Designing Intelligent Systems for mapping & understanding the world
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The likelihood function is:

$$L(\beta) = \prod_{i=1}^{N} \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{(y_i - \beta \cdot x_{p,i})^2}{2\sigma^2}\right)$$  (independence)

If we have \( y_1, \ldots, \beta \cdot x_{p-1,i} \), then the likelihood becomes:

$$\prod_{i=1}^{N} \frac{1}{\sqrt{2\pi\sigma}} \exp\left(-\frac{(y_i - \beta^T x_i)^2}{2\sigma^2}\right)$$

The log-likelihood is:

$$-N \log(\sqrt{2\pi\sigma}) - \frac{1}{2\sigma^2} \sum_{i=1}^{N} (y_i - \beta^T x_i)^2$$

This is equivalent to finding the estimate \( \hat{\beta} \) that maximizes the likelihood. So \( \hat{\beta} \) is found by making the derivative of the log-likelihood equal to zero:

$$\sum_{i=1}^{N} (y_i - \beta^T x_i) x_i = 0$$

This is equivalent to minimizing the sum of square error (SSE) when defining the response vector \( \mathbf{y} \) and the design matrix \( \mathbf{X} \), concatenating \( c_1, \ldots, c_N \), the vector

$$\mathbf{X} = \begin{bmatrix} 1 & x_{1,1} & \cdots & x_{p-1,1} \\ 1 & x_{1,2} & \cdots & x_{p-1,2} \\ \vdots & \vdots & \ddots & \vdots \\ 1 & x_{1,N} & \cdots & x_{p-1,N} \end{bmatrix}$$

Then \( \mathbf{e} = \mathbf{y} - \mathbf{X}\beta \). Minimising the SSE corresponds to finding \( \beta \):

$$\hat{\beta} = \arg \min_\beta \{ SSE = \sum_{i=1}^{n} c_i^2 = \|\mathbf{e}\|^2 \}$$

$$= \arg \min_\beta \{ SSE = \|\mathbf{y} - \mathbf{X}\beta\|^2 \}$$

$$= \arg \min_\beta \{ SSE = (\mathbf{y} - \mathbf{X}\beta)^T(\mathbf{y} - \mathbf{X}\beta) \}$$

$$= \arg \min_\beta \{ SSE = \mathbf{y}^T\mathbf{y} - \mathbf{y}^T\mathbf{X}\beta - \beta^T\mathbf{X}^T\mathbf{y} + \beta^T\mathbf{X}^T\mathbf{X}\beta \}$$
The survey used a DJI Phantom drone to capture 850 images.
Dublin
Any questions?
https://www.scss.tcd.ie/Rozenn.Dahyot/

News:

- **IMVIP 2019** Irish Machine Vision & Image Processing Conference  @WeAreTUDublin  http://imvip.ie/
- **EUSIPCO 2021** European Signal Processing Conference  expected in Dublin in 2021!

www.adaptcentre.ie