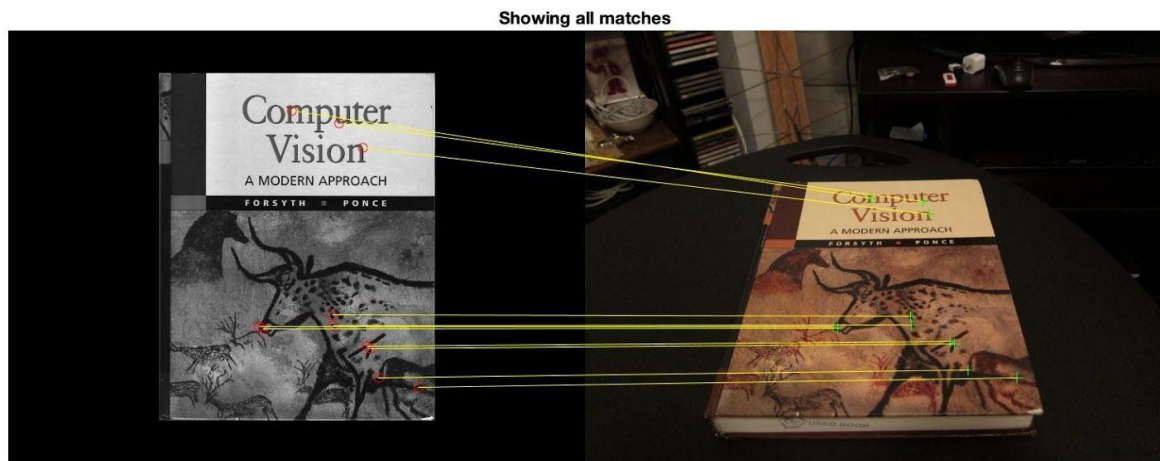


## 4.1. Feature Detection, Description, and Matching

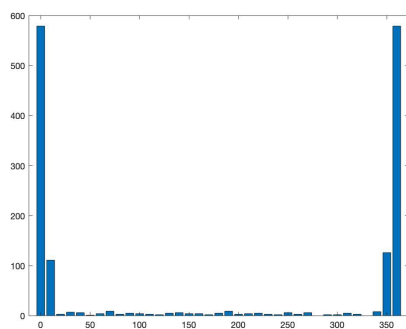
Image generated by 2\_1\_4.m with FAST detector in concert with the BRIEF descriptor:

'MatchThreshold' : 10.0,

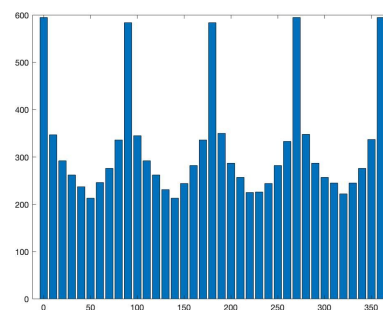
'MaxRatio' : 0.7



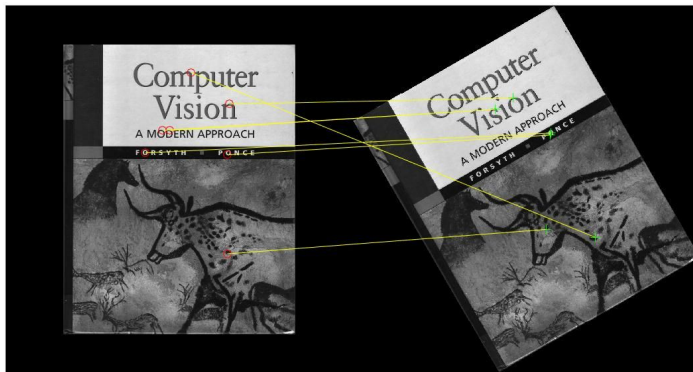
## 4.2. BRIEF and Rotations



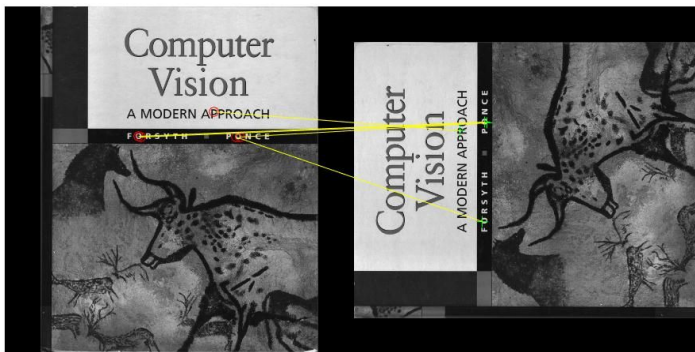
BRIEF



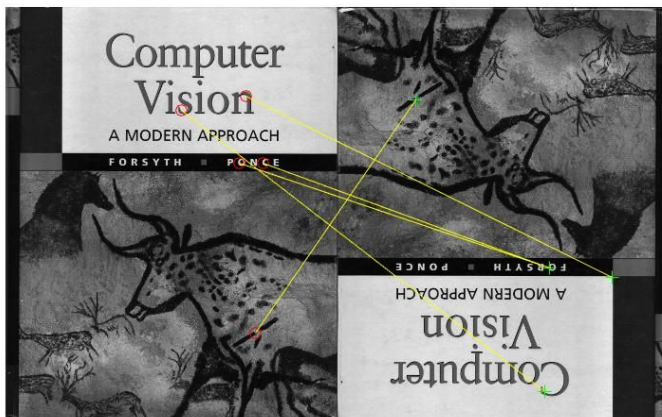
SURF



BRIEF Rotate 30 degrees



BRIEF Rotate 90 degrees



BRIEF Rotate 180 degrees

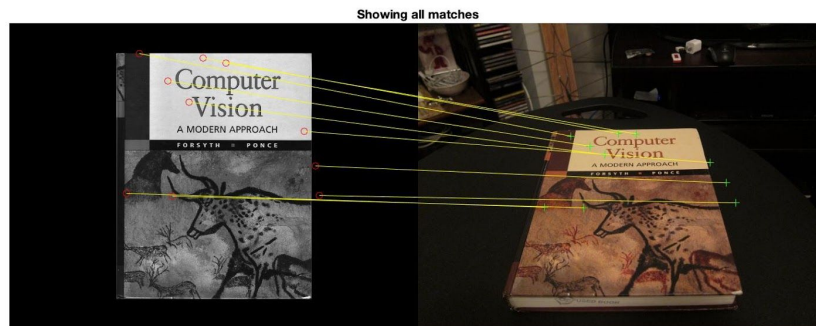
Brief convert image patches into a binary feature vector so that together they can represent an object. Binary feature vector is created from binary test( $\tau$ ) responses. When we use 'detectFASTFeatures', keypoints found by FAST gives us information of the location of determining edges in an image. FAST features do not have an orientation component and multiscale features. SO FAST - BRIEF isn't invariant to rotation.

SURF rely on determinant of the Hessian matrix for both scale and location. These features can be scale invariant, so even we rotate the image, we can still get many features.

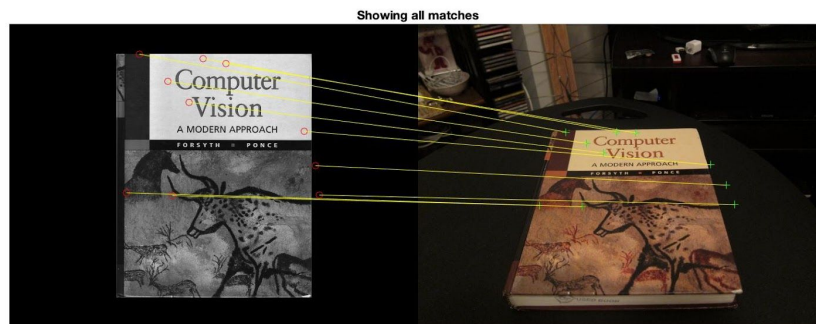
## 4.3 ~ 4.5 Homography Computation

I write a script to test the performance of  $H$ ,  $H_{\text{norm}}$ , and  $H_{\text{ransac}}$  (compute\_H\_test.m)

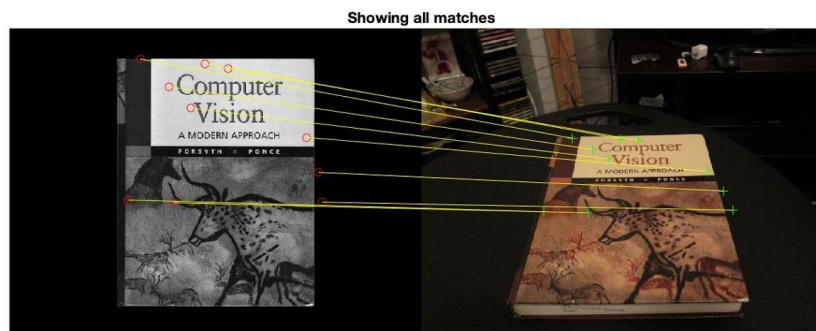
$H$ :



$H_{\text{norm}}$ :



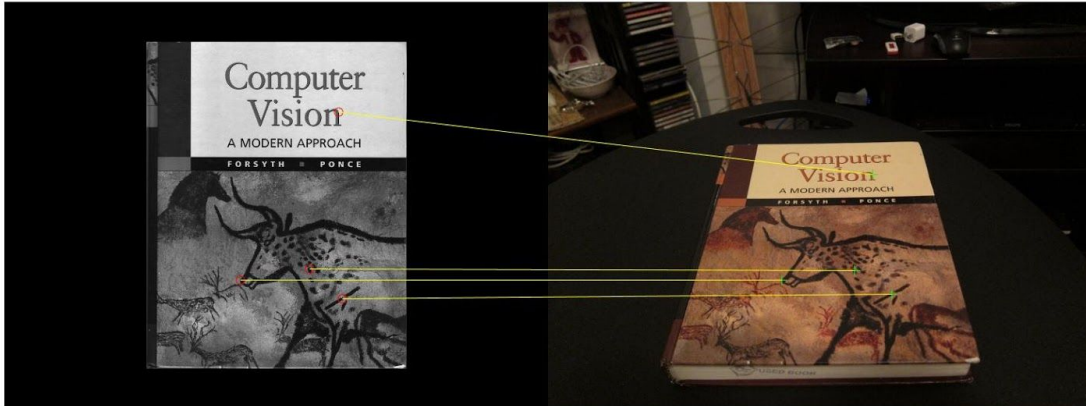
$H_{\text{ransac}}$ :



It randomly select 10 points, and try different transform matrix,  $H_{\text{ransac}}$  did perform better when it comes to the details. It does not take the average of error, but use the idea of support vector machine, so it can pick the best set of features.

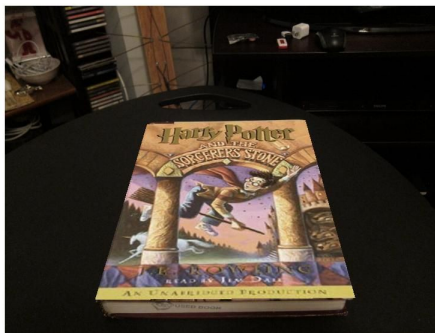
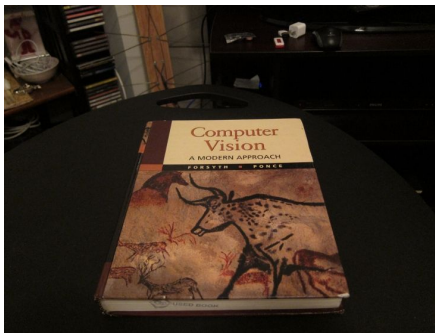
## 4.5. RANSAC

Visualization of 4 optimal features selected by RANSAC algorithm:



## 4.6. HarryPotterizing a Book

Visualization of textbook and HarryPotterized textbook:



## 5. Creating your Augmented Reality application

Video is in attachment.