COS429
Computer Vision
Homework No.2

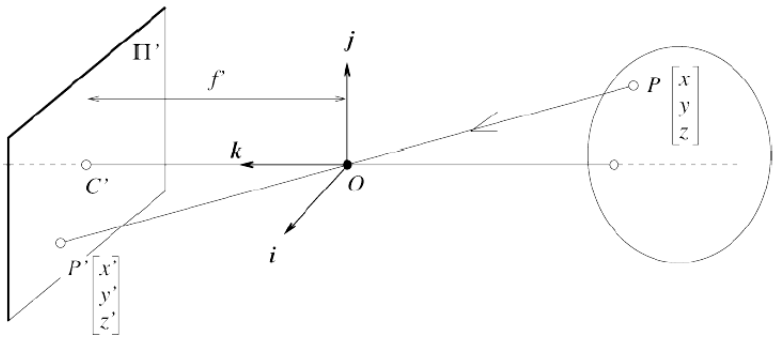
Due: 11:59pm, Tuesday, September 30, 2008
Submission: Please submit a hardcopy to a homework box that will be placed outside room 418a of the CS building.

Problem 1.1

Consider a perspective projection where a point

$$P = \begin{pmatrix} x \\ y \\ z \end{pmatrix}$$

is projected onto an image plane Π' represented by $k = f'$ as shown in the following figure.



The first, second and third coordinate axes are denoted by $\mathbf{i}, \mathbf{j}$ and $\mathbf{k}$, respectively.

Consider the projection of an infinitely long line

$$Q = \begin{pmatrix} 1 \\ 1 \\ 0 \end{pmatrix} + t \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix}$$

in the world coordinate system where $-\infty \leq t \leq -1$. Calculate its two end-points.

Problem 1.2

Consider a rigid transformation where a point A is rotated about the k-axis by the angle π (radian) and translated by

$$\begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$$

to another point A'. When the two points A and A' are represented in the homogeneous coordinate system by

$$A = \begin{pmatrix} x \\ y \\ z \\ 1 \end{pmatrix} \text{ and } A' = \begin{pmatrix} x' \\ y' \\ z' \\ 1 \end{pmatrix},$$

respectively, write a 4×4 matrix M such that

$$A' = MA.$$