RICE PRICE FORECASTING AND RULE-BASED ADVISORY SYSTEM FOR FOOD SECURITY IN THE PHILIPPINES

A Hybrid Machine Learning and Knowledge-Based Reasoning Project

Collaborative Final Project
CSST101 - Machine Learning
CSST102 - Knowledge Representation and Reasoning

Submitted by: Mendez, Jerick E.
Group Name: MLI

Group Members:
- Mendez, Jerick E.
- Mendoza, Nick Narry S.

Instructor: Mr. Mark P. Bernardino

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PROJECT OVERVIEW

This project is a hybrid Machine Learning and Knowledge-Based Reasoning system designed to forecast rice prices in the Philippines and generate policy-relevant advisories. The system integrates a Linear Regression forecasting model with forward-chaining rule-based reasoning aligned with SDG 2 (Zero Hunger) and SDG 8 (Decent Work and Economic Growth).

OBJECTIVES

General Objective:

To develop a hybrid system that forecasts rice prices using machine learning and provides actionable, rule-based advisories for food security and economic stability in the Philippines.

Specific Objectives:

- To preprocess and aggregate national and regional rice price data from PSA/WFP/World Bank sources.

- To train and evaluate a Linear Regression model for monthly rice price forecasting.
- To apply knowledge-based reasoning rules to interpret model outputs into policy advisories.
- To deploy the system through a desktop application for stakeholder use.

SYSTEM ARCHITECTURE

User Input → Machine Learning Model → KRR Rules → Final Risk Level → Recommendations

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MACHINE LEARNING COMPONENT (CSST101)

Algorithm Used: **Linear Regression**
Dataset Size: **Monthly aggregated rice price records from 2000–2025**
Model Accuracy: **Evaluated using RMSE and R^2 via time-series cross-validation and 12-month holdout testing**

MACHINE LEARNING PIPELINE

Data Collection:

Rice price data were collected from PSA, WFP, and World Bank sources and stored in `data/rice.csv`.

Data Preprocessing:

The dataset was cleaned, aggregated into monthly national and regional averages, and indexed by date. Missing values were handled during aggregation.

Model Training:

A Linear Regression model was trained using time-aware features such as lagged prices, rolling statistics, and seasonal encodings.

Model Evaluation:

Model performance was evaluated using 5-fold time-series cross-validation and a 12-month holdout window, with RMSE and R^2 metrics stored for auditability.

Model Deployment:

The best-performing model was serialized as `best_model.joblib` and integrated into a PySide6 desktop application.

DATASET DESCRIPTION

Dataset Type: **Time-series numerical dataset**
Number of Records: **Monthly records from 2000–2025**
Target Variable: **Rice price (monthly average)**

KNOWLEDGE REPRESENTATION & REASONING (CSST102)

Rule 1: IF forecasted price increases by more than 5% month-over-month THEN classify as Supply Risk advisory.

Rule 2: IF projected rice price declines by more than 3% THEN generate Market Opportunity advisory.

Rule 3: IF regional forecast exceeds national mean by more than one standard deviation THEN issue Consumer Protection advisory.

Rule 4: IF forecasted price is below national mean with a downward trend THEN recommend Trade Optimization.

Rule 5: IF persistent upward trend is detected across multiple months THEN trigger Local Government Action advisory.

HYBRID DECISION LOGIC

The system combines numerical predictions from the Linear Regression model with forward-chaining rules to transform forecasts into interpretable risk levels and policy recommendations.

SYSTEM FEATURES

- Wellness risk prediction
- Rule-based recommendations
- Dekstop App

TESTING AND EVALUATION

Test Case | Input Summary | Expected Output
Forecast generation | Monthly rice prices | Price forecast with advisory label

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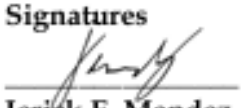
CONCLUSION

The hybrid system successfully integrates Linear Regression forecasting with knowledge-based reasoning to provide transparent and actionable rice price advisories, supporting food security and economic planning in the Philippines.

Member Name	Course	Role in the Project	Specific Tasks Completed	% Contribution
Mendez, Jerick E.	BSCS 3A	Developer	• Release Model training • Desktop Application (Backend & Frontend) • Documentation and Research	100%
Mendoza, Nick Narry S.	BSCS 3A	Developer	• Alpha Model training • Website Prototype • Documentation and Research	100%

Signatures



Jerick E. Mendez

Nick Narry S. Mendoza