Plane fitting with least squares

Tuesday, October 11, 2022 13:51

Find: $ax + by + cz + d = 0$

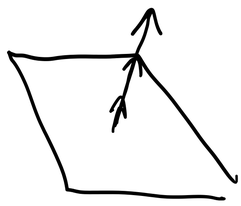
Given: points $P = n\begin{bmatrix} x & y & z \\ \vdots & \vdots & \vdots \end{bmatrix}_3$

Use Least squares: $Ax = b$

① Four variables are too many! They're connected...

ex) $[a, b, c, d]$ and $[-a, -b, -c, -d]$ are the same!

② normal can be scaled



$[a, b, c, d] = [2a, 2b, 2c, ?]$

$2(ax + by + cz + d = 0)$

$2ax + 2by + 2cz + 2d = 0$

Therefore... assume $\underline{c = -1}$

$$ax + by - z + d = 0$$

$$ax + by + d = z$$

$$\begin{bmatrix} x & y & 1 \\ \vdots & & \end{bmatrix} \begin{bmatrix} a \\ b \\ d \end{bmatrix} = \begin{bmatrix} z \\ \vdots \end{bmatrix}$$

$$\begin{bmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ \vdots & \vdots & \vdots \\ x_N & y_N & 1 \end{bmatrix} \begin{bmatrix} a \\ b \\ d \end{bmatrix} = \begin{bmatrix} z_1 \\ \vdots \\ z_N \end{bmatrix}$$

$$A \quad x = b$$

$a = x(0)$

$b = x(1)$

$d = x(2)$

$c = -1$