NutriScope: Predicting Hidden Hunger Risk

Background

Hidden hunger, or micronutrient deficiency without visible symptoms, affects billions worldwide. Even when people appear adequately nourished, their diets may lack key vitamins and minerals such as Vitamin A, Vitamin D, Zinc, Iron, and Folate. This problem especially impacts low-income and underserved communities, contributing to poor health, impaired cognitive development, and reduced economic productivity.

Problem Statement

There is no simple, accessible tool for individuals to understand their hidden hunger risk based on basic demographic and nutritional intake data. Existing research and surveys remain at the population level, leaving individuals and small communities without actionable insights. Policymakers also lack localized, real-time data to effectively allocate resources to the regions with the highest vulnerability.

Objectives

- Build an interactive web application where users input demographic and dietary information (Age, Gender, Income, Education, Vitamin A/D, Zinc, Iron, Folate).
- Predict each user's risk of hidden hunger using machine learning classification models.
- Provide insights in simple, visual formats to raise awareness of nutritional gaps.
- Identify broader community-level trends using data aggregation and visualization.
- Deliver a geospatial heatmap of vulnerable states or regions for policymakers.
- Offer educational articles and resources to help users understand hidden hunger.
- Show a nutrient breakdown to explain how deficiencies in Vitamin A, Folate, Zinc, Iron, or Vitamin D contribute to hidden hunger.

Methodology

Data Input: Users provide demographic and dietary information through a simple online form.
Processing: Preprocessing includes encoding categorical variables and normalizing nutrient intake for accurate comparisons.
Modeling: Logistic Regression provides a baseline, while Random Forest, Gradient Boosting, and Neural Networks improve predictive performance.
Evaluation: F1 score and ROC-AUC are used to measure reliability and accuracy.

Visualization and Output:

- The form generates a binary risk flag with a personalized nutrient gap analysis.
- A nutrient breakdown compares user intake with recommended levels to highlight deficiencies.
- A geospatial heatmap aggregates anonymized results with external survey data to identify high-risk regions, supporting policymakers.
- An article library offers users clear explanations of hidden hunger, its effects, and possible solutions.

Expected Outcomes

- A functional, user-friendly web platform that predicts hidden hunger risk.
- Greater awareness among individuals about their own nutritional gaps through nutrient breakdowns and educational resources.
- A heatmap tool that allows policymakers to see vulnerability trends across regions and take targeted action.
- A demonstration of how data-driven tools can connect personal health awareness with larger public health strategies.