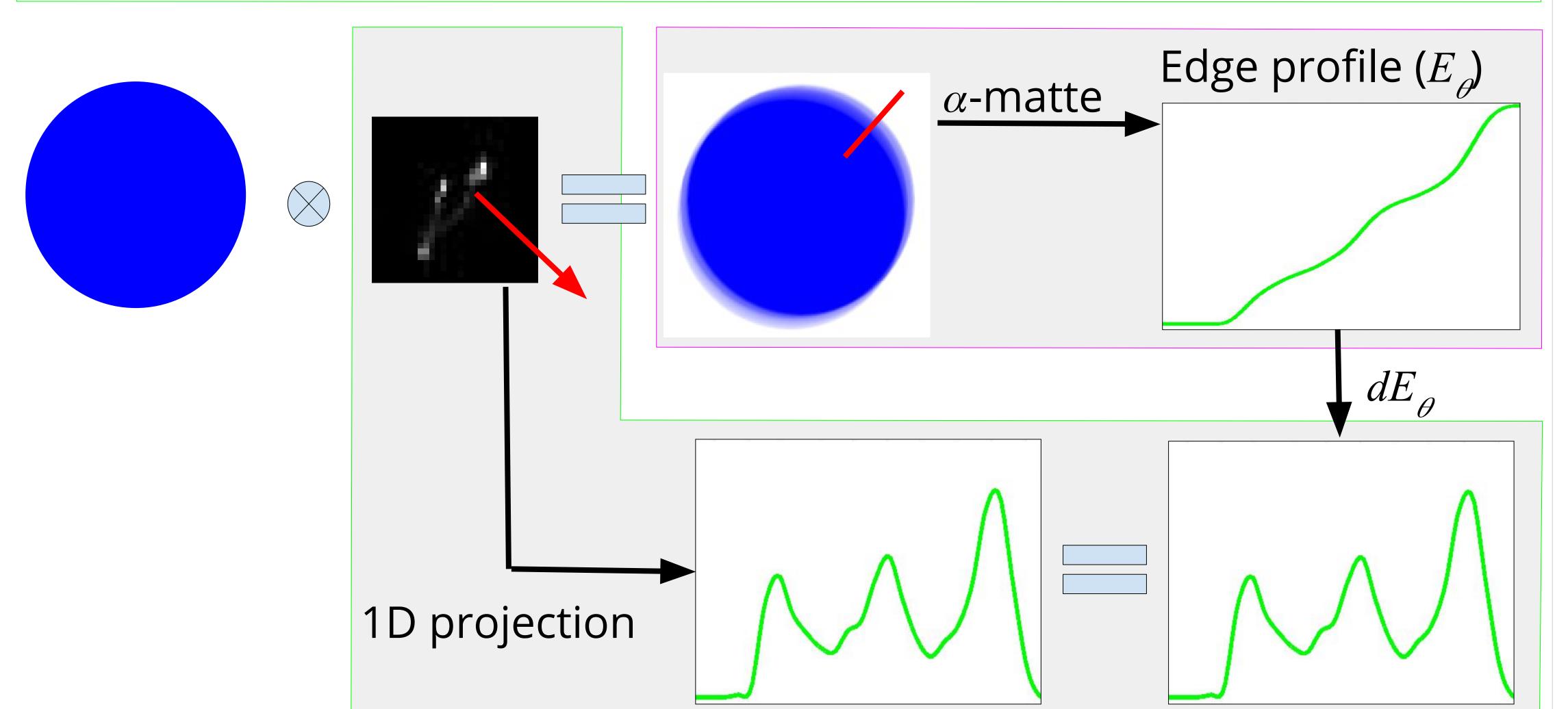


#### Goal

 Camera motion estimation from a single motion blurred image using edge-profiles

## Edge Profile:

- ullet Edge profile: Alpha matte over a line along edge orientation heta
- 1D projection of blur kernel (along  $\theta$ + $\Pi$ /2) is equal to differential of the edge profile



#### Edge Profile to Camera Motion

$$dE_{\theta,\mathbf{x}}(\rho) = \sum_{p=1}^{N_T} w(p)\delta(\rho - (H_x^p\mathbf{x} - x)\cos\theta - (H_y^p\mathbf{x} - y)\sin\theta)$$
 Edge profile Motion vector  $\theta$ : Edge orientation 
$$\hat{w} = \arg\min_{w} ||dE - Mw||_2 + \lambda ||w||_1$$
 Motion matrix

### Challenges

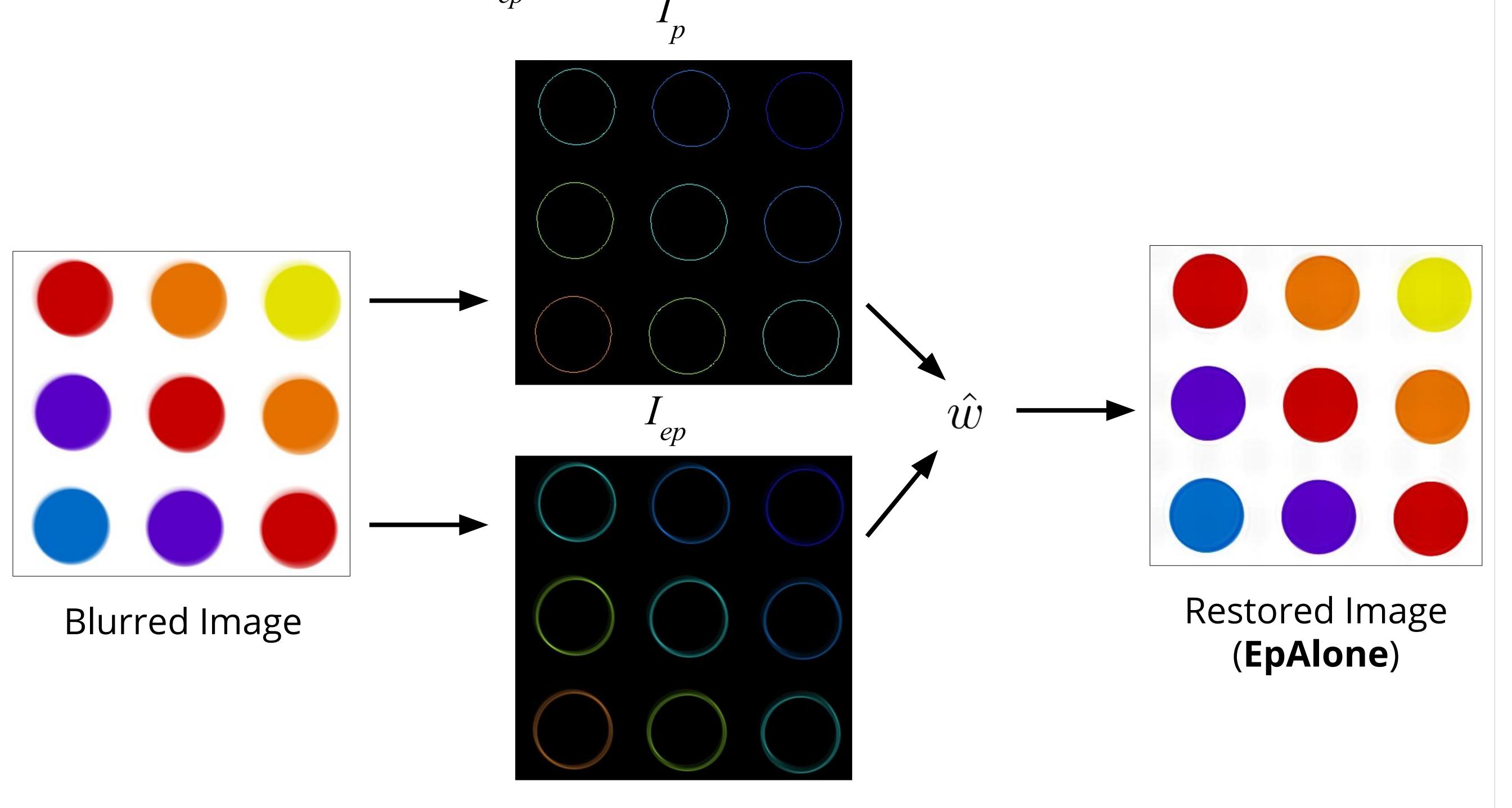
- Alignment of edge profiles obtained from a blurred image
- Computational complexity M is of large size

#### Key observations

- Edge profiles can be aligned by enforcing centroid consistency
- Centroid-alignment will retain the validity of camera motion
- Absolute value of differential of edge profile is equivalent to the normalized absolute gradient of a blurred image

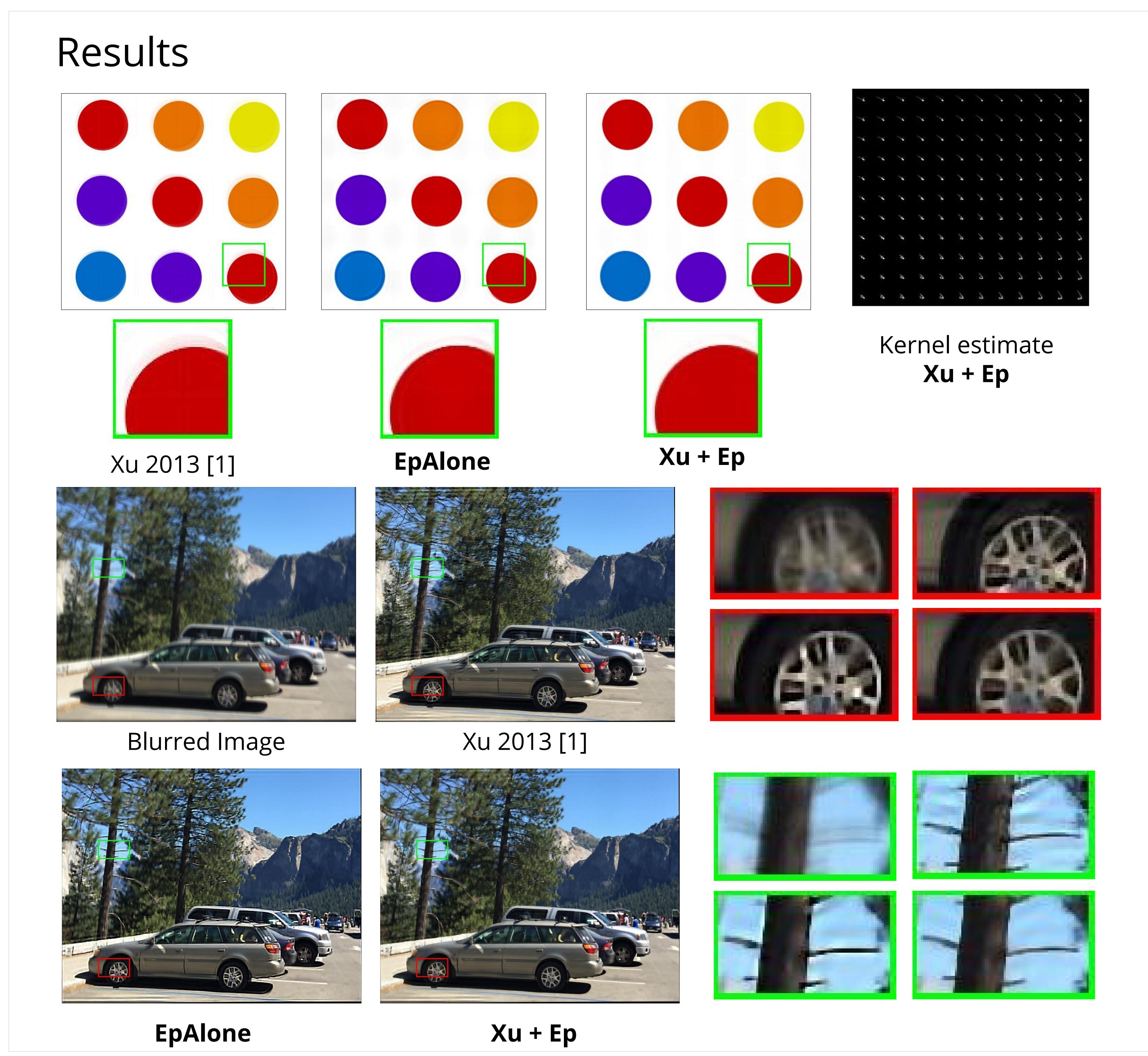
### Our approach

• Decompose the motion blurred image onto a prediction image  $I_p$  and an edge profile image  $I_p$ 



Proposed edge profile constraint

- $dE = Mw \longrightarrow I_{ep} = T_w(I_p)$
- Efficient filter-flow can be used to reduce computational complexity
- **EpAlone** Direct camera motion estimation  $\hat{w} = \arg\min_{w} ||T_w(\tilde{I_p}) \tilde{I_{ep}}||_2 + \lambda ||w||_1$
- Edge profile constraint can improve performance of existing methods
- Xu + Ep Image prior from Xu 2013 [1] + Edge profile constraint



#### Reference

[1] L. Xu, S. Zheng, and J. Jia. Unnatural lo sparse representation for natural image deblurring. In CVPR, 2013.



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