SIGGRAPH 2007 Computational Photography Papers Fast Forward

Digital Visual Effects, Spring 2007

Yung-Yu Chuang

2007/5/29

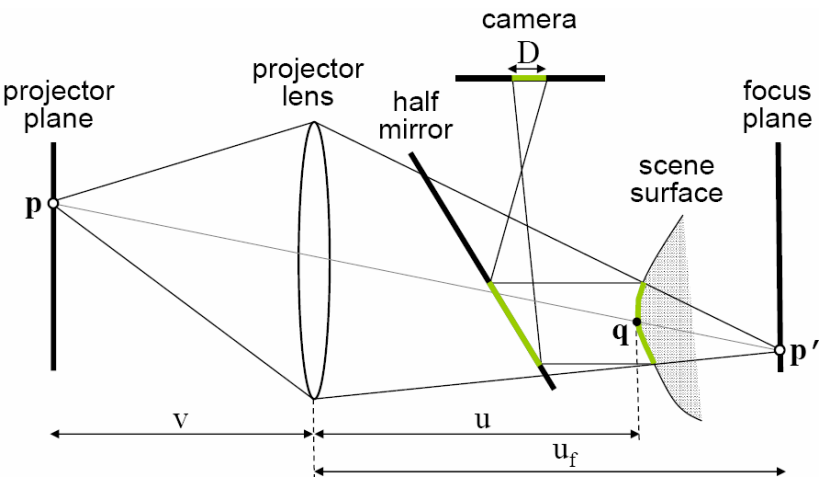
Announcements

- Voting for project #3 artifacts starts today and is due by the end of Next Monday
- Please send me the title and team members of your final project by the end of Sunday.
- Final project proposal next Tuesday. 5-min presentation for each team. Schedule will be announced next Monday.

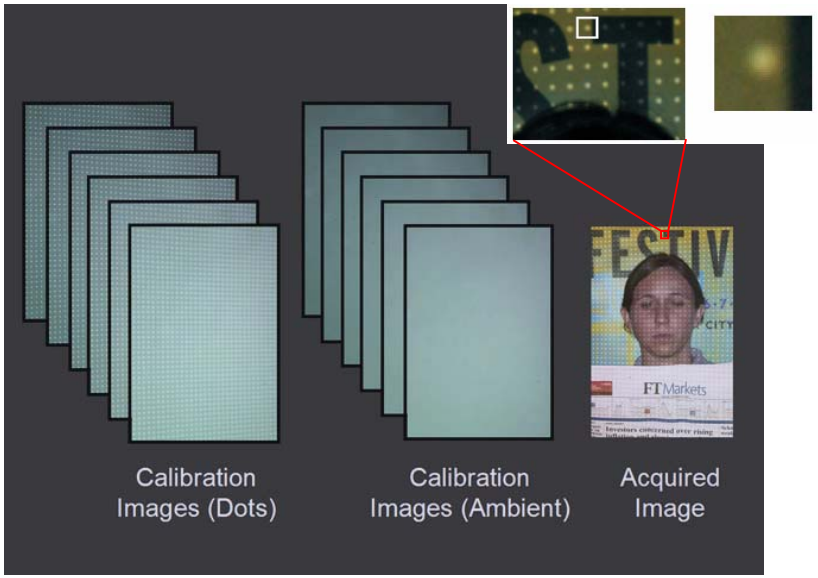
New cameras

- Active refocusing
- Coded aperture

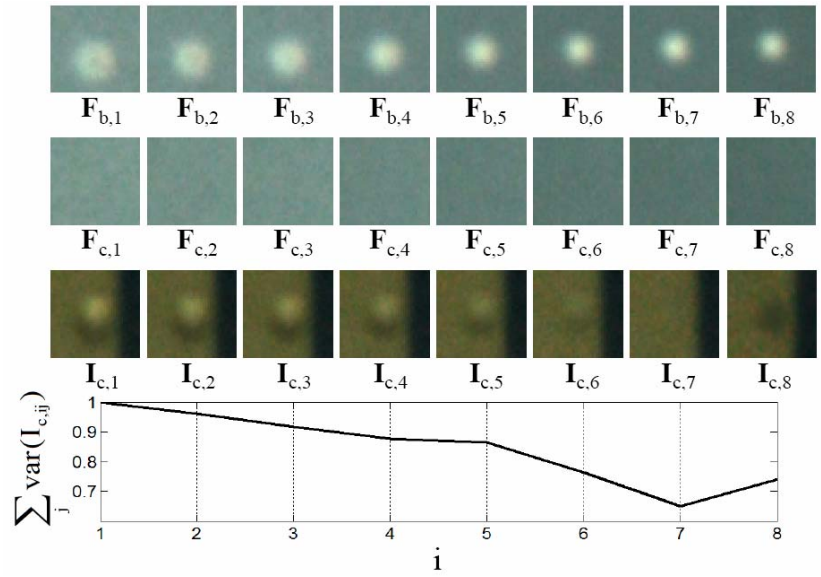
Active Refocusing



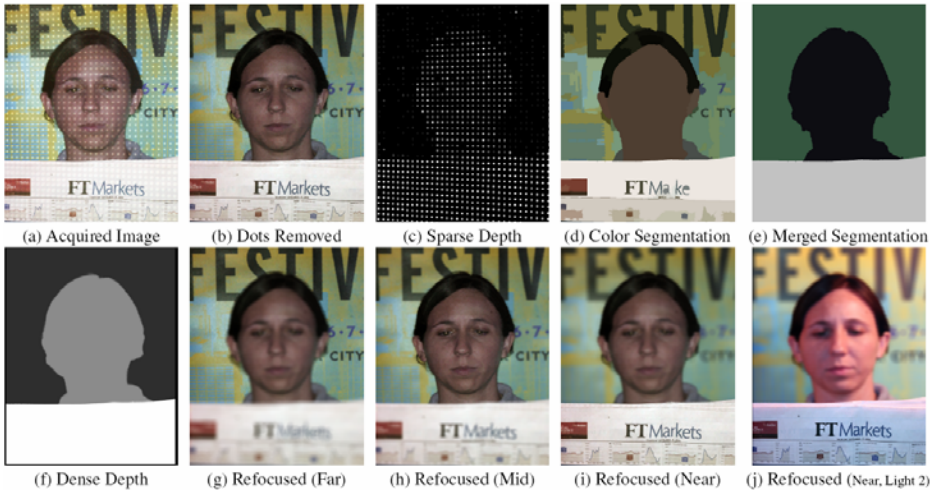
Active Refocusing



Active Refocusing

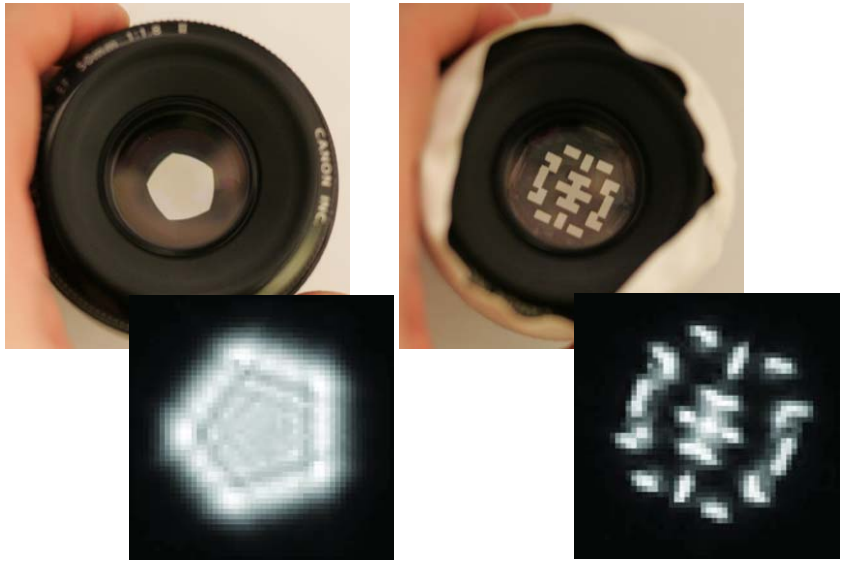


Active Refocusing



video

Coded aperture



Coded aperture

Coded aperture

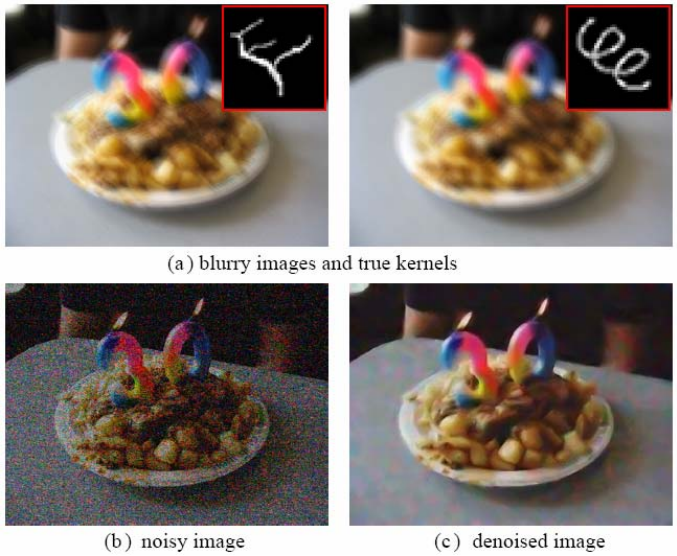
Better images from multiple photographs

- Image deblurring with blurred/noisy image pairs*
- Multiscale shape and detail enhancement from multi-light image collections*

Image deblurring

Image deblurring

Image deblurring



(a) blurry images and true kernels

(b) noisy image

(c) denoised image

Image deblurring

$$B = I \otimes K \qquad \mathbf{b} = \mathbf{Ak}$$

$$I = N_D + \Delta I$$

$$\min_{\mathbf{k}} ||\mathbf{Ak} - \mathbf{b}||^2 + \lambda^2 ||\mathbf{k}||^2$$

$$\text{subject to } k_i \geq 0, \text{ and } \sum_i k_i = 1$$

video

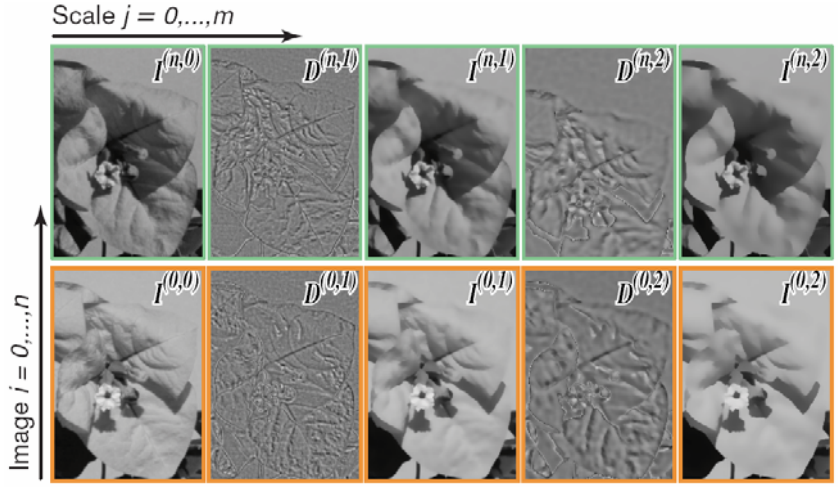
Shape and detail enhancement

Input: 3 MLIC Images

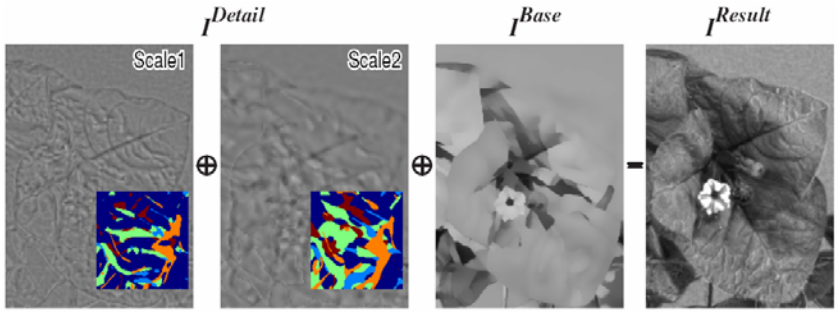
Shape and detail enhancement

Our Results: Enhanced Shape and Surface Detail

Shape and detail enhancement



Shape and detail enhancement



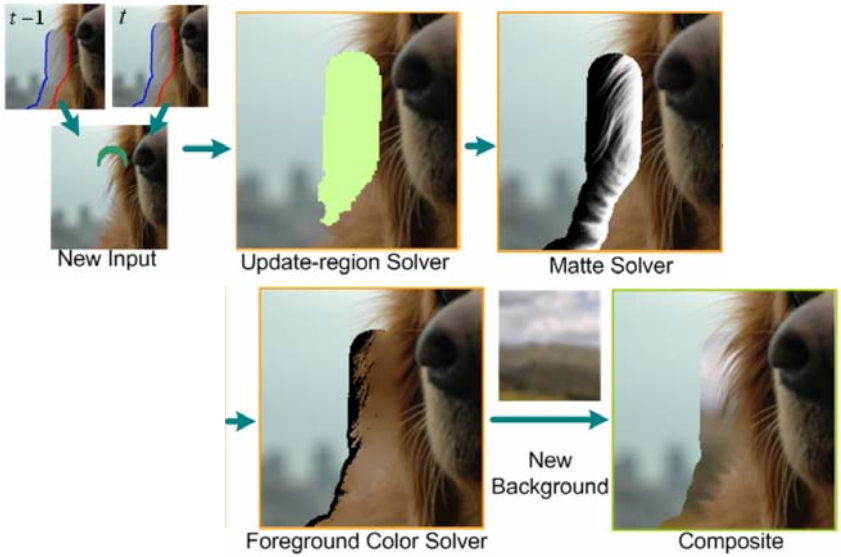
Shape and detail enhancement

Shape and detail enhancement

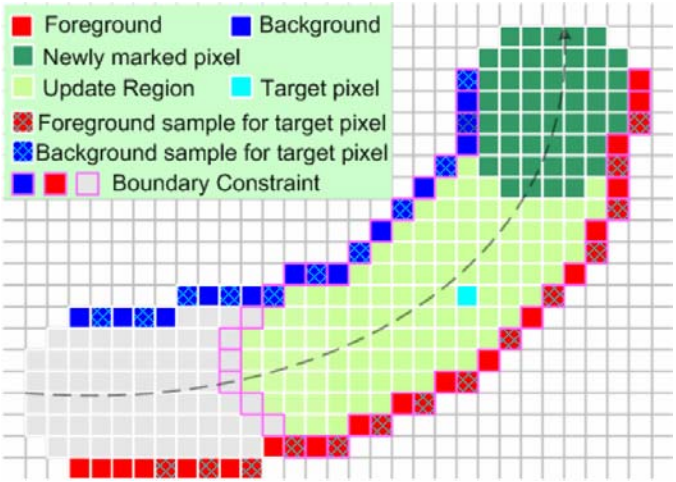
Image manipulation

- Soft scissor*
- Seam carving for resizing*

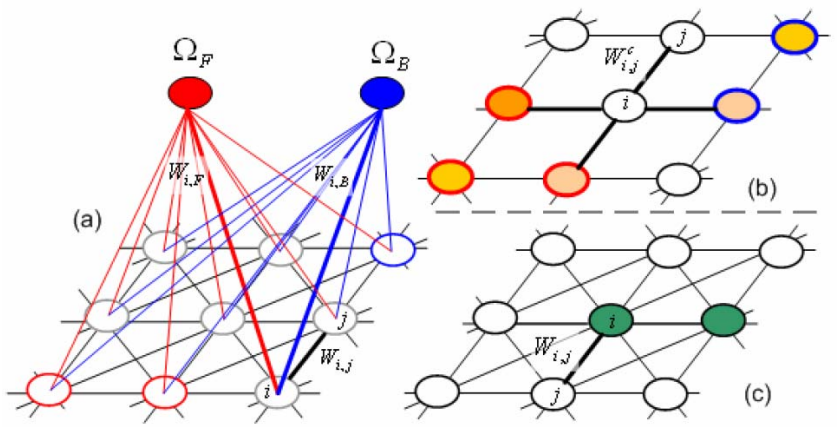
Soft Scissor



Soft Scissor



Soft Scissor

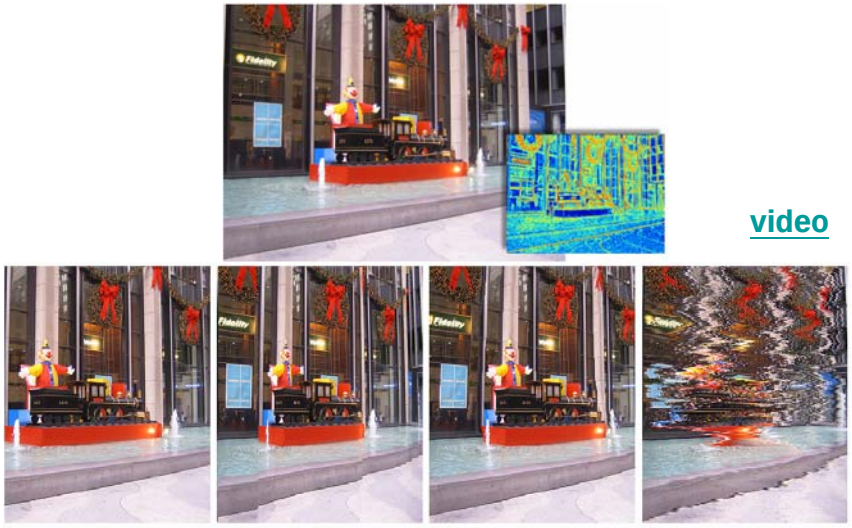


video

Seam carving for resizing

Seam carving for resizing

Seam carving for resizing



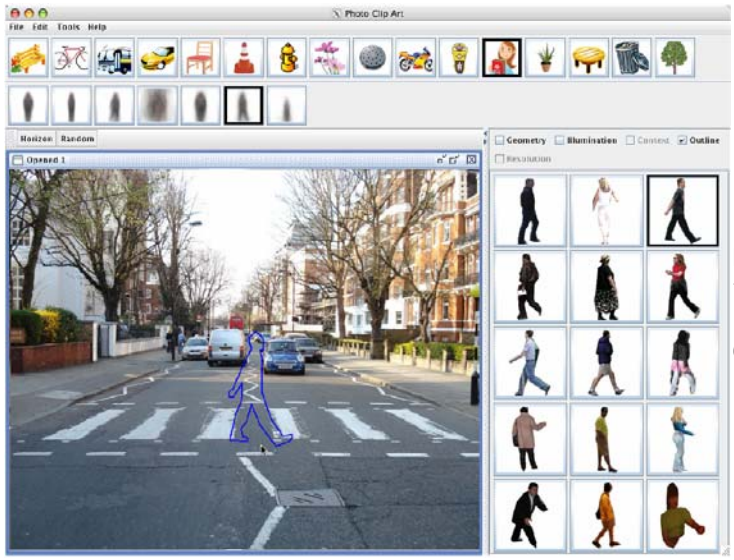
video

(b) Crop (c) Column (d) Seam (e) Pixel

Trends

- Many pictures
  - Photo clip art
  - Scene completion using millions of photographs
- Large pictures
  - Joint bilateral upsampling*
  - Real-time image processing with bilateral grid*
  - Efficient gradient-domain compositing
  - Capturing and viewing gigapixel images

Photo Clip Art



Extracted from LabelMe database

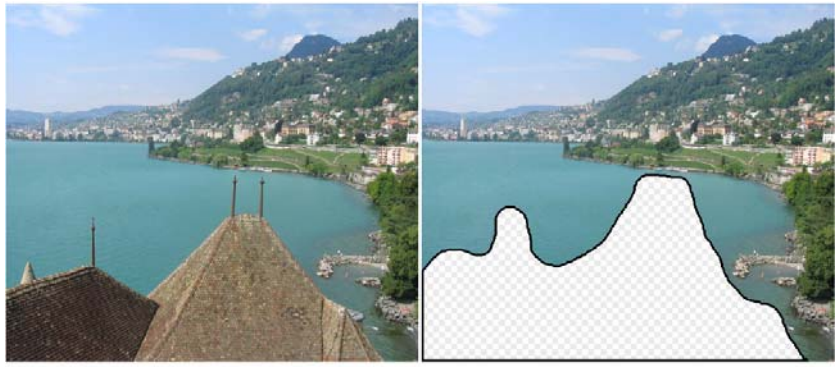
Photo Clip Art

- Challenges
  - Rich object library
  - Object segmentation
  - Estimating object size and orientation
  - Estimating light conditions
  - Intuitive user interface

Photo Clip Art

video

Scene Completion

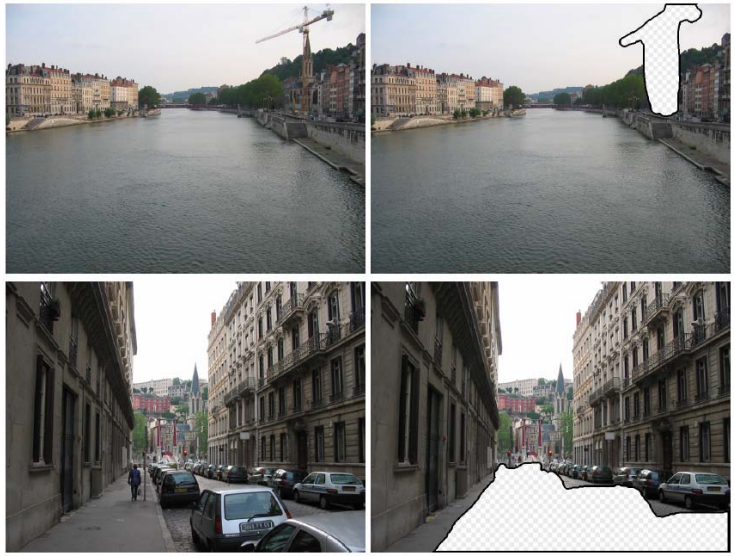


Original Image Input

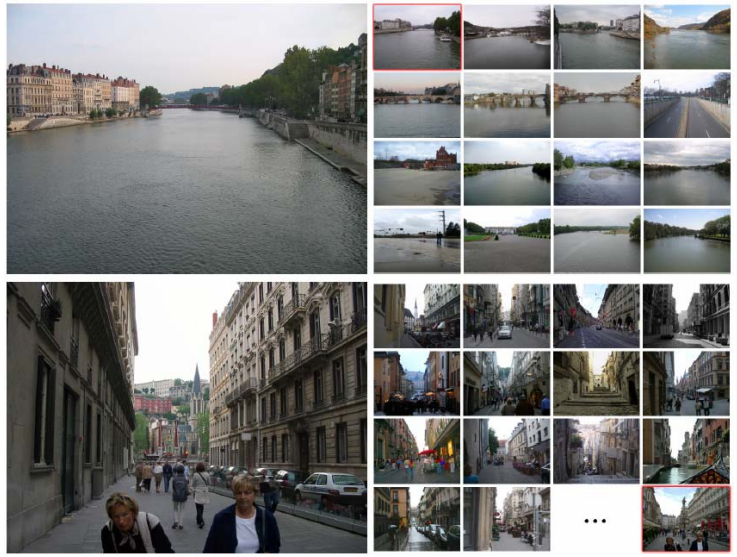
Scene Completion

Scene Matches Output

Scene Completion



Scene Completion



Scene Completion

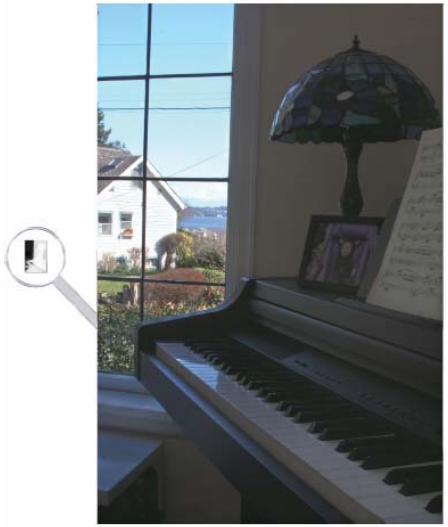
Joint bilateral upsampling

$$J_p = \frac{1}{k_p} \sum_{q \in \Omega} I_q \; f(||p - q||) \; g(||I_p - I_q||)$$

$$J_p = \frac{1}{k_p} \sum_{q \in \Omega} I_q \; f(||p - q||) \; g(||\tilde{I}_p - \tilde{I}_q||)$$

$$\tilde{S}_p = \frac{1}{k_p} \sum_{q_\downarrow \in \Omega} S_{q_\downarrow} \; f(||p_\downarrow - q_\downarrow||) \; g(||\tilde{I}_p - \tilde{I}_q||)$$

Joint bilateral upsampling

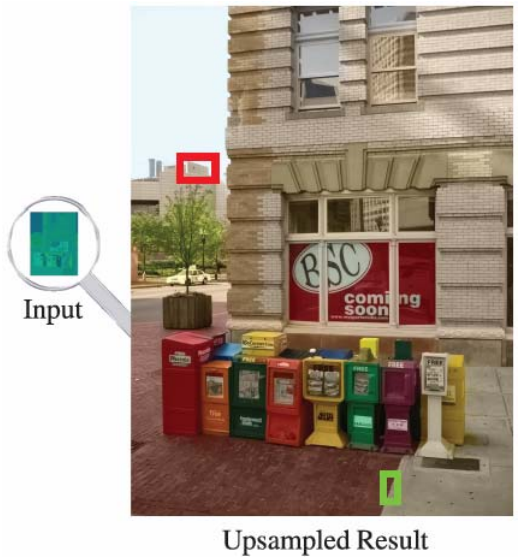


Upsampled Result

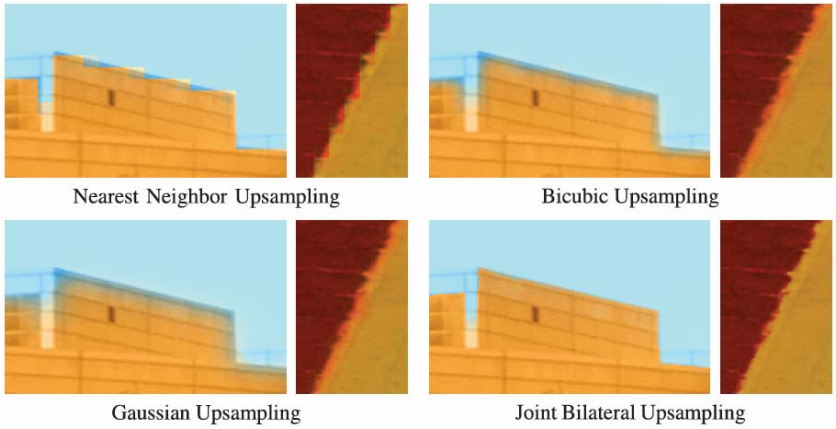
Joint bilateral upsampling

Nearest Neighbor | Bicubic | Gaussian | Joint Bilateral | Ground Truth

Joint bilateral upsampling

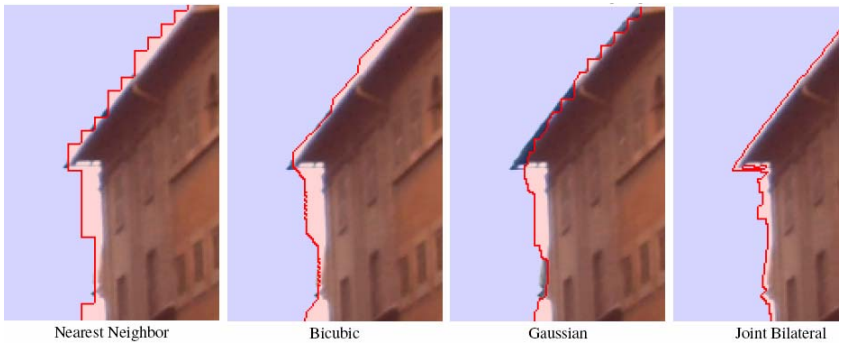


Joint bilateral upsampling



Joint bilateral upsampling

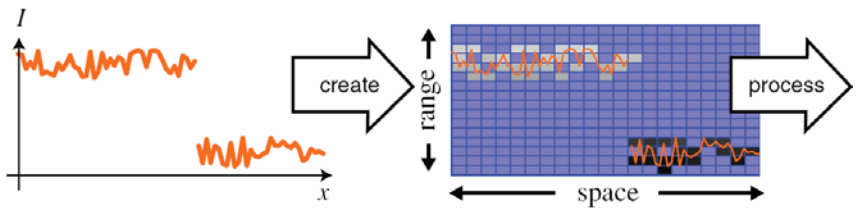
Joint bilateral upsampling

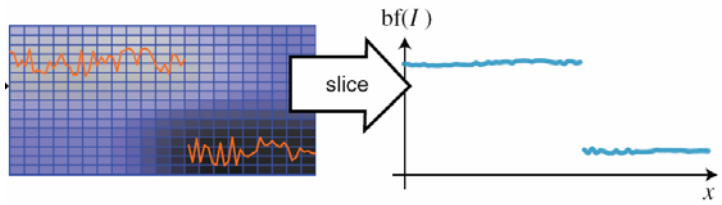


Joint bilateral upsampling

Upsampled Result

Bilateral grid

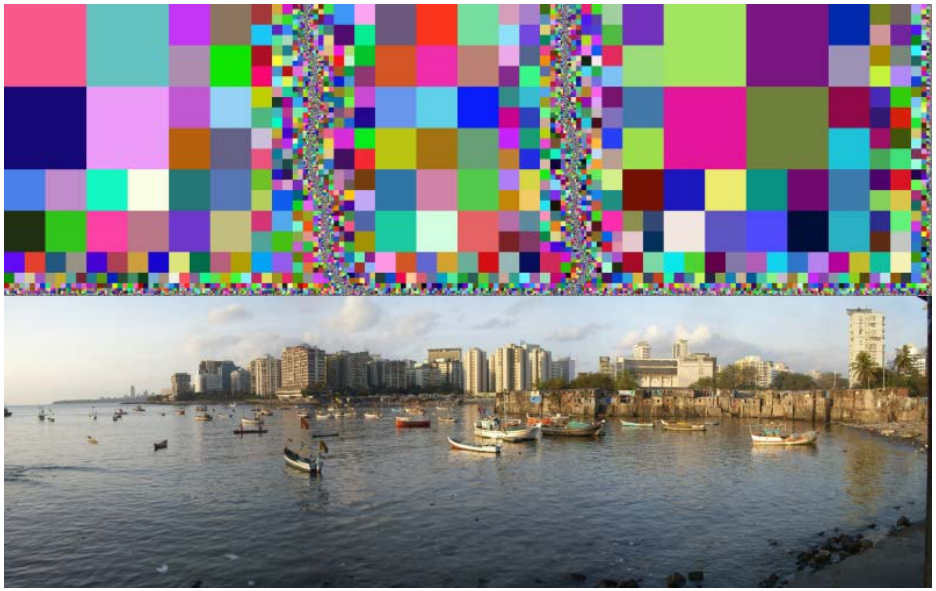




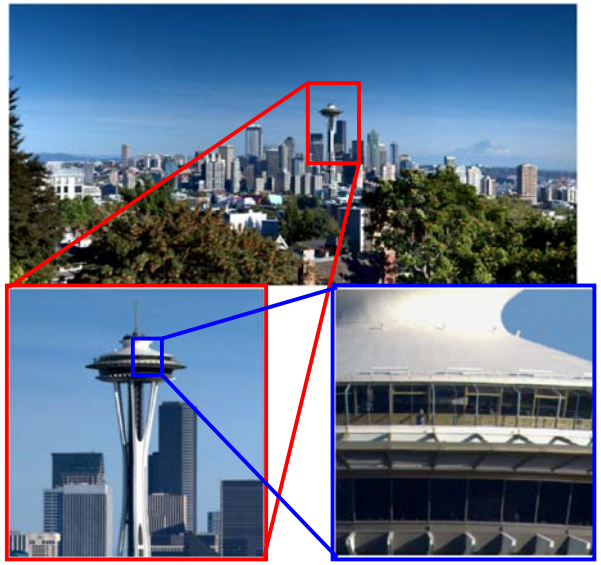
video

Efficient gradient domain compositing

Efficient gradient domain compositing



Gigapixel images



video

References

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- Raanan Fattal, Maneesh Agrawala, Szymon Rusinkiewicz, Multiscale Shape and Detail Enhancement from Multi-light Image Collections, SIGGRAPH 2007.
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- Jean-Francois Lalonde, Derek Hoiem, Alexei Efros, Carsten Rother, John Winn, Antonio Criminisi, Photo Clip Art, SIGGRAPH 2007.
- James Hays, Alexei Efros, Scene Completion Using Millions of Photographs, SIGGRAPH 2007.

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- Johannes Kopf, Matt Uyttendaele, Oliver Deussen, Michael Cohen, Capturing and Viewing Gigapixel Images, SIGGRAPH 2007.