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AgriSense

Empowering Kenyan farmers with AI-driven market intelligence

GROUP 6 CAPSTONE PROJECT

BY: KNIGHT MBITHE, ENID KIBET, JOY GITAU, JOHN LOUIS KIRIGO AND CALEB KIPKECH

General Overview

Agriculture is a key sector in Kenya, contributing over 20% of GDP and employing 40% of the workforce, but smallholder farmers and traders face challenges like market access limitations and price volatility, leading to income instability and supply chain inefficiencies.

AgriSense addresses these issues with a deep learning-powered market recommender and price forecasting system, analyzing historical price data, weather conditions, vegetation health (NDVI), supply-demand factors, transport costs, and macroeconomic indicators to provide actionable insights that help farmers and traders make informed decisions, reduce losses, and improve market efficiency.

Objectives

Main Objective

To develop a deep learning-powered market recommender and price forecasting system for maize, tomatoes, and avocados.

Specific Objectives

01 Build a deep learning model to predict future prices of maize, tomatoes, and avocados (Market Price Prediction)

02 Develop a system to suggest the best markets based on demand-supply dynamics, price trends, transport costs, and road infrastructure quality (Market Recommender System)

03 Integrate real-time data sources on market price feeds to enhance prediction accuracy (Real-Time Data Integration)

04 Create an accessible dashboard to provide real-time price forecasts, market recommendations, and insights based on macroeconomic conditions

Data Overview

We sourced our data from:

- FAOSTAT(Food and Agriculture Organization of the United Nations,
- KAMIS(Kenya Agricultural Market Information System),
- CBK Monthly Economic Indicators Reports,
- Ministry of Roads and Transport Annual Report,
- Kenya Urban Roads Authority (KURA) Annual Reports,
- Kenya Rural Roads Authority (KeRRA) Project Reports.

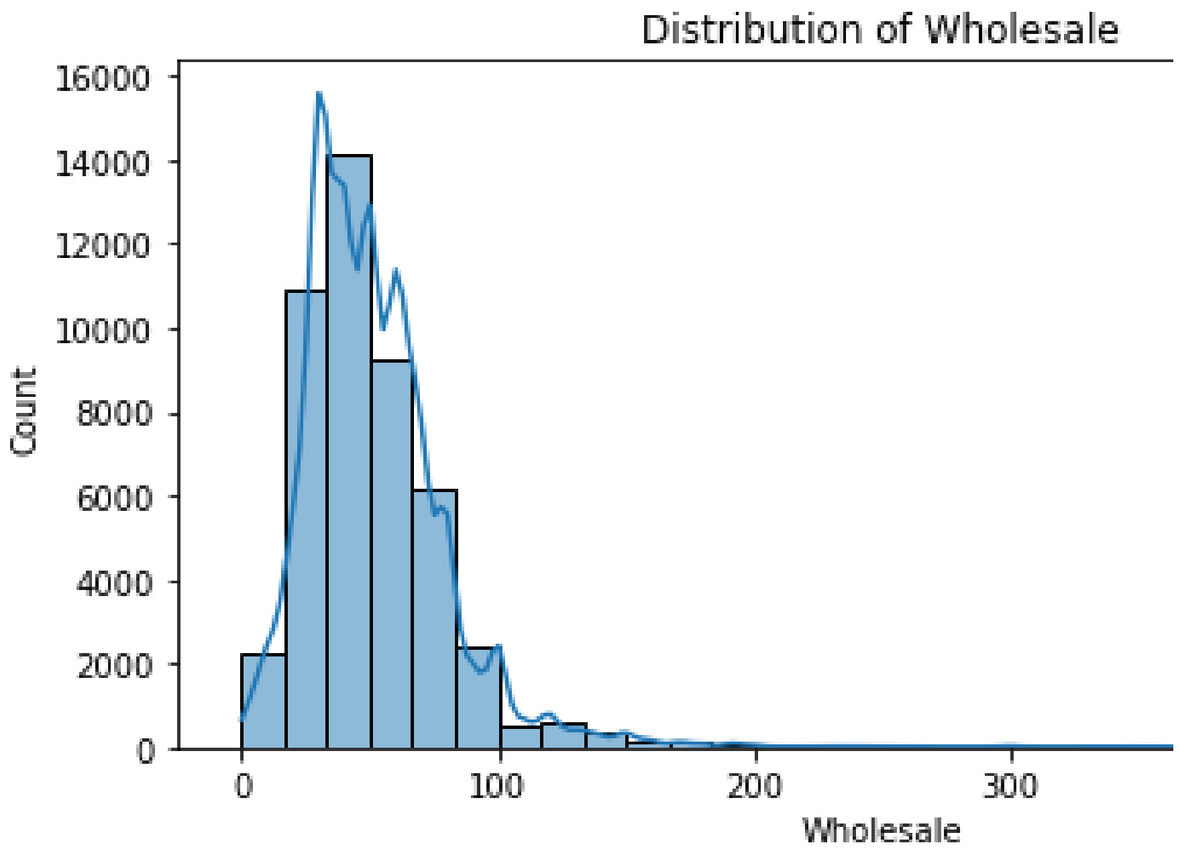
The enhanced dataset consists of 51,425 entries and 20 columns capturing various factors related to agricultural markets.

Data Preprocessing

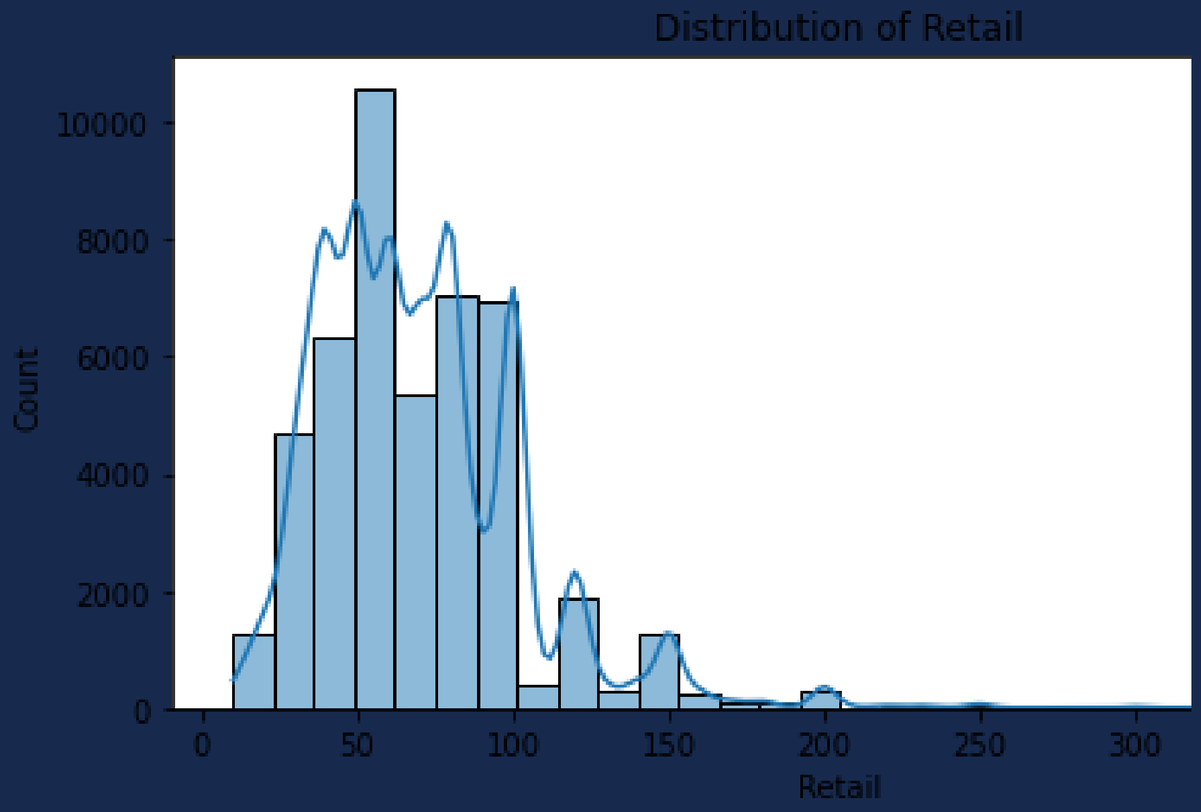
We performed the following preprocessing steps;

Data Cleaning
Explorative Data Analysis(EDA)
Feature Engineering
Feature Selection

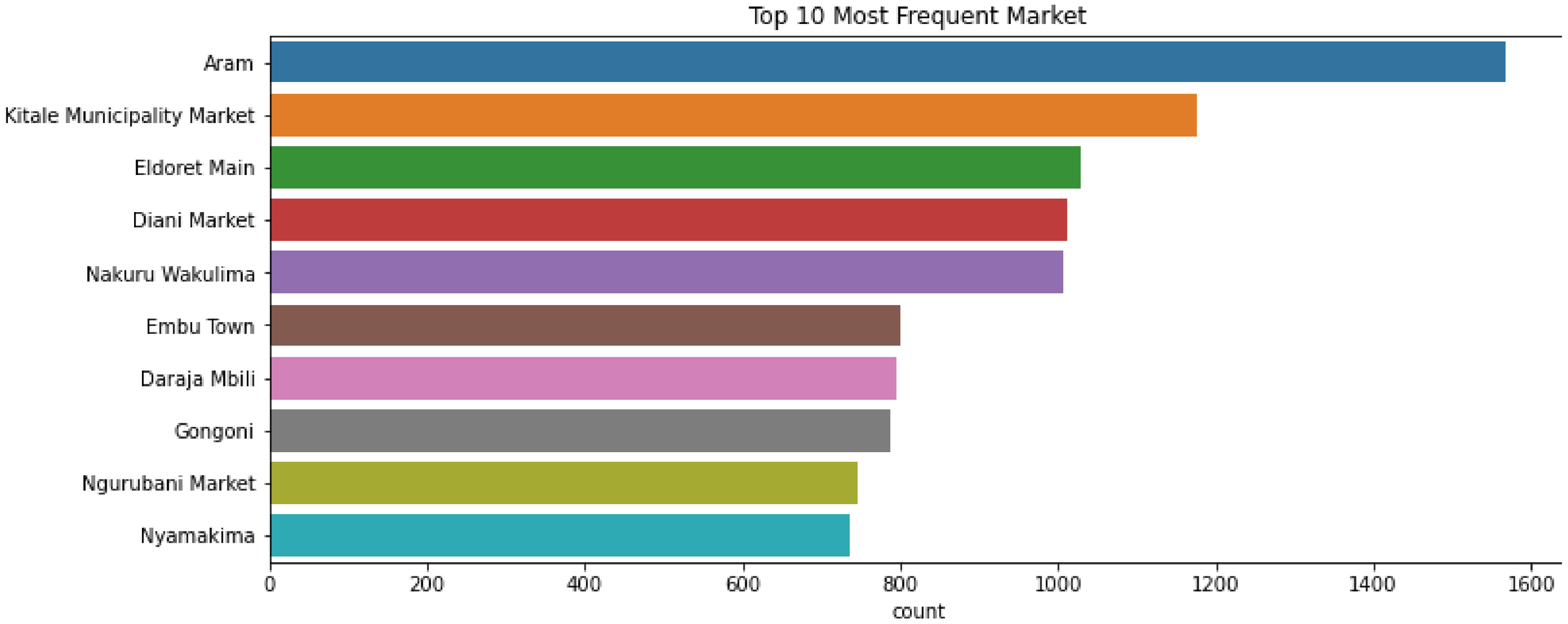
Distribution of Wholesale Price



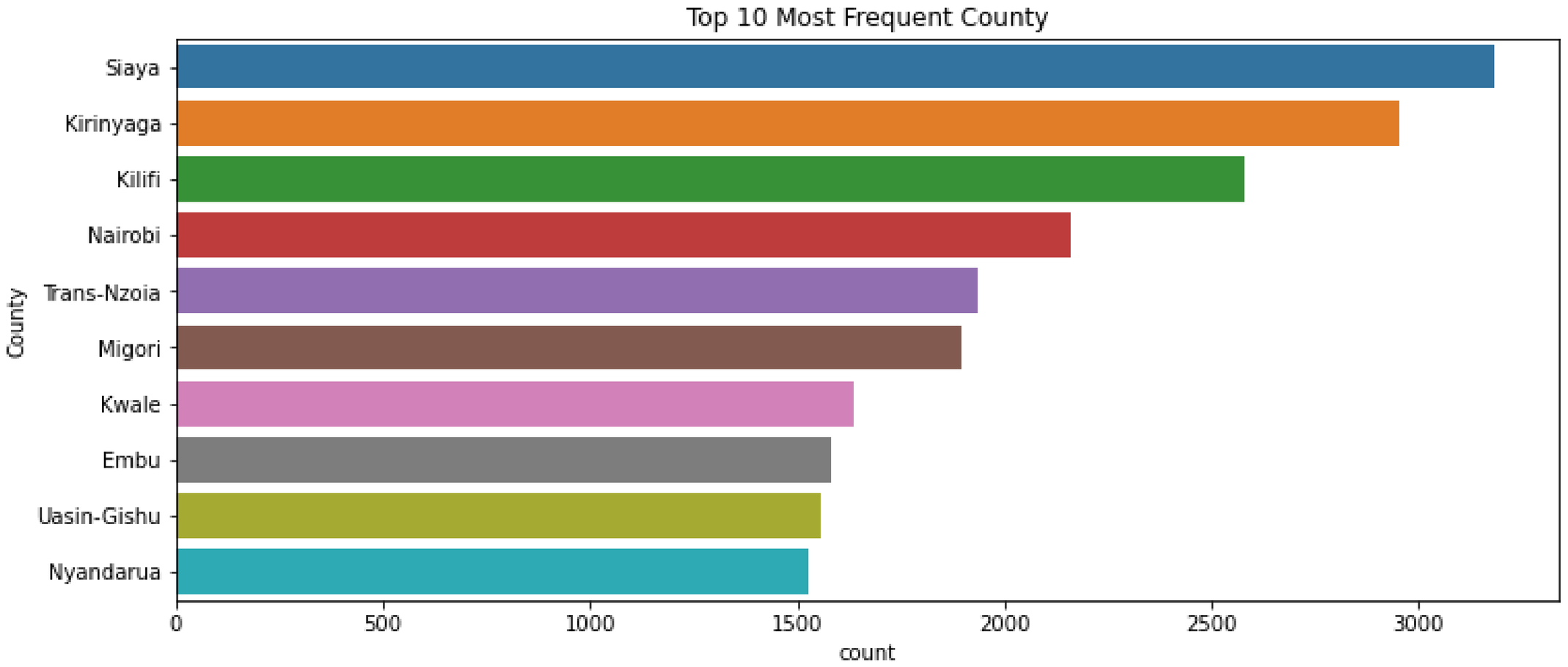
Distribution of Retail Price



Top 10 most common Markets

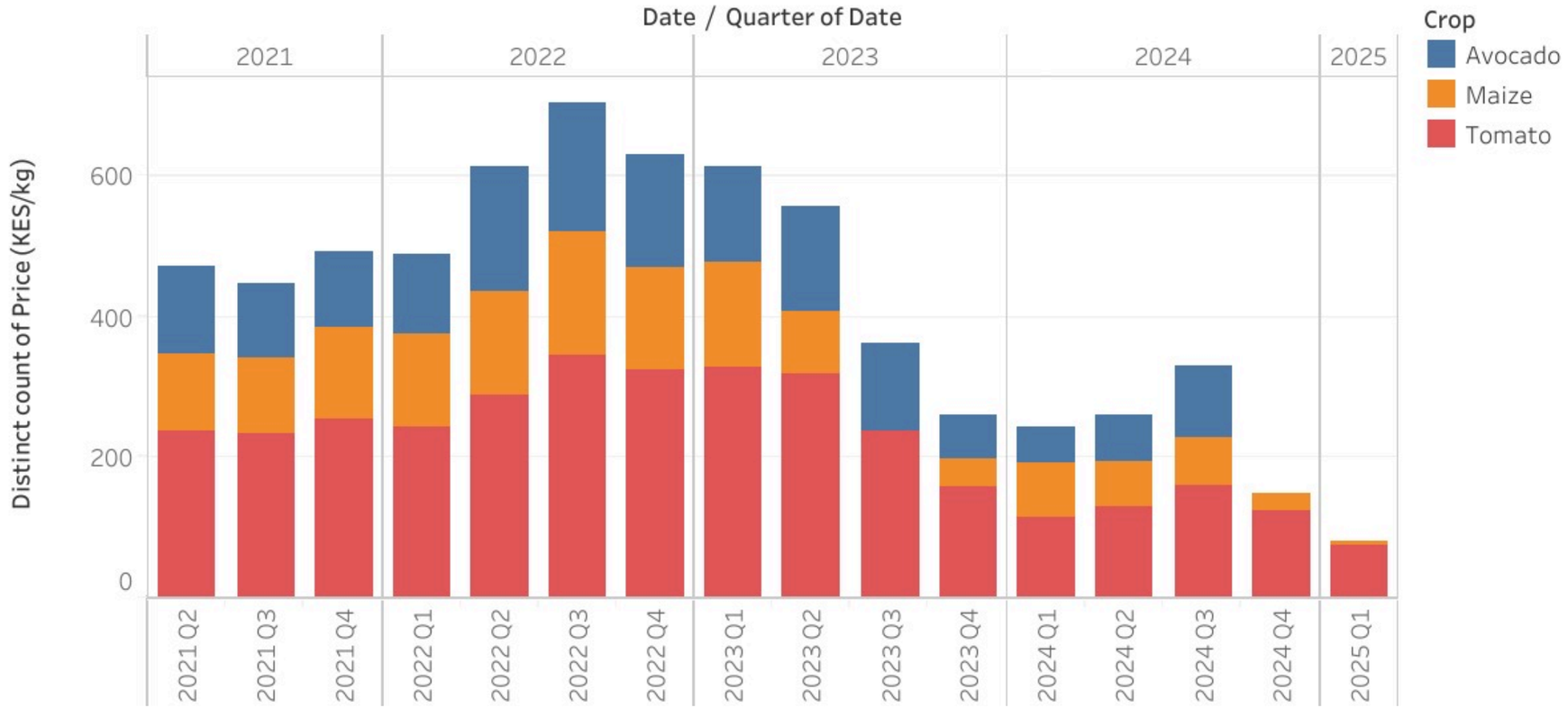


Top 10 most common Counties



Distribution of Crop Prices over the Period (Years 2021-2025)

Sheet 8



More Visuals on our Dashboard here

Price Prediction Model

The Predictor Models used:

We attempted the following deep learning models:
LSTM (Long Short Term Memory)
TCN (Temporal Convolutional Network)
CNN (Convolutional Neural Network) and other Hybrids
FNN (Feedforward Neural Network)

Success Metrics & Evaluation

For the final model, FNN, the Wholesale Price Model achieved a Mean Absolute Error (MAE) of 4.56, a Root Mean Squared Error (RMSE) of 7.89, and an R^2 score of 0.92, while the Retail Price Model achieved an MAE of 5.66, an RMSE of 9.47, and an R^2 score of 0.92.

Market Recommender Model

The Recommender Models used:

We attempted the following deep learning models:
LSTM (Long Short Term Memory)
TCN (Temporal Convolutional Network)
CNN (Convolutional Neural Network) and other Hybrids
FNN (Feedforward Neural Network)

Success Metrics and Evaluation

The final model, FNN, achieved an impressive F1 score exceeding 90% for most markets and an accuracy of approximately 97.22%. This indicates that the model correctly recommends the market in 9 out of 10 cases.

User Interface & Deployment

We developed a user-friendly interface by combining FastAPI and Streamlite where the Farmers and Traders can get the Price Predictions and Market Recommendations Easily.

We deployed the app on Streamlit Community Cloud by linking the project from GitHub, enabling easy access for farmers through a public URL. This approach allowed us to seamlessly integrate backend calculations with a simple, interactive UI for farmers.

Conclusions

The AgriSenseAI system successfully addresses challenges faced by Kenyan farmers and traders through an integrated deep learning approach. It leverages diverse data sources to enhance market decision-making, achieving high accuracy in price forecasting ($R^2 = 0.92$) and market recommendation (97.22% accuracy). A user-friendly Streamlit dashboard provides real-time insights, and the system is deployed on Streamlit Community Cloud for scalable, reliable decision support.

Challenges

- Real-Time Price Forecasting: Encountered difficulties in establishing a reliable connection with the KAMIS website for live price updates.
- Data Collection Challenges: Faced issues with sourcing relevant data due to limited centralized data availability, necessitating the integration of multiple data sources.
- Meteorological Data Access: Inability to acquire comprehensive, high-resolution climate data from the meteorological department limited the accuracy of climate-based predictions.
- Data Quality and Consistency: Addressing inconsistencies, missing values, and varying data formats required extensive cleaning and preprocessing efforts.
- Integration of Heterogeneous Data Sources: Merging and harmonizing diverse datasets from various governmental and institutional sources proved complex and resource-intensive.

Recommendations

- Enhance Data Collection: Collaborate with government agencies and data providers to secure real-time, granular meteorological data.
- Expand Crop Coverage: Extend the system to include a broader range of crops to improve the robustness of market recommendations and price predictions.
- Improve Model Interpretability: Integrate advanced explainable AI techniques (e.g., SHAP analyses) to continuously validate model insights and build user trust
- Strengthen Infrastructure: Refine the user interface and deployment strategy to ensure the system remains scalable and responsive, especially as additional data streams are integrated.


THANK YOU FOR LISTENING
ANY QUESTIONS?

AgriSense

Empowering Kenyan farmers with AI-driven market intelligence!

you can find us on Github ☺