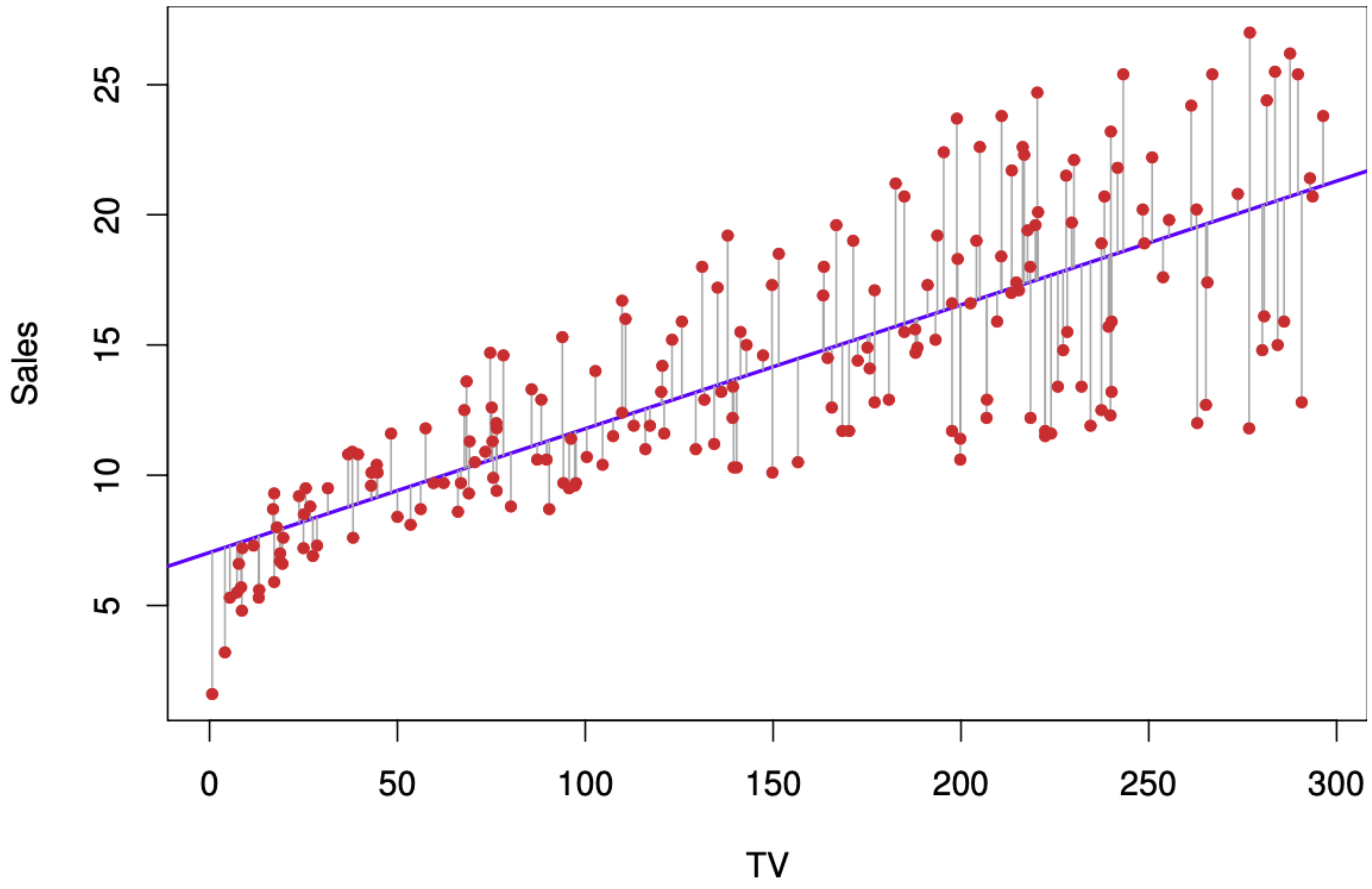
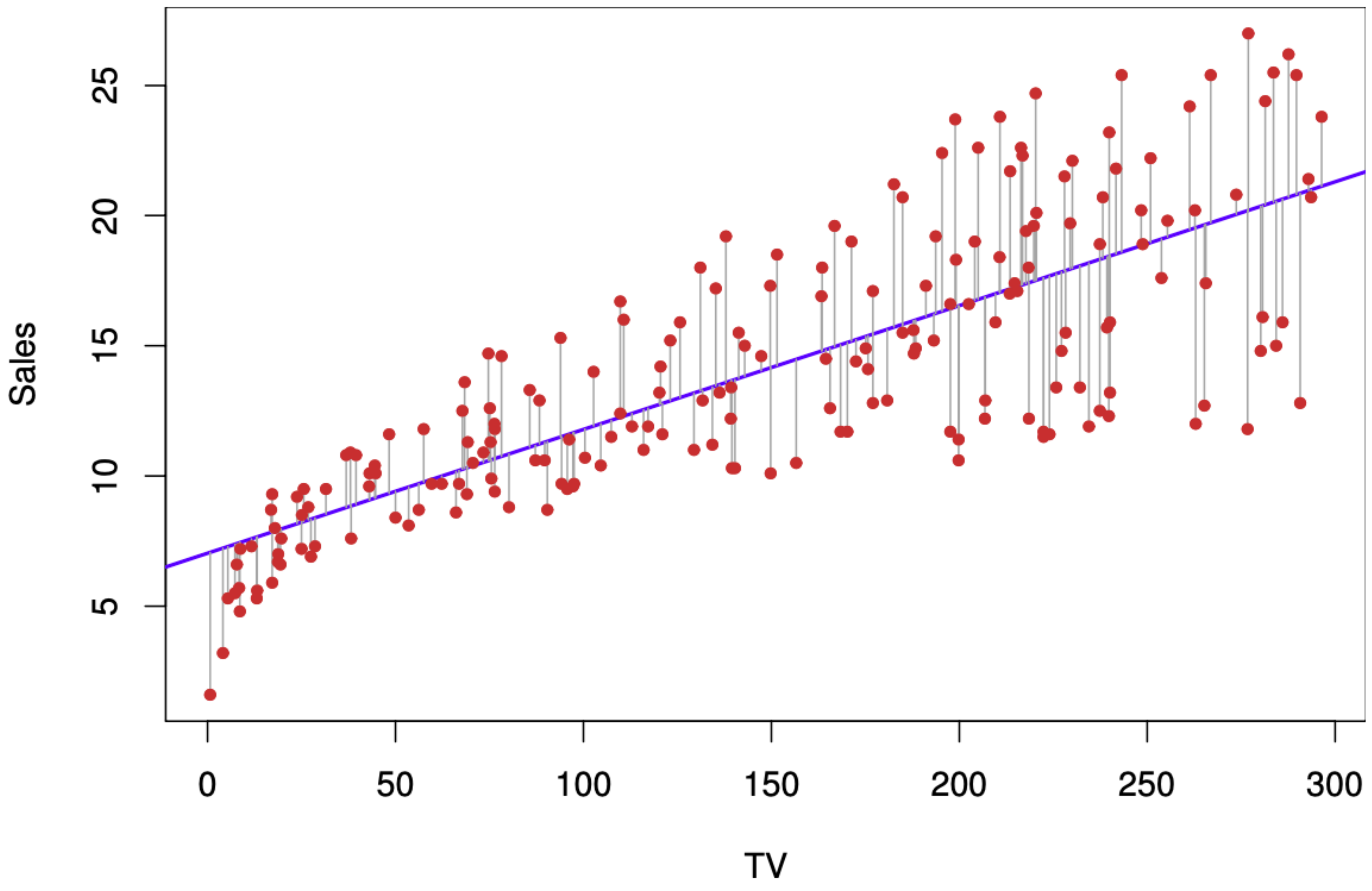
IDS 702

Estimating the linear regression coefficients



Sales
5
10
15
20
25
0
50
100
150
200
250
300
TV



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Ordinary Least Squares (OLS) estimation

- Minimize the residual sum of squares
- Does not make distributional assumptions
- Limited to linear regression

Multiple Linear Regression Model

$$y_i = \beta_0 + \beta_1 x_{i1} + \ldots + \beta_p x_{ip} + \epsilon_i; \epsilon_i \overset{\text{iid}}{\sim} N(0,\sigma^2), i = 1,...n$$

Estimation: Ordinary Least Squares

Coefficient estimates are obtained by taking partial derivatives of the sum of squares of the errors with respect to each parameter

$$\sum_{i=1}^{n} (y_i - [\beta_0 + \beta_1 x_{i1} + \ldots + \beta_p x_{ip}])^2$$

Matrix Representation

$$\mathbf{Y} = \mathbf{X}\beta + \epsilon; \epsilon \sim \mathbf{N}(\mathbf{0}, \sigma^2\mathbf{I})$$

Then the OLS estimates are:

$$\hat{\beta} = (\mathbf{X}^{\mathbf{T}}\mathbf{X})^{-1}\mathbf{X}^{\mathbf{T}}\mathbf{Y}$$

For more on LR matrix representation: “Plane Answers to Complex Questions” by Ronald Christensen