

DATA SCIENCE INTERN

Created By **Rim El abrouki**

# Smart Food Waste Management System



# INDEX

1.EXPLORATORY DATA ANALYSIS (EDA)

2.PREDICTIVE MODELING:

3.RECOMMENDATION SYSTEM:

4.USER INTERFACE

# INTRODUCTION

Food waste is a growing problem, with serious consequences for both the environment and global resources. This project seeks to address this issue by creating an intelligent system that empowers individuals to make better decisions around food consumption.

Through data analysis and machine learning, the system predicts food waste based on user behavior. It also offers personalized recommendations for minimizing waste, like meal planning tips and proper food storage. The project's ultimate goal is to create a simple, user-friendly tool to combat food waste effectively.



# 1. EXPLORATORY DATA ANALYSIS (EDA)

Dataset Overview:

- Dataset Name: synthetic\_food\_waste\_data.csv
- Dataset Purpose: Analyze household or restaurant food consumption and waste patterns, with a focus on identifying and minimizing food waste.

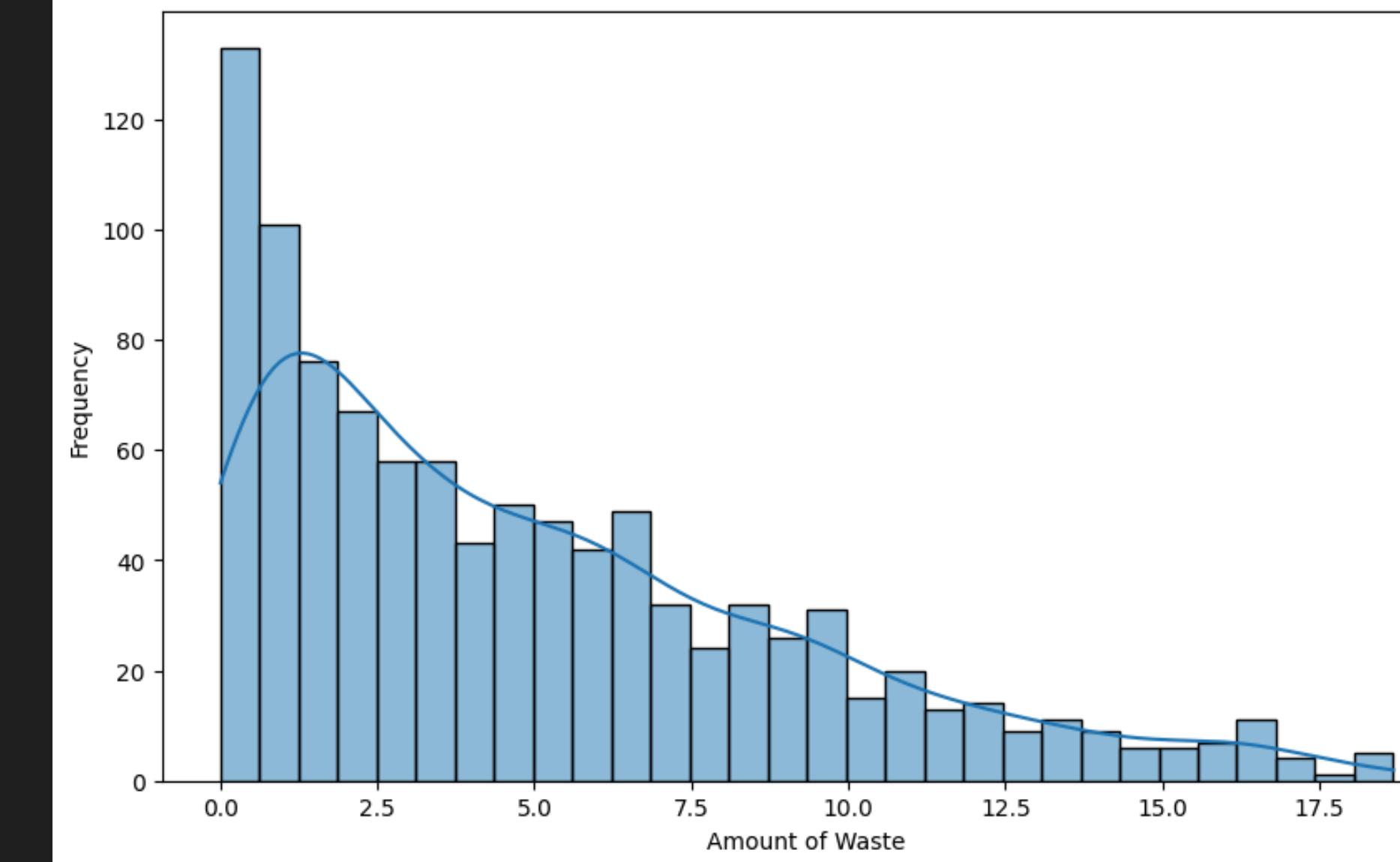
Key Data Summary:

- Family\_Size: Likely ranges from 1 to 10 members.
- Purchase\_Amount, Consumption\_Amount, Waste\_Amount: Expected to vary widely depending on food type, family size, and household habits (e.g., typically 0.1 kg to 20 kg).
- Waste\_Type: Two categories (Avoidable, Unavoidable).
- Storage\_Method and Disposal\_Method: Categorical, likely 2-5 common storage and disposal methods.

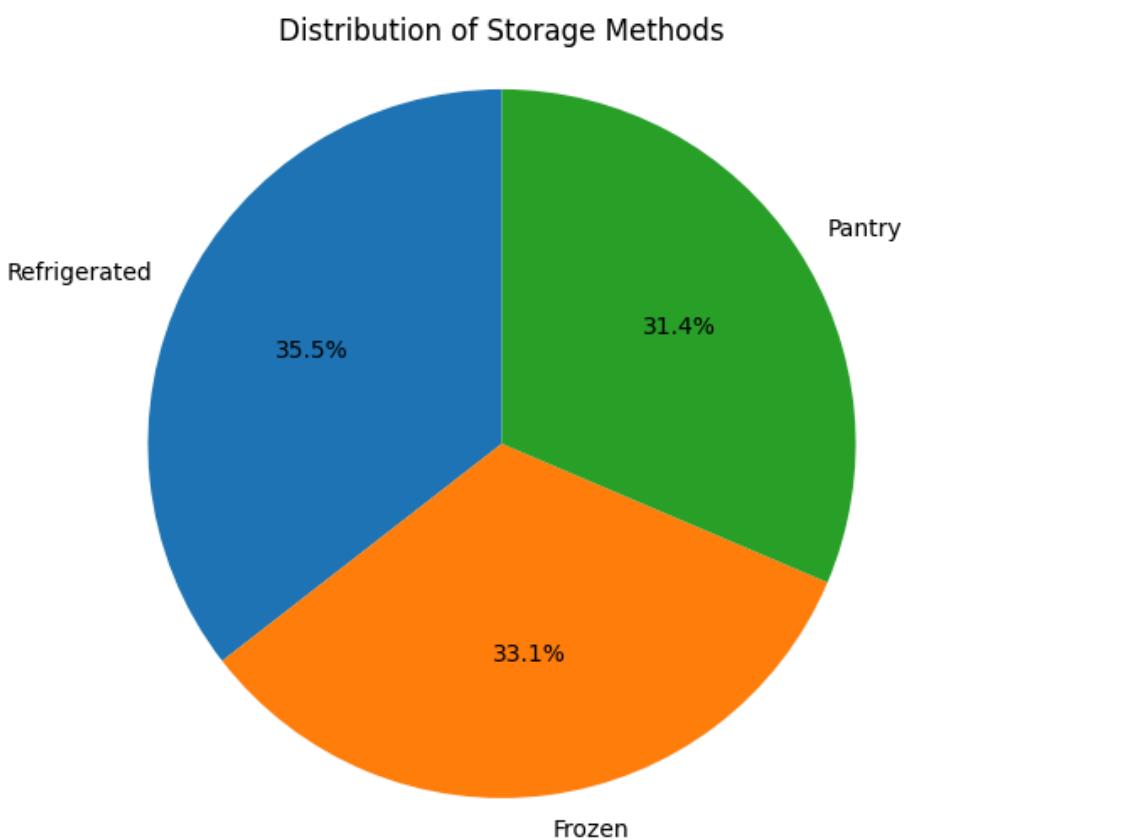
	Family_Size	Purchase_Amount	Consumption_Amount	Waste_Amount
count	1000.000000	1000.000000	1000.000000	1000.000000
mean	3.544000	10.263430	5.333450	4.930210
std	1.709089	5.385111	4.181347	4.248461
min	1.000000	1.040000	0.500000	0.000000
25%	2.000000	5.690000	1.810000	1.417500
50%	4.000000	10.170000	4.135000	3.865000
75%	5.000000	14.692500	7.902500	7.295000
max	6.000000	19.900000	19.890000	18.680000

# DISTRIBUTION OF FOOD WASTE

The histogram presents the frequency distribution of food waste amounts. Most of the waste is concentrated between 0 to 5 units, with the frequency decreasing as the amount of waste increases. The data shows a right-skewed distribution, meaning there are few instances of extremely high food waste.



Distribution of Storage Methods



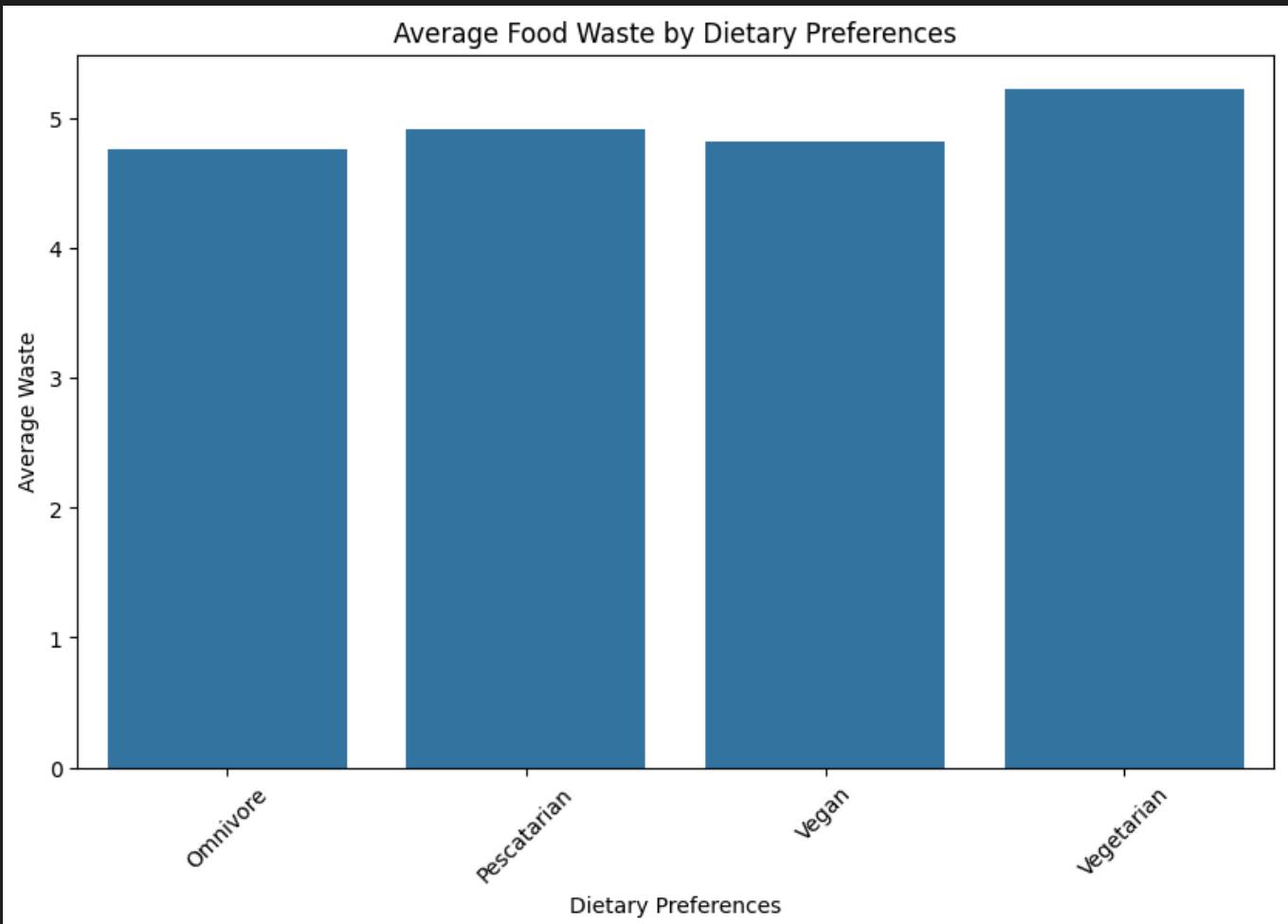
# DISTRIBUTION OF STORAGE METHODS

This pie chart shows that food is mainly stored by refrigeration (35.5%), followed by freezing (33.1%), and pantry storage (31.4%).

Refrigeration is the most common method, but frozen and pantry storage are also widely used.

# FOOD WASTE DISTRIBUTION

This bar chart compares the average food waste across different dietary preferences: Omnivore, Pescatarian, Vegan, and Vegetarian. The values are all close, with Vegetarians showing slightly higher average waste, while Omnivores have the least.

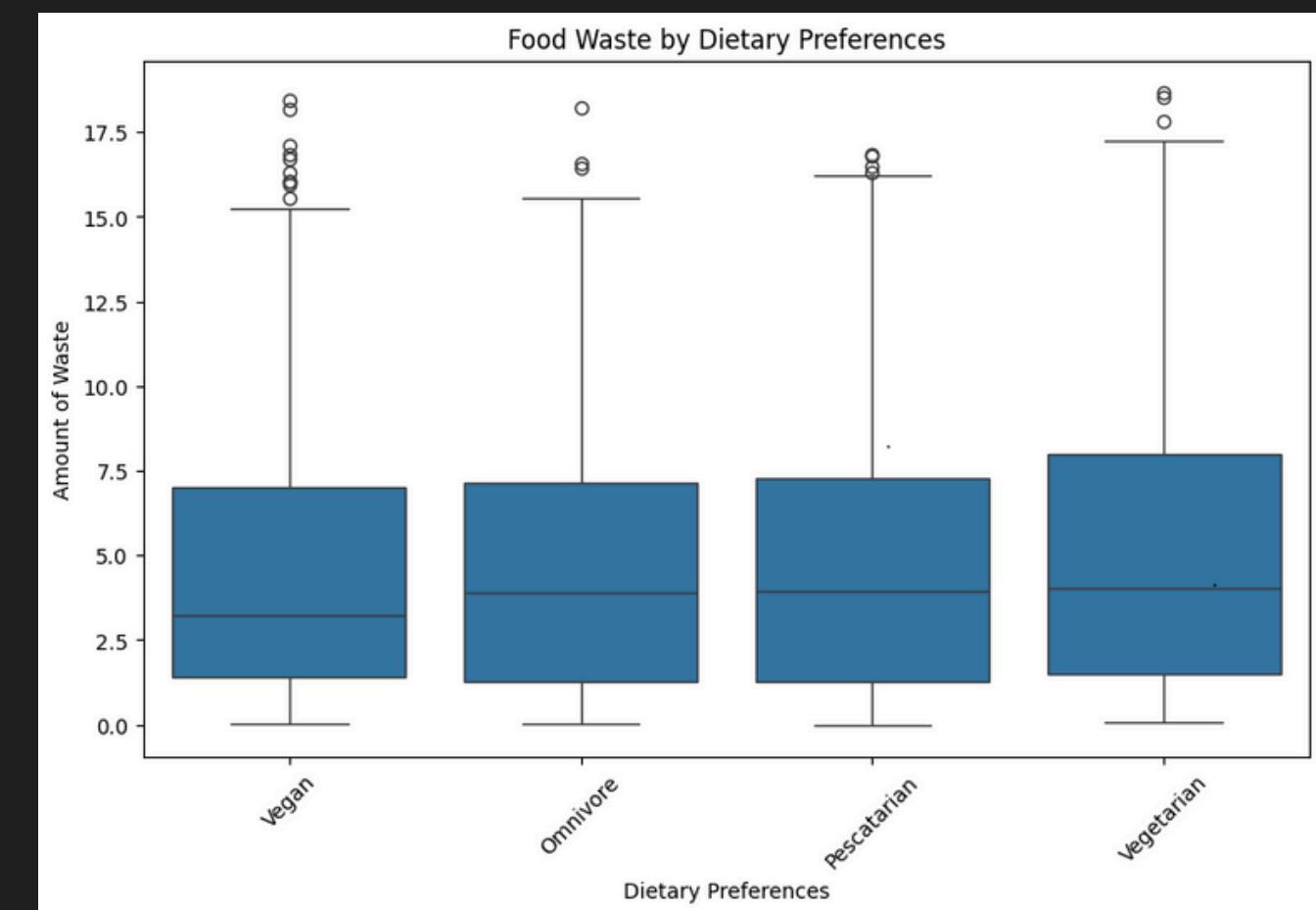


## FOOD WASTE BY DIETARY PREFERENCES

Boxplot: Food Waste by Dietary Preferences

The boxplot compares the amount of food waste across four different dietary preferences: Vegan, Omnivore, Pescatarian, and Vegetarian. It shows that:

The median amount of waste is relatively similar across these groups. There are a few outliers in each category, indicating individuals with significantly higher food waste. This chart helps visualize how dietary choices may affect food waste.

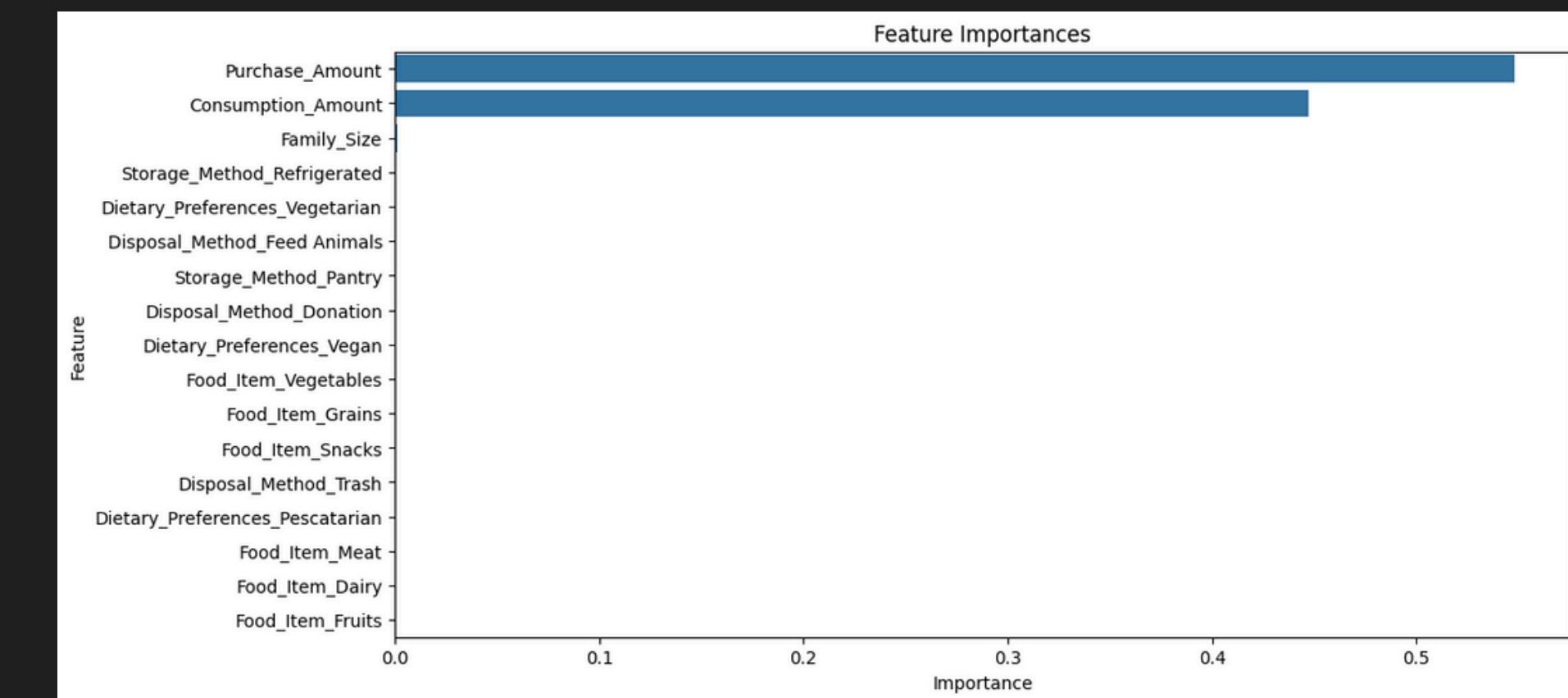


## 2. PREDICTIVE MODELING:

### FEATURE IMPORTANCE PLOT

The Feature Importance Plot highlights the key factors contributing to food waste. The relative impact of various predictors in the model is as follows:

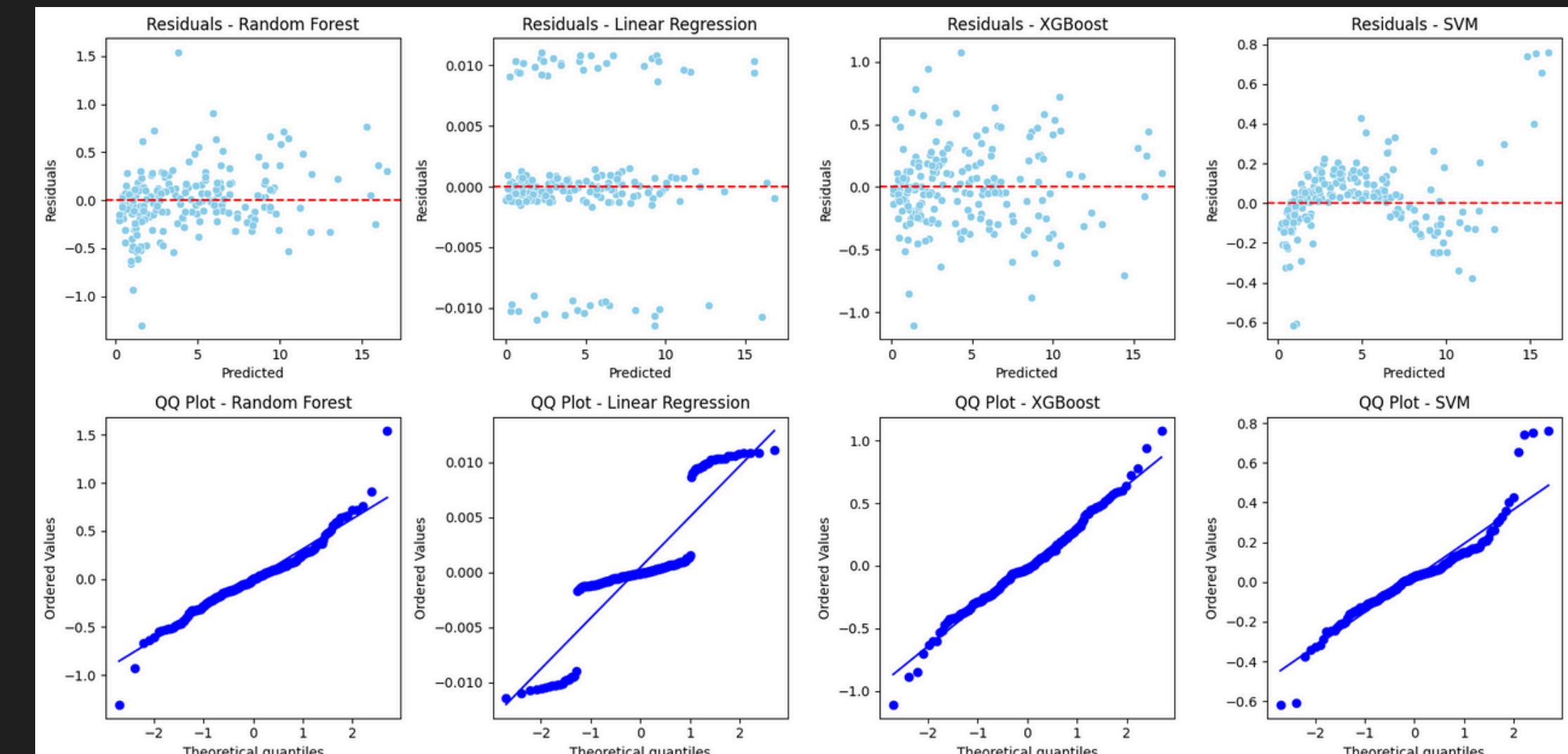
- Purchase Amount: The most significant predictor of food waste.
- Consumption Amount: A close second, significantly influencing waste levels.
- Family Size: Plays an important role in determining food waste.
- Storage Methods: Also contributes notably to the waste observed.



### RESIDUALS AND QQ PLOTS

These plots illustrate the performance of different predictive models:

1. Random Forest and XGBoost:
  - Show the best performance overall.
  - Residuals are close to zero, indicating accurate predictions.
  - Good alignment in QQ plots suggests normally distributed errors.
2. SVM (Support Vector Machine):
  - Indicates potential overfitting, suggesting it may not generalize well to unseen data.
3. Linear Regression:
  - Struggles with non-linear patterns, leading to less accurate predictions.



### 3. Recommendation System:

WasteLess Gradio App: A Smart Solution to Food Waste

#### About the App

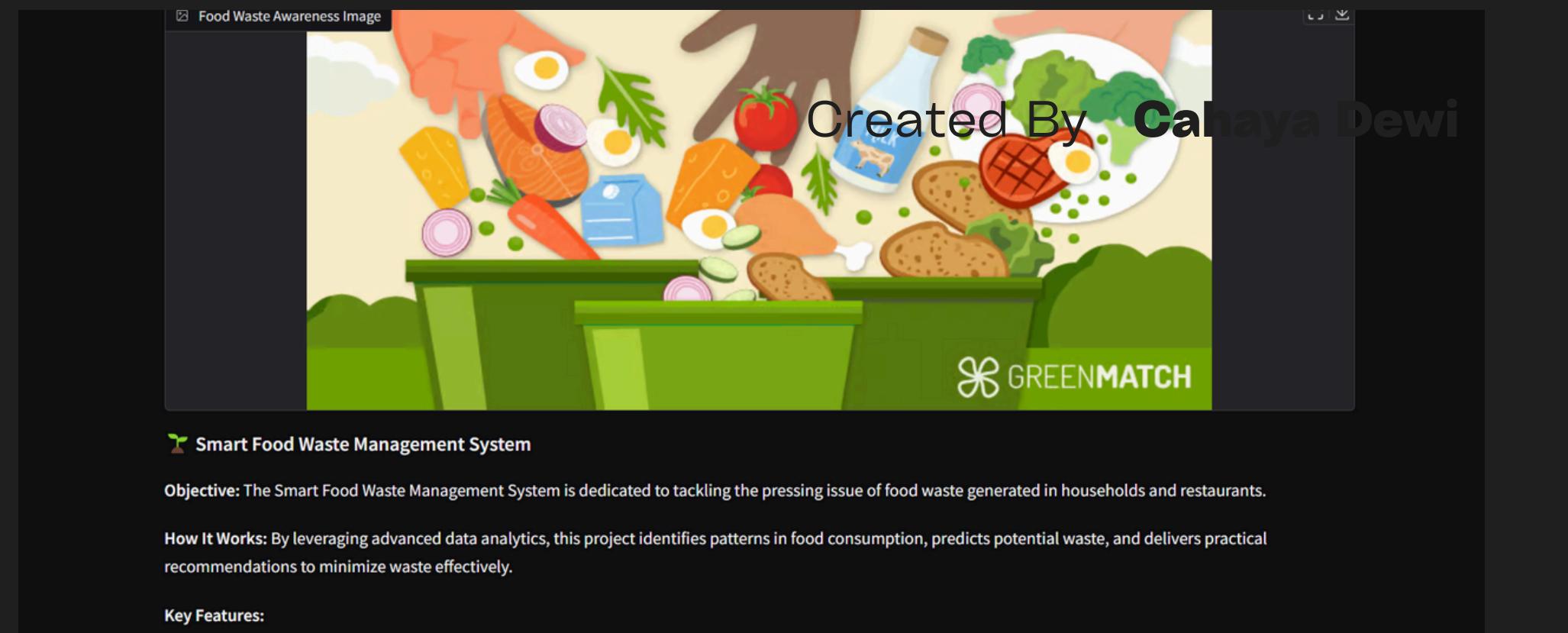
The WasteLess Gradio App is designed to empower users in their journey toward reducing food waste. By providing tailored recommendations and practical advice, this app helps you make smarter choices about what you buy, how you store food, and how you prepare meals.

#### Key Features

- Tailored Recommendations: Enter your household details to receive personalized meal planning ideas, shopping tips, and storage advice.
- Insightful Analytics: Gain real-time insights into your food consumption and waste patterns to make informed decisions.
- Smart Storage Tips: Discover the best ways to store various foods, ensuring they stay fresh for longer.
- Effective Waste Reduction Strategies: Access practical tips for minimizing waste and getting creative with leftovers.

#### Functional Highlights

- Easy Data Entry: User-friendly interface allows for quick input of household information and food inventory.
- Adaptive Suggestions: The app dynamically generates meal plans and tips based on your preferences and available ingredients.
- Clear Visuals: Intuitive graphics and charts help you easily understand your food waste and usage.



Created By Cahaya Dewi

Smart Food Waste Management System

**Objective:** The Smart Food Waste Management System is dedicated to tackling the pressing issue of food waste generated in households and restaurants.

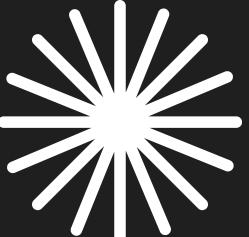
**How It Works:** By leveraging advanced data analytics, this project identifies patterns in food consumption, predicts potential waste, and delivers practical recommendations to minimize waste effectively.

**Key Features:**

Select Model	Predicted Waste Amount (kg)
Linear Regression	5.999375472227864
Purchase Amount (kg)	Mean Absolute Error (MAE)
15	0.0030067251036628344
Consumption Amount (kg)	Root Mean Square Error (RMSE)
9	0.00513061887251694
Dietary Preference	R-Squared ( $R^2$ )
Vegan	0.9999981281778164
Family Size	Recommendations
1	Consider meal planning with seasonal vegetables to reduce waste. Buy in bulk to minimize packaging waste and store properly. Your predicted waste is high. Consider meal planning and tracking your leftovers.

Clear Submit

## 4.User Interface



Select Model

Support Vector Regression

Purchase Amount (kg)

8

Consumption Amount (kg)

8

Dietary Preference

Vegetarian

Family Size

4 5

1 10

**Clear** **Submit**

Predicted Waste Amount (kg)

0.08495483902859835

Mean Absolute Error (MAE)

0.1244700904109915

Root Mean Square Error (RMSE)

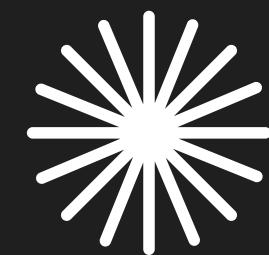
0.18083168319986204

R-Squared ( $R^2$ )

0.997674726025504

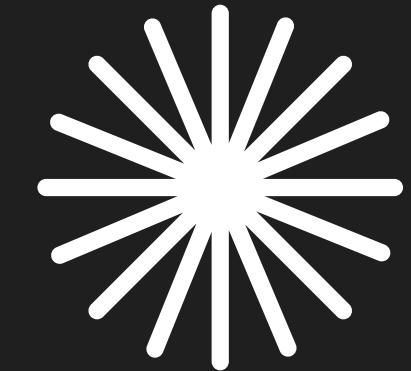
Recommendations

Incorporate a variety of grains and legumes into your meals.  
Plan your meals around ingredients that spoil quickly.  
Great job! Keep up the good work with minimizing food waste.



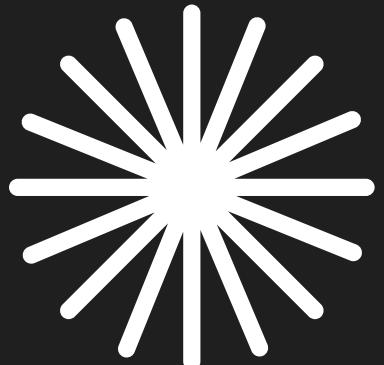
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# CONCLUSION



The Smart Food Waste Management System project provides a valuable framework for addressing food waste in our communities. By analyzing consumption patterns and generating personalized insights, the project empowers users to make informed decisions that reduce waste. This initiative not only fosters sustainable practices but also contributes to a broader cultural shift towards responsible food management, ultimately leading to a more sustainable future for all.

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THANK YOU

