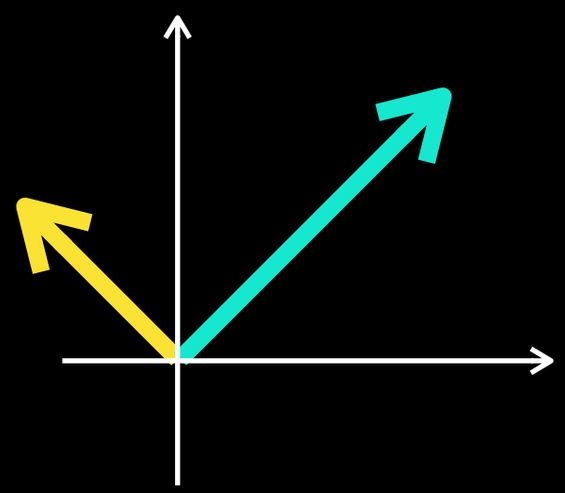
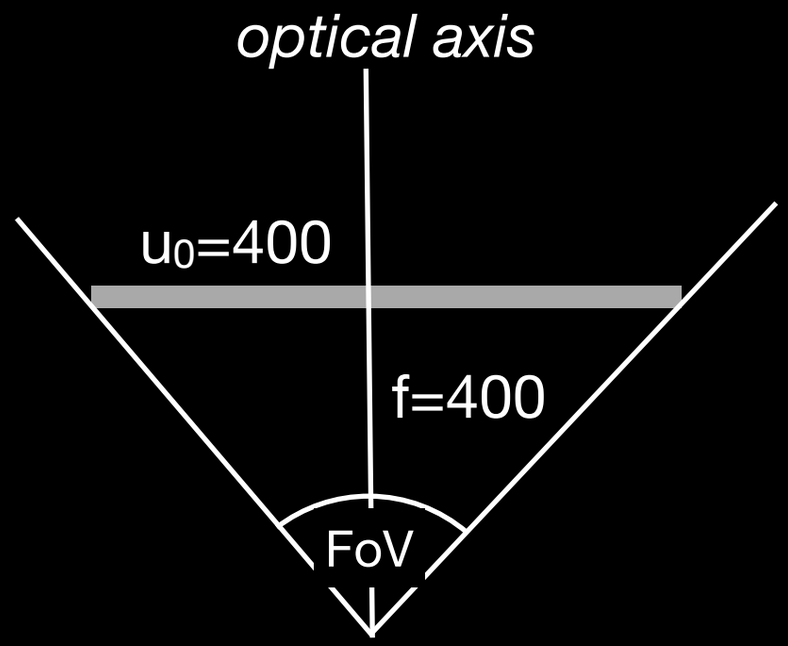
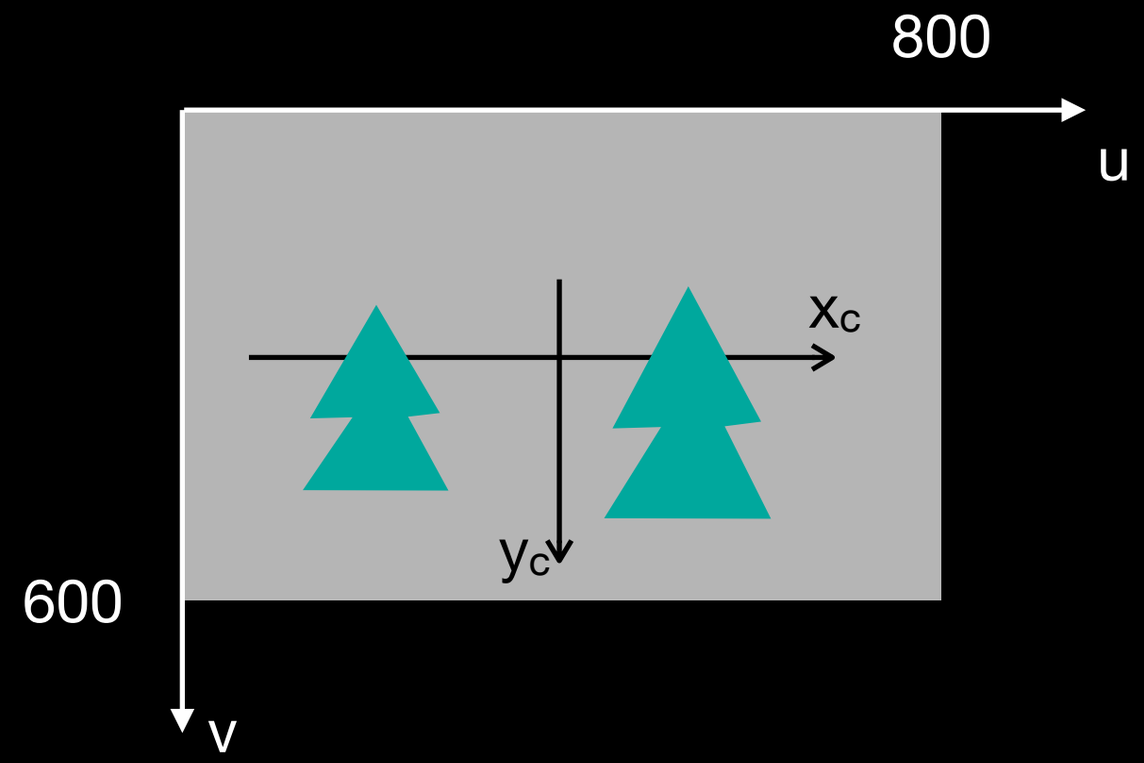
3D simulation with pinhole camera

Linear Algebra Essentials



Camera setup





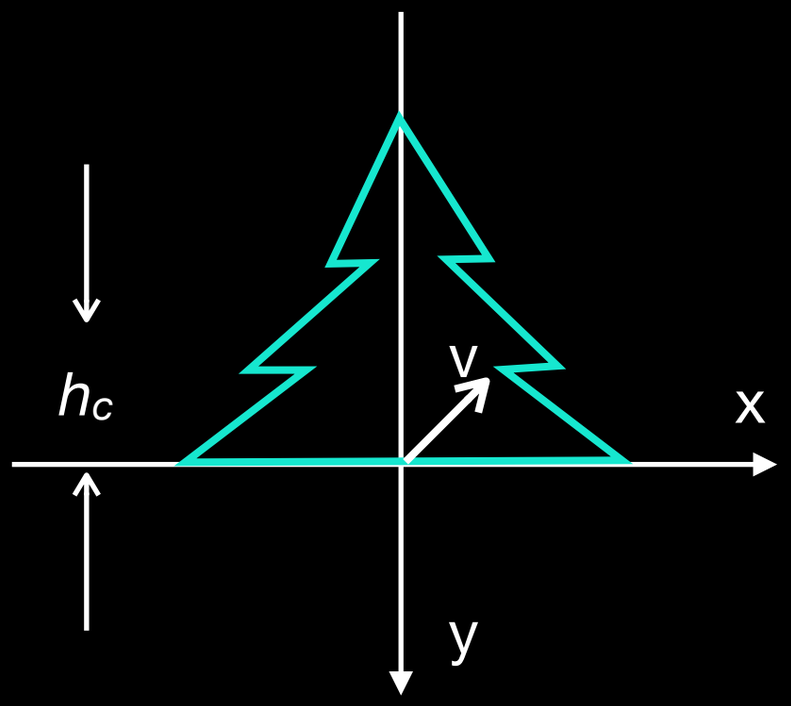
focal length = 400

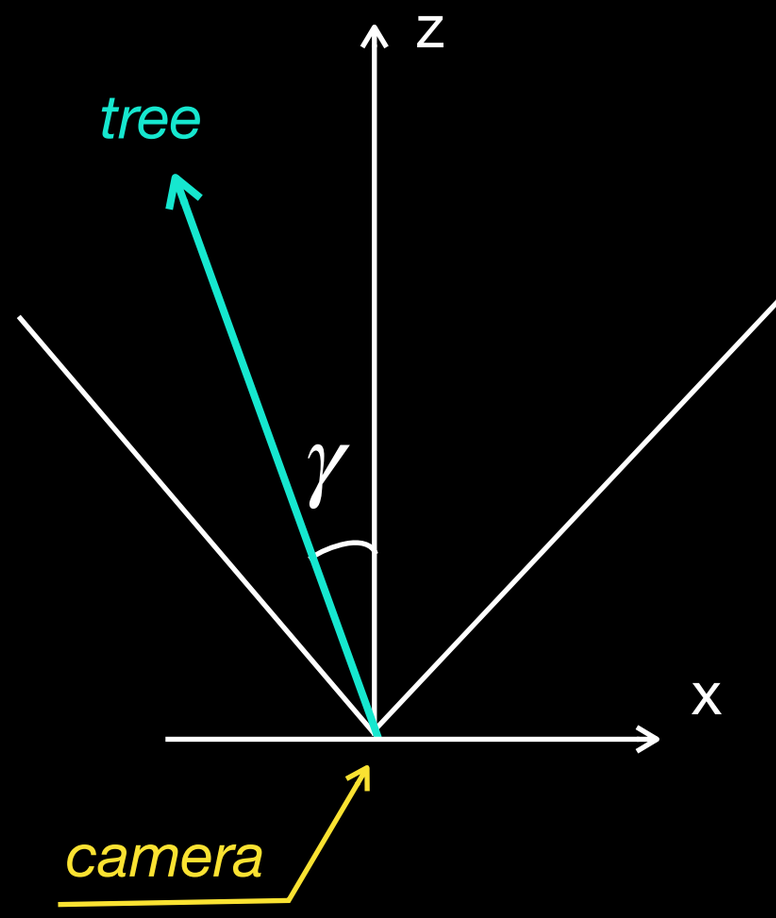
optical axis: (400, 300)

FoV = 90⁰

$$K = \begin{bmatrix} 400 & 0 & 400 \\ 0 & 400 & 300 \\ 0 & 0 & 1 \end{bmatrix}$$

Spruce generating





random distance

random angle

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix}_c = v + d \begin{bmatrix} sin(\gamma) \\ 0 \\ cos(\gamma) \end{bmatrix} + \begin{bmatrix} 0 \\ h_c \\ 0 \end{bmatrix}$$

$$\gamma \text{ from } -\pi/4 \text{ to } \pi/4$$

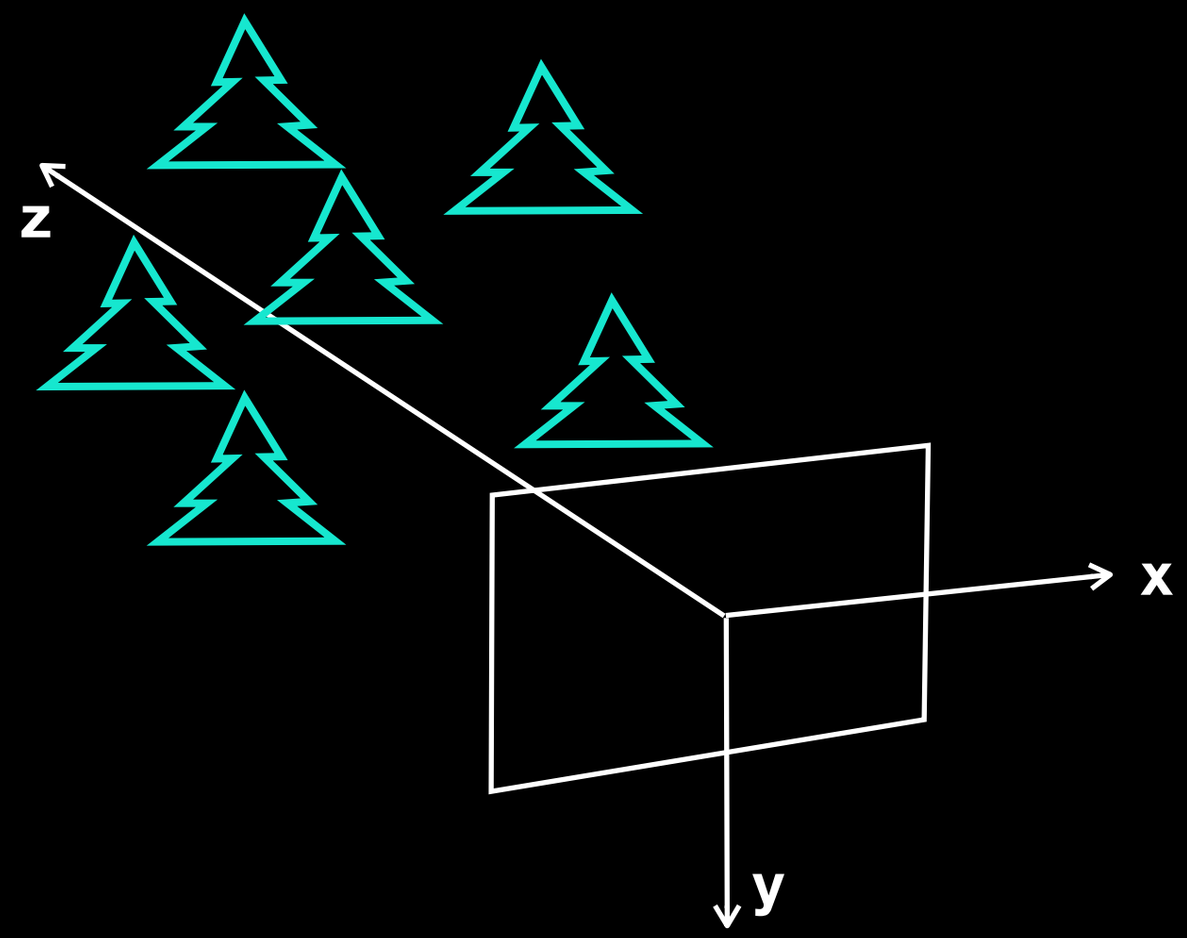
Projecting

intrinsic matrix

$$\frac{1}{z} K \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} u \\ v \\ 1 \end{bmatrix}$$

object coords in camera reference frame

pixels



$$\frac{1}{z} K \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} u \\ v \\ 1 \end{bmatrix}$$

1000 trees
shot made at 10m height

drawing-3d-spruces.ipynb