

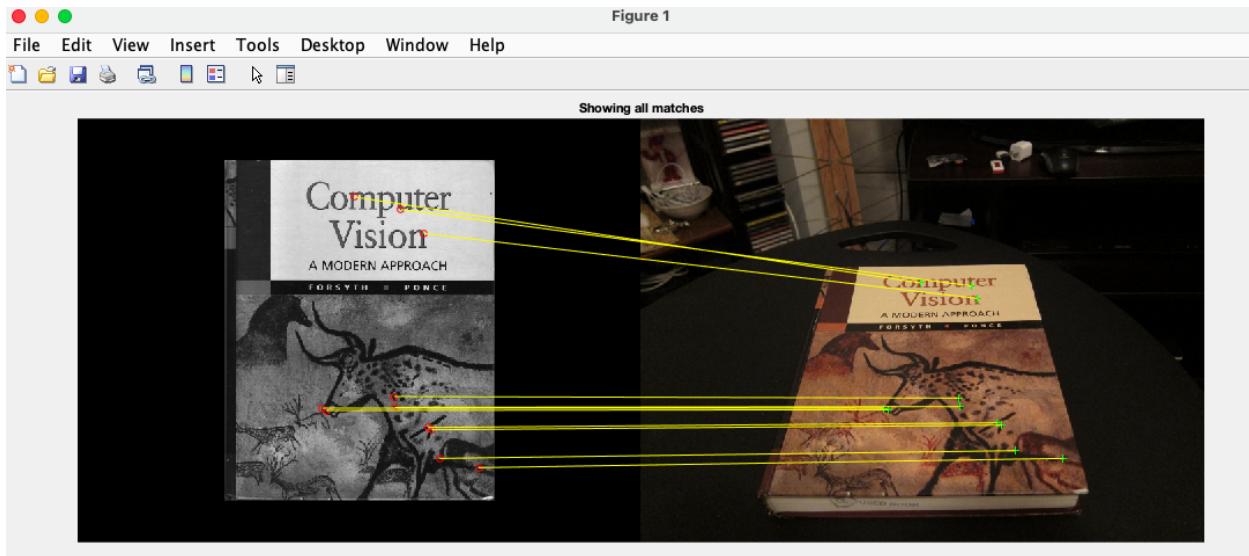
## Assignment 4

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Use 1 late day

### Q 4.1 Feature Detection, Description, and Matching

Use MaxRatio = 0.8 to get 11 accurate point pairs.

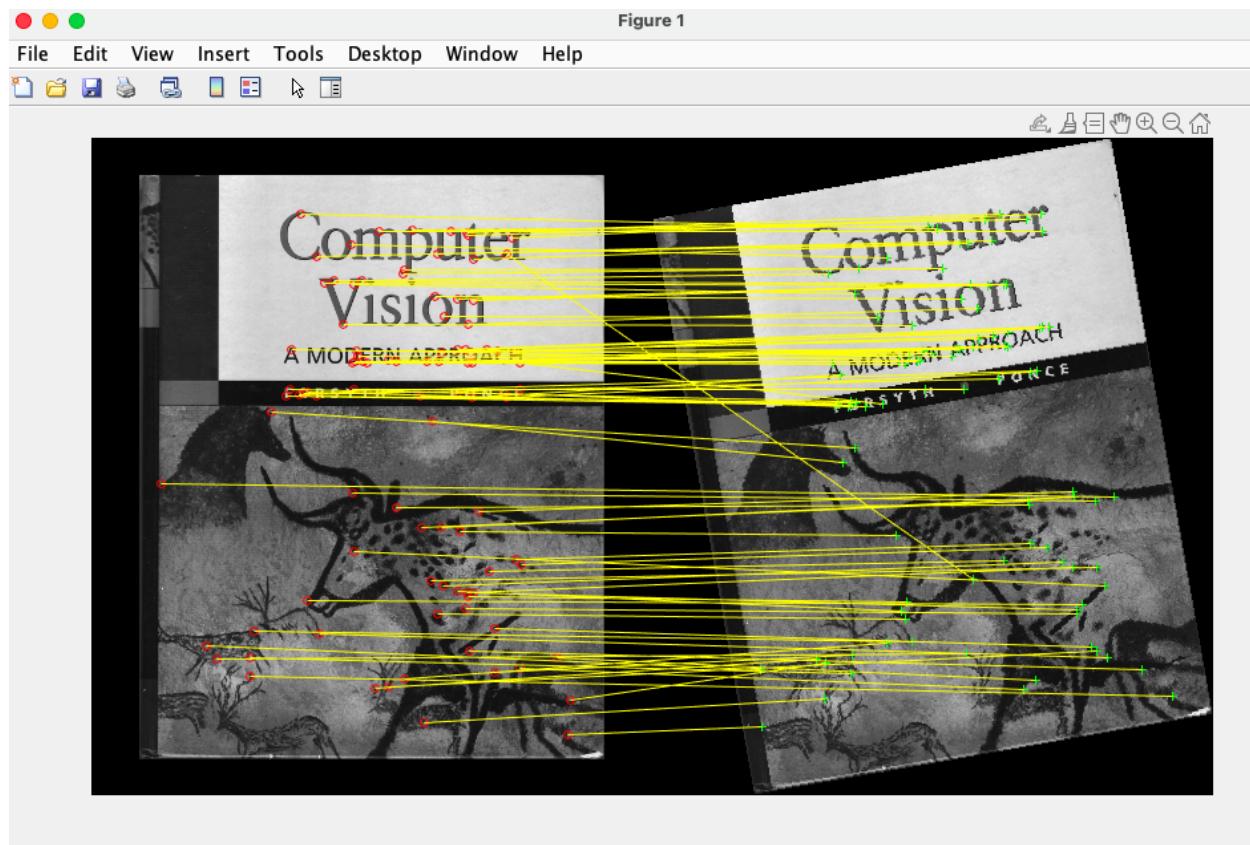


### Q 4.2 BRIEF and Rotations

Visualize the feature matching result at three different orientations (w/ FAST detector, BRIEF descriptor):

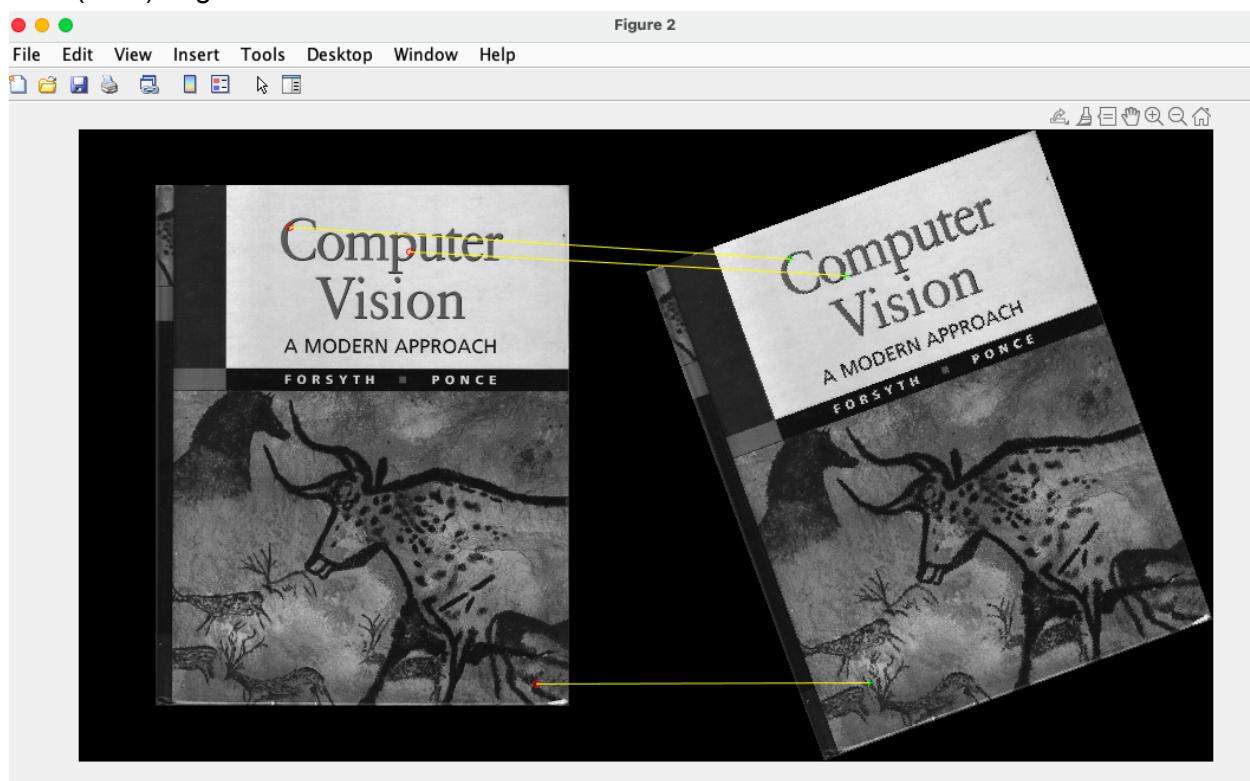
After (1\*10) degree rotation:

Figure 1

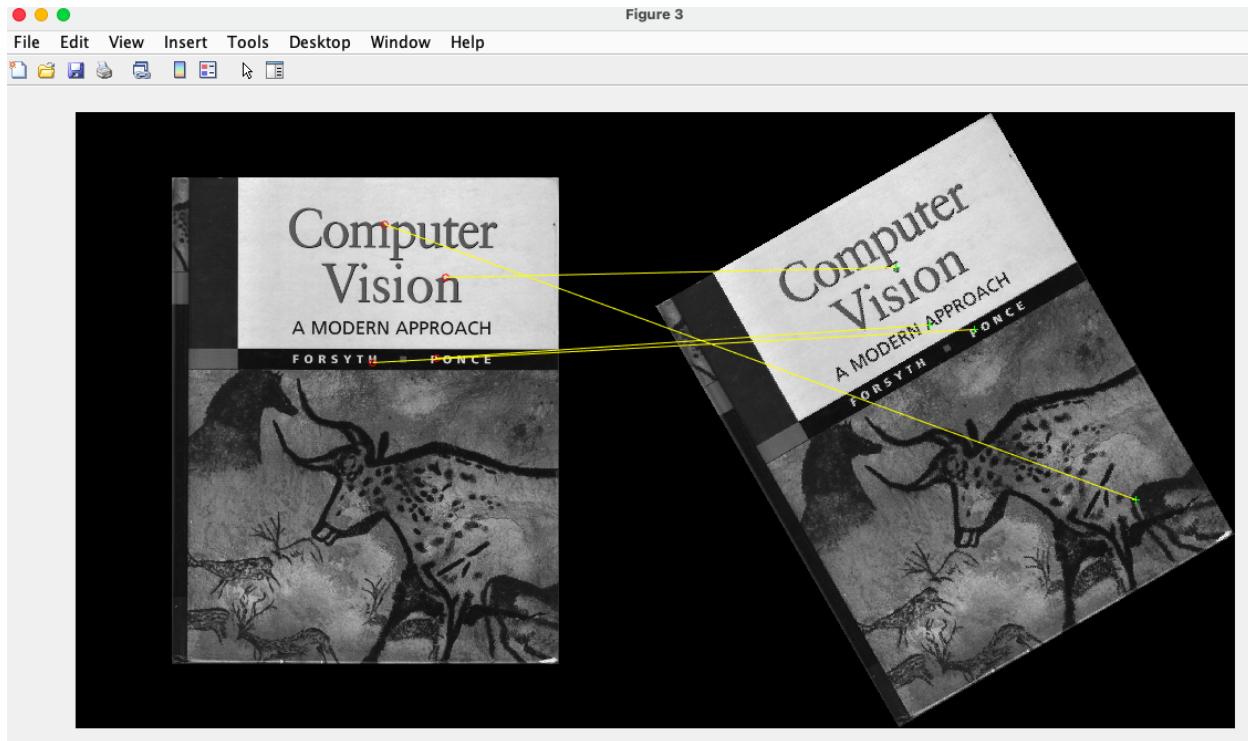


After (2\*10) degree rotation:

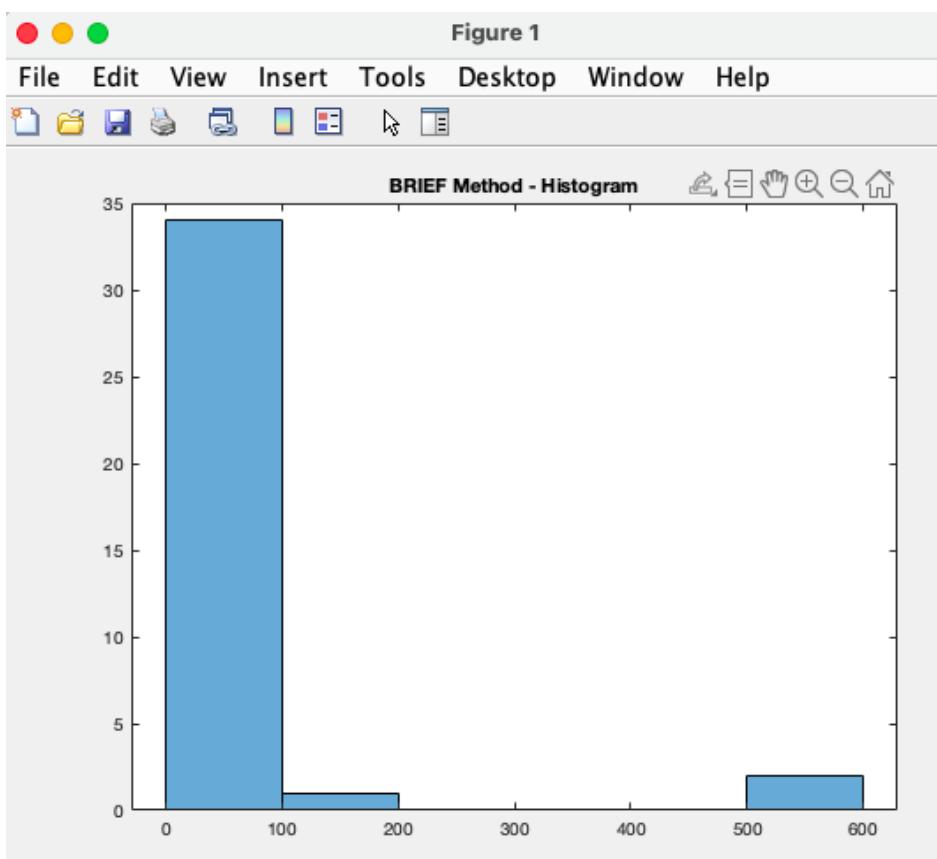
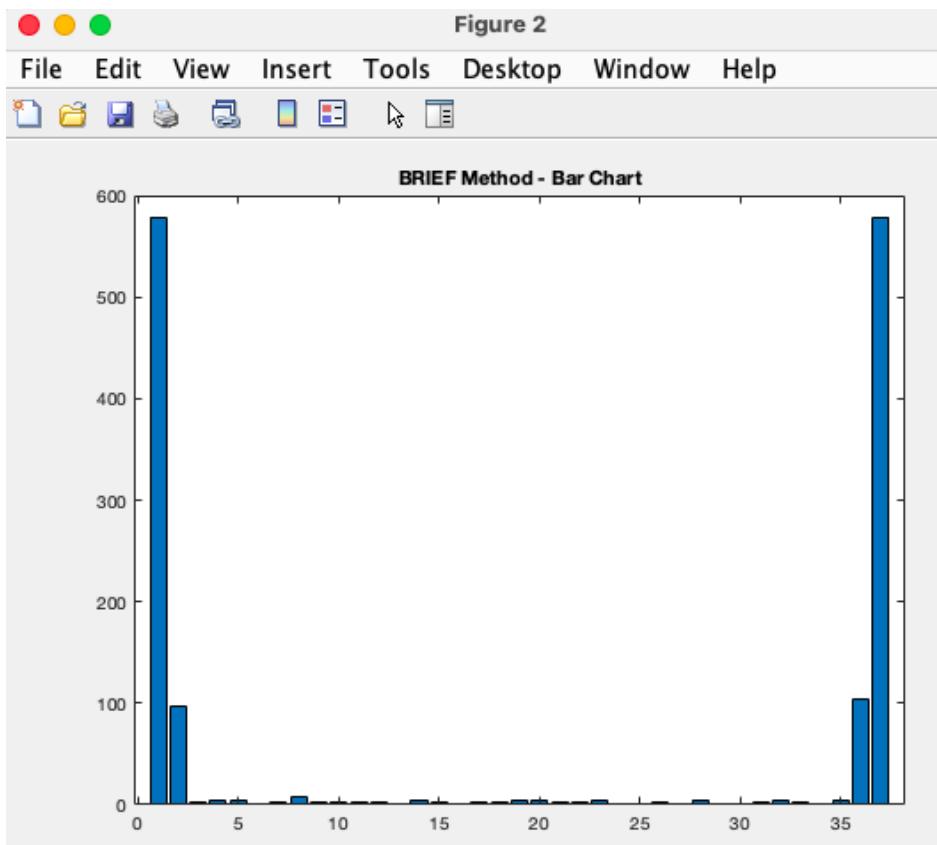
Figure 2



After (3\*10) degree rotation:



*Histogram and bar chart of the count of matches for each orientation (w/ FAST detector, BRIEF descriptor):*



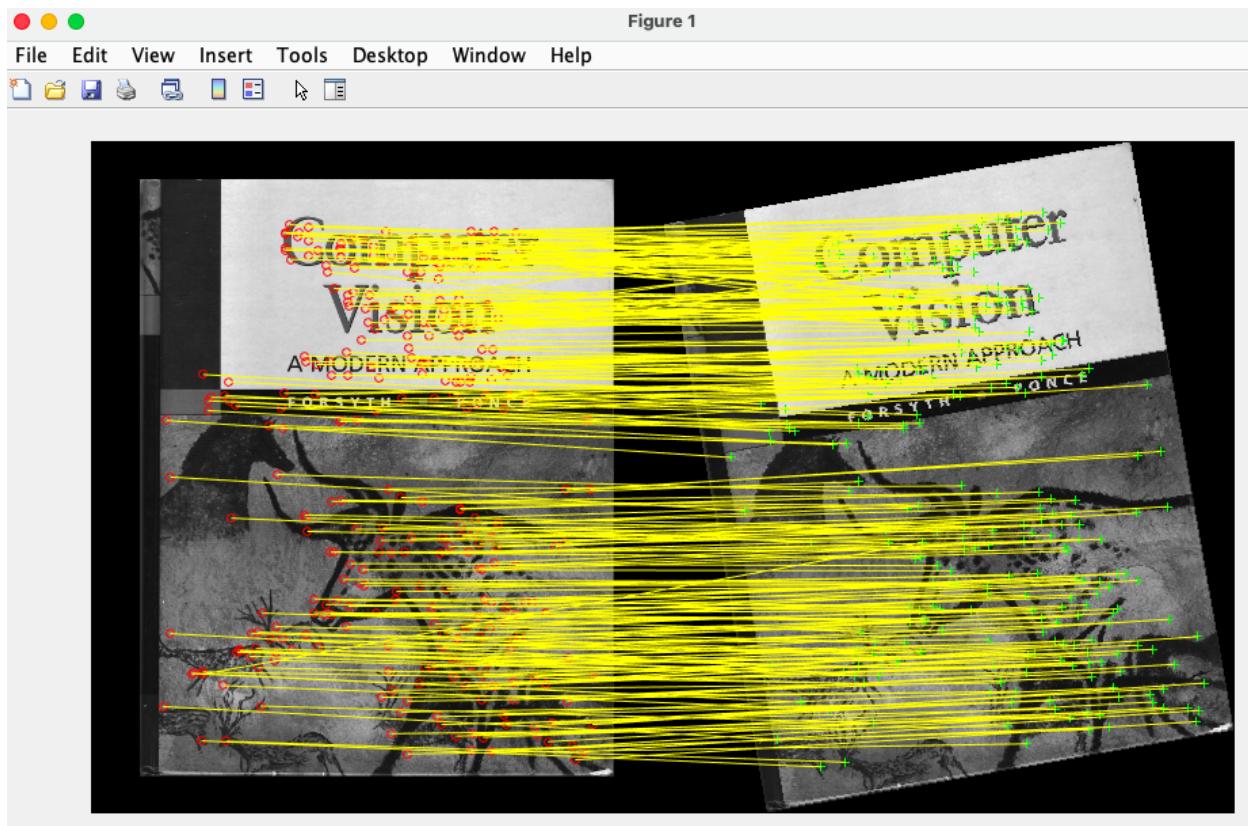
*Why you think the BRIEF descriptor behaves this way:*

BRIEF is not designed to be rotationally invariant. It tends to yield higher recognition rates, as long as invariance to large in-plane rotations is not a requirement. On images such as those that involve only modest amounts of in-plane rotation, there is a cost not only in terms of speed, but also of recognition rate to achieve orientation invariance. [1]

[1] Calonder, M., Lepetit, V., Strecha, C., Fua, P. (2010). BRIEF: Binary Robust Independent Elementary Features. In: Daniilidis, K., Maragos, P., Paragios, N. (eds) Computer Vision – ECCV 2010. ECCV 2010. Lecture Notes in Computer Science, vol 6314. Springer, Berlin, Heidelberg. [https://doi.org/10.1007/978-3-642-15561-1\\_56](https://doi.org/10.1007/978-3-642-15561-1_56)

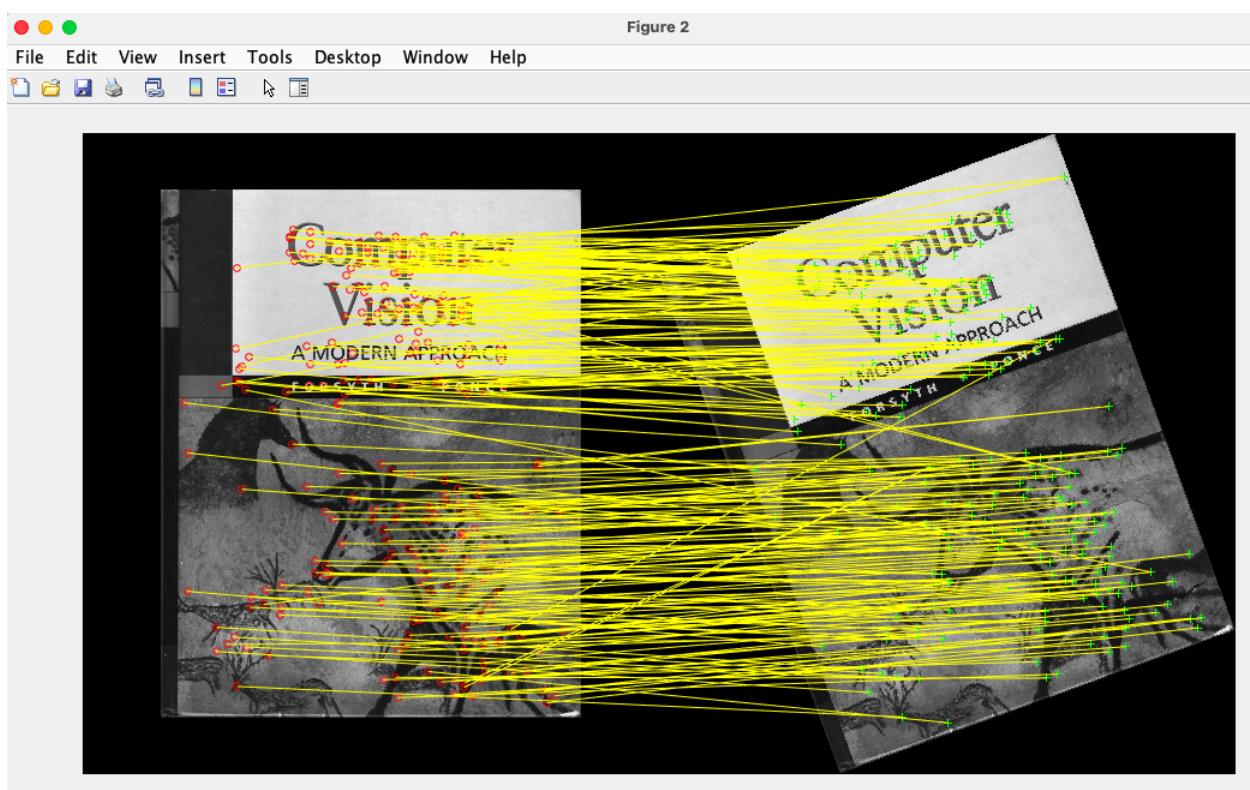
*Visualize the feature matching result at three different orientations (w/ SURF):*

After (1\*10) degree rotation:



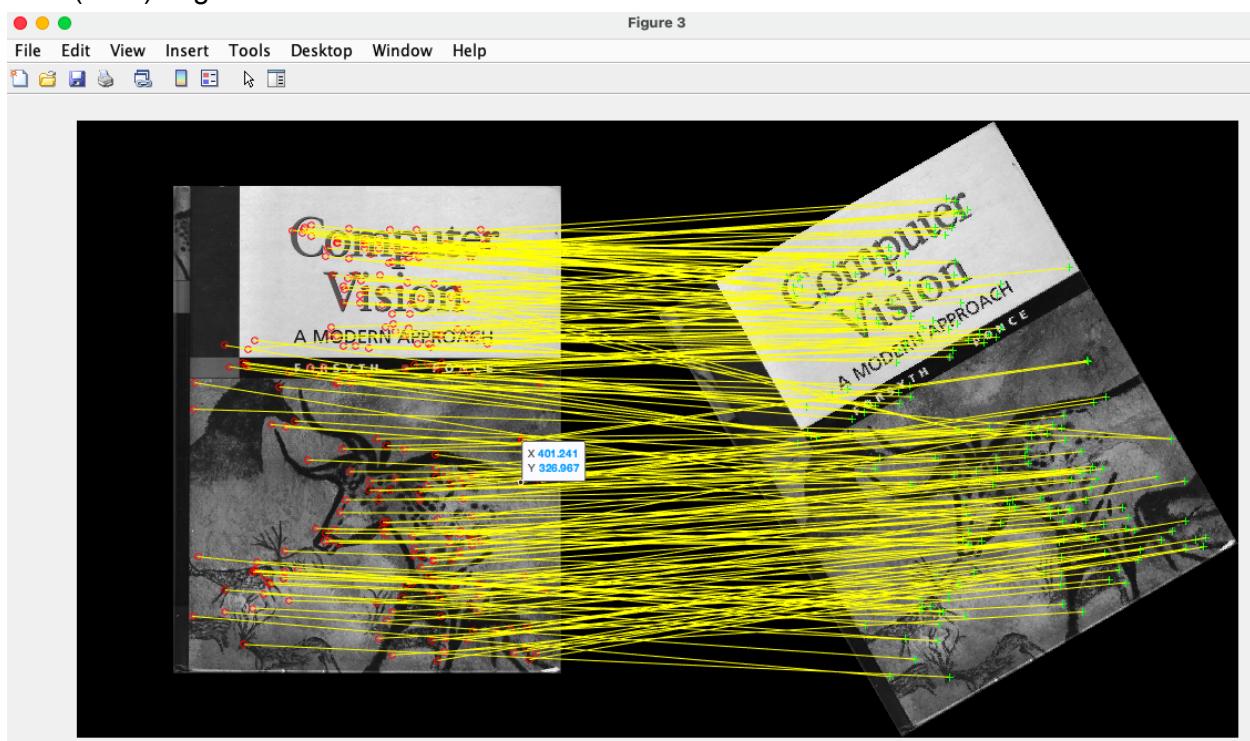
After (2\*10) degree rotation:

Figure 2

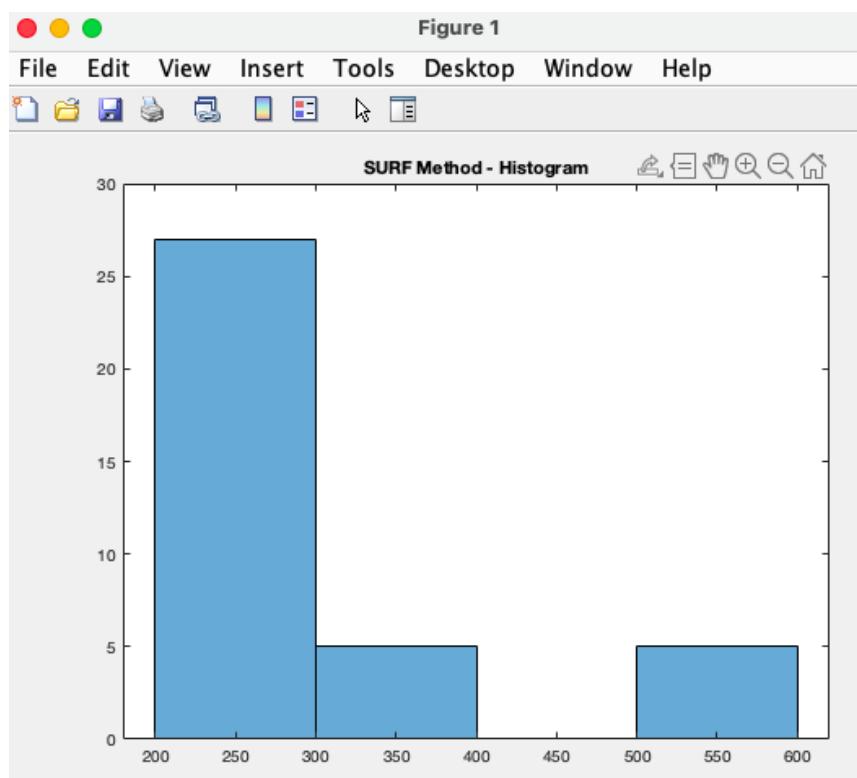
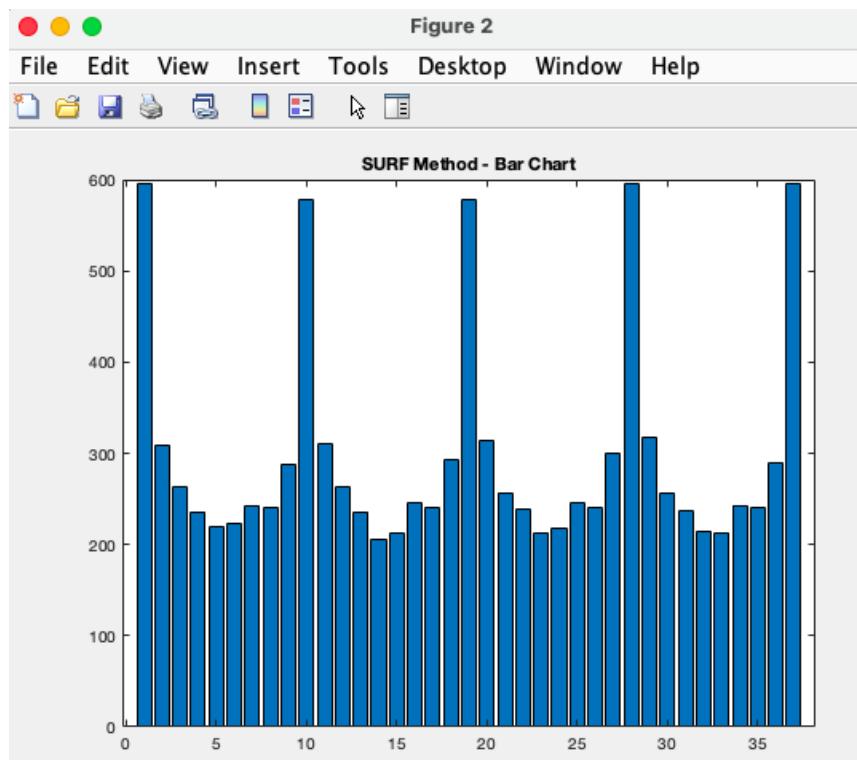


After (3\*10) degree rotation:

Figure 3



*Histogram and bar chart of the count of matches for each orientation (w/ SURF):*

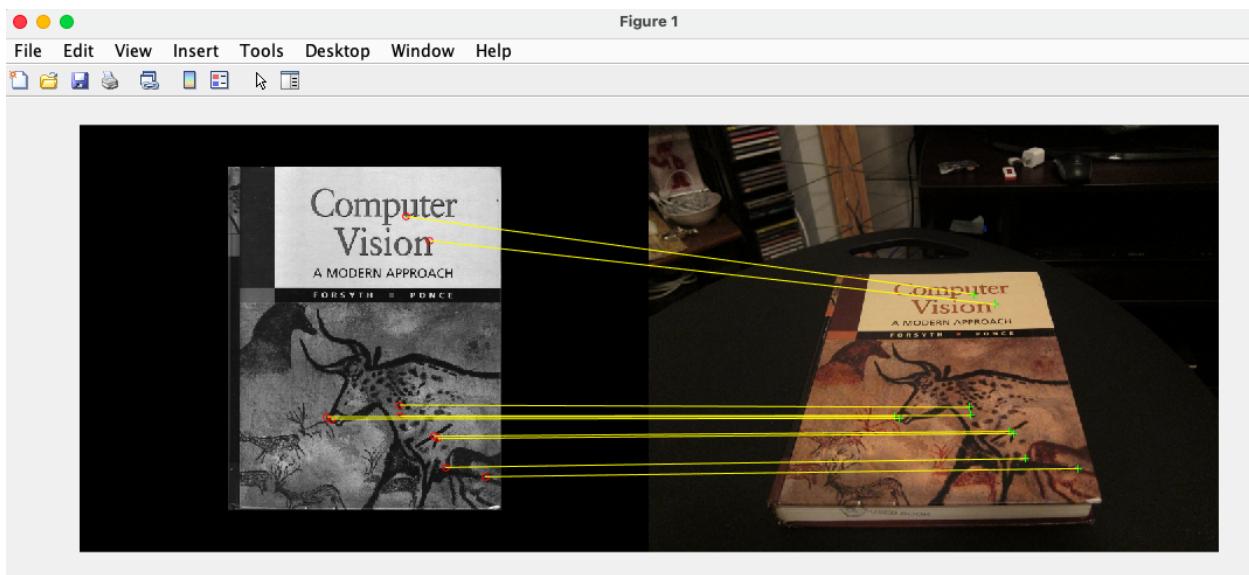


*Does the plot change significantly?*

Yes, plots have a relatively significant change with on average more feature pairs being detected with SURF method when rotation, while BRIEF performs better in small degree rotation (within 10 degree) but fails to detect most point pairs beyond that degree range. And it can be inferred from the bar chart that SURF performs better when the rotation angle is 90 degrees or its multiples.

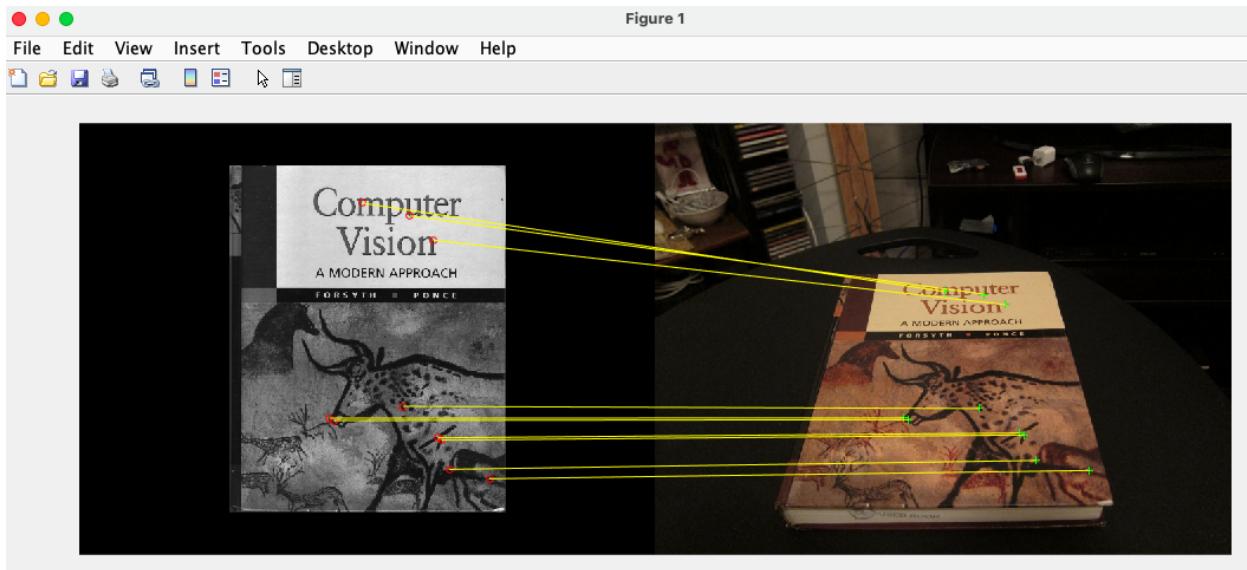
#### **Q 4.3 Homography Computation**

Visualization of 10 point pairs picked randomly from the match points by running q4\_3\_4\_script\_computeH.m file.



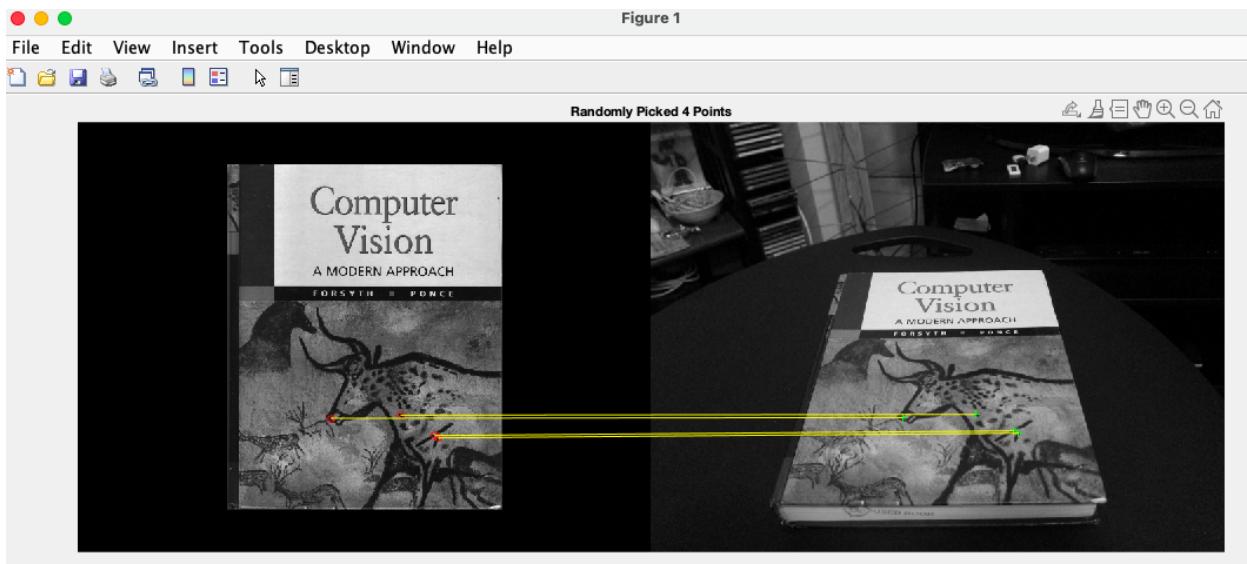
#### **Q 4.4 Homography Normalization**

Visualization of 10 point pairs picked randomly from the match points by running q4\_3\_4\_script\_computeH.m file.

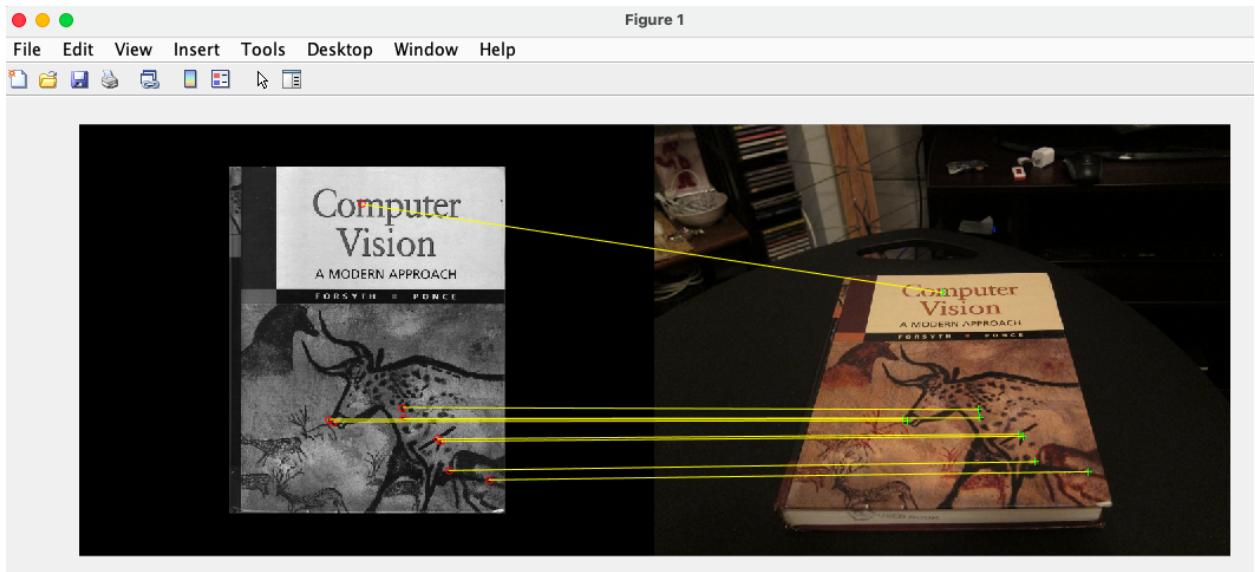


### Q 4.5 RANSAC

Visualization of the randomly picked 4 points:



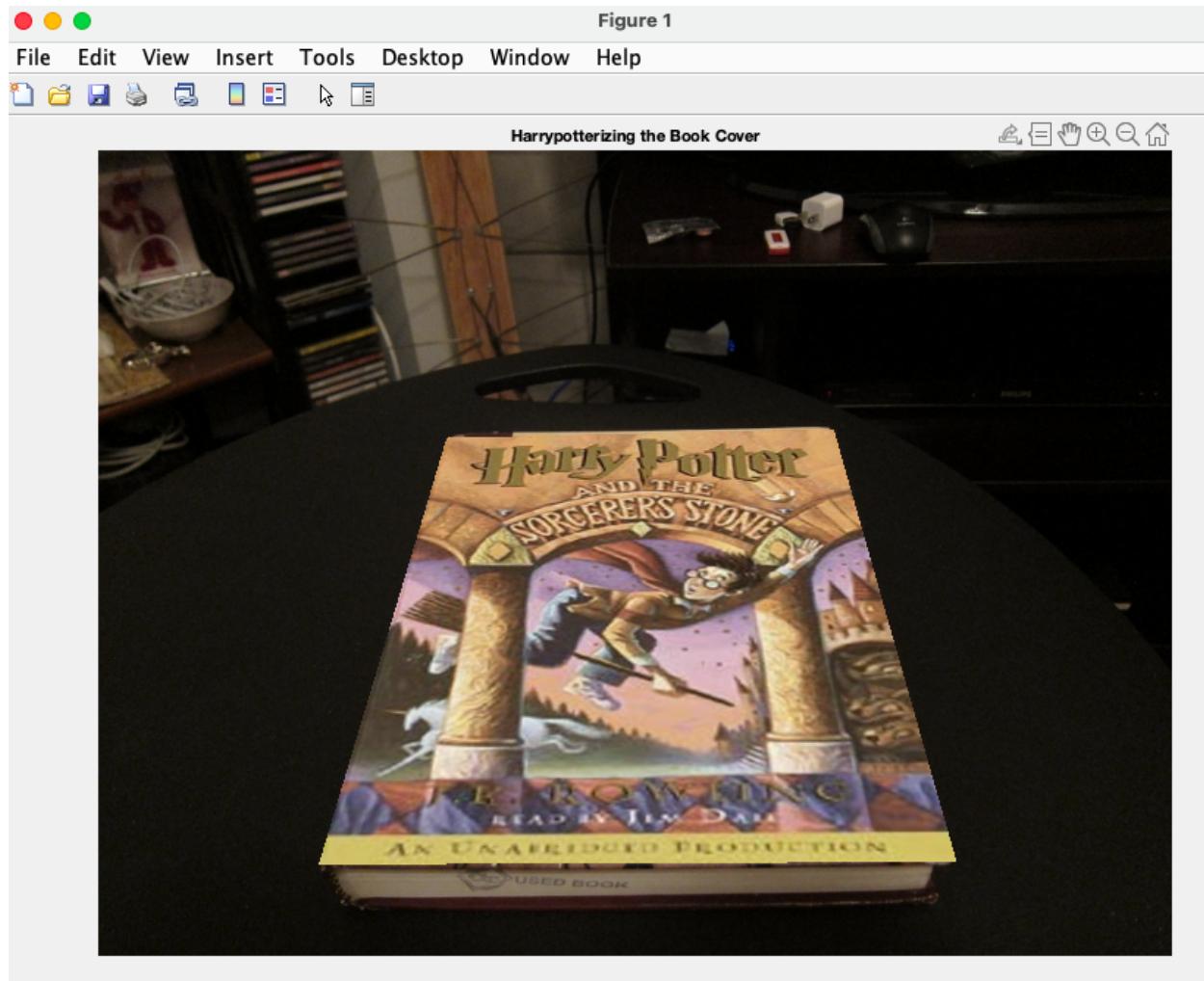
Visualization of point pairs rendered from the match points based on the four point-pairs that produce H with most inliers (by running q4\_5\_script\_computeH\_ransac.m file).



#### Q 4.6 HarryPotterizing a Book

Visualization result after warping transformation:

Figure 1



### Q 5 Creating your Augmented Reality application

Please refer to the video in result folder.

Screenshots as example:

