

Alignment-Free Exposure Fusion on Image Pairs

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Exposure Fusion

Long exposure image I_L



- Good brightness
- Motion blur
- Better colors in darker areas

Short exposure image I_S



- Low brightness
- Sharper details
- Better colors in brighter areas

Exposure Fusion

Well-exposed result



HDR radiance map + Tone mapping

Background

Challenges

- Camera motion
 - Input images are not spatially aligned
- Moving objects
 - Ghost or blurry effect

Existing methods

- An additional alignment step before fusion
 - e.g., registration of other images to a middle-exposed image [Tico et al. 2010]
 - e.g., warping the long exposure image to deform its shape but keep its color [Bertalmio et al. 2013]

Proposed Method

Idea

- NO image alignment preprocessing
- Not to directly fuse the exposure bracketed pairs

Fusing method

- Transferring colors of I_L to I_S by histogram matching
- Fusing the color transferred result I_T with I_S

$$I_f(\mathbf{x}) = \Lambda(\mathbf{x})I_S(\mathbf{x}) + (1 - \Lambda(\mathbf{x}))I_L(\mathbf{x})$$

- The fusion map

$$\min_{\Lambda} \sum_{\mathbf{x}} -v(I_f(\mathbf{x})) + \gamma e(I_f(\mathbf{x})) + \eta \sum_{\mathbf{x}, \mathbf{y} \in \mathcal{W}} \frac{|\Lambda(\mathbf{x}) - \Lambda(\mathbf{y})|^2}{M}$$

Spatially smooth

Maximizing local scene contrast

$$v(\mathbf{x}) = \max(d_l(\mathbf{x}), d_\alpha(\mathbf{x}), d_\beta(\mathbf{x}))$$

$$d_k(\mathbf{x}) = |I_k(\mathbf{x}) - \overline{I_k(\mathbf{x})}|, k \in \{l, \alpha, \beta\}$$

Minimizing exposedness level

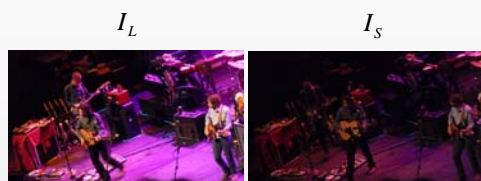
$$e(\mathbf{x}) = |l(\mathbf{x}) - (-0.5225)|$$

To have sharper details of I_S + accurate colors of I_L

WHY NOT just transfer colors from I_L to I_S ?

visible artifacts, e.g., color bleeding, overexposure

Experimental results

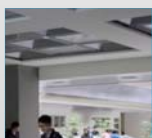


[Bertalmio et al. 2013]

Proposed



Color bleeding



[An et al. 2011]

Proposed



[Bertalmio et al. 2013]

[Tico et al. 2010]

Proposed

