

Mohan Dhar, Mehul Patel, Jiwon Shin

Problem 2

Camera : $[1, 2, 3]$
 Gaze : $[1, 1, 0]$
 View up: $[1, -1, 0]$

$$\begin{aligned}\vec{u} &= \vec{v} \times \vec{w} \\ \vec{v} &= \vec{f} / \|\vec{f}\| \\ \vec{w} &= -\vec{g} / \|\vec{g}\|\end{aligned}$$

$$\vec{v} = \frac{\vec{f}}{\|\vec{f}\|} = \frac{[1, -1, 0]}{\sqrt{1^2 + (-1)^2 + 0}} = \left[\frac{1}{\sqrt{2}}, \frac{-1}{\sqrt{2}}, 0 \right]$$

$$1) \quad \vec{w} = \frac{-\vec{g}}{\|\vec{g}\|} = \frac{[-1, -1, 0]}{\sqrt{(-1)^2 + (-1)^2 + 0}} = \left[\frac{-1}{\sqrt{2}}, \frac{-1}{\sqrt{2}}, 0 \right]$$

$$\begin{aligned}\vec{u} &= \begin{bmatrix} \frac{1}{\sqrt{2}} & \frac{-1}{\sqrt{2}} & 0 \\ \frac{-1}{\sqrt{2}} & \frac{-1}{\sqrt{2}} & 0 \end{bmatrix} \quad \begin{aligned} 0\hat{i} + 0\hat{j} + \left(-\frac{1}{2} - \frac{1}{2}\right)\hat{k} \\ 0\hat{i} + 0\hat{j} - \hat{k} \end{aligned} \\ &= \begin{bmatrix} 0 & 0 & -1 \end{bmatrix}\end{aligned}$$

2) 4×4 camera transformation matrix
 $= (U^T)^{-1}$

$$\frac{1}{2} \begin{bmatrix} 0 & 0 & -2 & 6 \\ \sqrt{2} & -\sqrt{2} & 0 & \sqrt{2} \\ -\sqrt{2} & -\sqrt{2} & 0 & 3\sqrt{2} \\ 0 & 0 & 0 & 2 \end{bmatrix}$$