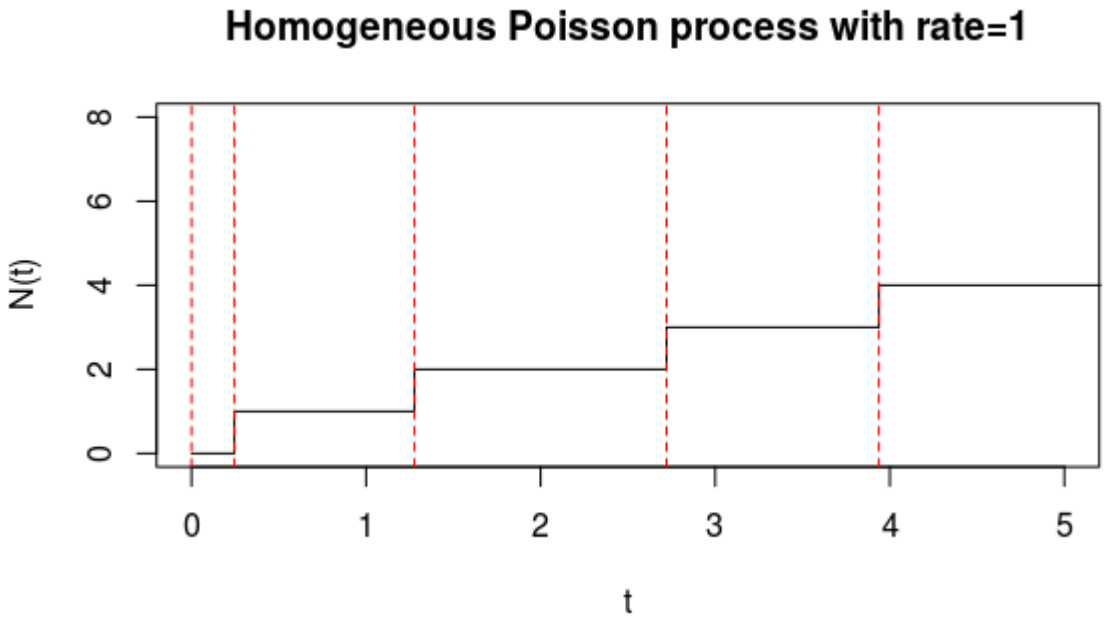
Simulation of Hawkes Process

Suhas Shastry

Poisson Process

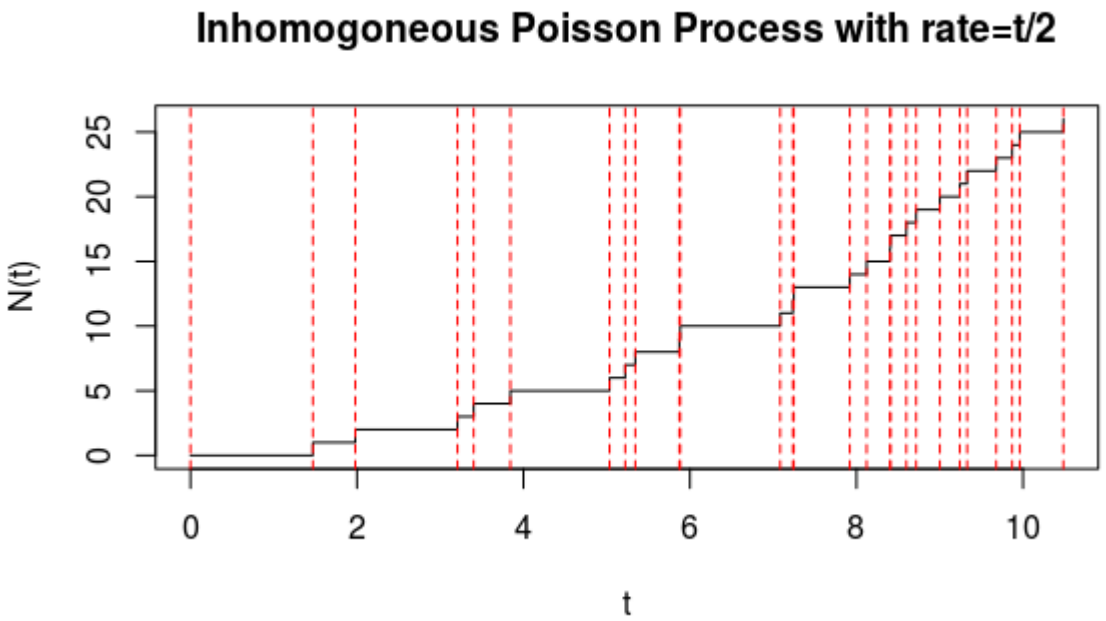
- Homogeneous

$$P\{X(t) = n\} = e^{-\lambda t}\frac{(\lambda t)^n}{n!} \quad n = 0,1,2,\ldots$$



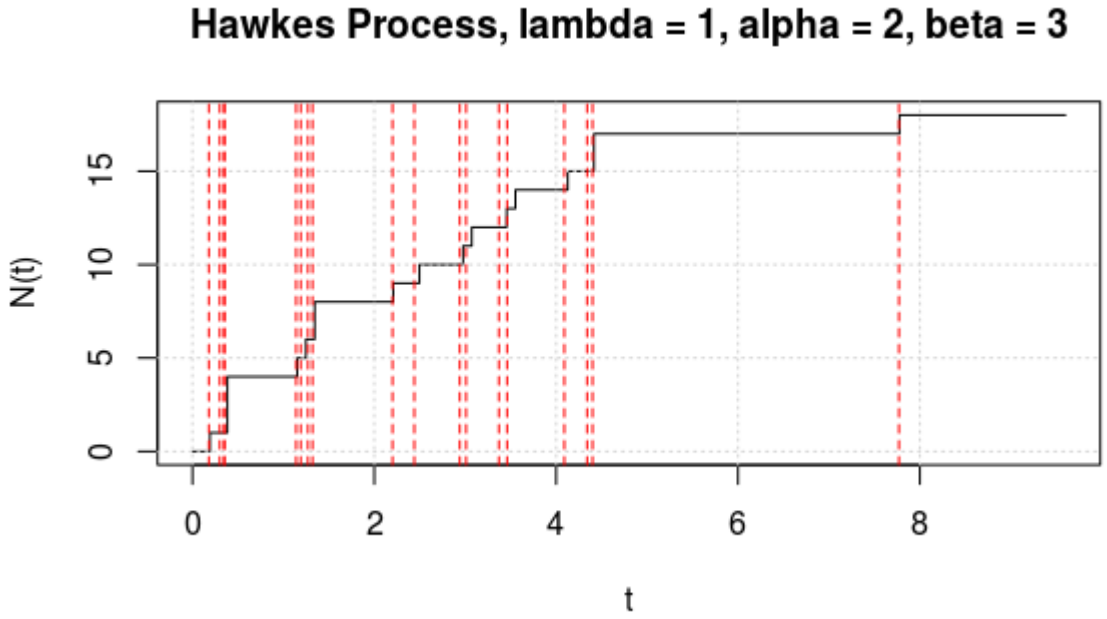
- Inhomogeneous

$$P\{X(t) = n\} = e^{-\Lambda(t)}\frac{\{\Lambda(t)\}^n}{n!} \quad n = 0,1,2,\ldots$$



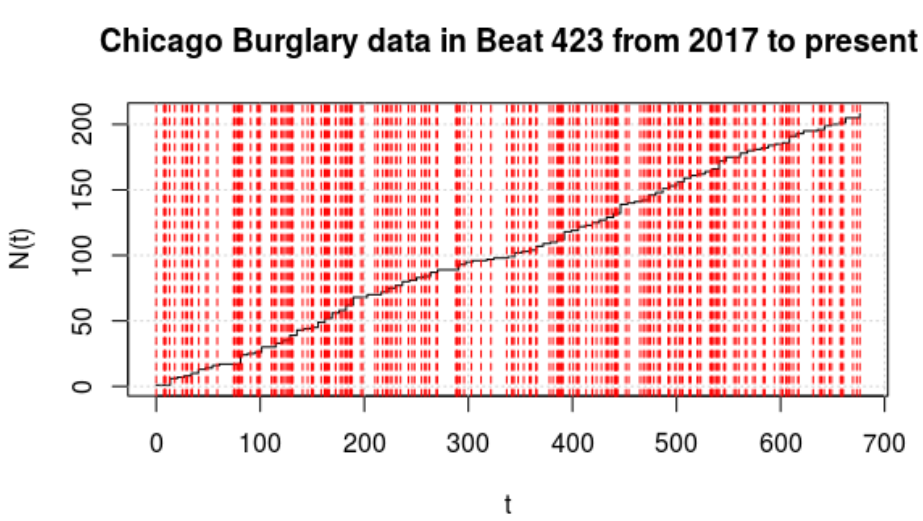
Hawkes Process

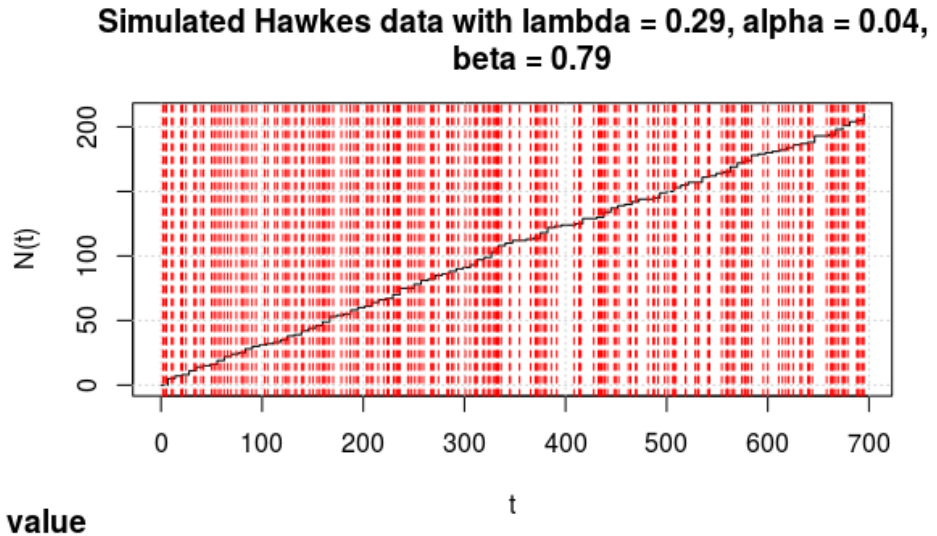
$$\Lambda(t) = \lambda_0 + \sum_{t_i<t} \alpha e^{-\beta(t-t_i)}$$

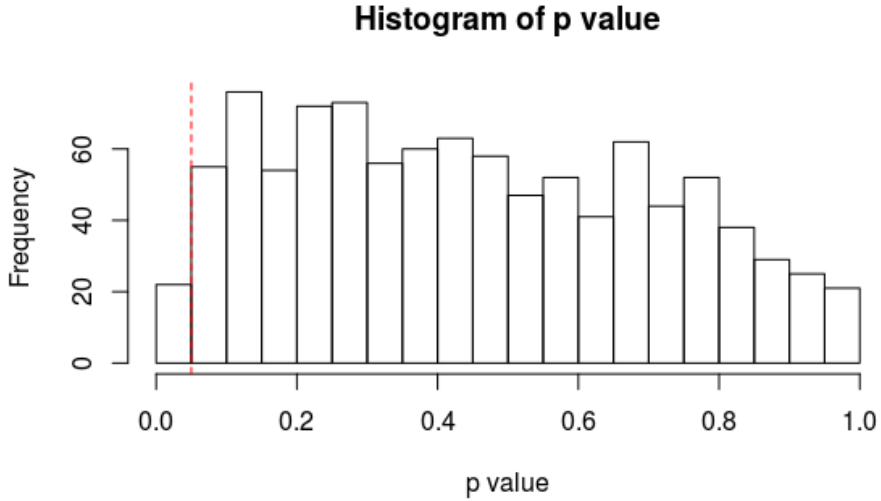


$$l = \sum_{i=1}^{k} \log\left[\lambda + \alpha \sum_{j=1}^{i-1} e^{-\beta(t_i-t_j)}\right] - \lambda t_k + \frac{\alpha}{\beta}\sum_{i=1}^{k}\left[e^{-\beta(t_k-t_j)} - 1\right]$$

Chicago Burglary data in Beat 423 (2017-18)







Thank you

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