CS 498: Virtual Reality
In-class Worksheet

Tracking: Pose

$$\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & -1 \end{pmatrix} \cdot \begin{pmatrix} r_{11} & r_{12} & t_x \\ r_{21} & r_{22} & t_y \\ r_{31} & r_{32} & t_z \end{pmatrix} = s \begin{pmatrix} h_1 & h_2 & h_3 \\ h_4 & h_5 & h_6 \\ h_7 & h_8 & 1 \end{pmatrix}$$

1. Imagine we are recovering a camera pose using the linear homography method.

a. We assume that the first two column vectors $\boldsymbol{r1} = (\boldsymbol{r_{11}} \quad \boldsymbol{r_{21}} \quad \boldsymbol{r_{31}})^{\boldsymbol{T}}$ and $\boldsymbol{r2} = (\boldsymbol{r_{12}} \quad \boldsymbol{r_{22}} \quad \boldsymbol{r_{32}})^{\boldsymbol{T}}$ in the ModelView matrix should be unit length. What justifies this assumption?

b. What should the value of $\boldsymbol{r1} \cdot \boldsymbol{r2}$ be?

c. Write out $\boldsymbol{r1}$ in terms of the elements of the matrix

$$H = \begin{bmatrix} h_1 & h_2 & h_3 \\ h_4 & h_5 & h_6 \\ h_7 & h_8 & 1 \end{bmatrix}$$

The vector $\boldsymbol{r1}$ should be unit length, so make sure that you scale the entries of $\boldsymbol{r1}$ so that the vector is normalized.

$$\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & -1 \end{pmatrix} \cdot \begin{pmatrix} r_{11} & r_{12} & t_x \\ r_{21} & r_{22} & t_y \\ r_{31} & r_{32} & t_z \end{pmatrix} = s \begin{pmatrix} h_1 & h_2 & h_3 \\ h_4 & h_5 & h_6 \\ h_7 & h_8 & 1 \end{pmatrix}$$

2. Suppose we have the following homography matrix:

$$H = \begin{bmatrix} 4 & 0 & 2 \\ 3 & 3 & 3 \\ 0 & 4 & 1 \end{bmatrix}$$

What are the values for t_x, t_y, and t_z?