**Computer Vision 2016 Spring HW#3 theory**

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**Q1.**

(a) Known part is like below.

Let’s think about a projection of reference camera center to plane . If the distance between the plane and the center of camera 2 is , we can consider a normal vectors from camera 2 center to plane , which’s length is

Then, we can know that

(5).

Now, let’s think about

(by (3) and (1))

( must have inverse because it’s rotation)

(by (4))

(by (5) and (4))

Then, we can get the homography matrix

This H satisfy the equation , which means it is a projective transformation of the plane.

Therefore, this H exists for any point X.

(b) Homography matrix is 3X3, therefore we have 9 unknowns. However, because it shows homogeneous equality, we can re-scale it. Therefore, only 8 unknowns left.

Because of above matrix equation, one pair of point makes two equations like below.

Therefore, to reveal 8 unknowns, 4 pairs of points are needed.

(c) From above equation, we can construct next equation using n pairs of points.

Then, a least squares could be performed to .

For , solution of least squares problem