SEAM CARVING & ITS APPLICATIONS

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Images widely used in today's day and age
Wide array of devices with varying resolutions
Primitive Resizing techniques:
- Scaling
- Cropping
Content aware image resizing: Seam carving
Seam Carving

- Content aware image resizing algorithm
- Seam: vertical (horizontal) path of pixels connected from top to bottom (left to right) with one pixel in each row.
- Preserves important regions based on Energy functions and user selected regions.
Process Overview

- Obtain input image
- Calculate the weight/density/energy of each pixel
  - Gradient magnitude
  - Entropy
  - Visual Saliency
- Generate a list of seams ranked by energy
  - Dynamic Programming
  - Graph Cuts
- Remove/Insert seams from the image
Energy Functions

- Gradient magnitude
  \[ e(x,y) = |\frac{\partial I}{\partial x}| + |\frac{\partial I}{\partial y}| \]

- Histogram of Gradient (HoG)
  \[ e_{HoG}(I) = \frac{|\frac{\partial I}{\partial x}| + |\frac{\partial I}{\partial y}|}{\max (HoG(I(x,y)))} \]

- Entropy
  \[ S = -k \sum p_i \log p_i \]
Gradient Magnitude

Entropy

HoG
Seam Calculation

- Implemented using dynamic programming
- Direction:
  - Vertical
  - Horizontal
  - Hybrid
- One pixel per row (column)
- Choose seams from lowest to highest energy
100 seams in
Horizontal direction
100 seams

100 seams less

100 seams more
Object Protection/Removal

- Select Region of Interest
  - Better energy functions
  - User defined regions
- Assign higher/lower energy to this region
Normal seam carving (100 seams)

Seam carving with protection
Results
Visible non-linear gradient

Horse head distorted
Future Updates

- Calculating Seams: Combination of Horizontal and Vertical
- Object Protection & Removal
- Creating Simple GUI for user
- Implementing Graph Cuts (for images)
- Extending Graph Cuts for video (If time permits)
References