

Computational Photography

- * Study the basics of computation and its impact on the entire workflow of photography, from capturing, manipulating and collaborating on, and sharing photographs.



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Digital Images: Cutting Images for Merging

- * methods for Combing multiple Images by Cutting to Generate a Novel Image



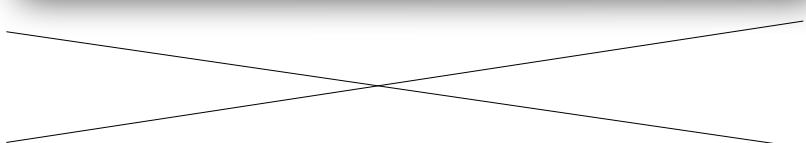
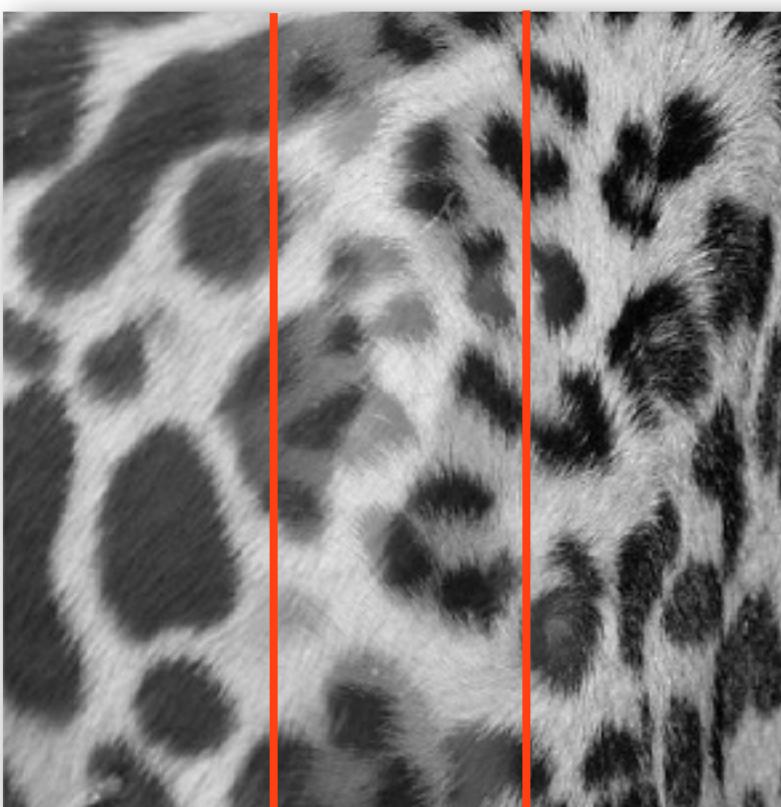
Lesson Objectives

1. An additional method for merging images besides blending
2. Finding seams in images
3. Benefits of cutting images over blending images

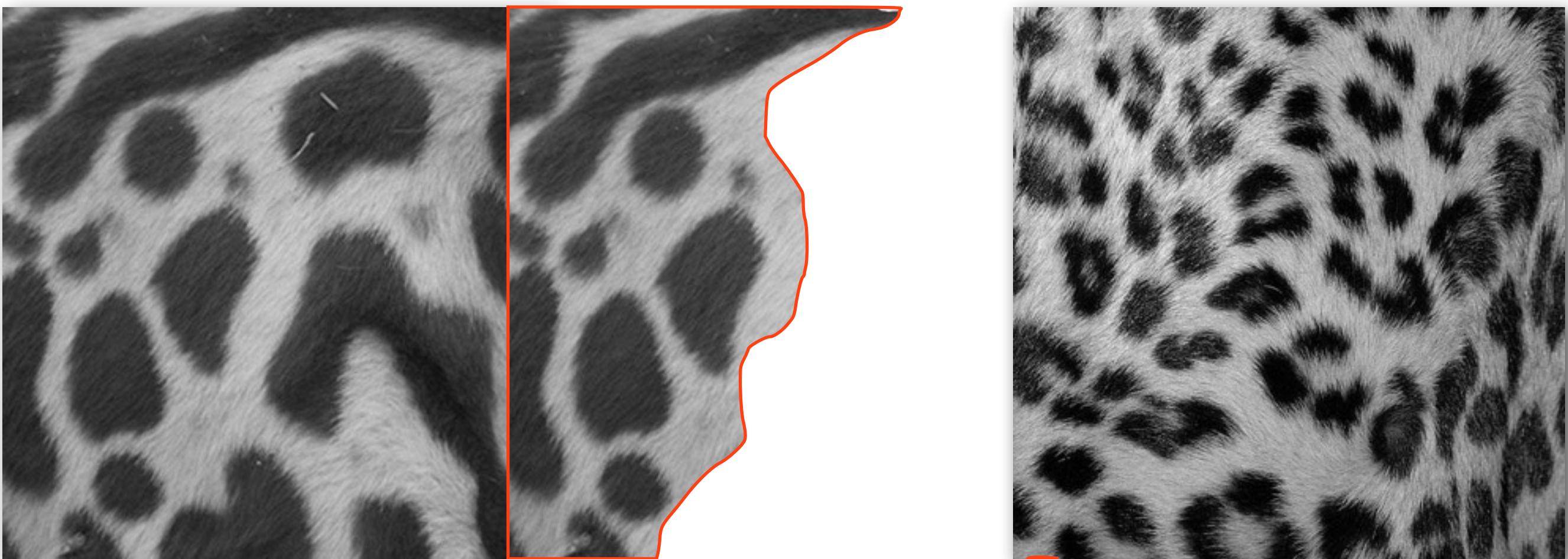
Recall: Combine, Merge, Blend Images



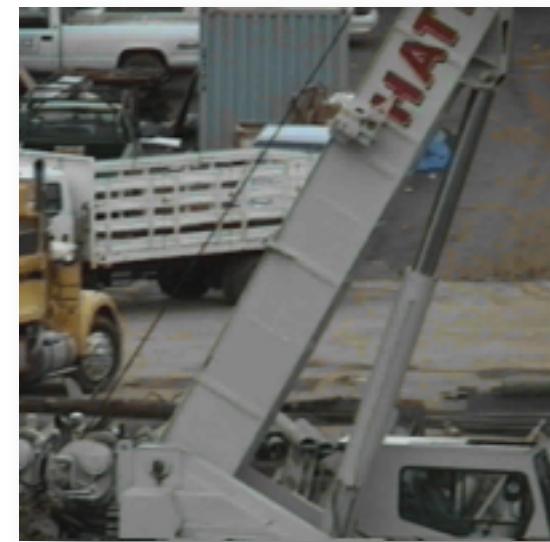
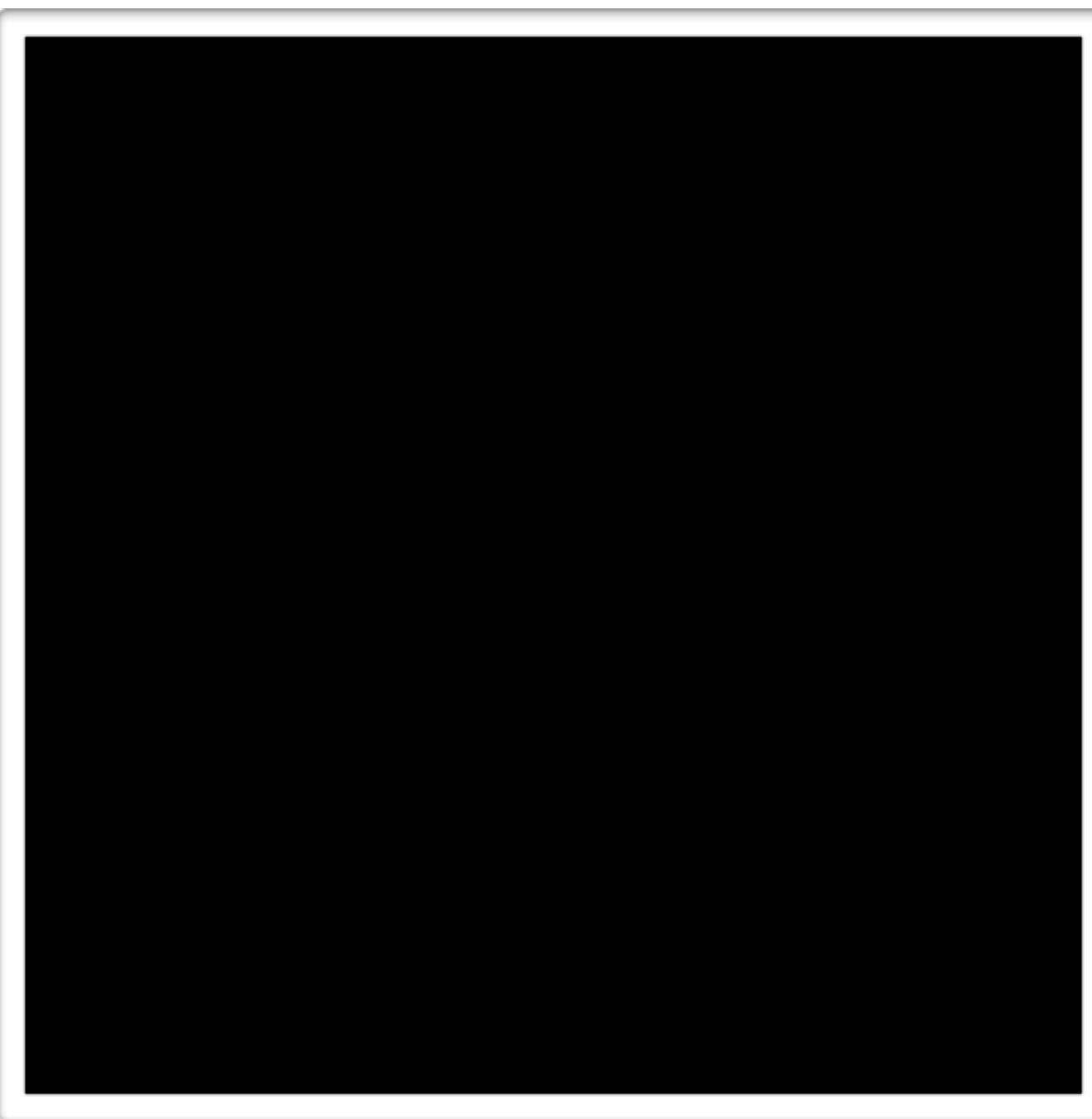
Recall: Cross-Fading Window Size



Cut, Don't Blend!

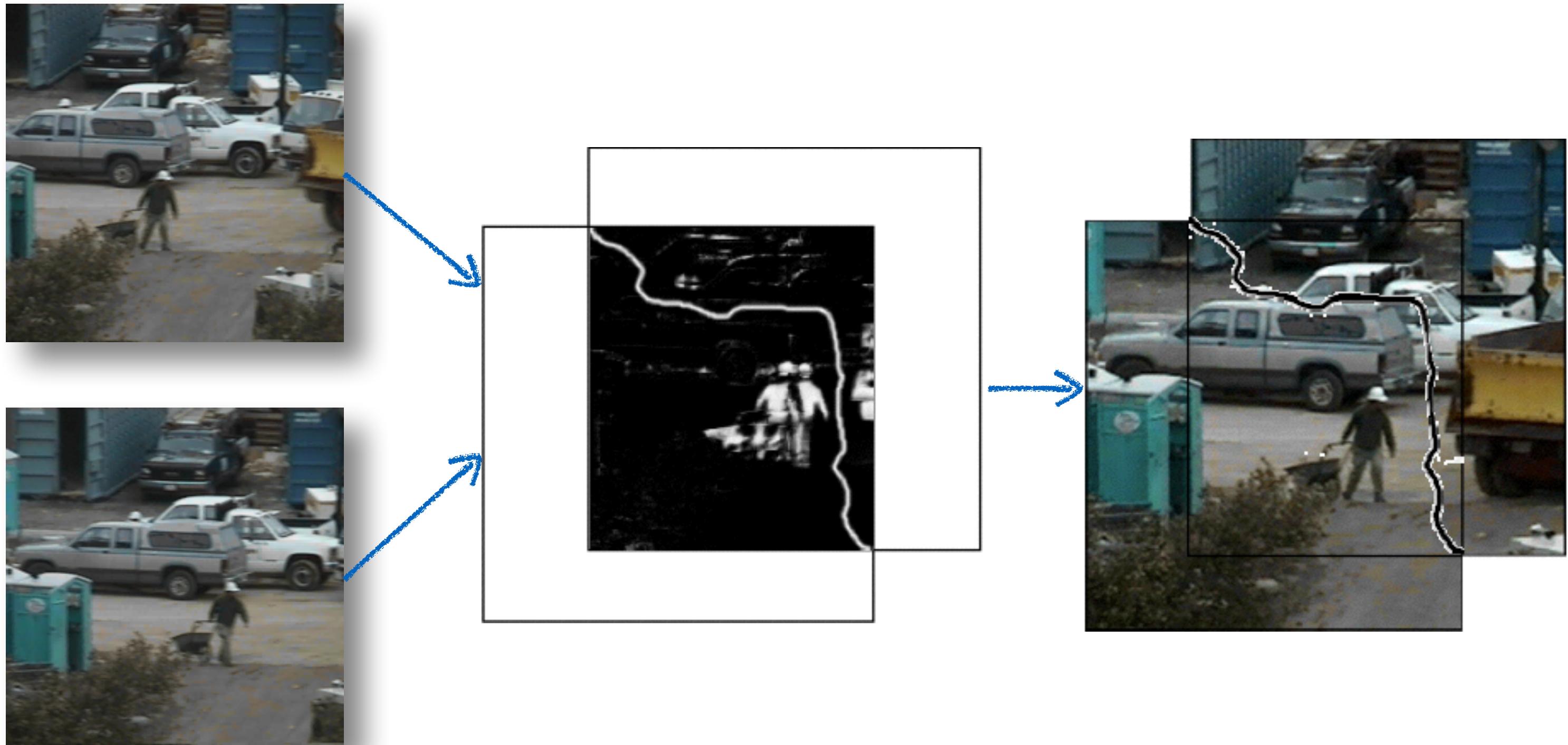


Cut, Don't Blend



Davis (1998)

Cut, Don't Blend



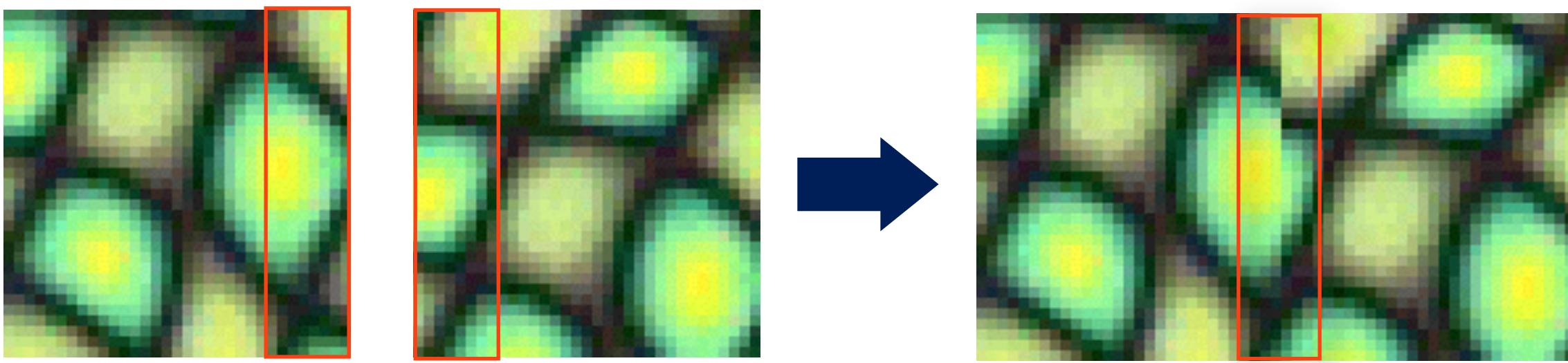
Davis (1998)



- * Moving objects cause "ghosting"
- * Find an optimal seam as opposed to blend between images
- * Final has exact pixels from an image

Davis (1998)

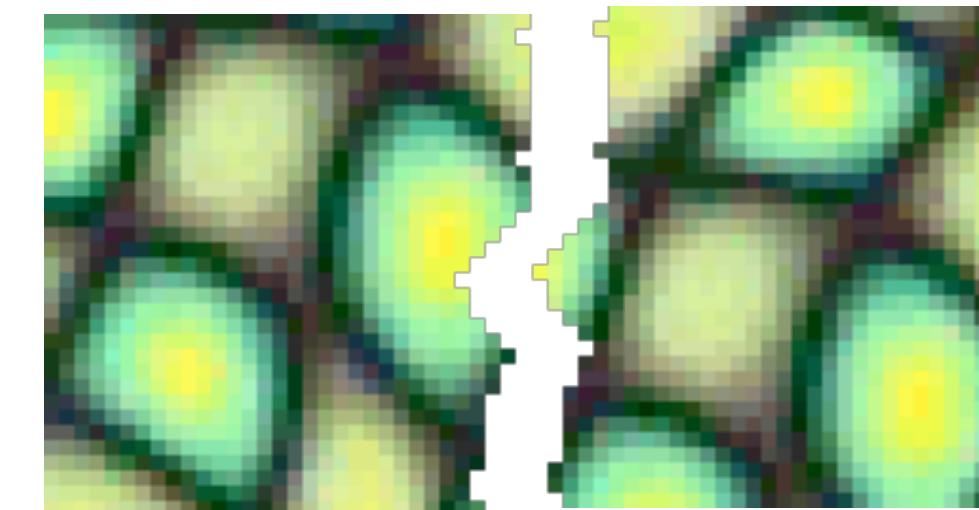
Finding the Seams



overlapping blocks

vertical boundary

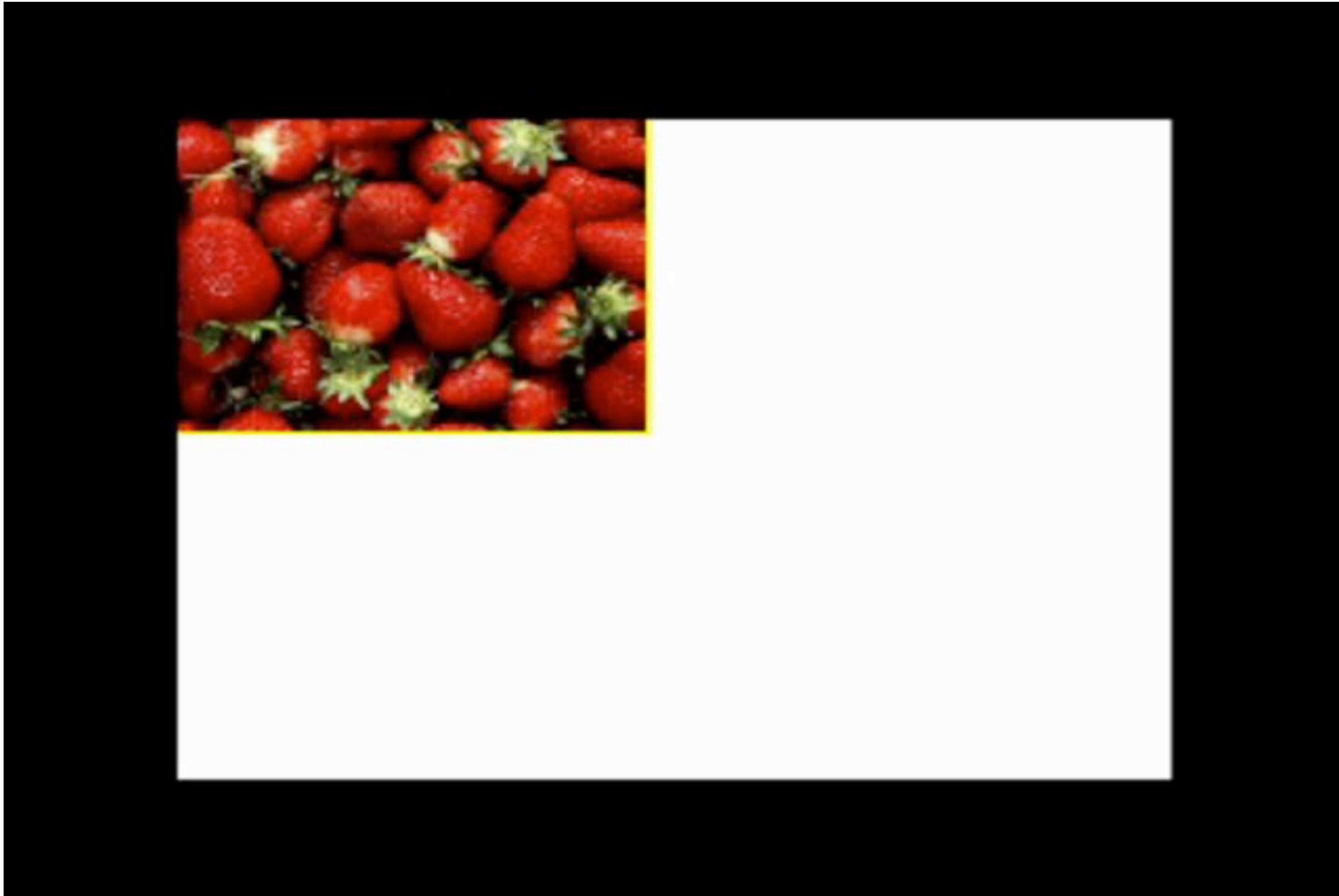
$$\left(\begin{array}{c} \text{block 1} \\ - \\ \text{block 2} \end{array} \right)^2 = \text{overlap error}$$



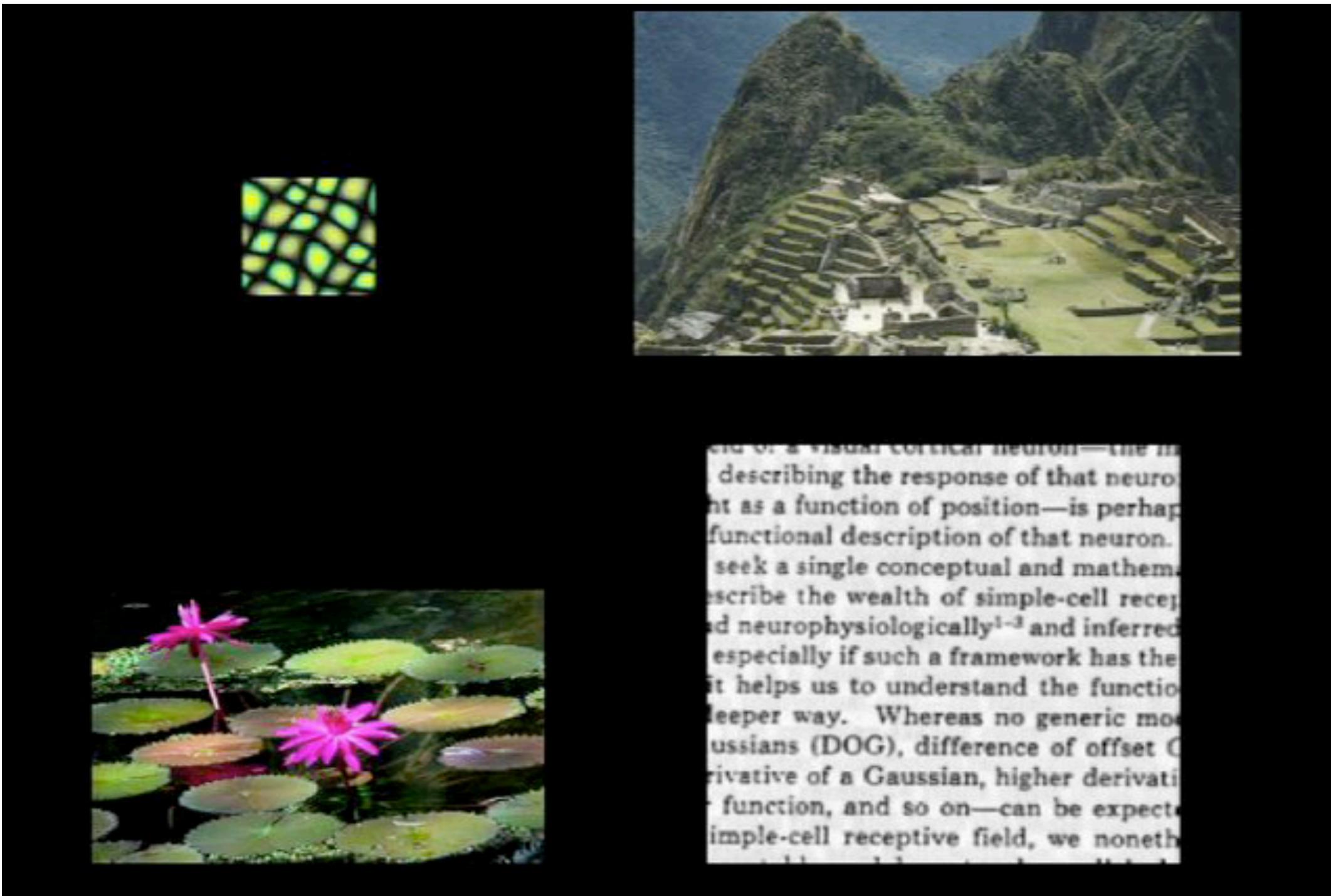
min. error boundary

Efros and Freeman (2001)

Finding Seams



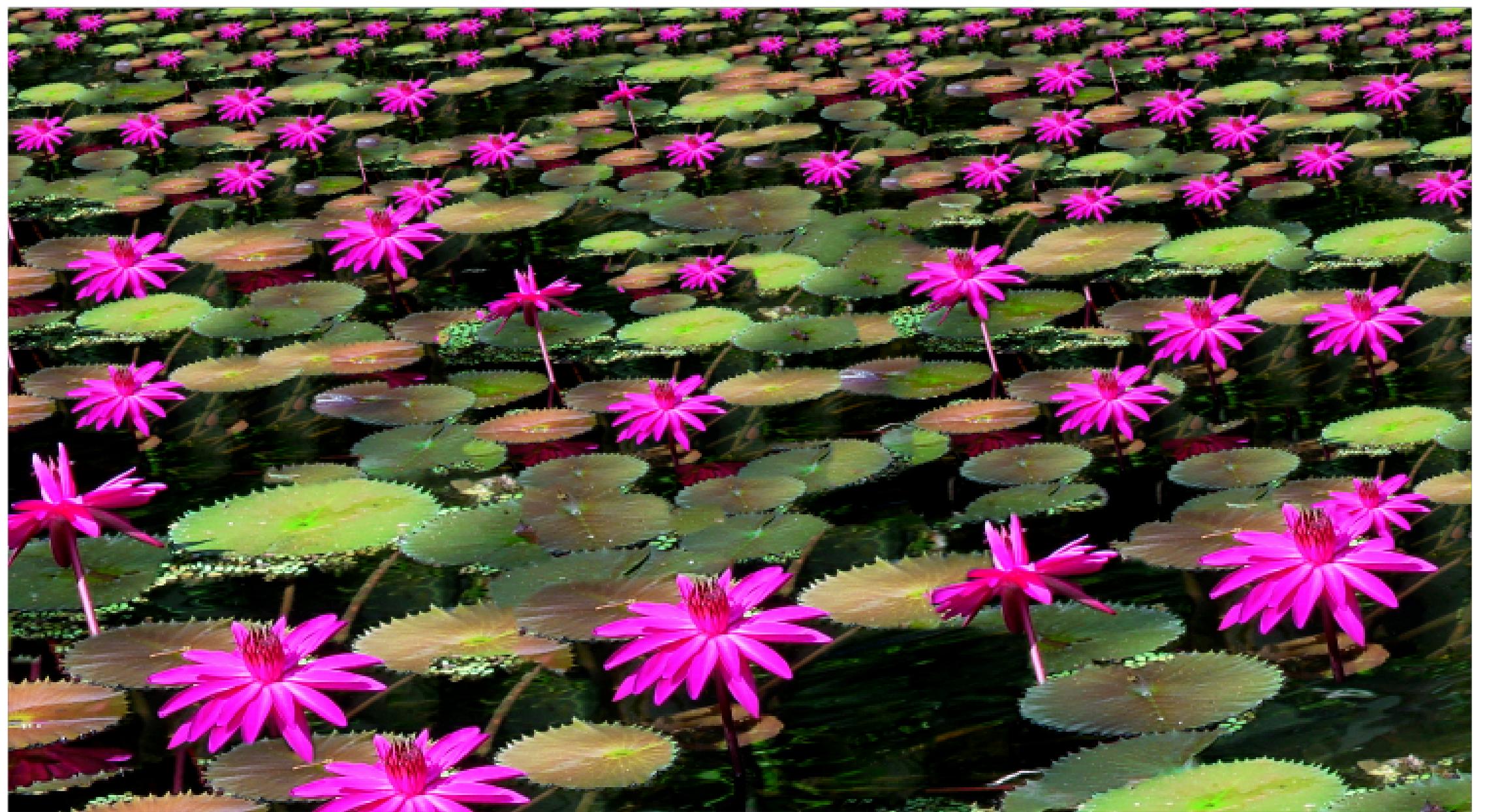
Generating Novel Images



Kwatra et al. (2003)

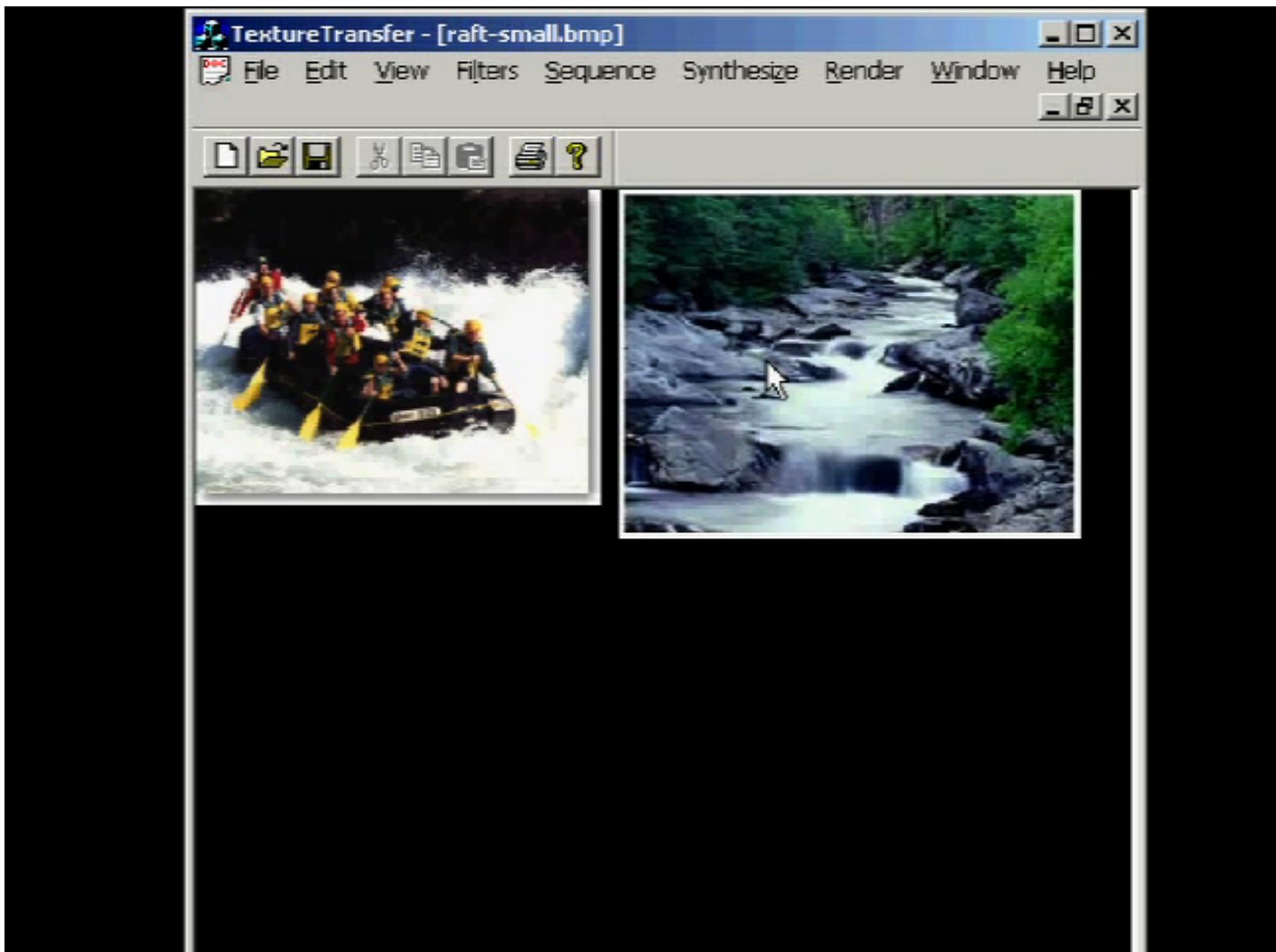
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Extending Images



Kwatra et al. (2003)

Editing Images



Editing Images



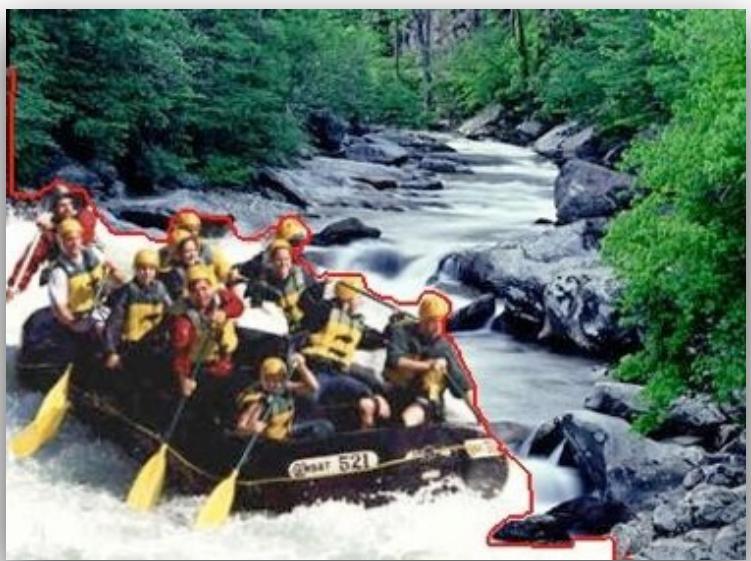
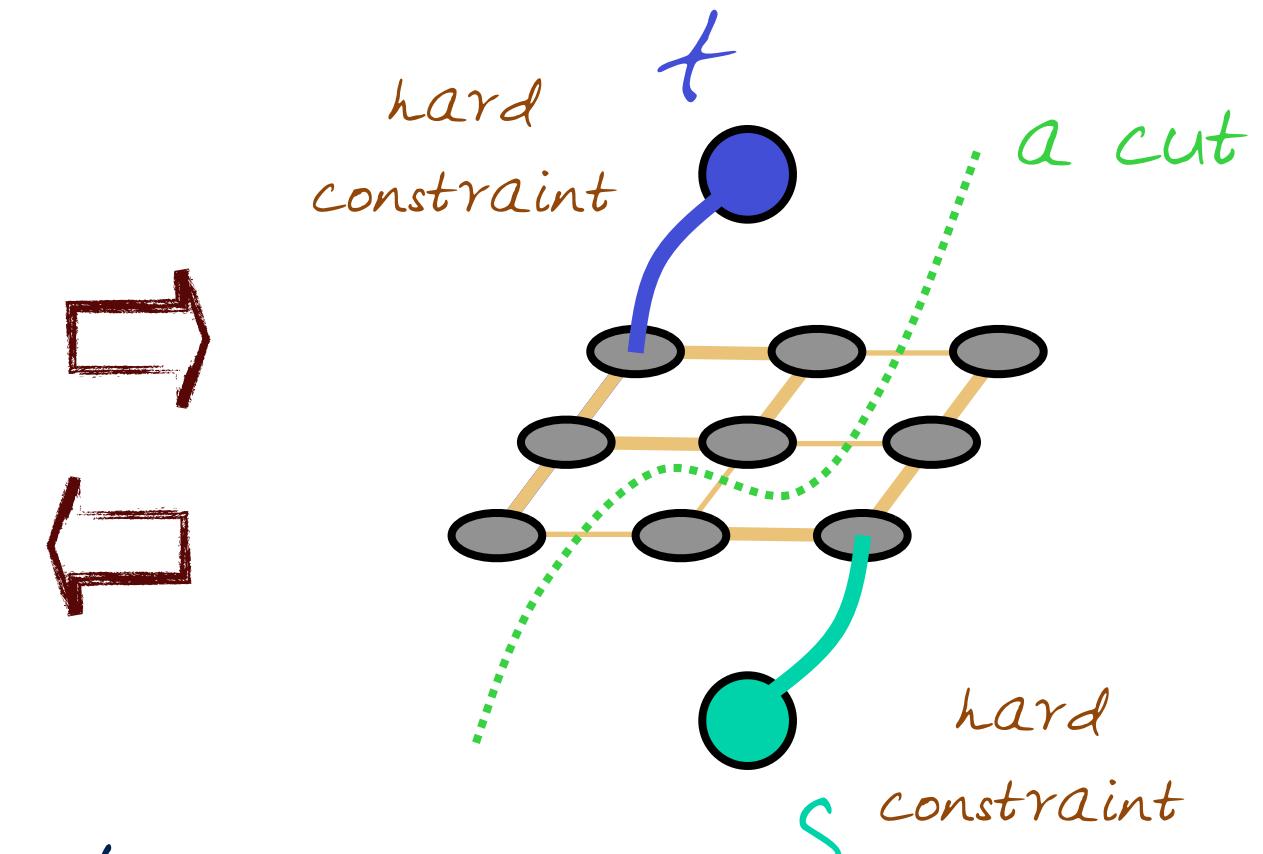
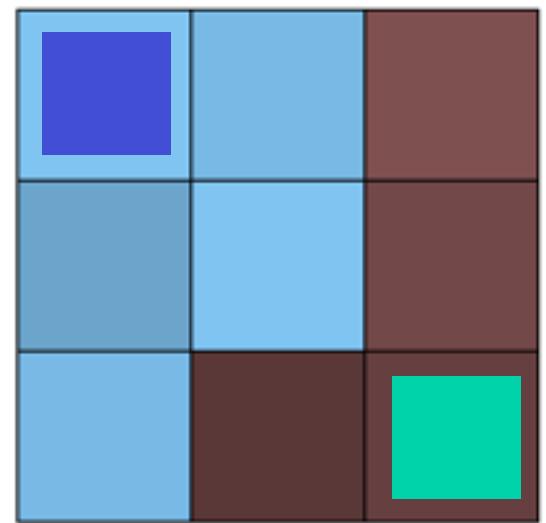
Kwatra et al. (2003)

Seam Finding using Graph-cuts



t

s

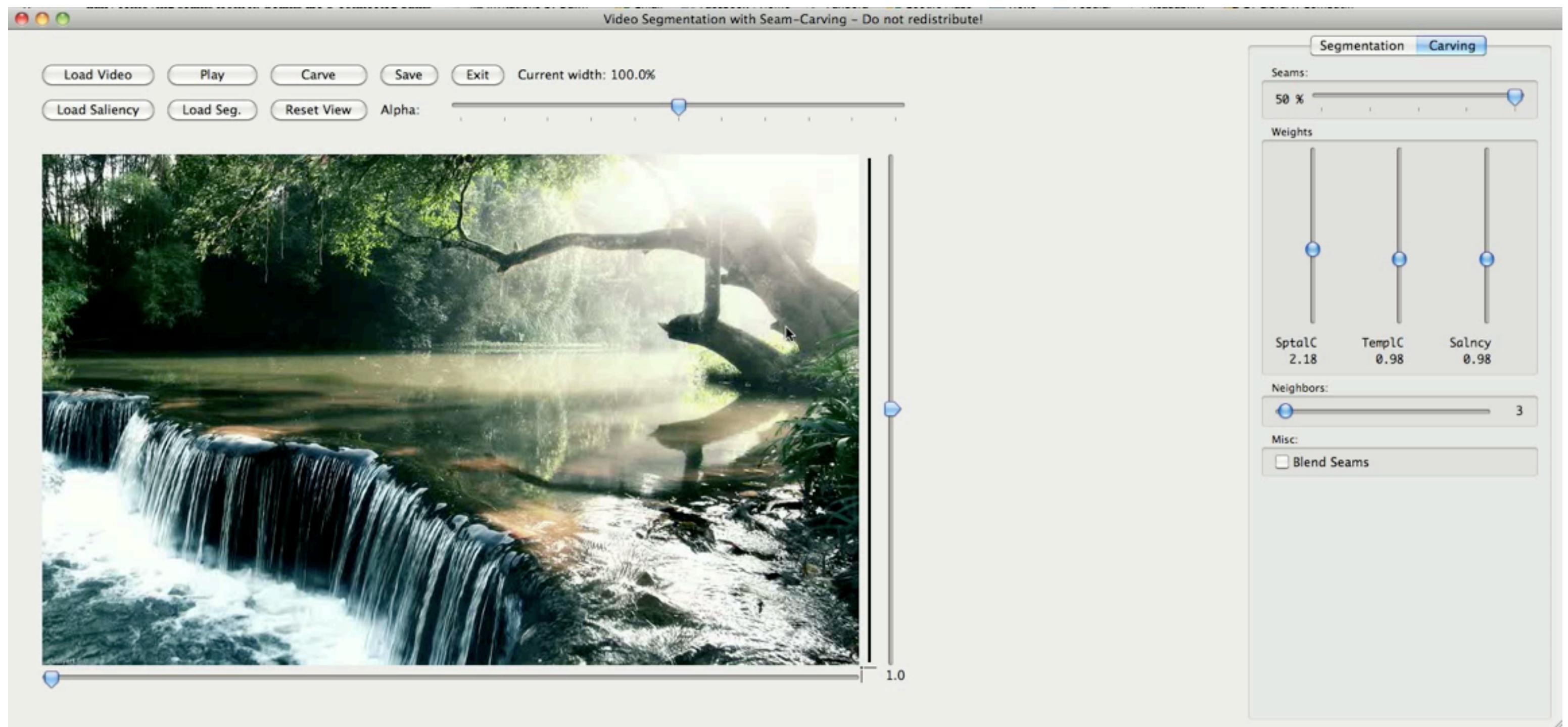


Minimum cost cut can be computed in polynomial time (max-flow/min-cut algorithms)

Another approach is to use Dynamic Programming to find seams

Boykov and Jolly (2001) & Kwatra et al. (2003)

Seam Carving



Grundmann et al. (2010), Avidan and Shamir (2007)

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Summary



- * Introduced an additional method for merging images besides blending
- * Described how seams are found in images
- * Discussed the benefits of cutting images over blending images

Further Reading



- * Davis (1998), "Mosaics of Scenes with Moving Objects" » IEEE Computer Vision and Pattern Recognition (CVPR), 1998 .
- * Efros and Freeman (2001), "Image Quilting for Texture Synthesis and Transfer" » SIGGRAPH 2001
- * Kwatra, Schödl, Essa, Turk, Bobick (2003), "Graphcut textures: image and video synthesis using graph cuts" » SIGGRAPH 2003
- * Boykov and Jolly (2001), "Interactive Graph Cuts for Optimal Boundary & Region Segmentation of Objects in N-D images, ICCV 2001 .
- * Avidan and Shamir (2007), "Seam carving for content-aware image resizing" , SIGGRAPH 2007 .
- * Agarwala, Dontcheva, Agrawala, Drucker, Colburn, Curless, Salesin, Cohen (2004), "Interactive Digital Photomontage" » SIGGRAPH 2004 .

Neat Class

- * Feature Detection
and matching



Credits



- * For more information, see
 - * Richard Szeliski (2010) Computer Vision: Algorithms and Applications, Springer.
 - * Some concepts in slides motivated by similar slides by A. Efros and J. Hays.
 - * Some images retrieved from
 - * <http://commons.wikimedia.org/>.
 - * List will be available on website.

Computational Photography

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