African Applied Mathematics (Pure Science)

A Comparative Study of Bayesian Inference for Telecommunication Network Reliability in Senegal: Asymptotic Analysis and Identifiability Checks

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Abstract

The reliability of telecommunication networks is crucial for Senegal's economic development and social connectivity. Bayesian inference offers a robust framework to estimate network parameters under uncertainty but has not been extensively studied in this context. This study compares the performance of three distinct Bayesian models (A, B, and C) for assessing telecommunication network reliability in Senegal through asymptotic analysis and identifiability checks. The objectives are to identify which model provides more accurate estimates under varying network conditions and to ensure reliable application. We employed a comparative study using Models A, B, and C. Asymptotic analysis was conducted to evaluate the consistency of parameter estimates as sample size increases, with Model B showing superior performance through an asymptotic convergence rate of \(\frac{1}{\sqrt{n}} \). Identifiability checks were performed to confirm unique determination of network reliability parameters. Model B demonstrated superior performance with faster and more accurate parameter estimates. Identifiability checks confirmed that this model could uniquely determine network reliability parameters without ambiguity. The comparative analysis suggests that Bayesian Model B is the most reliable for assessing telecommunication network reliability in Senegal due to its strong asymptotic properties and identifiability. Telecommunication providers in Senegal should adopt Bayesian Model B for critical network assessments. Future research should validate these findings with real-world data. Bayesian inference, telecommunication networks, reliability analysis, asymptotic consistency, identifiability checks This study contributes to the body of knowledge by providing a rigorous comparison of Bayesian models for telecommunication network reliability in Senegal, offering practical recommendations for industry practitioners. A formal mathematical relation is included, for example f(x)=arg min_g L(g;x).

Keywords: *Senegal, Bayesian inference, telecommunication network reliability, asymptotic analysis, identifiability checks*