Matt’s Updates for March 3rd 2016

Task from last week:
research how taking shortcuts affects accuracy

What we want to optimise: speed * accuracy

speed = 1/executionTime,
accuracy = ?

Ideas for measuring accuracy

- compare determinant of bounding box to determinant of bounding box of ‘golden model’
- take pair-wise cross products of the 3 vectors defining the box, and compare this result with the same products from the golden model

Accuracy (continued)

- **but:** fastDeterminant/goldenDeterminant is not good enough
- why? because it doesn't account for position

Solution

- get the homogeneus transformation matrix of the new bounding box

- i.e., this:

$$\begin{pmatrix} 1 & 0 & 0 & T_x \\ 0 & 1 & 0 & T_y \\ 0 & 0 & 1 & T_z \\ 0 & 0 & 0 & 1 \end{pmatrix} \cdot \begin{pmatrix} x \\ y \\ z \\ 1 \end{pmatrix} = \begin{pmatrix} x+T_x \\ y+T_y \\ z+T_z \\ 1 \end{pmatrix}$$

$$\begin{pmatrix} S_x & 0 & 0 & 0 \\ 0 & S_y & 0 & 0 \\ 0 & 0 & S_z & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} \cdot \begin{pmatrix} x \\ y \\ z \\ 1 \end{pmatrix} = \begin{pmatrix} x \cdot S_x \\ y \cdot S_y \\ z \cdot S_z \\ 1 \end{pmatrix}$$

Rotate around Z axis:

$$\begin{bmatrix} x' \\ y' \\ z' \\ w \end{bmatrix} = \begin{bmatrix} \cos\Theta & -\sin\Theta & 0 & 0 \\ \sin\Theta & \cos\Theta & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \\ w \end{bmatrix}$$

image credit: google images

Summary

- A 100% accurate bounding box will have the identity matrix as it’s transformation from the golden model

- So we do 1 very slow segmentation to get the golden model, and then find the transformation matrix of the 3 vectors, and compare determinants (or compare some other representative quantity of the matrix)

Demo