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Bayesian Hierarchical Modelling for Risk Reduction in Ghanaian Field Research Stations Systems

Kofi Asare[1], **Yaw Gyamfi**[2]

[1] Department of Cybersecurity, University of Professional Studies, Accra (UPSA)

[2] Department of Cybersecurity, Water Research Institute (WRI)

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Correspondence: kasare@aol.com

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Author notes

Kofi Asare is affiliated with Department of Cybersecurity, University of Professional Studies, Accra (UPSA) and focuses on Computer Science research in Africa.

Yaw Gyamfi is affiliated with Department of Cybersecurity, Water Research Institute (WRI) and focuses on Computer Science research in Africa.

Abstract

Field research stations in Ghana are critical for agricultural development but face challenges related to system efficiency and risk management. Bayesian hierarchical models were employed to analyse data collected from Ghanaian research stations. The model accounts for spatial and temporal variability in risk factors across different sites. The analysis revealed that Bayesian hierarchical modelling effectively quantified the reduction in risks associated with improper land use practices, achieving a significant 15% decrease over a year. Bayesian hierarchical models provided robust insights into reducing agricultural risks within Ghanaian field research stations, offering a method for improved risk management strategies. The findings suggest that implementing Bayesian hierarchical models can enhance the effectiveness of risk reduction measures in similar settings. Further validation and application are recommended. Model estimation used $\hat{\{}\theta\}=argmin\{\theta\}sumiell(yi,f\theta(\xi))+\lambda lVert\theta rVert2^{2}$, with performance evaluated using out-of-sample error.

Keywords: *Bayesian statistics, Hierarchical modelling, Geographic Information Systems, Spatial analysis, Quantitative methods, Risk assessment, Agricultural development*

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