Assignment-4

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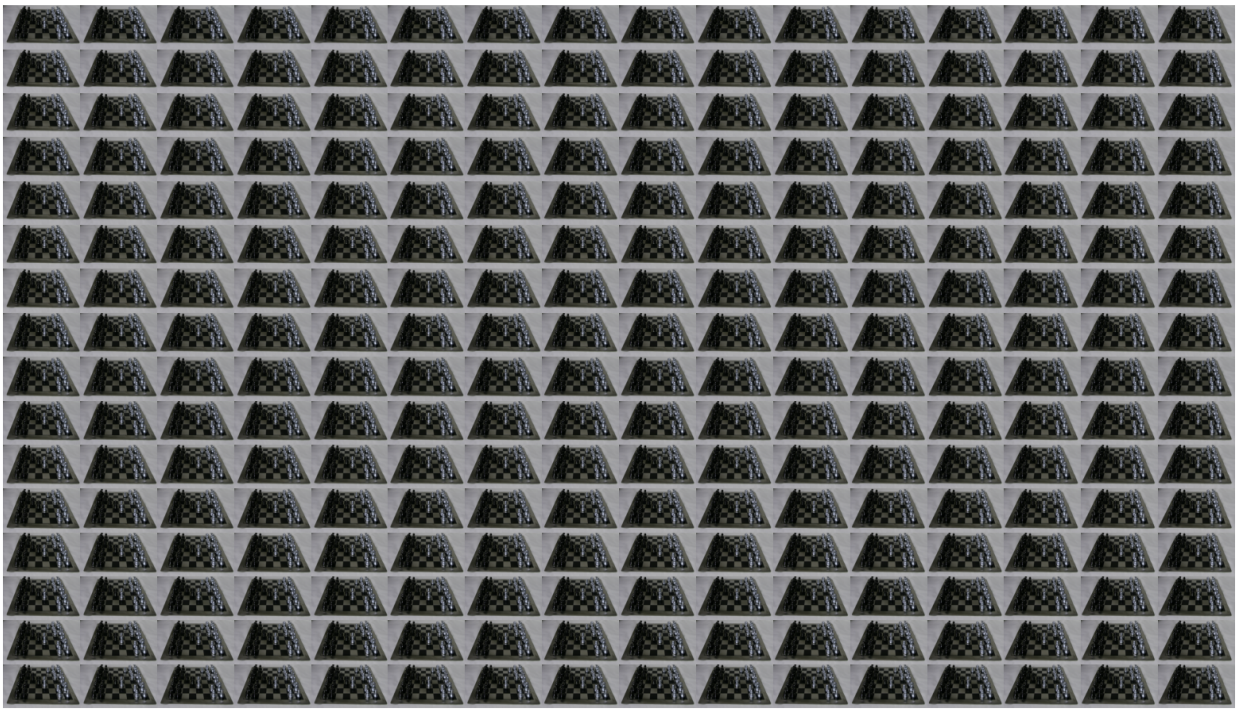
1. Lightfield rendering, depth from focus, and confocal stereo (100 points)

Initials (5 points)

Sub-aperture views (20 points)

256 sub-aperture views



Mosaic of 256 sub-aperture images

Discussion

1. The plenoptic camera stores the image as (6400, 11200, 3)
2. Every lenslet covers 16x16 pixels. The 5 dimentional image L(u,v,s,t,c) can be created by changing u, v as we move in every circle and change s, t as we move across circles.
3. The u, v is set with-respect to the middle from [-8, 7]

Refocusing and focal-stack simulation (25 points)

Depth = 0.1

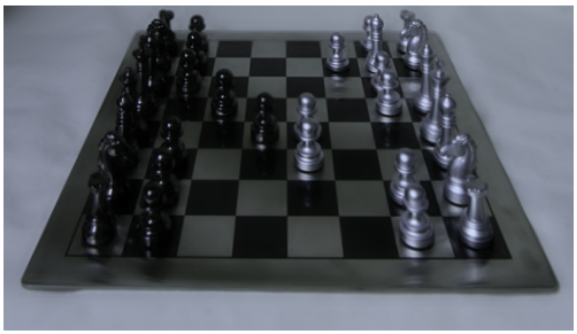
Depth= 0.4

Depth=0.75

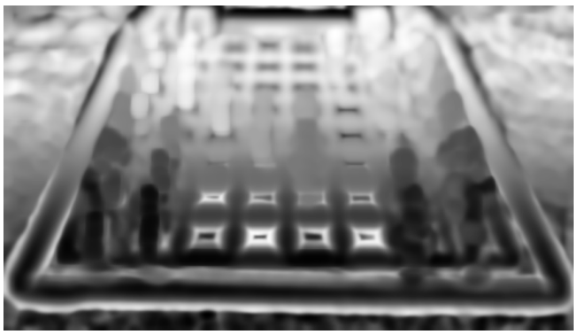
Depth=1.3

Depth=1.8

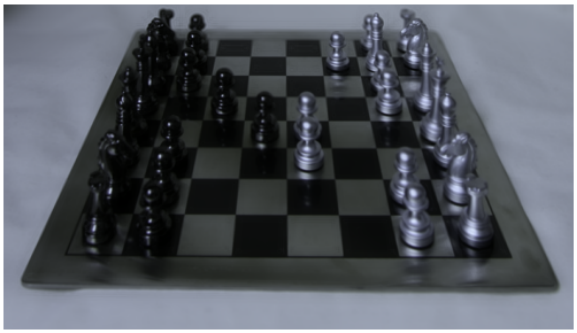
All-in-focus image and depth from focus (25 points)



All in focus image



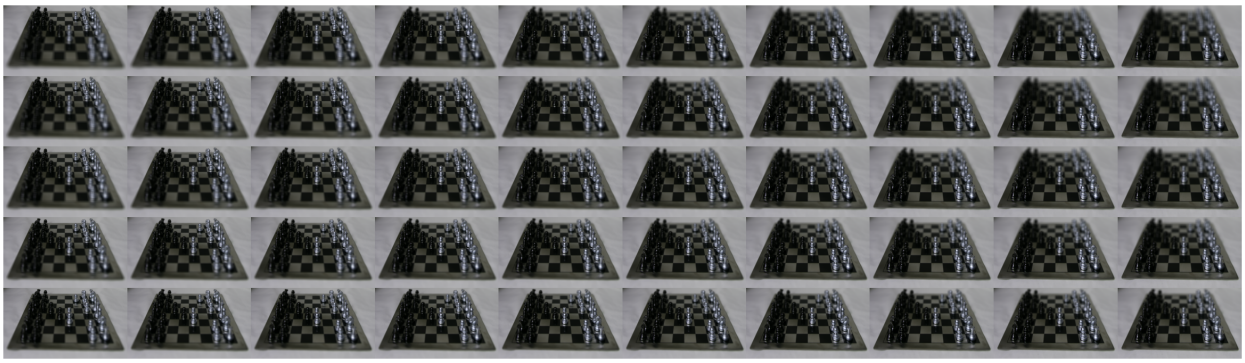
Sigma1=5, sigma2=5



All in focus image

Sigma1=2, sigma2=5

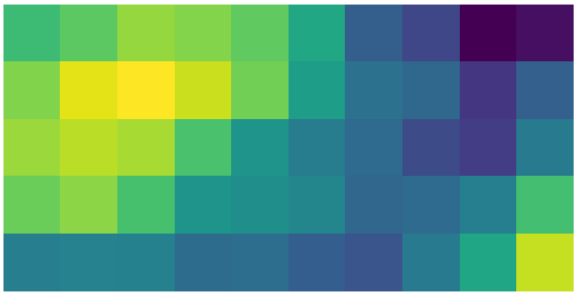
Focal-aperture stack and confocal stereo (25 points)



Focal-aperture stack

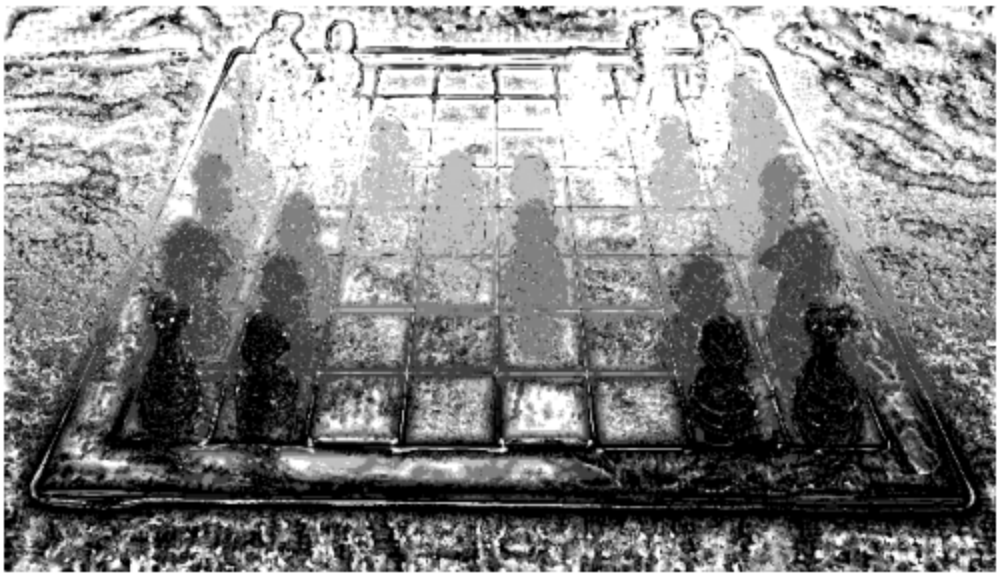
AFI for pixel 0,0

AFI for pixel 150, 200



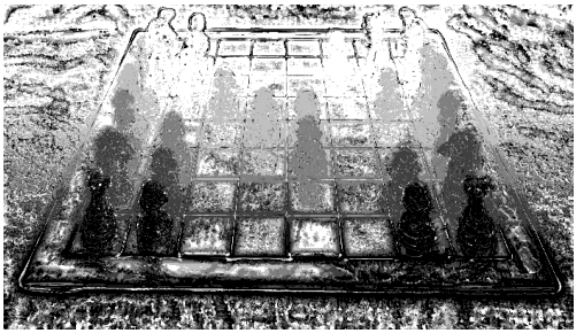
AFI for pixel 300, 200

AFI for pixel 380, 600

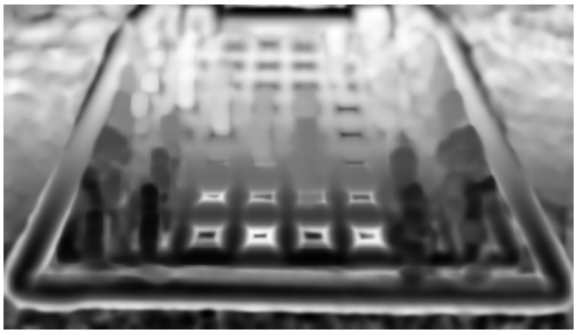


Confocal stereo depth

Discussion



Confocal stereo depth



Sigma1=5, sigma2=5

We can see from the two depth map that the depth map from the focal stack is smoother. This is because of it is calculated using gaussian filter and the confocal stereo is worked at the pixel level by choosing the depth with least variance across all the apertures.

3. Capture and refocus your own lightfield (100 points)

Capturing an unstructured lightfield. (30 points)

Refocusing an unstructured lightfield. (70 points)

Template

Focused around the card

Discussion

In this question, we did not have the structure or the amount by which our camera moves. After extracting the frame (Around 200)

1. Decide a template and a search window. The idea is to shift every image by calculating the shift between the template(a small patch from the middle frame) and the same pixels within the search window in all the other images.
2. For template matching, for every template_contestant from the search window we calculate the correlation. We chose the pixel values of the template_contestant ith maximum correlation —>sx and sy. We calculate the correlation using the luminance channel.
3. The correlation is calculated as in the pdf.
4. We then use the sx and sy values for every frame and shift every frame by these values.

Template

Middle frame

Template

The final refocussed image

Template

Final refocussed image