Daniel Korsunsky

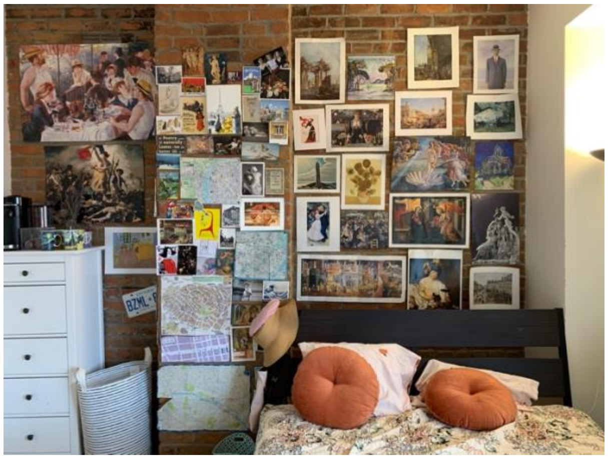


image1.jpg

image2.jpg

Composite image

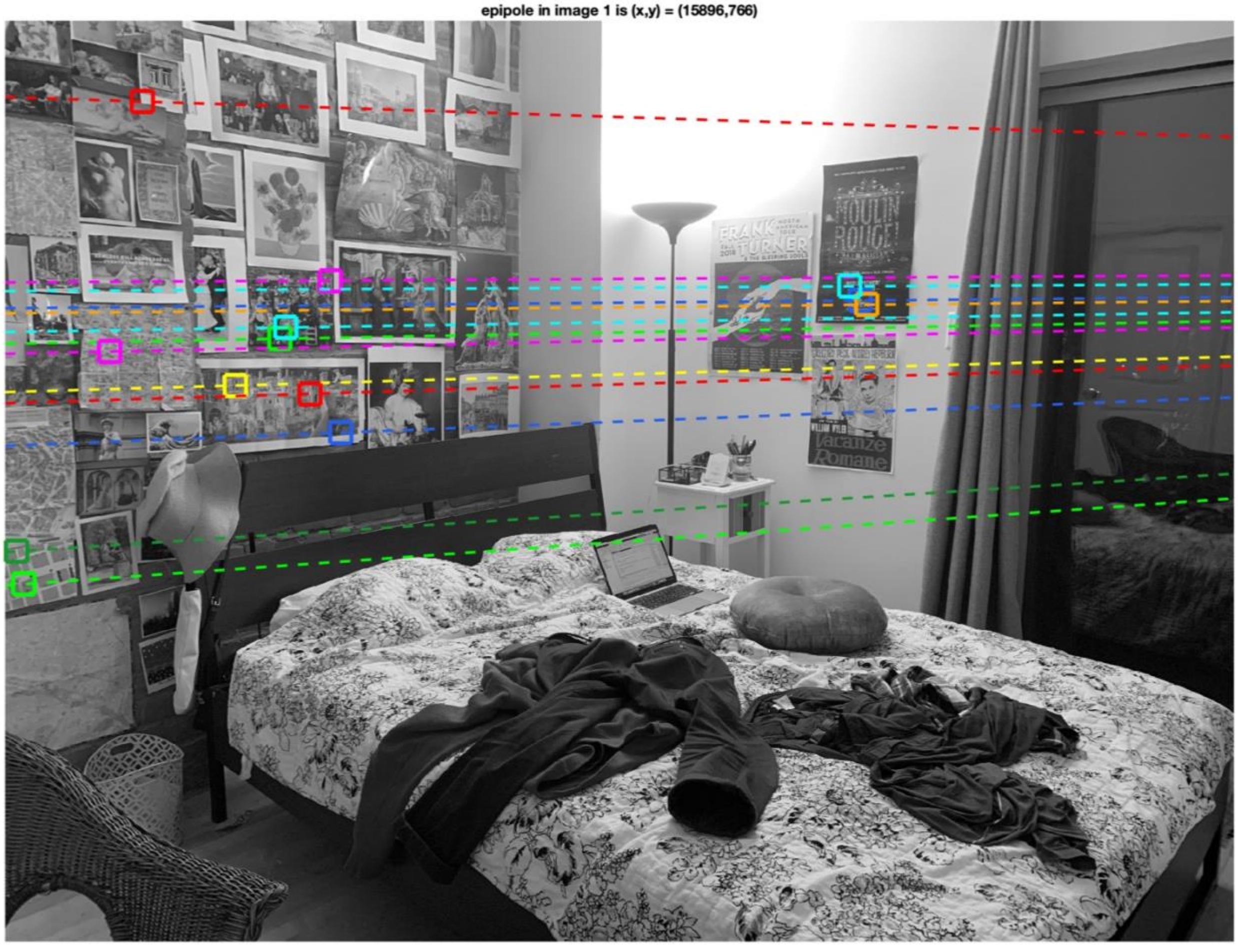
```
Note: The script may take a while to run, as the conditions for the consensus set are
rather high (90% of all matched points, with less than a 1e-4 error. If it is taking
too long, feel free to loosen the constraints (Lines 31 and 35).
```

Q2: Uncalibrated Stereo

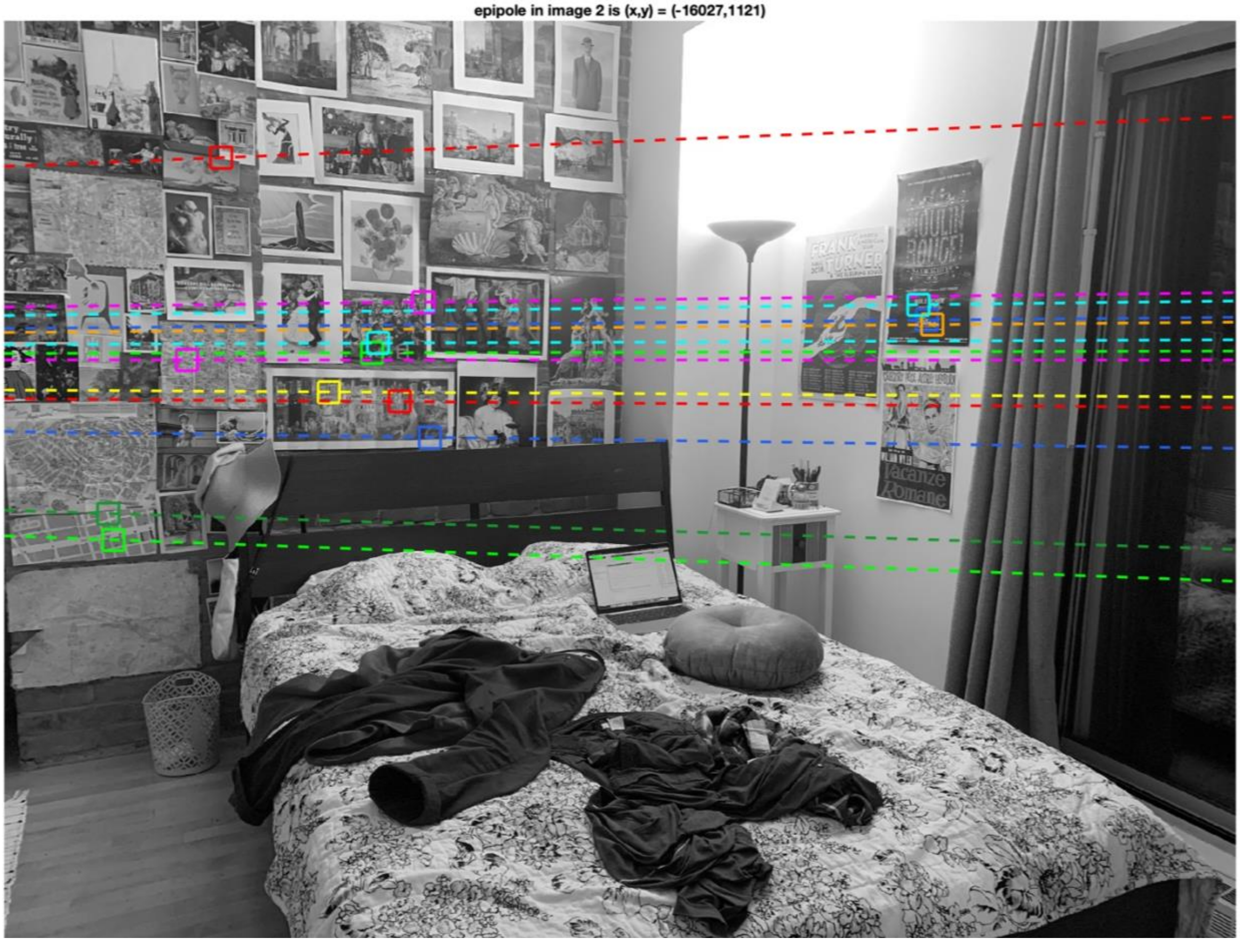
stereo1.png (left)

stereo2.png (right)

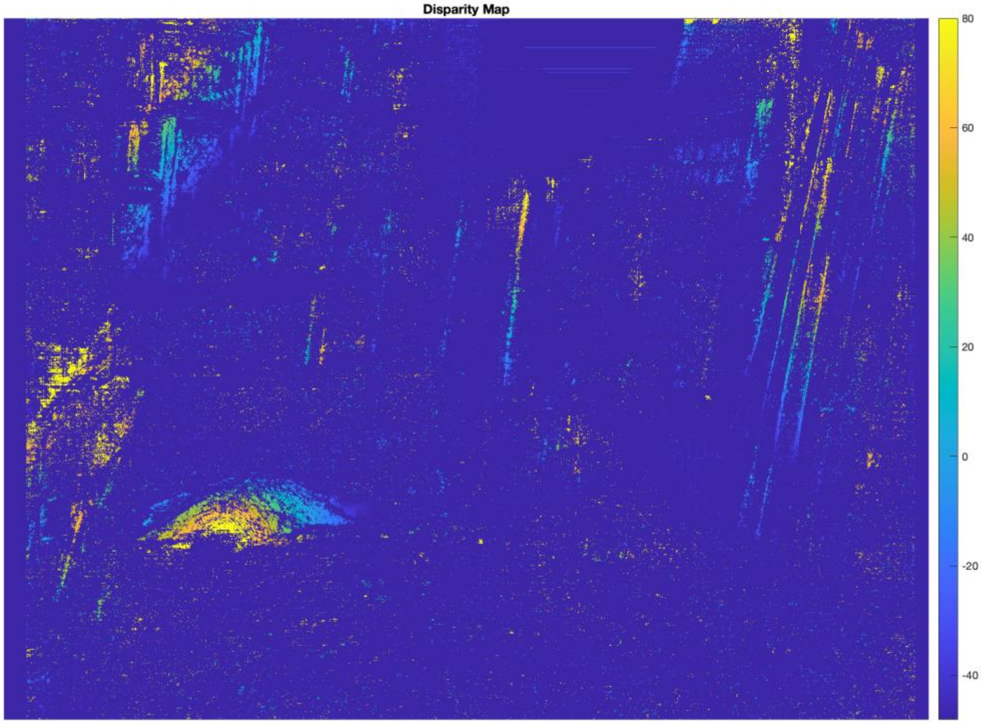
epipole in image 1 is (x,y) = (15896,766)



epipole in image 2 is (x,y) = (-16027,1121)



Disparity Map



Write-up:

I had a very difficult time taking a pair of images that MATLAB would accept without giving me an error such as in this example:

```
Error using estimateFundamentalMatrix>checkRuntimeStatus (line 236)
Could not find enough inliers in matchedPoints1 and matchedPoints2.
```

Unsurprisingly, it was the technicalities of using MATLAB that gave me the hardest time. The bedroom photos that you see on the previous two pages became my final examples because I could not take any other pair of images that I didn't get that runtime error with. Additionally, I spent a lot of time trying to debug and figure out why my script was giving me different matched point inliers each run, not knowing that this was to be expected.

Thus, in the meantime, I started working using the bookshelf example given by Prof. Langer and comparing my progress to the photos in the assignment. The following uses my script:

Understanding MATLAB's computer vision library was not extremely difficult, so I managed to derive the fundamental matrix pretty easily. I also thought I would have a hard time computing the inliers and matching points, but the `estimateFundamentalMatrix` function did most of the heavy lifting for me.

I had a much more difficult time subsequently calculating the epipolar lines and epipoles. This is because I didn't know how to interpret the parameters given by multiplying $F * x_1 = L_2$. Then, I realized that for each matched point in image 1 (and later similarly for image 2), I could compute the epipolar lines by dividing the first parameter of L_2 (kcosθ) by the second parameter (ksinθ) to find the slope of the line, after which it was simple to find the two points on the left and right sides of the image through which the epipolar line passes through. As you can see in the pictures of the bedroom, the lines successfully correspond (as well as the matched points).

I thought it would be simple to then calculate the coordinates of the epipole of each image, but found myself stumped. As we learned in the lectures, the epipoles in pixel space depend on knowing the K matrix, which I did not. I finally realized that the epipoles are defined at the point at which all epipolar lines intersect. Thus, during the loop where I calculated the epipolar lines, I also converted two of the lines to standard form and put them into a matrix. Performing a Gauss-Jordan elimination on this matrix produced the x- and y-coordinates of each image's epipole, which I could then add to the title.

What I perhaps struggled with most (and am still not confident about) was the disparity map, which you can see a few pages earlier. I spent a lot of time trying to find the best disparity range that would represent the depth variation in my images of the bedroom. As you might agree, it's very vague and seemingly inaccurate, which I believe is a result of the images having a confusing bedsheet pattern and not enough depth variation among objects (as well as many scattered posters on the back wall, which is confusing to the algorithm). I would have liked to introduce more depth variation in my example photos, but as I mentioned earlier, MATLAB was giving me a hard time whenever I tried to set up an image with objects at varying depths. In my disparity map, I would expect the bed at the bottom of the map to be designated as more yellow (higher positive disparity) since it is closest to the camera, which it is not (it has mostly very negative disparities). As I mentioned, I would attribute this inaccuracy to the fact that the bedding pattern make the bed plane confusing to the algorithm.

However, I do still think that the disparity map algorithm is working mostly as it is supposed to. If you examine some of the yellow and orange regions of the map (the pillow and right wall), they are all approximately at the same depth away from the camera. The other regions that correspond to art posters on the back wall are likely designated by large positive disparities (yellow and orange) because the posters depict scenes that have many details and depths that also skew the algorithm data.