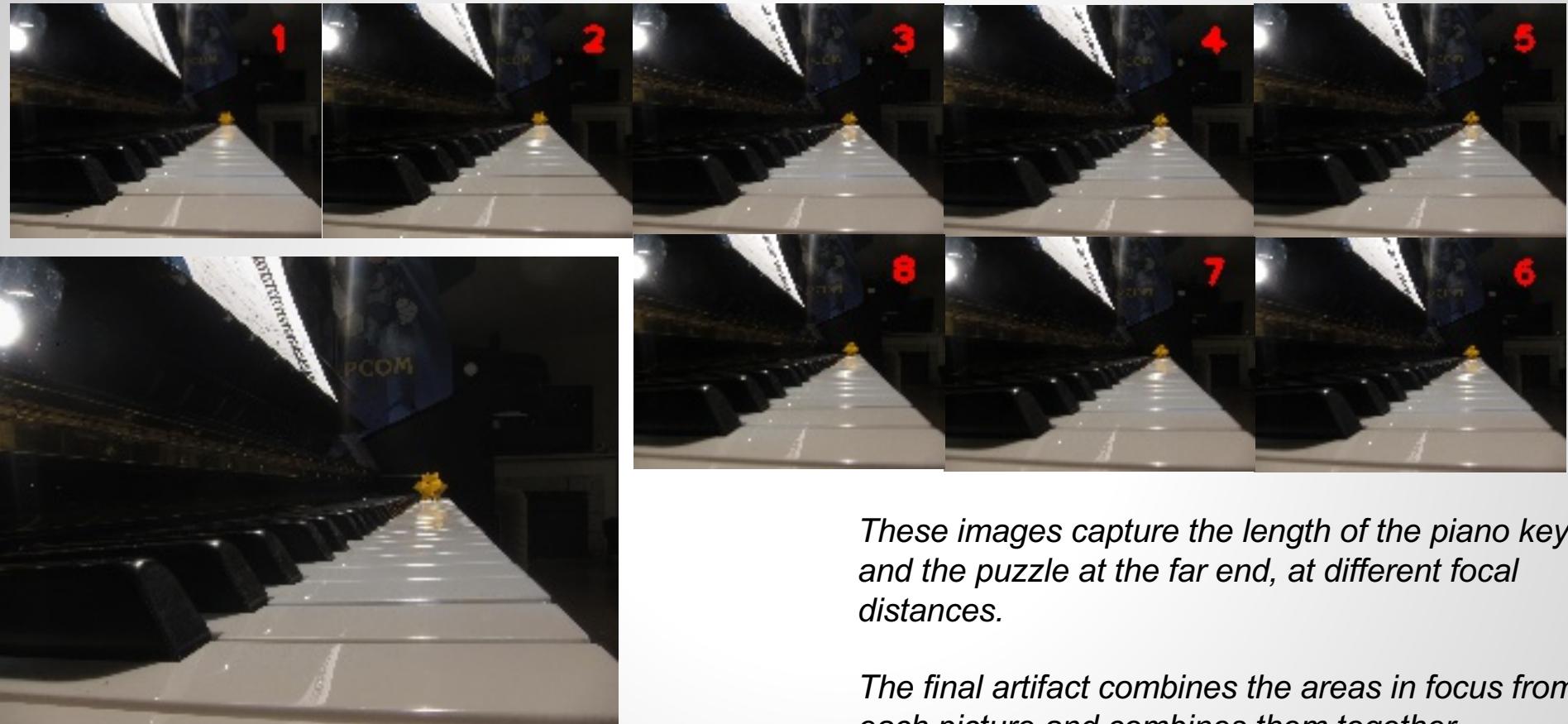


Computational Photography

Assignment #3: Epsilon Photography

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A Brief Look at My Epsilon Project



Final Artifact

These images capture the length of the piano keys and the puzzle at the far end, at different focal distances.

The final artifact combines the areas in focus from each picture and combines them together.

What was the motivation or goal?

I wanted to explore focus stacking with a series of images taken at different focal distances.

The motivation to do this came from my friend, whose research focuses (pun intended) on stacking planar images of tissues (which are usually a few microns thick) to form a complete 3-D image of the tissue. Granted, this is not exactly equivalent as its final product is a 3-D image of all parts from constituent images, whereas mine is simply a 2-D stack of only some parts (namely, parts in focus) from the constituent images.

In order to make the final artifact more pronounced, I placed an object with pointy texture (the puzzle) at the far end of the piano.

Details of the Pictures you Took

What are these images of?

The keys on my Yamaha upright piano, a simple spatial puzzle and my arcade in the background.

Santa Clara, CA. Between the hours of 18:28 and 18:30 on the 18th of September, 2016.

What is your epsilon?

Focal plane/distance (i.e. focus)

How did you control the setting and the camera to meet your epsilon requirement?

Using manual controls on my Canon Powershot S95. I tried to use CHDK and a script to automatically take pictures at intervals of f.d., but it always crashed and I couldn't figure out why :(

Image 1



Focus Distance: 0.09 m

Exposure time: 1s

Aperture: f/8.0

ISO: 80

Focal Length: 6.0 mm

Image 2



Focus Distance: 0.12 m

Exposure time: 1s

Aperture: f/8.0

ISO: 80

Focal Length: 6.0 mm

Image 3



Focus Distance: 0.20 m

Exposure time: 1s

Aperture: f/8.0

ISO: 80

Focal Length: 6.0 mm

Image 4



Focus Distance: 0.26 m

Exposure time: 1s

Aperture: f/8.0

ISO: 80

Focal Length: 6.0 mm

Image 5



Focus Distance: 0.38 m

Exposure time: 1s

Aperture: f/8.0

ISO: 80

Focal Length: 6.0 mm

Image 6



Focus Distance: 0.63 m

Exposure time: 1s

Aperture: f/8.0

ISO: 80

Focal Length: 6.0 mm

Image 7



Focus Distance: 1.63 m

Exposure time: 1s

Aperture: f/8.0

ISO: 80

Focal Length: 6.0 mm

Image 8



Focus Distance: 3.67 m

Exposure time: 1s

Aperture: f/8.0

ISO: 80

Focal Length: 6.0 mm

Final Artifact



Final Artifact Details

Your final product demonstrates your epsilon.

- The final image was generated by stacking areas in focus in each of the 8 pictures (which differed in the focus distance) and stitching them together i.e. focus stacking.
- Notice in the final image you can see the yellow object sharply as well as the small black speck on dust on the foreground towards the left edge, whereas in no single image were the two simultaneously in focus.
- In order to stack the photos together, I used a software called “ZereneStacker”, available for free on the internet. The specific algorithm I used was ‘DMap’, which produced better results than the other algorithm ‘PMax’.

Was your epsilon successful?

What were you happy with?

I'm quite happy with the results, especially since all parts of the subject (piano keys, yellow object and the arcade in the background) are clearly in focus in the final picture. It has definitely stoked my interest in learning the algorithms behind focus stacking. :)

What would you do differently?

I tried my best at writing a BASIC script to automatically takes pictures at different focal distances. But no matter what I did, my script always crashed on my camera. I wasn't able to find too much help online and so I had to resort to manual methods.

I'd be very interested in compiling my own version of CHDK to see why my script crashes on my camera.

Resources

Include technical resources that you relied on.

Canon Hack Development Kit (CHDK)

CHDK wiki

ZereneStacker