Bayesian Statistics

R2WinBUGS

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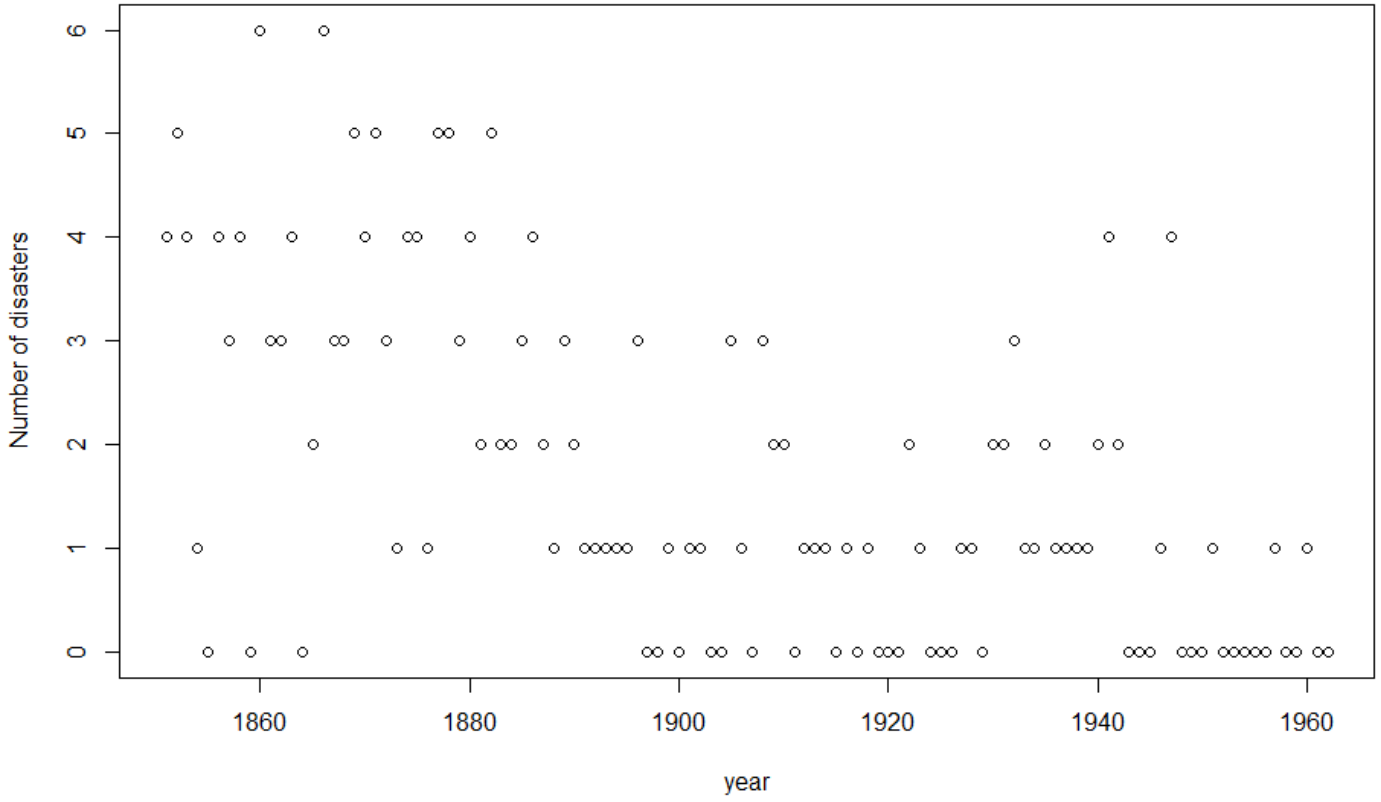
Example: A change-point model

- The number of coal mining disasters is recorded for each year from 1851 to 1962



Example: A change-point model (cont)

- An analysis of counts of British coal mining disasters described in Carlin et al (1992).
  - Model: Poisson regression with a change point

$$y_t \sim \text{Poisson}(\mu_t),\ \log(\mu_i) = \beta_0 + \beta_1 \times \delta(t - \tau),$$

    - Assume in the earlier years $(t < \tau)$, $\log \mu_t = \beta_0$
    - For the later years $(t \geq \tau)$, $\log \mu_t = \beta_0 + \beta_1$.
  - Prior:
    - vague uniform priors on β_0 and β_1,
    - $\tau \sim U(1, N)$, where N is the number of years
  - R code + WinBUGS program

Example: Robust regression

- One is interested in the relationship between the vote count in the 1996 and 2000 presidential elections in the state of Florida. For each of 67 counties in Florida, one records the voter count for Pat Buchanan, the Reform Party candidate in 2000, and the voter count for Ross Perot, the Reform Party candidate in 1996.

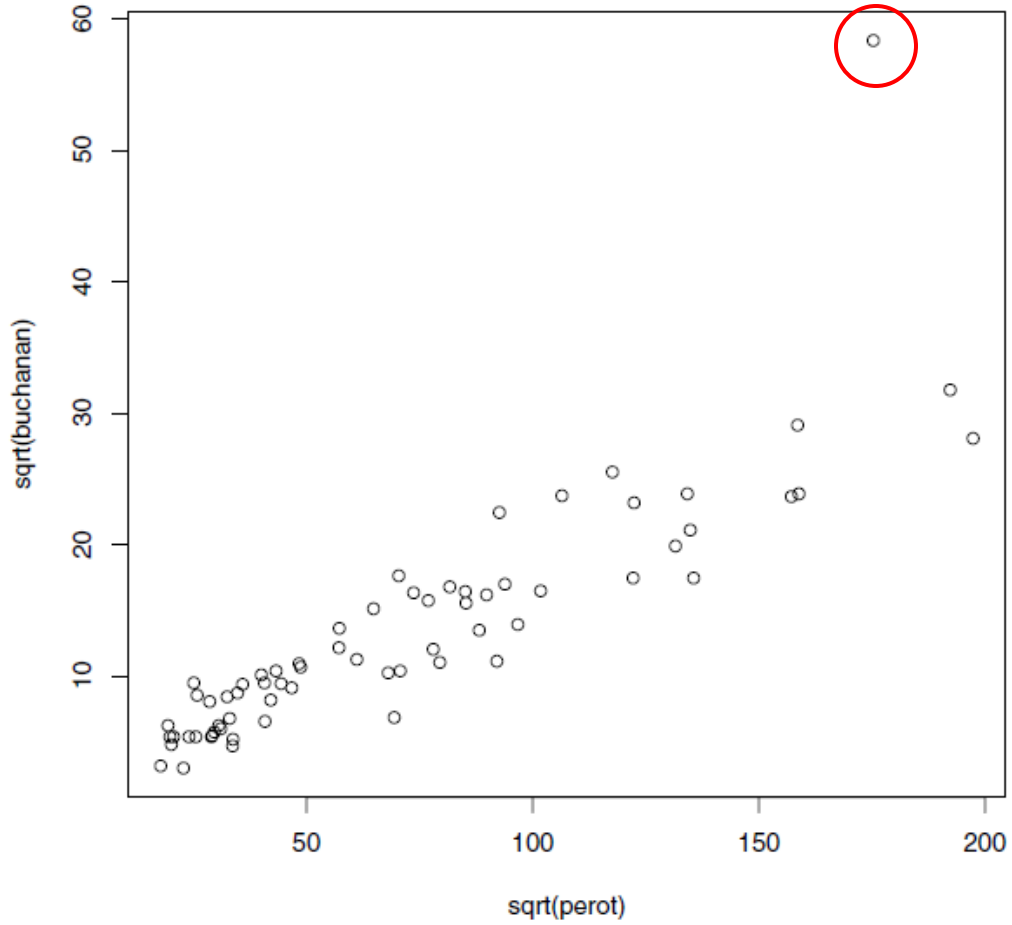


Fig. 11.4. Scatterplot of Buchanan and Perot voter counts in Florida in the 1996 and 2000 presidential elections.

Both axis's are transformed by the square root function.

A robust linear regression model with t-errors

- Linear regression: $y_i = \beta_0 + \beta_1 x_i + \epsilon_i,$
  - where $\epsilon_1, \ldots, \epsilon_n$ are a random sample from a t distribution with mean, scale parameter σ and $\nu = 4$ degrees of freedom
- Represent t-distribution as a scale-mixture normal distributions

$$y_i \sim N(\beta_0 + \beta_1 x_i, (\tau\lambda_i)^{-1/2}),$$
$$\lambda_i \sim \text{gamma}(2, 2).$$

- Prior
  - vague uniform priors on β_0 and β_1,
  - $\pi(\tau) \propto 1/\tau$
- R code + WinBUGS program