Georgia Tech's Computational Photography Portfolio

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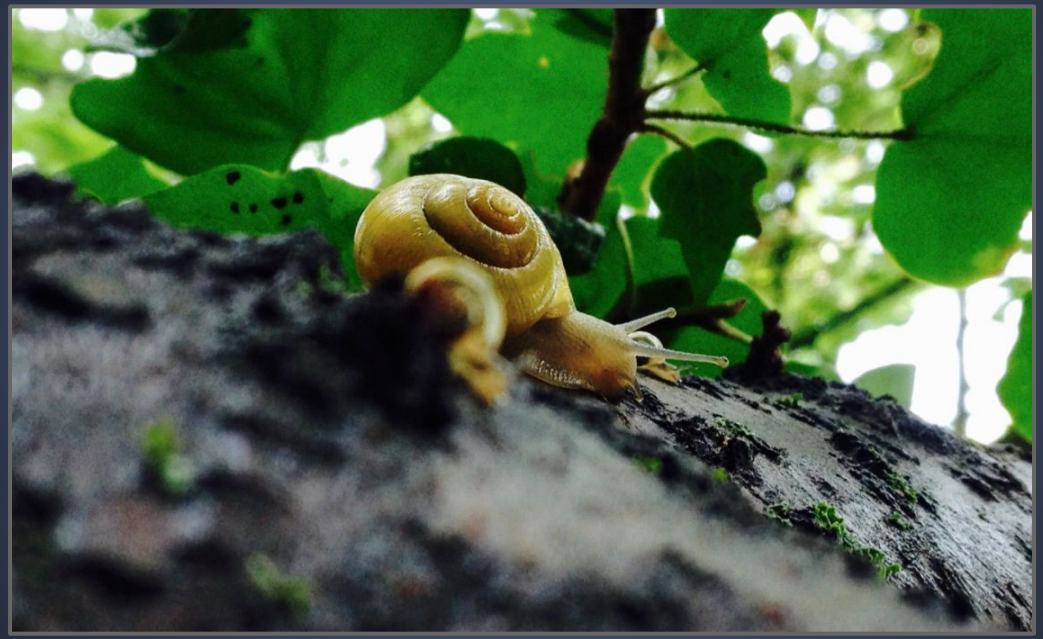
Assignment #1: A Photograph is a Photograph



After the Rain
Bratislava, Slovakia
iPhone 4S (yes iPhone 4S)

Assignment #1: A Photograph is a Photograph

That day, it had just rained. My dogs had been cooped up all day, and I had let them out into the yard and was preparing to take them for a walk in the woods behind our home. While they were running around the yard, I noticed a family of snails climbing the tree and took a few photos of them. This group of snails was roughly neck level with me (I am 5' 9" / 176 cm for reference). The photo on the previous slide is my favorite photo of the set.

Assignment #2: Epsilon Photography

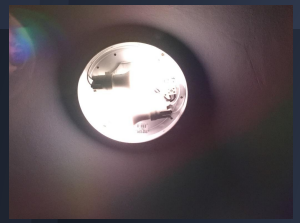


Image 1

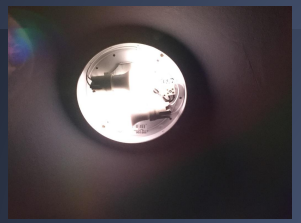


Image 2

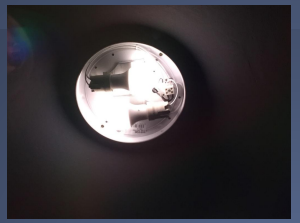


Image 3

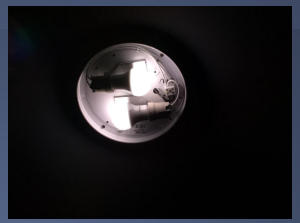


Image 4

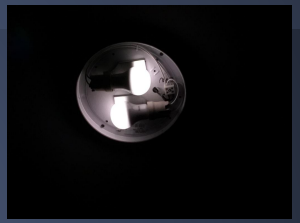


Image 5

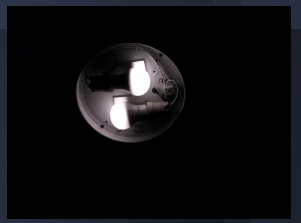


Image 6

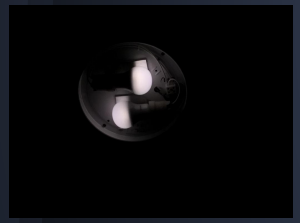


Image 7

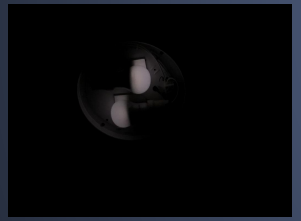


Image 8

Final Artifact

Description:

Photos of a LED light bulb using a light filter and varying shutter speed. Photos taken with an iPhone 6.

Photos are combined in GIMP to produce the final output.

Assignment #2: Epsilon Photography

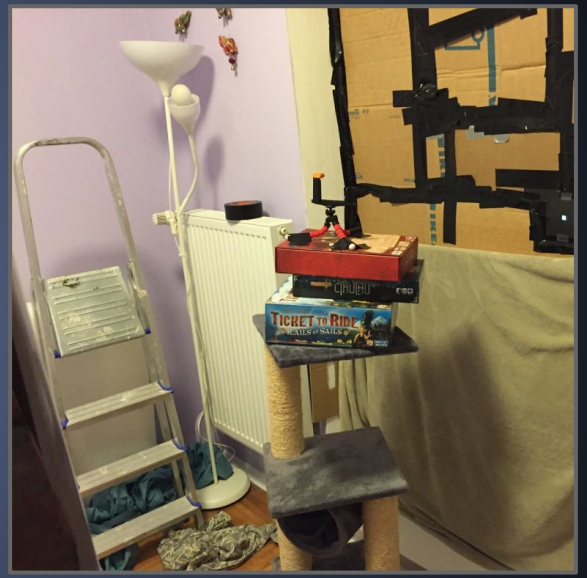
Above - Final Artifact. **Below** - animated GIF of epsilon photos

https://drive.google.com/file/d/0B83gCKMmvPD6VDZpak9ISFdjUlk/view?usp=sharing

Assignment #3: Camera Obscura

The Scene

The Image



The Set-up

This is an example of a form of pinhole camera. This is produced by light-sealing a room and allowing the outdoor scene to be projected onto a screen surface. Unedited, the scene is projected upside down due to the optics of the pinhole camera. **Left:** the original scene; **center:** the captured scene (only rotated and cropped); **right:** the camera setup.

Assignment #4: Blending

Black

Mask

White

The purpose of this assignment is to blend two images (see above, **left** and **right** images) in a novel way using a blending mask (**center**). The subjects of my two input images were taken from the internet.

- **Black Image**: A Meme of a Bear hugging a Dog. The caption reads “So now, show me, which one called you a Yorkshire” (Image version was making the rounds on Facebook. The original image is from: http://mojhumor.sk/gag/4773/no-ukaz-ktory-ti-to-povedal-ze-si-yorkshire.html)
- **White Image**: Is a digital reproduction of an oil painting of George Washington’s crossing of the Delaware River (Paiting Details: https://en.wikipedia.org/wiki/Washington_Crossing_the_Delaware, Image URL: https://upload.wikimedia.org/wikipedia/commons/thumb/9/95/Washington_Crossing_the_Delaware_by_Emanuel_Leutze%2C_MMA-NYC%2C_1851.jpg/1200px-Washington_Crossing_the_Delaware_by_Emanuel_Leutze%2C_MMA-NYC%2C_1851.jpg)

Assignment #4: Blending

Above - Final blended artifact.
Title: *Now show me which one called you a Yorkshire*

Assignment #5: Panoramas

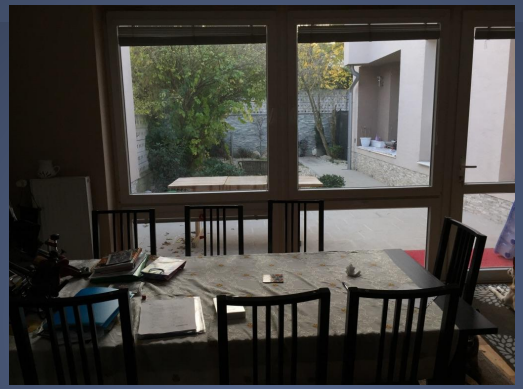


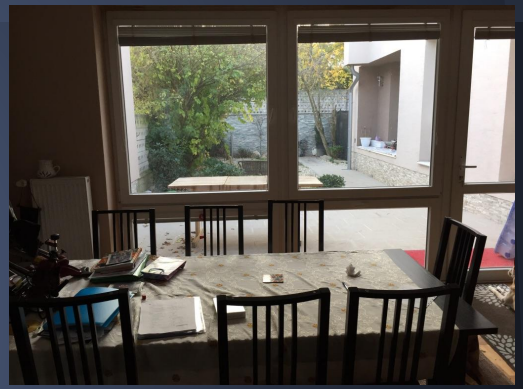
Above - Panorama Input Images

Assignment #5: Panoramas

Above - Final Panorama Output

Assignment #6: HDR





High Dynamic Range (HDR) images attempt to reproduce the range of luminosities visible by the human vision system by extrapolating the real luminosity of the scene from a set of input images.

This set of photos were the original inputs to my HDR project.

Assignment #6: HDR

Basic HDR

HDR with Color Remapping

Assignment #7: Video Textures

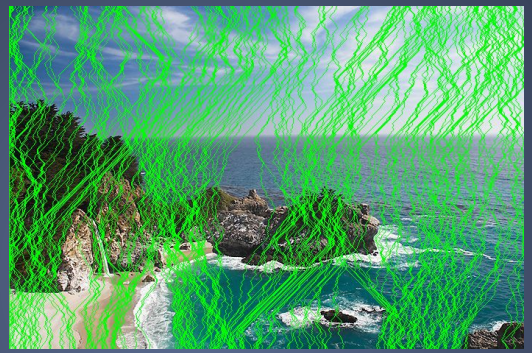
Start frame filename: frame_0032.png
Index frame number: 32

End frame filename: frame_0096.png
Index frame number: 96

The purpose of this assignment was to produce a video texture - a form of infinitely looping video. The final animated gif is produced by locating the best pair of frames to produce the loop. Above are the two frames selected.

Input video from YouTube: https://www.youtube.com/watch?v=8v2sAylgkgc
Link to your video texture gif - https://drive.google.com/open?id=1Z_O7GhY5inAUuyk4eYWGmCM1EVvfqoVG
Link to the input frames (folder) - https://drive.google.com/open?id=1m2po73EX3C33qmji5bgFdnpJxqHC5GZo

Midterm Project (1)


The purpose of this project was to replicate the research results presented in the paper “Seam Carving for Context Aware Image Resizing” (https://inst.eecs.berkeley.edu/~cs194-26/fa16/hw/proj4-seamcarving/imret.pdf). The purpose of the paper was to demonstrate an improved means for image retargeting (cropping / expanding) using automatic methods to protect content.

Left: original image,
Center: original image - showing seams to remove (**Scharr**)
R***ight:*** final image - removing 200 vertical seams

Midterm Project (2)

This set of images demonstrates the technique of context aware resizing used to increase the size of a sample photo.

Left to Right:

- Original Image
- 30% expanded image showing the seams to be added
- 30% single step expand resulting image
- **M**ulti step result, showing 75% image size expansion, ***Scharr*** seam finder

Final Project

Replication of the results of *Improved Seam for Video Retargeting (Rubinstein, Shamir and Avidan)*

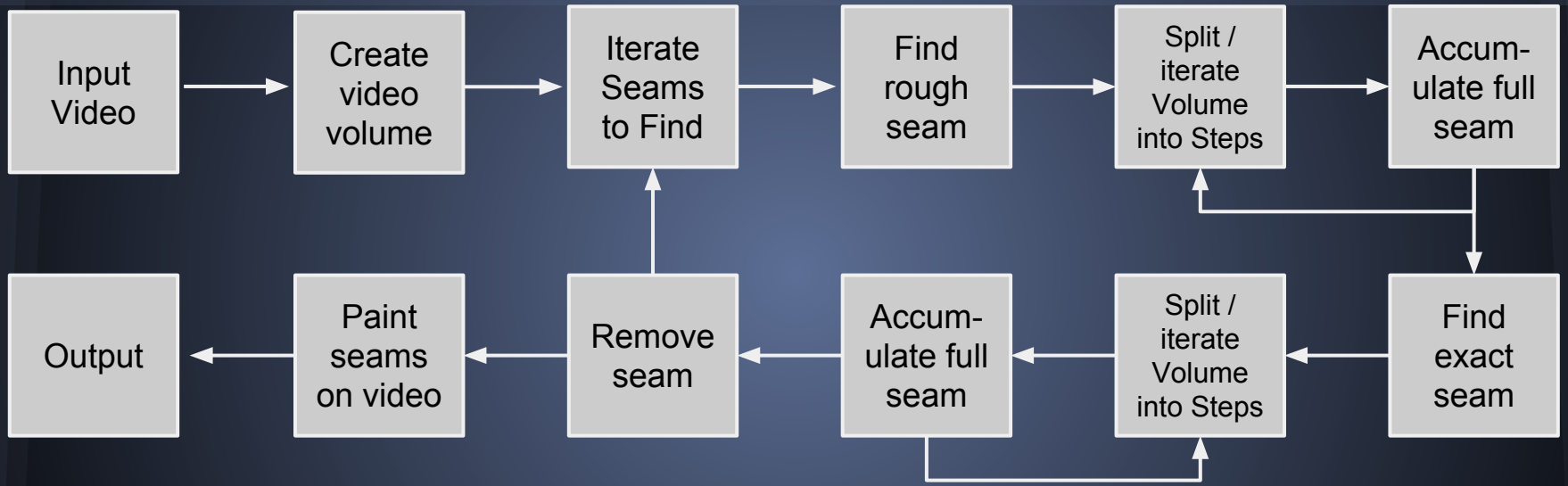
Goal of Project:

Utilize an algorithmic technique known as Graph Cut (Max-flow / Min-cut) to replicate the results for size reduction pictured on the slide “Midterm Project (1)”. Graph cut is a generic technique that allows for simple representation of complex optimization problems.

Thanks to this representation, the project also demonstrates an improved retargeting method known as “forward energy” that helps to better preserve image content by considering the quality of the resulting image.

Finally the technique is extended to 3-dimensions (**Time**, Y, X) and used to crop videos.

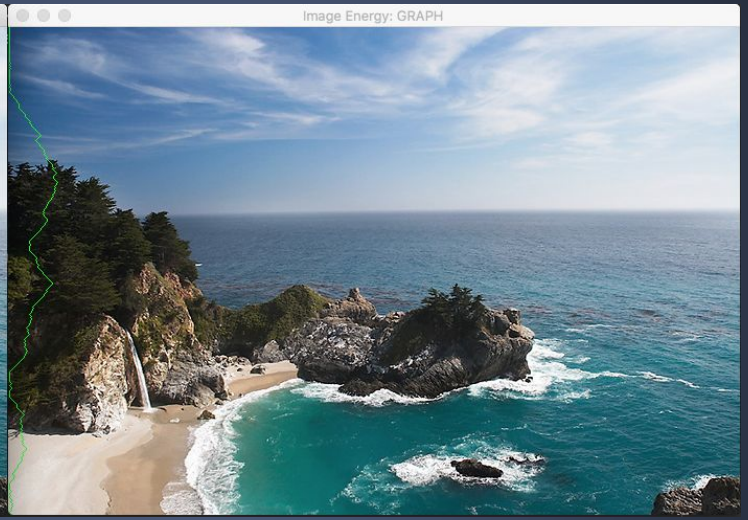
Final Project

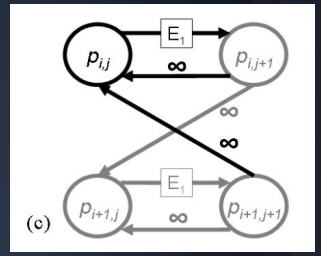


Description

The diagram above represents the fully automated video pipeline implemented for this project. Seams are iteratively removed from the final image. Due to computational efficiency issues of graph cut, the pipeline first finds a “rough” cut over a low-resolution version of the video and then “localizes” the exact cut using a sliver of pixels surrounding the rough seam found.

Final Project - Seam Carving w/Graph

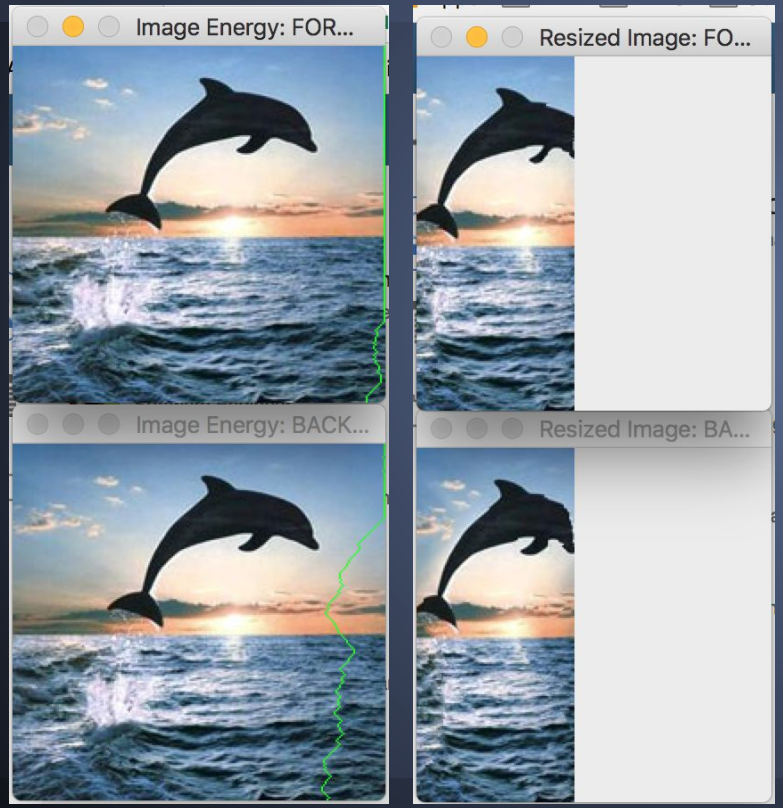


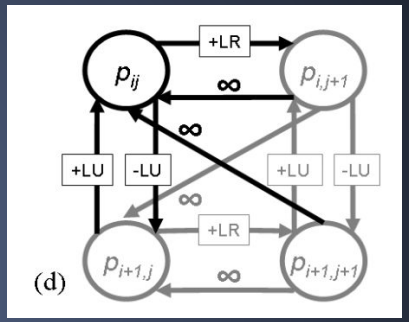


Replication of Midterm Seam Carving Results using Graph Cut.

Left: Midterm; **Center**: Graph Cut; **Right**: Graph Cut Formulation used.

Final Project - Improved Seam Carver



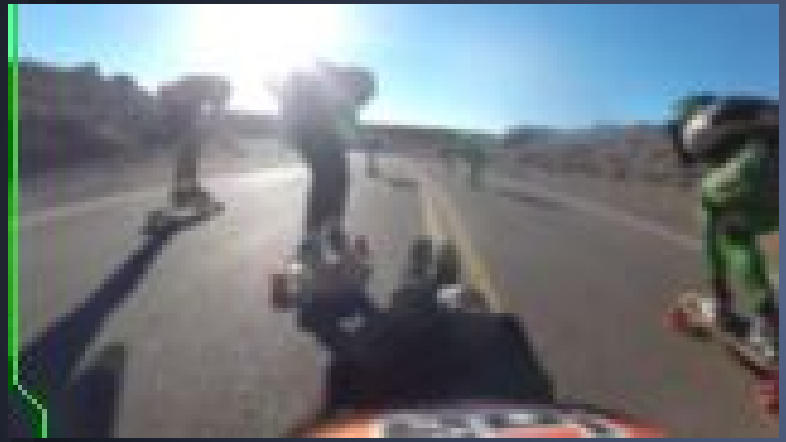


Above: Forward Energy Graph Formulation.

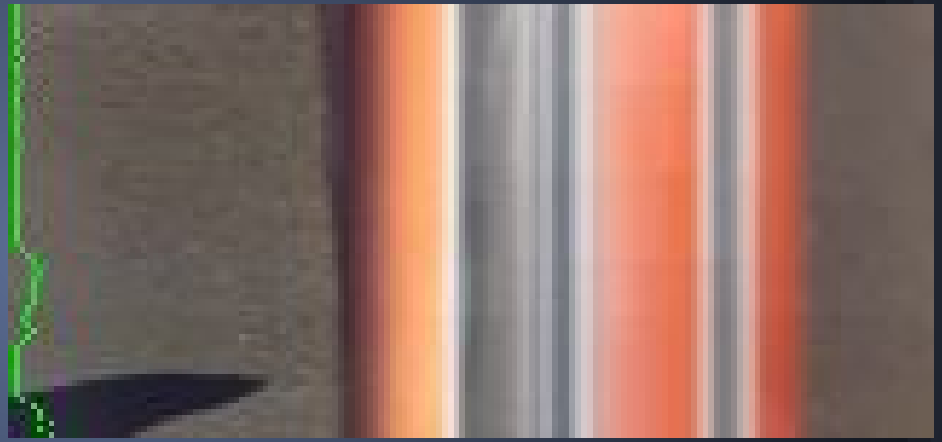
Comparison of Forward Energy (Left, Top) and Backward Energy (Left, Bottom / Midterm) Energy functions.

Forward energy will introduce less distortion in the dolphin (favoring cropping the image) in over cropping scenarios.

Final Project - 3D Seam Carving



Single seam [f=0] in Spatial [YX] Plane



Same seam viewed in Temporal [TX] Plane

Demonstration of the seam method over 3D volume of data volume. To the left, the seam is viewed from the perspective of frame 0 of the video; to the right, the bottom most row of pixels is viewed from above over time.

Final Project - 3D Seam Carving

Demonstration of removing 25 seams viewed from Spatial YT Plane (Top) and Temporal [TX] Plane (Bottom)

Video: https://drive.google.com/file/d/1oHwskJrFRe5BG3rXjoIYxIH4RbhM5jY8/view?usp=sharing

Video (Left: original with seams drawn on; Right: Final Output)