

HA3 Report

Homographies & RANSAC & Image Stitching

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Q1.1

(a)

$$\lambda_n \tilde{x}_n = H \tilde{u}_n$$

$$\therefore x_i = \frac{h_{11}u_i + h_{12}v_i + h_{13}}{h_{31}u_i + h_{32}v_i + h_{33}}$$

$$\therefore y_i = \frac{h_{21}u_i + h_{22}v_i + h_{23}}{h_{31}u_i + h_{32}v_i + h_{33}}$$

$$0 = Ah = \begin{bmatrix} u_1 & v_1 & 1 & 0 & 0 & 0 & -x_1u_1 & -x_1v_1 & -x_1 \\ 0 & 0 & 0 & -u_1 & -v_1 & -1 & y_1u_1 & y_1v_1 & y_1 \\ . & . & . & . & . & . & . & . & . \\ u_N & v_N & 1 & 0 & 0 & 0 & -x_Nu_N & -x_Nv_N & -x_N \\ 0 & 0 & 0 & -u_N & -v_N & -1 & y_Nu_N & y_Nv_N & y_N \end{bmatrix} \begin{bmatrix} h_{11} \\ h_{12} \\ h_{13} \\ h_{21} \\ h_{22} \\ h_{23} \\ h_{31} \\ h_{32} \\ h_{33} \end{bmatrix}$$

(b)

9 elements

(c)

4 points pairs

(d)

- First we apply SVD decomposition
- So we get $A = USV^T$
- $\therefore ||USV^T h||^2 = ||SV^T h||^2$
- Assume $p = V^T h$, so we need to minimize $||Sp||$ with constraints $||p|| = 1$
- \therefore we let $p = [0, 0, \dots, 1]^T$, in this way, we could minimize $||Sp||$
- $\therefore h = Vp$ is the last column of V

Q4.1

- The result of warped image `incline_R.jpg` according to the homography contained by RANSAC



Q4.2

- The panorama image after stitching

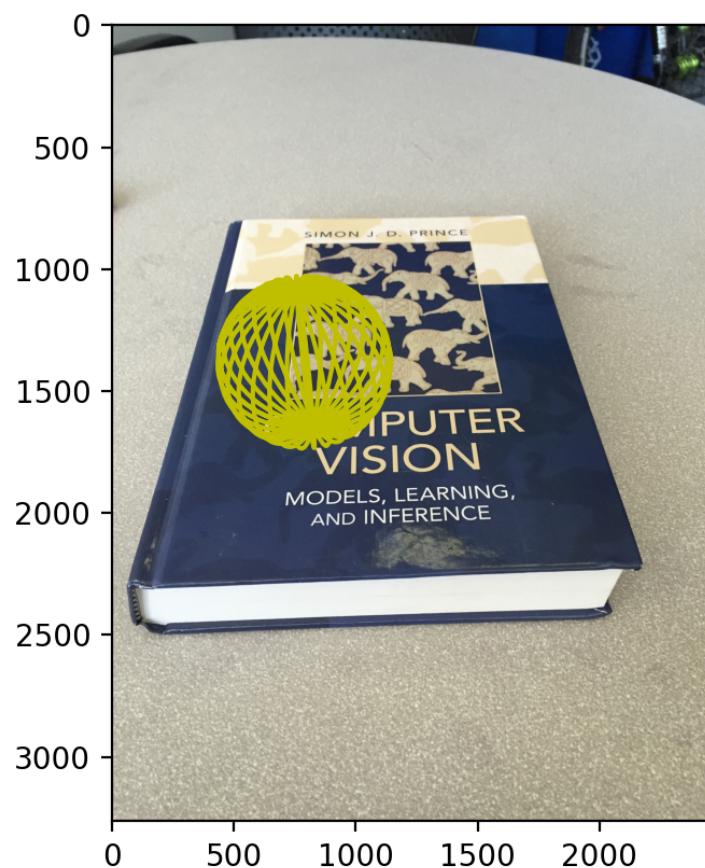


- The panorama image after stitching without clipping



Q5.2

- Use matplotlib function to draw the placement of the ball in the middle of the "o" in "Computer" using yellow color.
- Normal linewidth



- Use linewidth=0.4

