Least squares estimation

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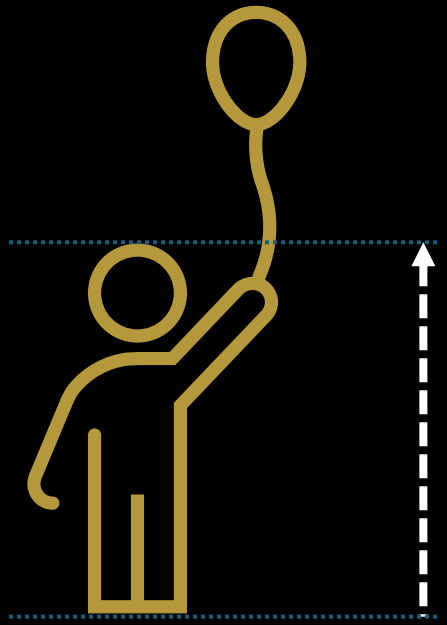

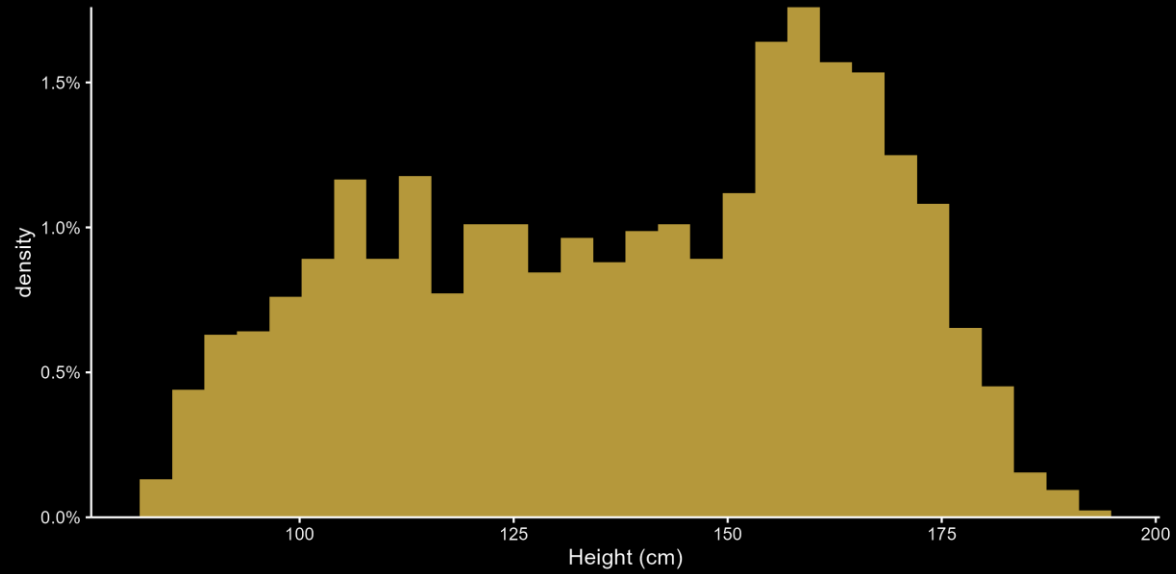

$$Y_i = \beta + \epsilon_i$$

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$$Y_i = \beta_0 + \beta_1 X_i + \epsilon_i$$

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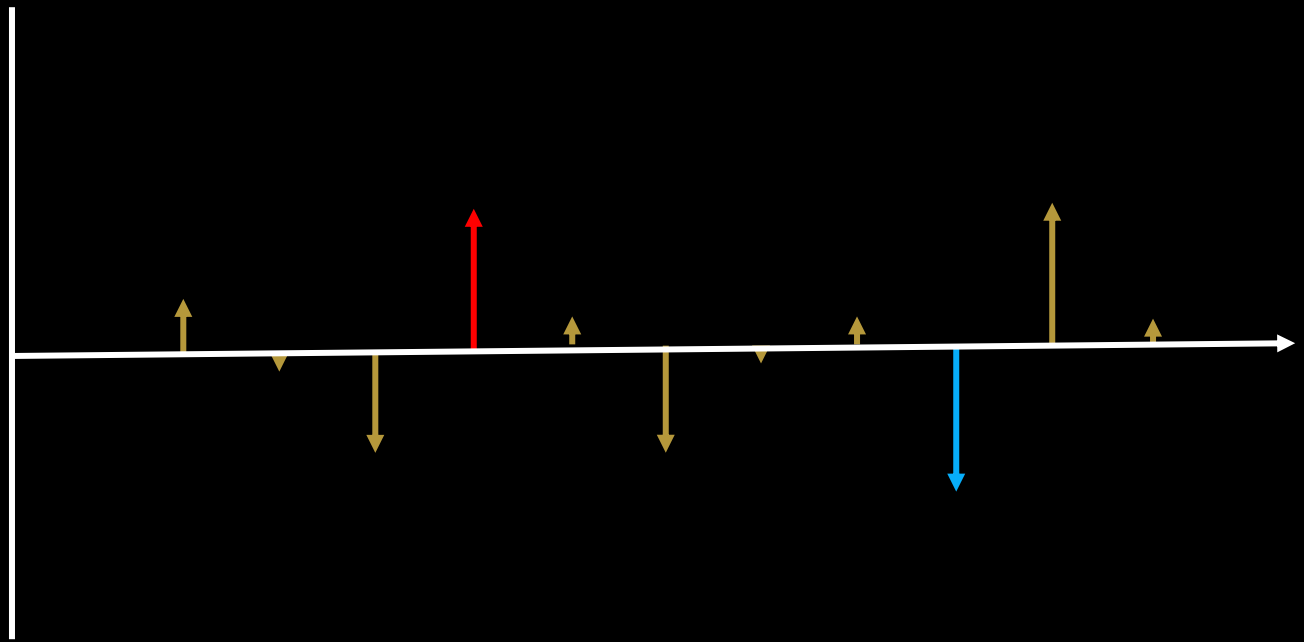
$$\epsilon_i = Y_i - \beta$$

Find the β that minimze $\sum_{i=1}^{n} \epsilon_i$?



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$$\epsilon_i = Y_i - \beta$$

Find the β that minimze $\sum_{i=1}^{n} \epsilon_i^2$?

$$\sum_{i=1}^{n} \epsilon_i^2 = \sum_{i=1}^{n} (Y_i - \beta)^2 = \sum_{i=1}^{n} Y_i^2 - 2\beta \sum_{i=1}^{n} Y_i + n\beta^2$$

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$$\sum_{i=1}^{n} \epsilon_i^2 = \sum_{i=1}^{n} (Y_i - \beta)^2 = \sum_{i=1}^{n} Y_i^2 - 2\beta \sum_{i=1}^{n} Y_i + n\beta^2$$

$$\frac{\partial}{\partial \beta}\left(\sum_{i=1}^{n} Y_i^2 - 2\beta \sum_{i=1}^{n} Y_i + 2n\beta^2\right) = 0$$

$$-2\sum_{i=1}^{n} Y_i + 2n\beta = 0$$

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$$-2\sum_{i=1}^{n} Y_i + 2n\beta = 0$$

$$2n\beta = 2\sum_{i=1}^{n} Y_i$$

$$\hat{\beta} = \frac{1}{n}\sum_{i=1}^{n} Y_i = \bar{Y}$$

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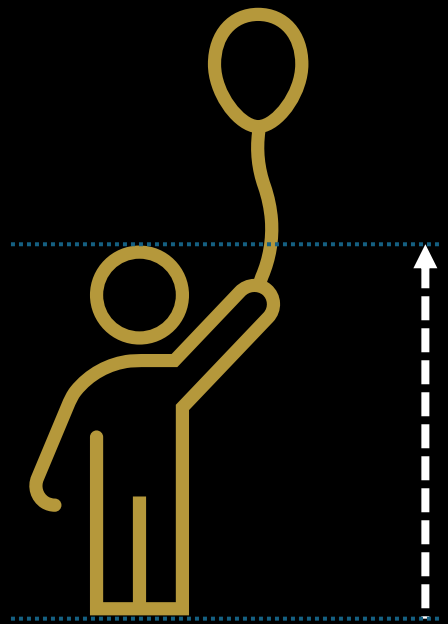

Sum of squared errors:

$$\sum_{i=1}^{n} \epsilon_i^2 \quad (\mathrm{cm}^2)$$

Root mean squared errors (RMSE)

$$\sqrt{\frac{1}{n}\sum_{i=1}^{n} \epsilon_i^2} \quad (\mathrm{cm})$$

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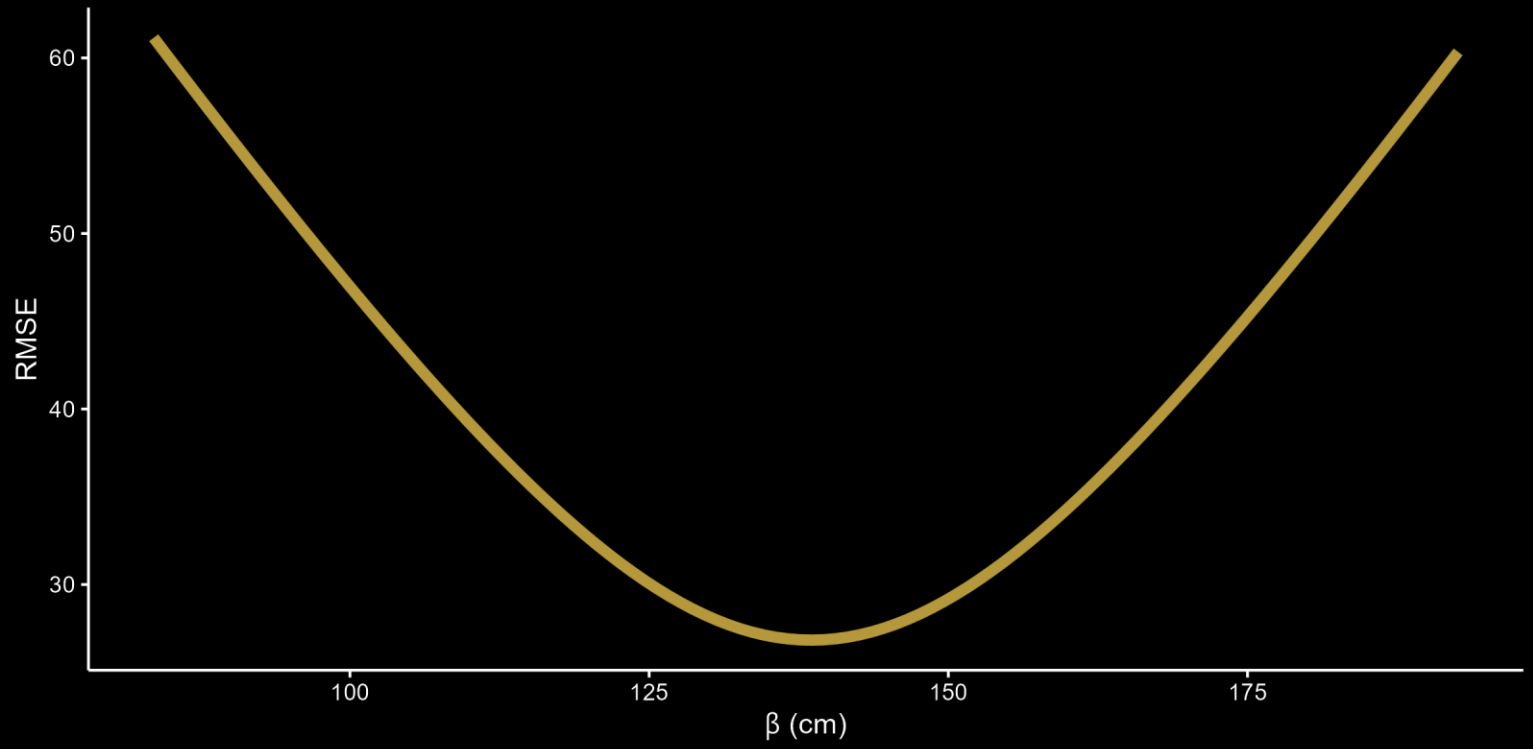

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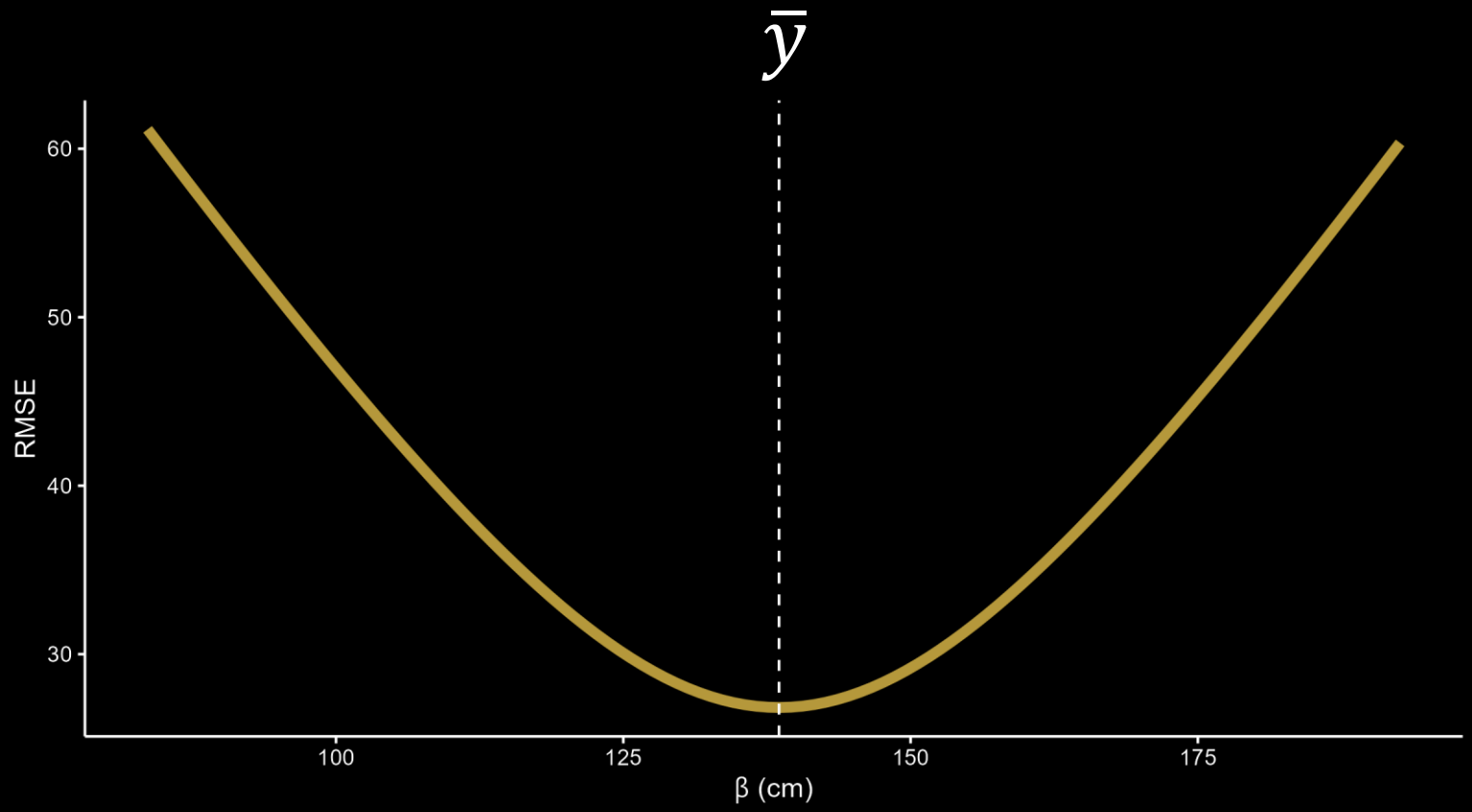

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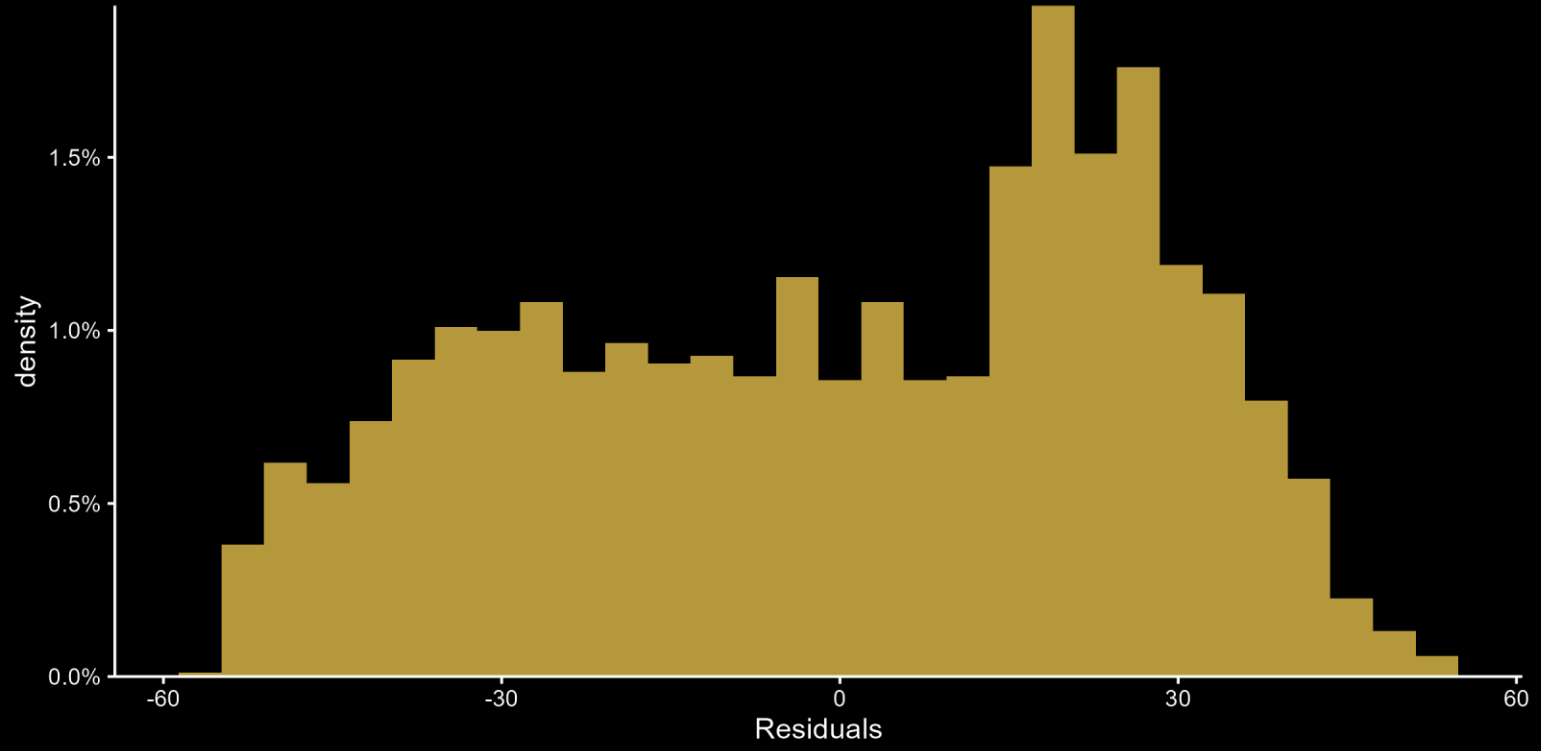

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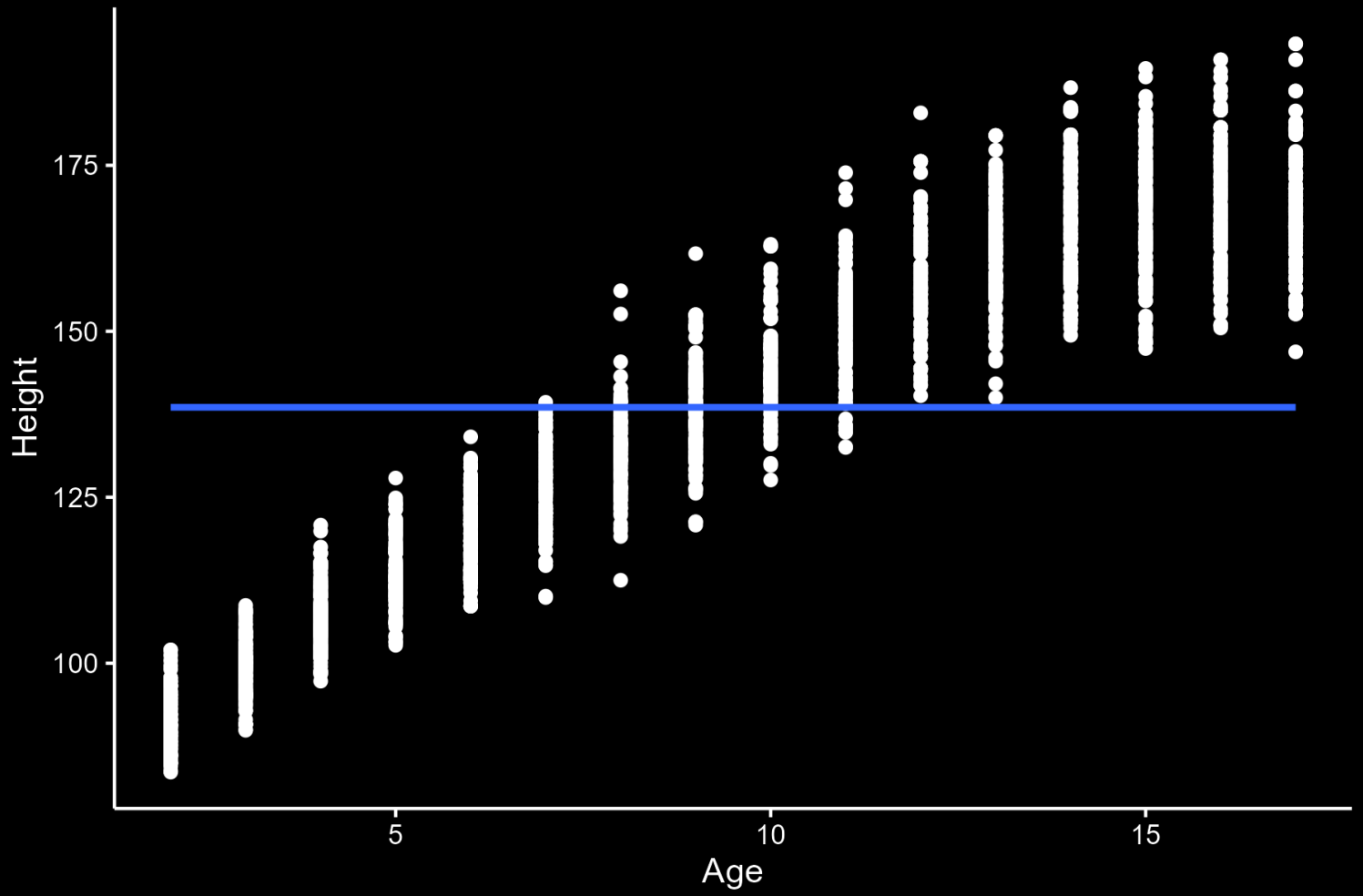

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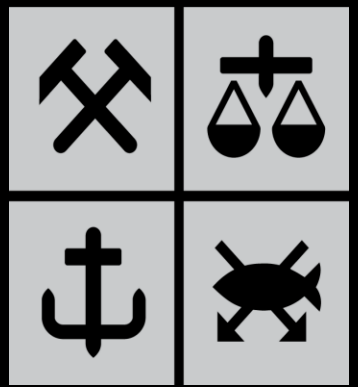

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