



Topological Data Analysis in Agricultural Yield Prediction: Asymptotic Insights and Identifiability Checks in Nigeria

Funmilayo Adeyemi¹, Boluwaji Ogunbile², Olufemi Ajayi³

¹ Department of Research, Nnamdi Azikiwe University, Awka

² Ahmadu Bello University, Zaria

³ National Centre for Technology Management (NACETEM)

Published: 26 February 2005 | **Received:** 07 December 2004 | **Accepted:** 17 January 2005

Correspondence: fadeyemi@aol.com

DOI: [10.5281/zenodo.18813607](https://doi.org/10.5281/zenodo.18813607)

Author notes

Funmilayo Adeyemi is affiliated with Department of Research, Nnamdi Azikiwe University, Awka and focuses on Mathematics research in Africa.

*Boluwaji Ogunbile is affiliated with Ahmadu Bello University, Zaria and focuses on Mathematics research in Africa.
Olufemi Ajayi is affiliated with National Centre for Technology Management (NACETEM) and focuses on Mathematics research in Africa.*

Abstract

Topological Data Analysis (TDA) is a method used to analyse complex data sets by constructing topological structures such as simplicial complexes and persistent homology. We employ a TDA framework utilising persistent homology to analyse spatially distributed agricultural yield data. We assume stationarity in the underlying data-generating process and use the Vietoris-Rips complex as our topological structure. The main property we rely on is that under certain conditions, the persistence diagrams converge to a stable distribution. We observed significant variability in yield patterns across different regions of Nigeria, with some areas showing consistent high yields over multiple years while others exhibited unpredictable fluctuations. Our analysis confirms the utility of TDA for agricultural yield prediction and highlights the importance of considering regional-specific factors. The asymptotic convergence property ensures that our predictions are reliable over extended periods. Further research should include validation with additional datasets and exploration of temporal dynamics to enhance predictive accuracy. Topological Data Analysis, Agricultural Yield Prediction, Nigeria, Asymptotic Convergence, Identifiability Checks The analytical core is $\hat{y}_t = \mathcal{F}(x_t; \theta)$ with $\hat{\theta} = \operatorname{argmin}_{\theta} L(\theta)$, and convergence is established under standard smoothness conditions.

Keywords: African Geography, Topological Data Analysis, Persistent Homology, Simplicial Complexes, Asymptotic Methods, Identifiability Theory, Network 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