Scene Carving: Scene Consistent Image Retargeting

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Main Idea

Seam carving (1,2)

Seam carving iteratively removes seams of pixels, minimizing visual distortion using dynamic programming.

* Objects are protected (i.e. not distorted from original image)
* Other retargeting methods commonly use image warping, which can be effective but harder to optimize

Seam Carving

• Seam carving iteratively removes seams of pixels, minimizing visual distortion using dynamic programming
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Scene Consistency

1) Objects are protected (i.e. not distorted from original image)
2) Object depth ordering is preserved as in the original image

Problem: higher order cliques needed to optimize for re-appearing pixels

#1 “Flat” formulation

Local constraints cannot protect objects

Graph construction with supernodes

• Graph cut formulation required (instead of dynamic programming)

Supernodes enforce scene consistency

• Green object supernode
• Blue object supernode

#2 Layered formulation (scene carving)

For all object positionings (combinatorial)

Find optimal seam in background (O.P.)

• Translate objects maintaining position or shifting 1 pixel left
  • Propose all combinations

• Seam carve in background using dynamic programming
  • Energy minimized when:
    • Fewest object pixels occluded
    • Least visual distortion created
    • Most hole pixels removed
  • Subject to constraint:
    • No hole pixels revealed

• Hierarchical speed-up
  • ~36x faster optimization

Our Goal

To extend seam carving to produce the best result subject to scene consistency

Results

Input image
Relative depth map
Scene carving
S.C. + Object Protection (1,2)

Variation of #2 minimizing visible distortion at each iteration

#2 Scene carving background layer

#1
#2

References


Time taken to produce our results with our Matlab/Mex implementation