OHP Picture 1

Diagram: Dot-Plot

Body Weight (BW)

linear regression model that describes relationship between BC and BW

$E(y) = b_0 + b_1 x$

Breast Circumference (BC)

Observations

- general tendency between BW and BC
- not deterministic $\Rightarrow$ exceptions
- relationship between BW and BC independent of range of values (whether BC is low or high) $\Rightarrow$ Linear Relationship
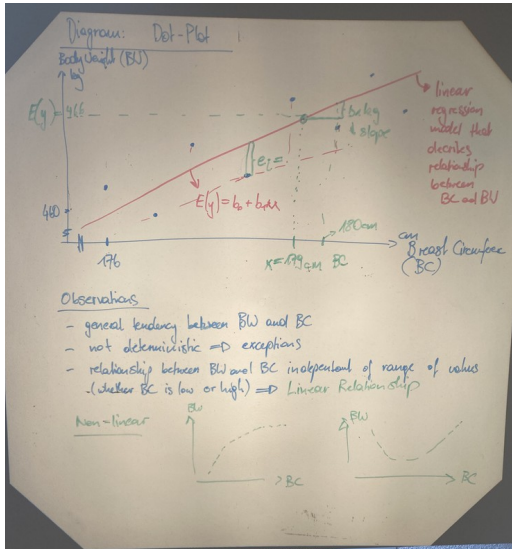
Non-linear

OHP Picture 2

Least Squares

- For a given regression line (red line)
  - compute for each animal the e_i value
  - square all e_i - values
  - sum squared e_i

$e_i = y_i - b_0 - b_1 x_i$ for example data set:
$\quad e_1$
$\quad e_2$
$\quad \vdots$
$\quad e_{10}$

$$\underline{e} = \begin{bmatrix} e_1 \\ e_2 \\ \vdots \\ e_{10} \end{bmatrix} \quad ; \quad \text{compute}: \quad \underline{e}^T \cdot \underline{e} = \sum_{i=1}^{N} e_i^2 = \sum_{i=1}^{N} \left[y_i - b_0 - b_1 \cdot x_i \right]^2$$

Task: find numeric values for b_0 and b_1 such that
$\quad \overline{e}^T e$ is minimal.

Minimization: - compute $\dfrac{\partial \underline{e}^T \underline{e}}{\partial b_0}$; $\dfrac{\partial \underline{e}^T \underline{e}}{\partial b_1}$

- Find $\hat{b}_0$ and $\hat{b}_1$ such that
$\dfrac{\partial \underline{e}^T \underline{e}}{\partial b_0} = 0$; $\dfrac{\partial \underline{e}^T \underline{e}}{\partial b_1} = 0$