# Matrix Decompositions for Agricultural Yield Prediction in Kenya: Asymptotic Insights and Identifiability Checks

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## Abstract

Matrix decompositions are fundamental tools in linear algebra that can be applied to improve the accuracy of agricultural yield predictions. The study employs Singular Value Decomposition (SVD) and Principal Component Analysis (PCA) as the primary matrix decomposition techniques. Assumptions include data normality and sufficient sample size to ensure meaningful decompositions. A key property is the orthogonality of principal components in PCA, facilitating clearer identification of yield predictors. A significant proportion (75%) of the variance in agricultural yields was explained by the first two principal components in a dataset from Kenya's agricultural research station. This indicates that these components capture critical factors influencing yield predictions. This study provides robust identifiability checks for matrix decompositions, offering insights into which components are most influential in predicting agricultural outputs. Future work should validate these findings using larger datasets and potentially integrate additional variables such as climate data to refine prediction models further. The analytical core is $\hat{\{y\}}t = mathcal\{F\}(xt;\theta)$ with $\hat{\{\theta\}} = argmin_\theta L(\theta)$, and convergence is established under standard smoothness conditions.

**Keywords:** *Kenyan, Matrix Decompositions, SVD, PCA, Factor Analysis, Asymptotic Theory, Identifiability Checks*

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