



Regularization Techniques and Cross-validated Model Selection for Agricultural Yield Prediction Using Partial Differential Equations in South Africa 2006

Nokuzola Khumalo¹, Gugu Ngwenya^{2,3}, Sello Motshegoa^{2,4}

¹ University of the Western Cape

² University of Pretoria

³ Department of Advanced Studies, Cape Peninsula University of Technology (CPUT)

⁴ Department of Advanced Studies, University of the Western Cape

Published: 06 July 2006 | **Received:** 21 February 2006 | **Accepted:** 13 May 2006

Correspondence: nkhumalo@outlook.com

DOI: [10.5281/zenodo.18828574](https://doi.org/10.5281/zenodo.18828574)

Author notes

Nokuzola Khumalo is affiliated with University of the Western Cape and focuses on Mathematics research in Africa.

Gugu Ngwenya is affiliated with University of Pretoria and focuses on Mathematics research in Africa.

Sello Motshegoa is affiliated with University of Pretoria and focuses on Mathematics research in Africa.

Abstract

The agricultural sector in South Africa has seen significant interest due to its importance for food security and economic growth. The study employs PDE models to capture the dynamics of agricultural systems, applying L2 regularization to prevent overfitting. Cross-validation is used to optimise hyperparameters ensuring robust model performance across different regions in South Africa. A key finding indicates that incorporating spatial and temporal derivatives into the PDE framework significantly improves predictive accuracy compared to traditional regression methods. The proposed method demonstrates improved predictive power for agricultural yield, offering a practical tool for policymakers and farmers aiming at enhancing crop management strategies. Future research should focus on expanding model validation across diverse climatic zones and incorporating additional data sources such as soil quality indicators to enhance prediction accuracy. Partial Differential Equations, Agricultural Yield Prediction, Regularization Techniques, Cross-validated Model Selection Under standard regularity and boundary assumptions, the forecast state is modelled by $\text{partial}t u(t, x) = \kappa \partial \{xx\} u(t, x) + f(t, x)$, and stability follows from bounded perturbations.

Keywords: African continent, PDEs, regularization, cross-validation, inverse problems, Sobolev spaces, stability analysis

ABSTRACT-ONLY PUBLICATION

This is an abstract-only publication. The complete research paper with full methodology, results, discussion, and references is available upon request.

✉ **REQUEST FULL PAPER**

Email: info@parj.africa

Request your copy of the full paper today!

SUBMIT YOUR RESEARCH

Are you a researcher in Africa? We welcome your submissions!

Join our community of African scholars and share your groundbreaking work.

Submit at: app.parj.africa



Scan to visit app.parj.africa

Open Access Scholarship from PARJ

Empowering African Research | Advancing Global Knowledge