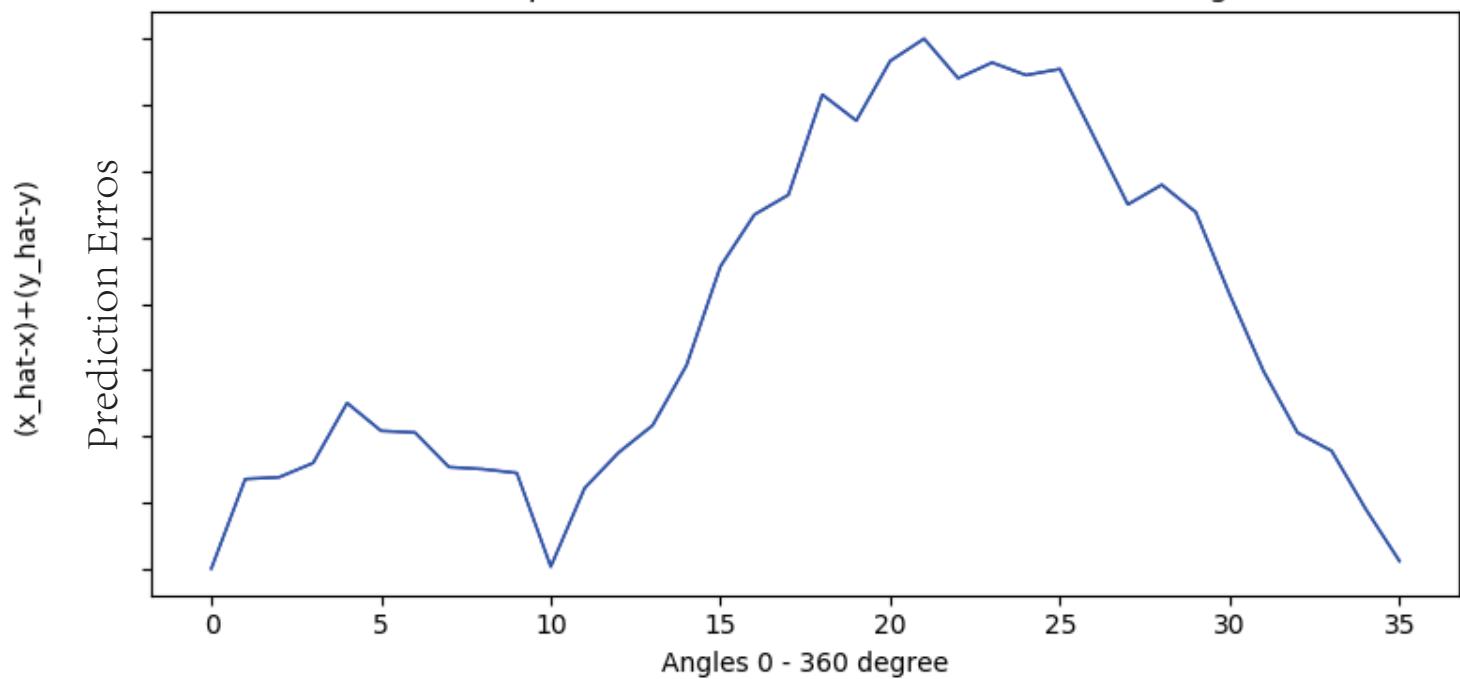


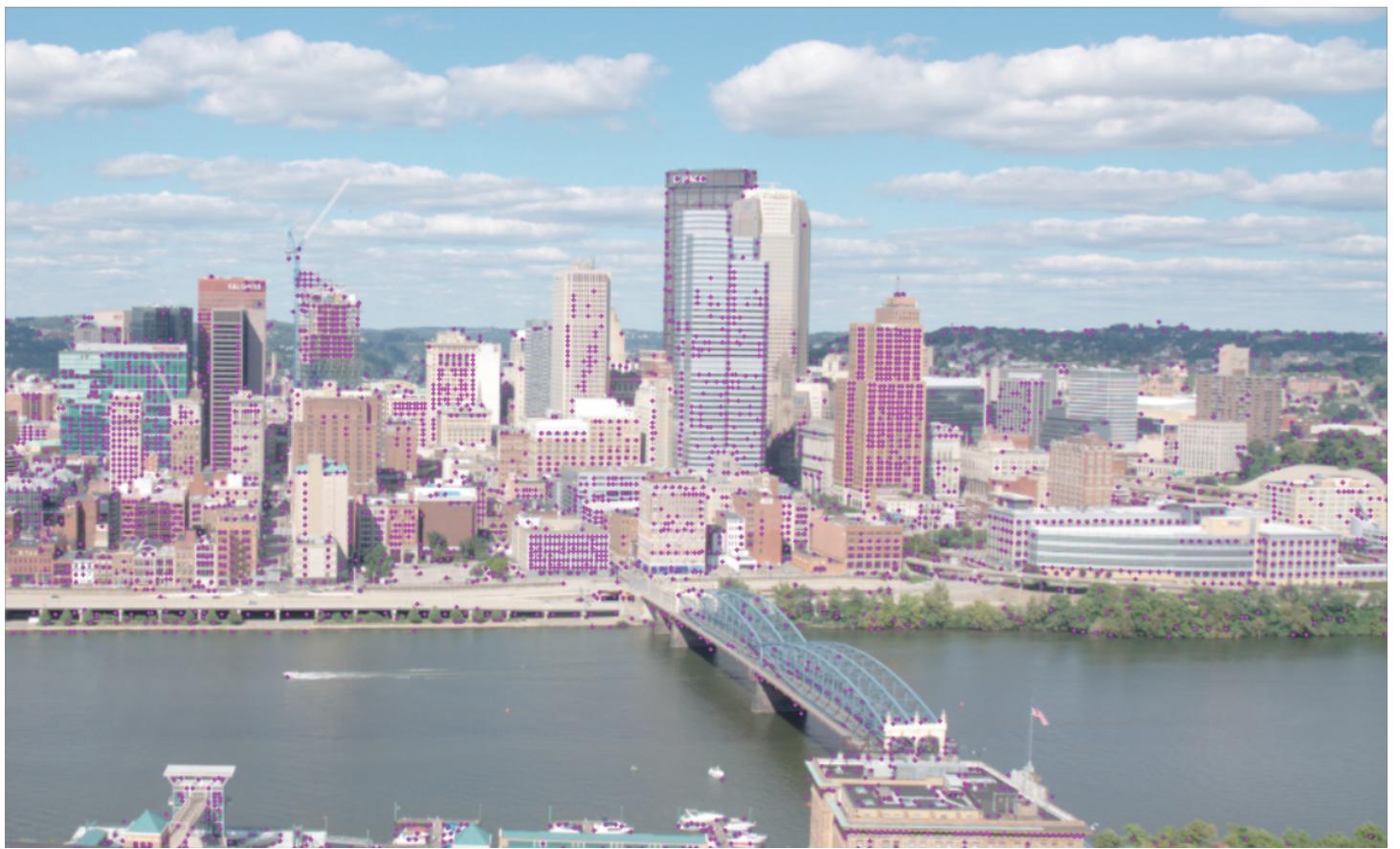
1.2

Relationship between Prediction Error and Rotation Angle

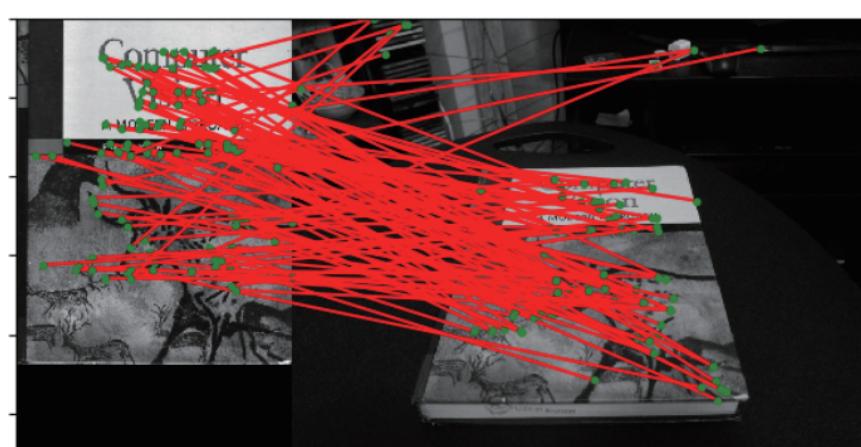
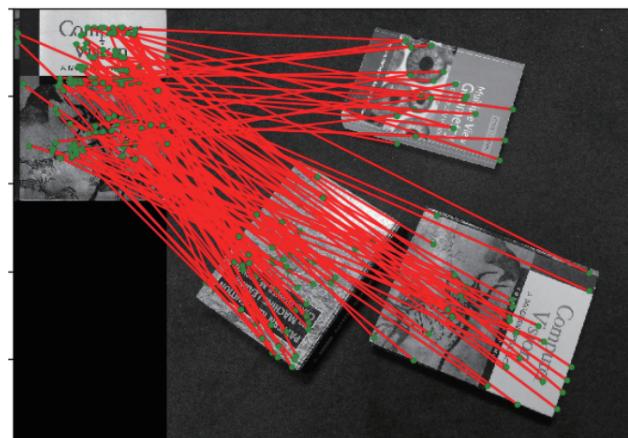
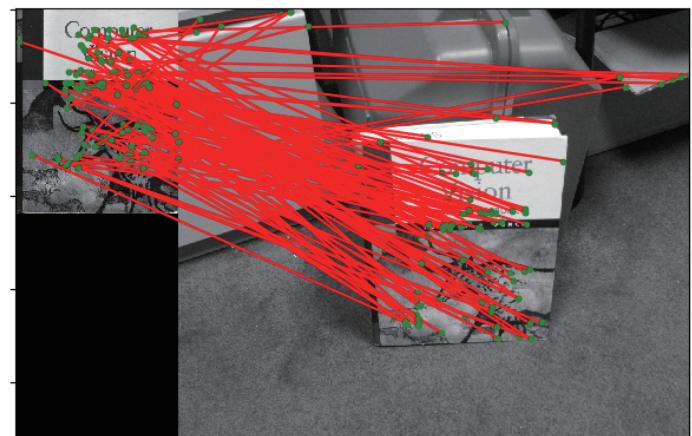
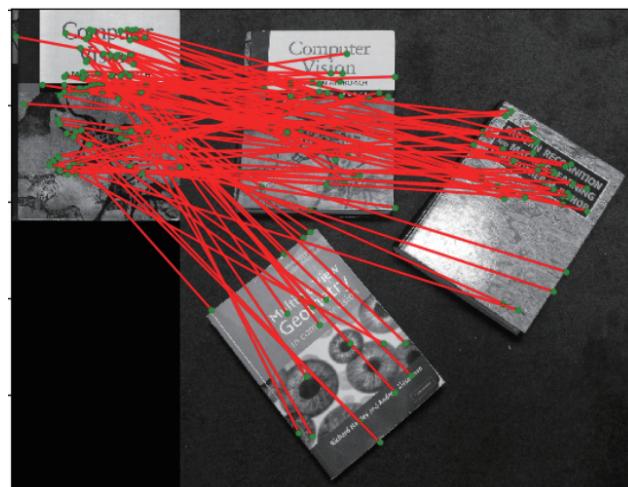


I detect the errors of different angle $(x_xhat)+(y_yhat-y)$

It shows when the rotation angle is between 180 degrees and 250 degrees, the error is the biggest
It is because when the image is totally rotated, the descriptor of the same corner is too different



1.5



When there is similar object in the image, the performance is not very good
When the object is rotated, the performance is not very good

2. How many elements are there in h?

9

3. How many point pairs (correspondences) are required to solve this system?

Hint: How many degrees of freedom are in H? How much information does each point correspondence give?

8 freedom, 8 pairs

4. Show how to estimate the elements in h to find a solution to minimize this homogeneous linear least squares system. Step us through this procedure.

Hint: Use the Rayleigh quotient theorem (homogeneous least squares).

$$h = (H_{11}; H_{12}; H_{13}; H_{21}; H_{22}; H_{23}; H_{31}; H_{32}; H_{33})$$

$$ax = (-x_1; -y_1; -1; 0; 0; 0; 0; x_2x_1; x_2y_1; x_2)$$

$$ay = (0; 0; 0; -x_1; -y_1; -1; y_2x_1; y_2y_1; y_2)$$

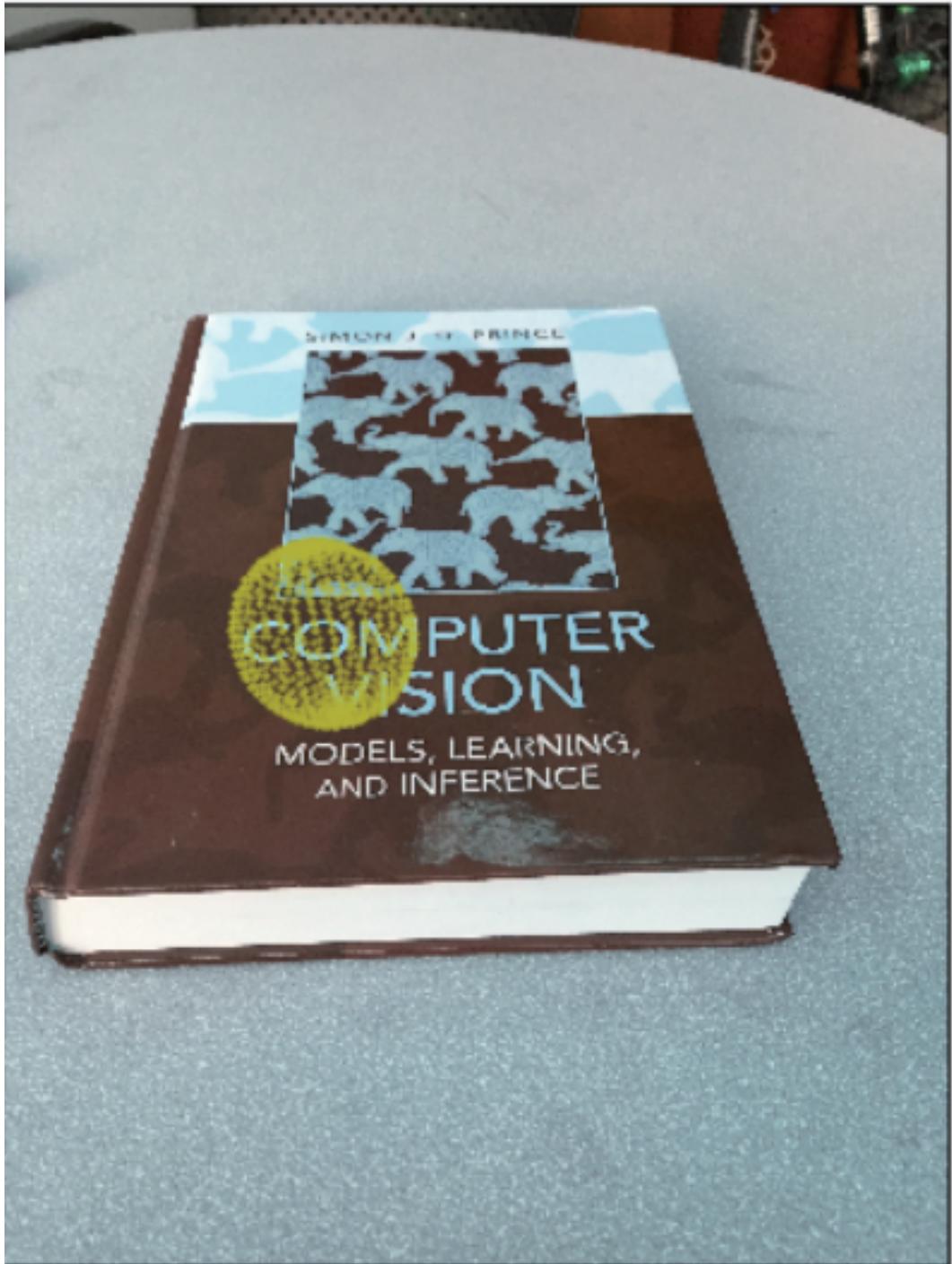
$$A = \begin{pmatrix} ax_1 \\ ay_2 \\ \dots \\ ax_N \\ ay_N \end{pmatrix}$$

$$[U, D, V] = \text{svd}(A, 0);$$

$$h = V(:, \text{end});$$



6.3



7.2