Likelihood and Log Likelihood

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1 Background

The likelihood is the probability that a given set of parameters would give rise to a given data set.

Formally, the likelihood is a product of probabilities.

$$\mathcal{L}(\beta) = \prod p(\beta|x, y) \tag{1}$$

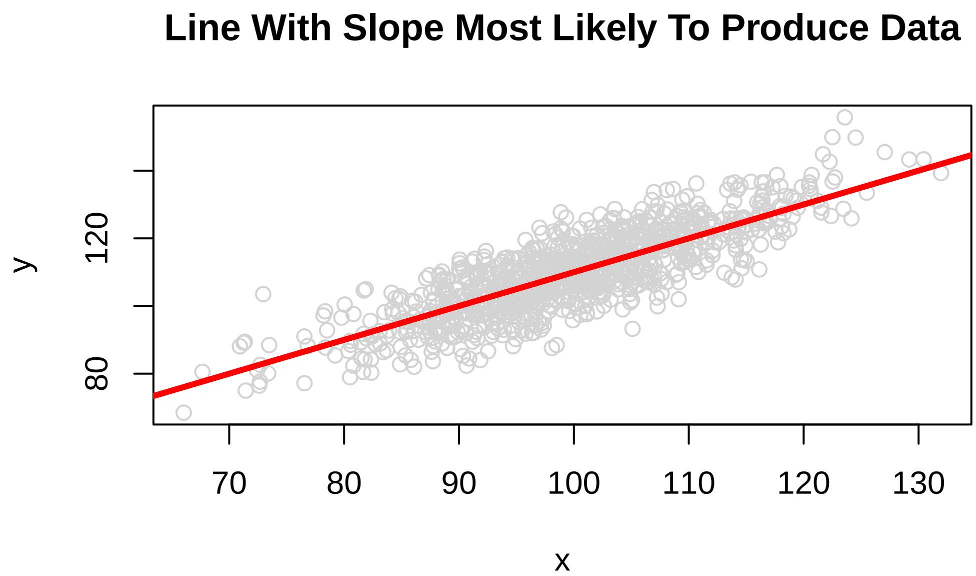

Figure 1: An Empirical Example

2 An Empirical Example

3 Maximum Likelihood Estimation

Maximum Likelihood Estimation is essentially the process of finding the *combination* of parameters (e.g. β) which maximizes the likelihood of producing the data.

4 Log-Likelihood

Because probabilities are by definition < 1, the likelihood $\mathcal{L}$ tends to be a very small number. For a variety of reasons, it is often easier to work with the logarithm of the likelihood: $\ln \mathcal{L}$.

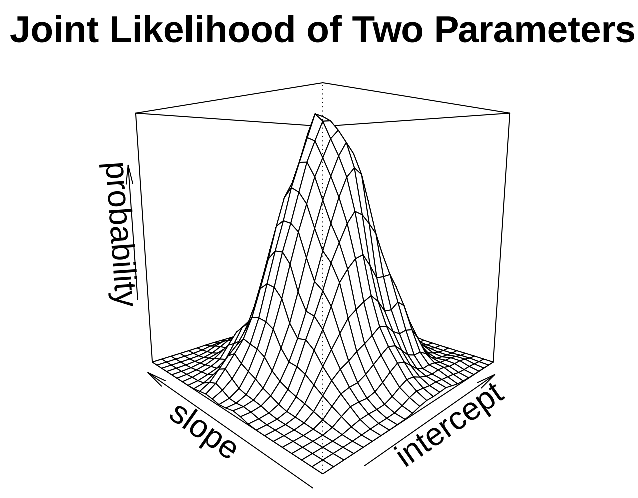

Figure 2: Joint Likelihood of Two Parameters

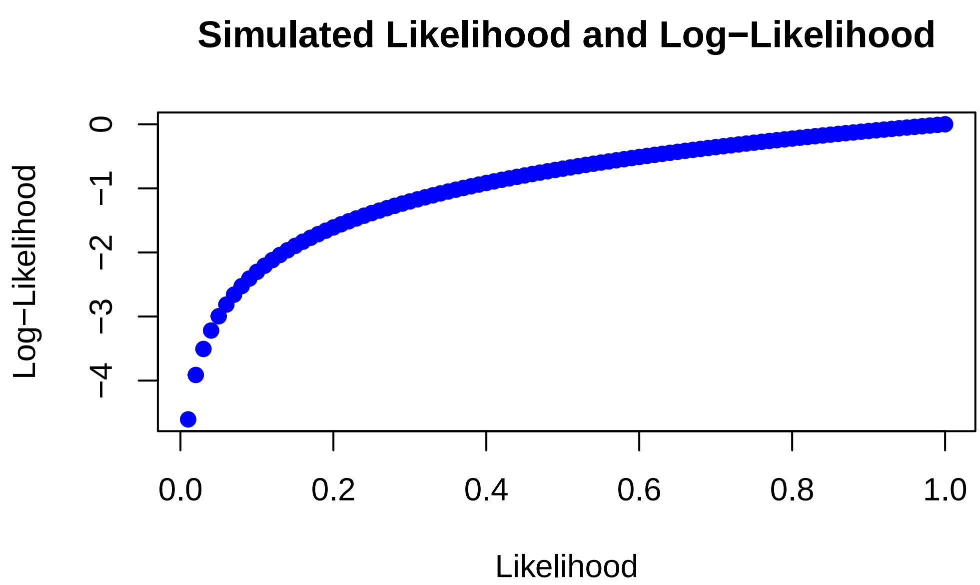

Figure 3: Likelihood and Log-Likelihood

5 Visualizing the Likelihood and Log-Likelihood

6 Conclusion

Higher values of the *log-likelihood*, closer to 0, represent models with a better fit.