

## UAS GRAFIKA KOMPUTER

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Prodi : Informatika

$$1. n = \frac{p_{eye} - p_{ref}}{|p_{eye} - p_{ref}|} = \frac{(4, 4, 4) - (0, 1, 4)}{|(4, 4, 4) - (0, 1, 4)|} = \frac{(4, 3, 0)}{|(4, 3, 0)|} = \frac{(4, 3, 0)}{\sqrt{4^2 + 3^2 + 0^2}} = \left(\frac{4}{5}, \frac{3}{5}, 0\right)$$

$$u = \frac{v_{up} \times n}{|v_{up} \times n|} = \frac{(0, 1, 0) \times \left(\frac{4}{5}, \frac{3}{5}, 0\right)}{|(0, 1, 0) \times \left(\frac{4}{5}, \frac{3}{5}, 0\right)|} = \frac{(0, 0, -\frac{4}{5})}{|(0, 0, -\frac{4}{5})|} = (0, 0, -1)$$

$$v = n \times u = \left(\frac{4}{5} \times \frac{3}{5}, 0\right) \times (0, 0, -1) = \left(-\frac{3}{5}, -\frac{4}{5}, 0\right)$$

$$M_{cam}^{-1} = \begin{bmatrix} u_x & u_y & u_z & 0 \\ v_x & v_y & v_z & 0 \\ n_x & n_y & n_z & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} * \begin{bmatrix} 1 & 0 & 0 & -p_{eye}x \\ 0 & 1 & 0 & -p_{eye}y \\ 0 & 0 & 1 & -p_{eye}z \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$M_{cam}^{-1} = \begin{bmatrix} 0 & 0 & -1 & 0 \\ -\frac{3}{5} & \frac{4}{5} & 0 & 0 \\ \frac{4}{5} & \frac{3}{5} & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} * \begin{bmatrix} 1 & 0 & 0 & -4 \\ 0 & 1 & 0 & -4 \\ 0 & 0 & 1 & -4 \\ 0 & 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 0 & 0 & -1 & 4 \\ -\frac{3}{5} & \frac{4}{5} & 0 & -\frac{4}{5} \\ \frac{4}{5} & \frac{3}{5} & 0 & -\frac{28}{5} \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Posisi titik tersebut terhadap bidang pandang kamera adalah

$$p_{kamera} = M_{cam}^{-1} * p_{alam} = \begin{bmatrix} 0 & 0 & -1 & 4 \\ -\frac{3}{5} & \frac{4}{5} & 0 & -\frac{4}{5} \\ \frac{4}{5} & \frac{3}{5} & 0 & -\frac{28}{5} \\ 0 & 0 & 0 & 1 \end{bmatrix} * \begin{bmatrix} 0 \\ 1 \\ 4 \\ 1 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ -5 \\ 1 \end{bmatrix}$$

$$p_{kamera} = (0, 0, -5)$$

2. Diketahui
- A (10, 5, 6)
  - B (15, 10, 2)
  - C (30, 25, 10)

a. Translasi  $x = 2, y = -3, z = 4$

$$\begin{aligned} \text{Titik A} &= 10 + 2 = 12 \\ 5 + (-3) &= 2 \\ 6 + 4 &= 10 \end{aligned} \quad \left. \vphantom{\begin{aligned} \text{Titik A} &= 10 + 2 = 12 \\ 5 + (-3) &= 2 \\ 6 + 4 &= 10 \end{aligned}} \right\} (12, 2, 10)$$

$$\begin{aligned} \text{Titik B} &= 15 + 2 = 17 \\ 10 + (-3) &= 7 \\ 2 + 4 &= 6 \end{aligned} \quad \left. \vphantom{\begin{aligned} \text{Titik B} &= 15 + 2 = 17 \\ 10 + (-3) &= 7 \\ 2 + 4 &= 6 \end{aligned}} \right\} (17, 7, 6)$$

$$\begin{aligned} \text{Titik C} &= 30 + 2 = 32 \\ 25 + (-3) &= 22 \\ 10 + 4 &= 14 \end{aligned} \quad \left. \vphantom{\begin{aligned} \text{Titik C} &= 30 + 2 = 32 \\ 25 + (-3) &= 22 \\ 10 + 4 &= 14 \end{aligned}} \right\} (32, 22, 14)$$

Dihasilkan  
Ditranslasi

$$A = (12, 2, 10)$$

$$B = (17, 7, 6)$$

$$C = (32, 22, 14)$$

b. Penskalaran,  $x = 5, y = -3, z = 4$

$$\begin{aligned} \text{Titik A} &= 10 \times 5 = 50 \\ 5 \times (-3) &= -15 \\ 6 \times 4 &= 24 \end{aligned}$$

$$\begin{aligned} \text{Titik B} &= 15 \times 5 = 75 \\ 10 \times (-3) &= -30 \\ 2 \times 4 &= 8 \end{aligned}$$

$$\begin{aligned} \text{Titik C} &= 30 \times 5 = 150 \\ 25 \times (-3) &= -75 \\ 10 \times 4 &= 40 \end{aligned}$$

$$\text{Dihasilkan} = A = (50, -15, 24)$$

$$B = (75, -30, 8)$$

$$C = (150, -75, 40)$$

c. Rotasi  $45^\circ$  sumbu y

$$\begin{aligned} \text{Titik A} &= 10 \cos 45^\circ - 5 \sin 45^\circ \\ 10 \sin 45^\circ - 5 \cos 45^\circ &= 3,15 \end{aligned}$$

$$\begin{aligned} B &= 15 \cos 45^\circ - 10 \sin 45^\circ = 12,16 \\ 15 \sin 45^\circ - 5 \cos 45^\circ &= 8,11 \end{aligned}$$

$$\begin{aligned} C &= 30 \cos 45^\circ - 25 \sin 45^\circ = 26,6 \\ 30 \sin 45^\circ - 25 \cos 45^\circ &= 13,7 \end{aligned}$$

3. Diketahui titik titik (5,7)  
(0,4)

- ~~word~~ to (8,7)
- word coordinates system P-P<sub>0</sub>

Jawab:

a. P<sub>0</sub> (4,8) dan P (8,8)

$$V = \frac{P - P_0}{|P - P_0|} = \frac{(8,8) - (4,8)}{|(8,8) - (4,8)|} = \frac{4,0}{\sqrt{4}} = 4,2$$

$$U = (U_y, -U_x) = (2, -4)$$

$$M = \begin{bmatrix} U_x & U_y & 0 \\ -U_y & U_x & 0 \\ 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} 1 & 0 & -x_v \\ 0 & 1 & -y_v \\ 0 & 0 & 1 \end{bmatrix}$$

$$M = \begin{bmatrix} 2 & -4 & 0 \\ 4 & 2 & 0 \\ 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} 1 & 0 & 4 \\ 0 & 1 & 8 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 2 & -4 & 24 \\ 4 & 2 & -32 \\ 0 & 0 & 1 \end{bmatrix}$$

P<sub>new</sub> = m x P<sub>old</sub>

$$= \begin{bmatrix} 2 & -4 & 24 \\ 4 & 2 & -32 \\ 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} 5 & 8 & 0 \\ 7 & 4 & 7 \\ 1 & 1 & 1 \end{bmatrix} = \begin{bmatrix} 6 & 24 & 12 \\ 2 & 8 & 14 \\ 1 & 1 & 1 \end{bmatrix}$$

$$P_{new} = (6,2) (24,8) (12,14)$$

b. P<sub>0</sub> (4,2) dan P (4,7)  
Vektor satuan U

$$V = \frac{P - P_0}{|P - P_0|} = \frac{(4,7) - (4,2)}{|(4,7) - (4,2)|} = \frac{(0,5)}{\sqrt{0^2 + 3^2}} = 0,2$$

$$U = (U_y, -U_x) = (2, 0)$$

$$M = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$



$$P_{\text{transform}} = M \times P_{\text{world}}$$

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} 5 & 0 & 0 \\ 7 & 4 & 7 \\ 1 & 1 & 1 \end{bmatrix} = \begin{bmatrix} 5 & 0 & 0 \\ 7 & 4 & 7 \\ 1 & 1 & 1 \end{bmatrix}$$

$$og \quad (5, 7), (8, 4), (8, 7)$$

#### 5. • Kurva Spline

→ Data dapat berupa satu dimensi / multidimensi

Fungsi untuk Interpolasi Spline biasanya didefinisikan sebagai langkah kepat minimizers dari ketidaksamaan terdapat pada interpolasi tersebut

#### • Kurva B-spline

→ Cukup ampuh secara algoritmik tetapi tidak secara ekspresif menyatakan bentuk fungsionalnya

#### Contoh - • Finerprint

• Start blocks

• Row Graphics

• Power BI

• Canvas

• Usmg

• Livegap

$$4. \quad n = \frac{p_{\text{ore}} - p_{\text{ref}}}{\|p_{\text{ore}} - p_{\text{ref}}\|} = \frac{(3, 5, 10) - (2, 1, 6)}{\sqrt{1^2 + 4^2 + 2^2}} = \frac{(1, 4, 2)}{\sqrt{1^2 + 4^2 + 2^2}}$$

$$= \frac{1, 4, 2}{\sqrt{1^2 + 4^2 + 2^2}} = \frac{1}{\sqrt{21}}, \frac{4}{\sqrt{21}}, \frac{2}{\sqrt{21}}$$

$$v = \frac{v_{\text{up}} \times n}{\|v_{\text{up}} \times n\|} = \frac{(2, 1, 3) \times \left(\frac{1}{\sqrt{21}}, \frac{4}{\sqrt{21}}, \frac{2}{\sqrt{21}}\right)}{\| (2, 1, 3) \times \left(\frac{1}{\sqrt{21}}, \frac{4}{\sqrt{21}}, \frac{2}{\sqrt{21}}\right) \|} = \frac{(2, 1, 3) \times \left(\frac{1}{\sqrt{21}}, \frac{4}{\sqrt{21}}, \frac{2}{\sqrt{21}}\right)}{\sqrt{2^2 + 1^2 + 3^2}} = \frac{(2, 1, 3) \times \left(\frac{1}{\sqrt{21}}, \frac{4}{\sqrt{21}}, \frac{2}{\sqrt{21}}\right)}{\sqrt{14}}$$

$$\frac{(2, 1, 3) \times \left(\frac{1}{\sqrt{21}}, \frac{4}{\sqrt{21}}, \frac{2}{\sqrt{21}}\right)}{\sqrt{14}} = \frac{(2, 1, 3) \times \left(\frac{1}{\sqrt{21}}, \frac{4}{\sqrt{21}}, \frac{2}{\sqrt{21}}\right)}{\sqrt{14}} = (0, 0, -1)$$

$$V = n \times v = \left( \frac{1}{4}, \frac{4}{4}, \frac{2}{4} \right) \times (0, 0, 1)$$

$$= \left( \frac{4}{4}, \frac{1}{4}, \frac{2}{4} \right)$$