
# CS 6475 Course Portfolio

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# Assignment 1: Camera Obscura Setup

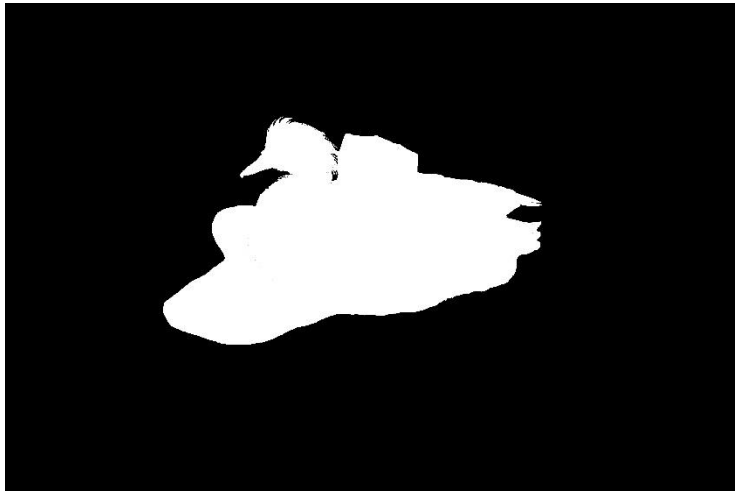
The camera obscura is a room-sized pinhole camera. I blocked out all sources of light, covering the windows with plastic trash bags and the door frames with electrical tape. I made holes in the plastic bags with drill bits to allow specific amounts of light through. With the correct aperture – or size of hole, a crisp, inverted projection of the scene appears within the room. As the aperture grows beyond the optimal point, the projection starts to grow blurry.

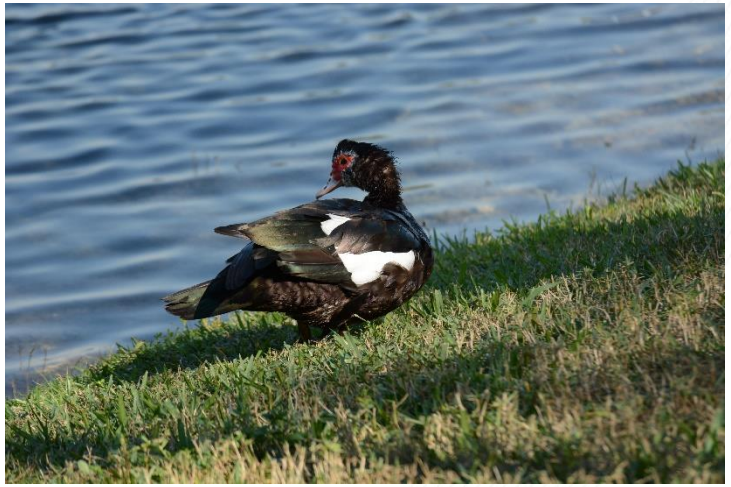
I was surprised to see the lengths I would need to go to block out all light in the room. Even the door frames that led to the unlit hallway needed to be taped over for the obscura to work correctly. In addition, the projected image was only just perceptible to me. When taking pictures of it, my shutter speed was very low to increase the exposure so that it could be visible.

# Assignment 1: More Camera Obscura Results

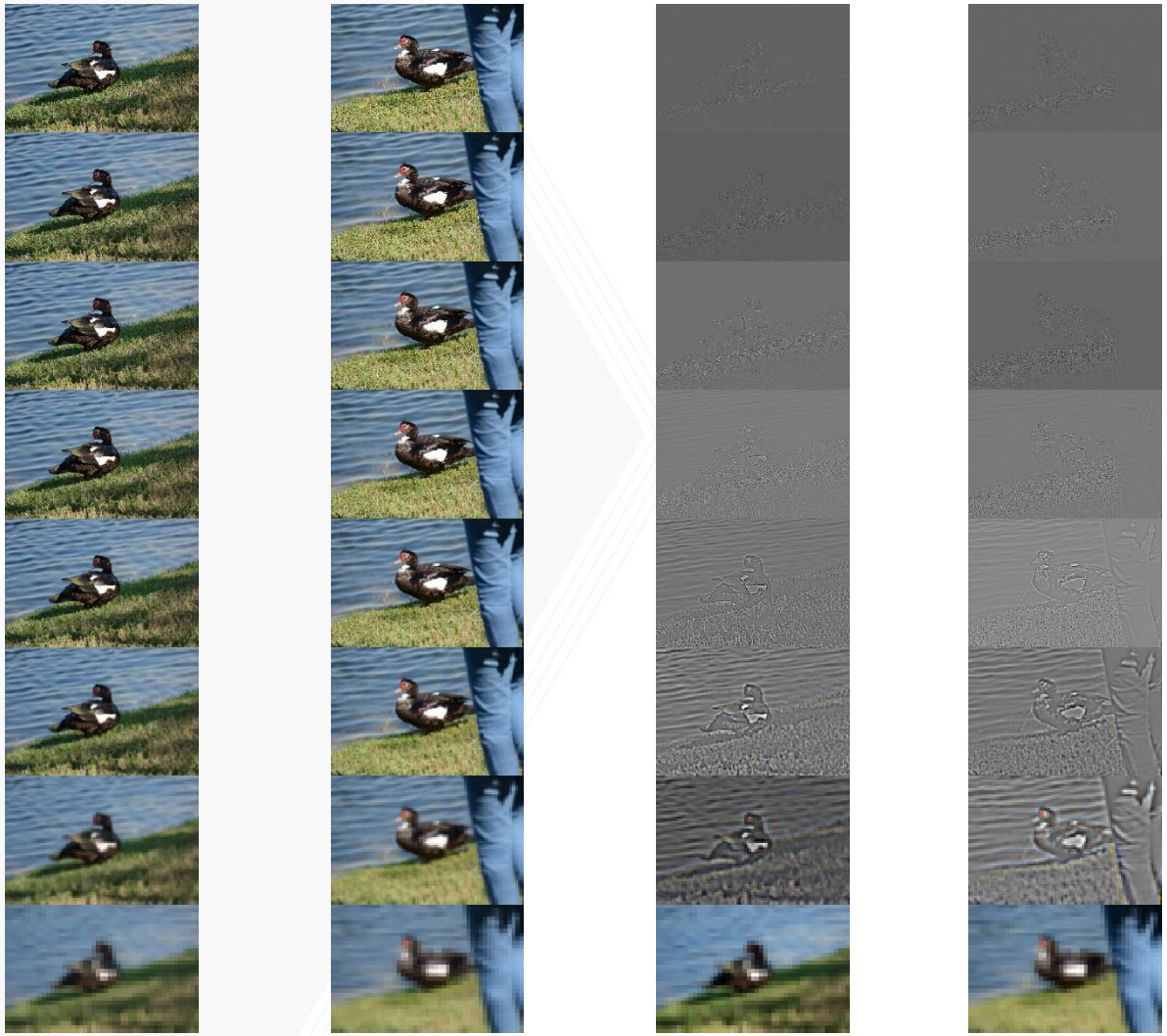
# Assignment 2: Pyramid Blending

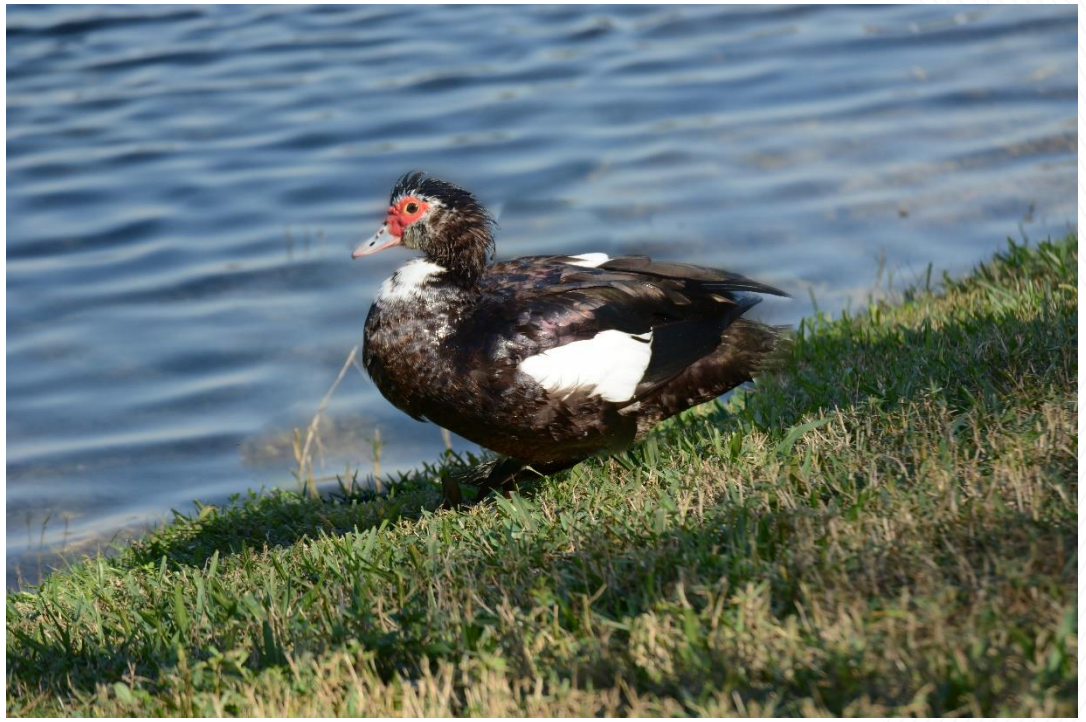
Pyramid blending is a process by which two images are merged using a mask. Content from the left, or “white,” image will be inserted into the right, or “black” image. The mask (middle image below) shows what parts of the white image will be used. The borders of the mask are also smoothed to create a less abrupt transition. This is opposed to a cut-based merge, where a seam is found to optimally split the images and join them.
I was impressed with how well the blend worked! I needed to add some extra parts on the white mask to account for the duck’s head and tail in the black image (when I didn’t, my result showed a duck monster). The idea with the blend was to take the better perspective of the duck in the white image and to remove the legs that got caught in the photo.





# Assignment 2: More Pyramid Blending Results

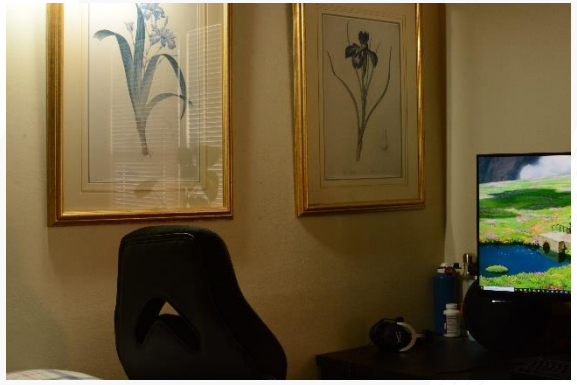




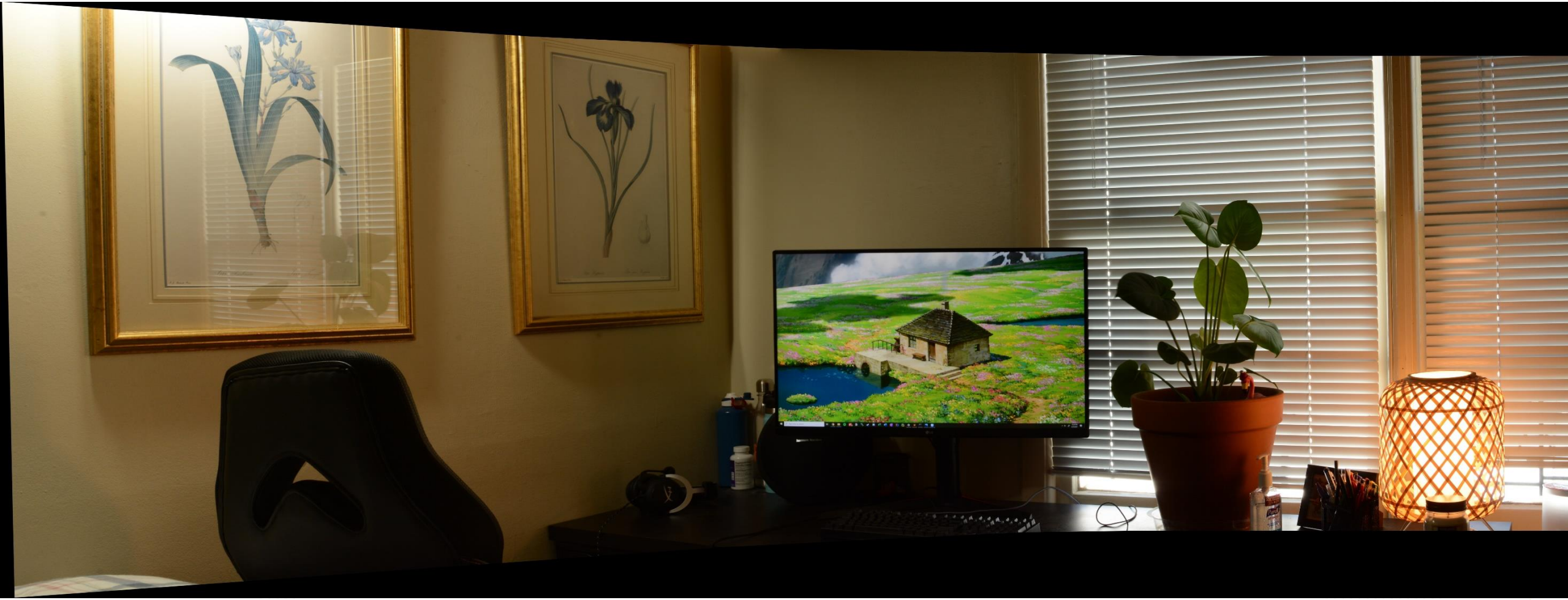
# Assignment 3:Panorama

Panoramas are created by finding common features between two images and using them to describe a function that can warp the images so that the features will overlap. The quality of the panorama are highly dependent on the accuracy of the feature matching.

The first panorama I tried to make was of pictures of my outdoor plants. The panorama ended up not working well due to the leaves appearing too similar to each other. This caused my feature matcher to incorrectly pair up different leaves. Indoors, however, the program was able to correctly map the features.



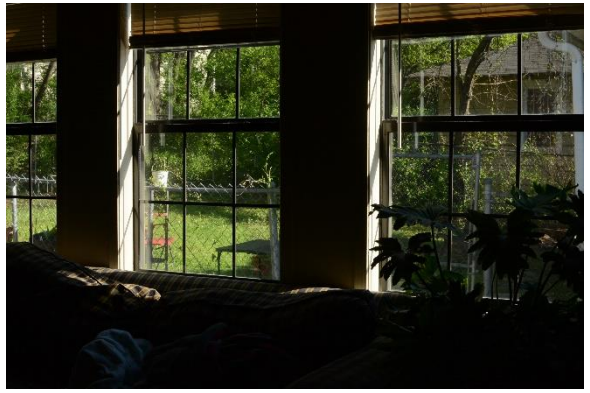

# Assignment 3: Panorama Results

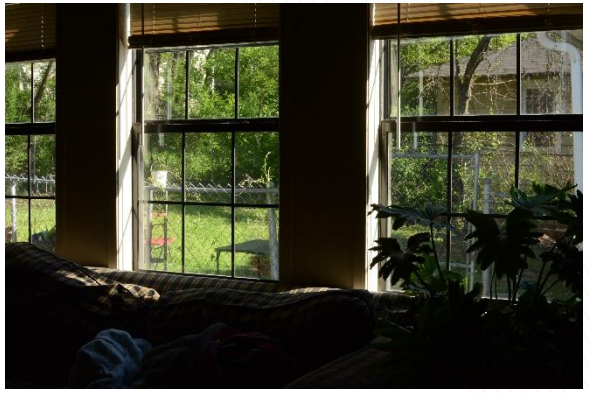


# Assignment 4: HDR

High dynamic range is a process by which several pictures of different exposures are processed to create one image of optimized lighting. With my input images, you can see that when the shutter speed is high, the outdoor portion is visible, but the indoor portion is underexposed. Increasing my shutter speed to improve the indoor exposure causes the outdoor portion to blow up and have light bleeding. HDR would ideally combine the outdoor portion of the high shutter speed images and the indoor portion of the low-speed images. The assignment also involved an additional step to improve the contrast within the image.

My results turned out much more visible than any one image. However, I found some issues with image artifacts and wrong coloring. For example, you can see a green tint overlaying the output images.





# Assignment 4: More Results

Original Output

Contrast-Improved Output

# Project 1

Project 1 involved implementing a content-aware cropping method. When resizing an image, you usually have two options: stretch/compress the image or crop details from the image. Here, we instead try to find parts of the image a human would be least likely to notice gone and either take them out (removal) or duplicate them (insertion).

The images used for this project were provided by the class. The left image is the original and the right is the removed/inserted image. For some of them, the cropping worked really well, but for others, a lot of artifacts appeared that I could not remove (see the car photo).

# Project 1: More Results

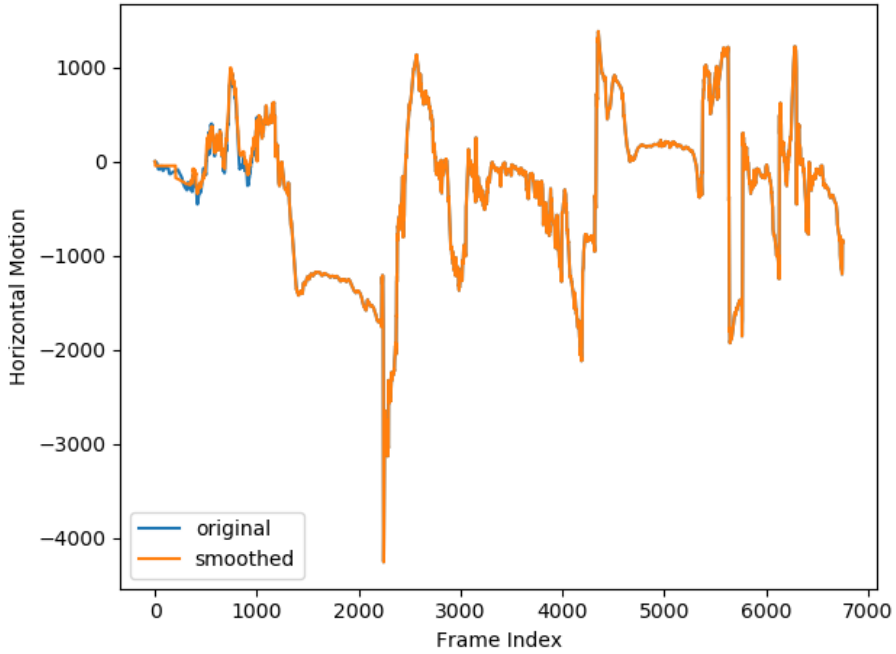
# Project 1: More Results

# Project 1: More Results


# Project 2

Our final assignment was to create a video stabilizer. It works in three main steps: predict the motion of the camera when it was taking the video, find a function to smooth out the motion path, and then warp and crop the frames to remove the motion noise. In each result slide, the graphs show the original camera motions and the smoothed ones. The image with the red rectangle shows how a certain frame of the video was cropped to stabilize it. The figure skating video was provided by the course and the cat and plant videos were shot by me.

This project took me a significant amount of time. It took a lot of work to correctly tune the model that found the camera path and the mathematical solver for the smoothing. My code did remove a lot of motion though!





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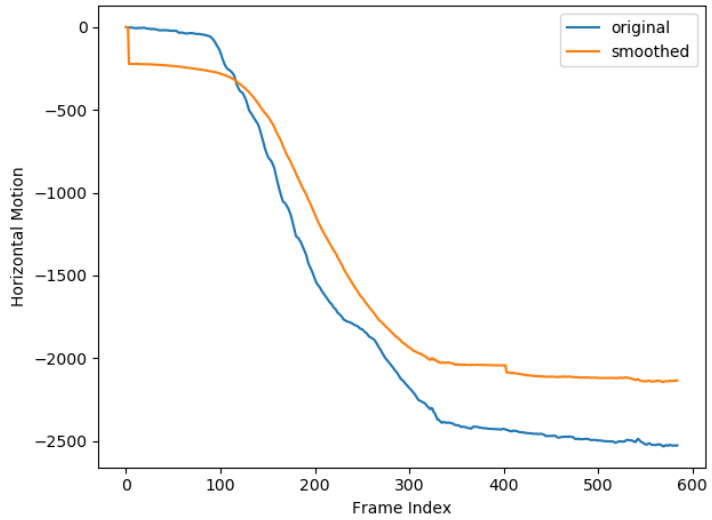
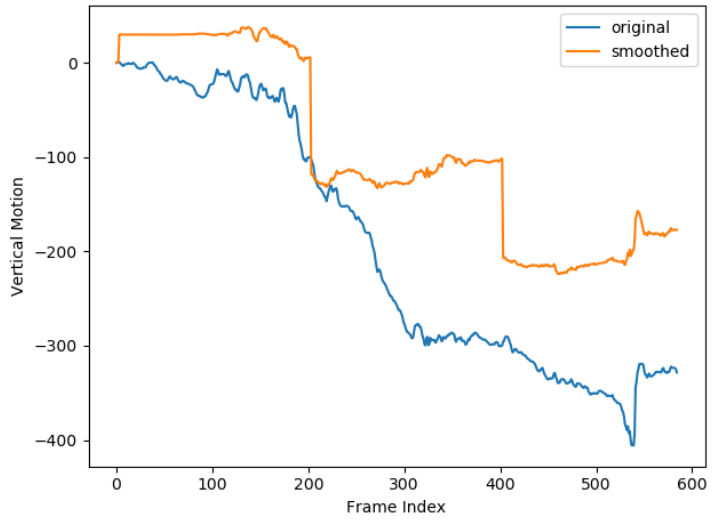
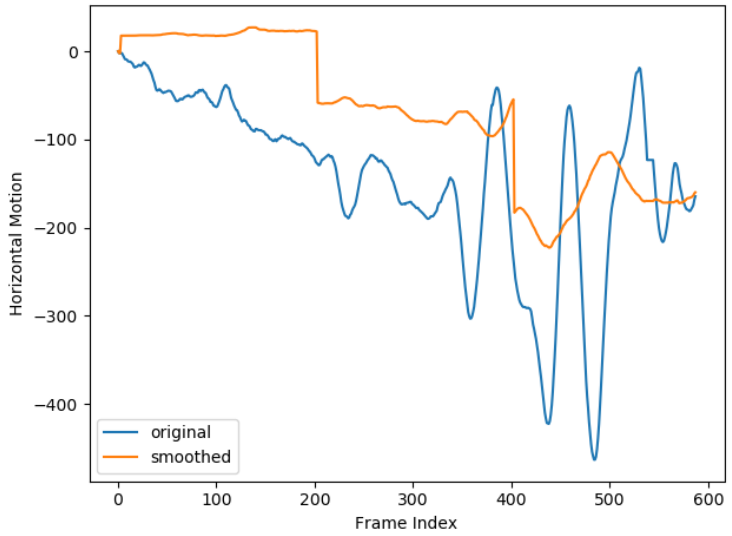
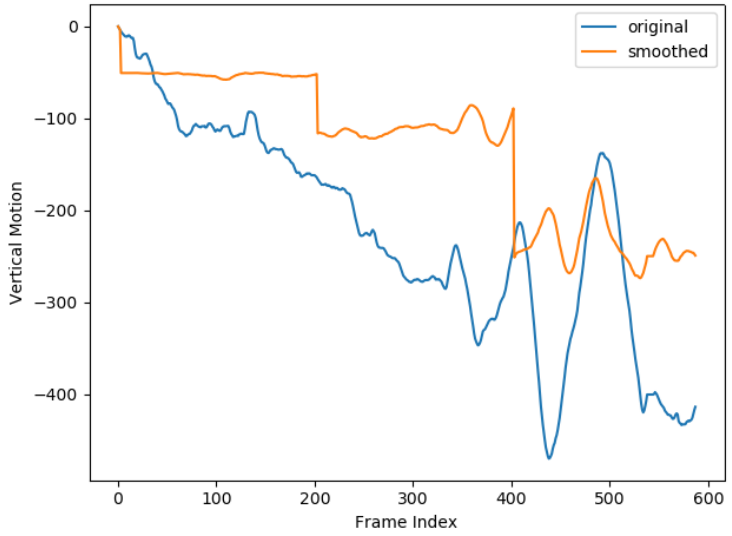
# Project 2: More Results




# Project 2: More Results

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