Seam Carving

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Before start...
Any solution to adjust size but no distortion?

✨ Seam Carving!
Seam Carving?

Algorithm of image resizing

known as content-aware image resizing, content-aware scaling, liquid resizing, or liquid rescaling...

Shai Avidan and Ariel Shamir from MERL (Mitsubishi Electric Research Laboratories)
What is Seam Carving?

- Resize image without losing important part
- Display images without distortion on various media
How to do it?

- Establish seams (path of energy)
- Removes seams to reduce image size
- My Project:
  --Use GPU and OpenCL to do Horizontal Seam Carving
  --Based on the dependency, use different work group-size to do parallel computing
Project: Seam Carving

- In CPU
- --Import image and new size
- --Calculate "Grayscale Image"
  
  \[ \text{gray} = 0.299r + 0.587g + 0.114b \]
- --Preparation for kernels
Kernels

--Calculate gradient of each pixel (HPC on whole matrix)

--Calculate Seam (Dynamic Programming)

--Find Seam with lowest Energy

--Delete it!
Kernel to calculate Seam

CPU

GPU
## Find Seam and Delete

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*Left panels are aligned by a vertical seam and their edges are deleted.*
Result

- Speed: Depend on the width and height, also the new width of the graph
- ex. 12 seconds to shrink 2000X1078 image to 1000x1078 (on Bowery)
- Seam Calculation cost most time, then the gradient(energy) calculation part
Application!
Further Study

- Weakness of Seam Carving
- Possible Improvements
IF YOU SHRIKN TOO MUCH...
KEEP IMPORTANT DATA NOT EQUAL TO KEEP IMPORTANT DATA UNCHANGE
Weaknesses

- What’s the “best shrink size”? 
- Energy Function (Calculate Gradient) 
- Boundary Problem 
- Only depend on seam value 
- Speed limitation
Possible Improvements

- Better energy function
- Deal with boundary more accurately
- Find other variable to adjust size
- Use other HPC tools to construct the program
Any Questions?

"WHO IS THE REAL ME?"

Wednesday, December 19, 12
Thank you!