# Improved Seam Carving for Video Resizing



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### **Previous Work (Size Change)**

- Cropping & Scaling:
  - [Wang et al. 2004]
  - [Fan et al. 2003]
  - [Liu and Gleicher 2006]
  - [Deselaers et a. 2008]
- Segment & Recombine
  - [Tao et al. 2007]
- Non linear scaling (Warping)
  - [Wolf et al. 2007]
- Time manipulations:
  - [Pritch et al. 2008] Object based video
  - [Chen and Sen 2008] Graph cut



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## Naïve (2): Global Projection

 Reduction of the video problem to image seam carving by using projection of maximum energy through time:































#### **New Construction** • This construction guarantees monotonic E1 and connected seams $p_{i,j+1}$ p<sub>ij</sub> ∞ • This construction ∞ creates seams that are equivalent to the ∞ dynamic programming E1 р<sub>i+1,j</sub>. approach ∞ (Proofs in the paper) (c) ariel shamir































$$M(i,j) = E(i,j) + \min \begin{cases} M(i-1,j-1) \\ M(i-1,j) \\ M(i-1,j+1) \end{cases}$$

























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### Contributions

- Extend the seam carving operator from images to video while maintaining its simplicity.
- Formulate using graph cut
- Allowing vertical and horizontal content aware size change and define multi-size video
- A novel forward energy for better content preservation with







## Monotonic: One Cut in Each Row





