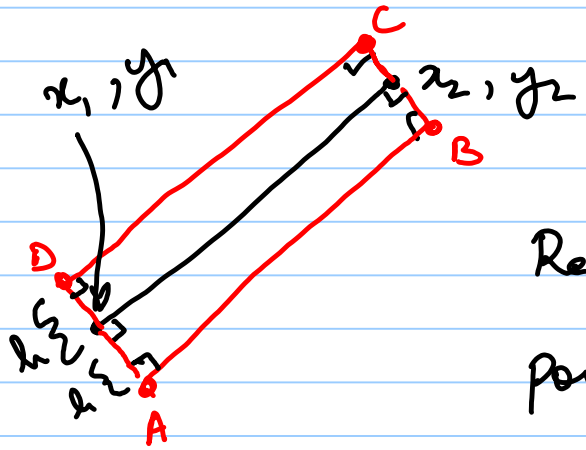
Bounding Rectangle Coordinate Calculation

Note Title 7/14/2019



$h = \frac{Grid}{2}$

Rectangle is given by points A, B, C, D

Line is

$$y = \frac{y_2 - y_1}{x_2 - x_1} x + y_1 - \frac{y_2 - y_1}{x_2 - x_1} x_1$$

$$\Rightarrow m_{LINE} = \frac{y_2 - y_1}{x_2 - x_1}$$

Line AD is:

$$\frac{y - y_1}{x - x_1} = \frac{y_0 - y_1}{x_0 - x_1}$$

$$\Rightarrow y = \frac{y_0 - y_1}{x_0 - x_1} x - \frac{y_0 - y_1}{x_0 - x_1} x_1 + y_1$$

$$m_{AD} = \frac{y_0 - y_1}{x_0 - x_1}$$

$$\tan(\theta_1 - \theta_2) = \frac{\tan\theta_1 - \tan\theta_2}{1 + \tan\theta_1 \tan\theta_2}$$

If $\theta_1 - \theta_2 = \pm 90$

then $\tan\theta_1 \tan\theta_2 = -1$

$$\Rightarrow \quad \frac{y_0 - y_1}{x_0 - x_1} \cdot \frac{y_2 - y_1}{x_2 - x_1} = -1$$

Also $$\sqrt{(y_0 - y_1)^2 + (x_0 - x_1)^2} = h$$

$$(y_0 - y_1)^2 + (x_0 - x_1)^2 = h^2$$

$$\frac{(y_0 - y_1)^2}{(x_0 - x_1)^2} \cdot \frac{(y_2 - y_1)^2}{(x_2 - x_1)^2} = 1$$

$$\frac{h^2}{(x_0 - x_1)^2} - 1 = \frac{(x_2 - x_1)^2}{(y_2 - y_1)^2}$$

$$\frac{h^2}{(x_0 - x_1)^2} = \frac{(x_2 - x_1)^2}{(y_2 - y_1)^2} + 1$$

$$= \frac{(y_2 - y_1)^2 + (x_2 - x_1)^2}{(y_2 - y_1)^2}$$

$$= \frac{L^2}{(y_2 - y_1)^2} \quad (L = \text{length of line})$$

$$\left(\frac{h}{L}\right)^2 = \frac{(x_0 - x_1)^2}{(y_2 - y_1)^2}$$

$$\frac{h}{L} = \pm \frac{x_0 - x_1}{y_2 - y_1}$$

(1)

$$hy_2 - hy_1 = Lx_0 - Lx_1$$

$$x_{0_1} = \frac{h(y_2 - y_1) + Lx_1}{L}$$

(2) $$hy_2 - hy_1 = Lx_1 - Lx_0$$

$$x_0 = x_1 \pm \frac{h}{L}(y_2 - y_1) \qquad x_{0_2} = \frac{Lx_1 - h(y_2 - y_1)}{L}$$

$$x_{0_1} > x_{0_2} \quad \therefore \quad x_{0_1} = x_A, \quad x_{0_2} = x_D$$

$$\frac{y_0 - y_1}{x_0 - x_1} = -\frac{x_2 - x_1}{y_2 - y_1}$$

$$x_0 - x_1 = \pm \frac{h}{L}(y_2 - y_1)$$

$$y_0 - y_1 = \mp \frac{h}{L}(y_2 - y_1)\frac{(x_2 - x_1)}{(y_2 - y_1)}$$

$$\& \quad \boxed{\begin{aligned} y_0 &= y_1 \mp \frac{h}{L}(x_2 - x_1) \\ x_0 &= x_1 \pm \frac{h}{L}(y_2 - y_1) \end{aligned}}$$

A (1st sign) D (2nd sign)

Swapping x_1 & x_2
y_1 & y_2

we can get coordinates for BC

$$y_{BC} = y_2 \mp \frac{h}{L}(x_1 - x_2)$$
$$x_{BC} = x_2 \pm \frac{h}{L}(y_1 - y_2)$$

B (1st sign) C (2nd sign)