Project Title: Early Detection of Malnutrition Risk in Children Under Five Using Community-Based Data

Problem Statement:

Malnutrition remains a major public health issue in Africa, particularly in Sub-Saharan regions where food insecurity, poverty, and limited access to healthcare are prevalent. Malnutrition is responsible for nearly half of all deaths in children under five, yet early detection systems remain inadequate in many rural and underserved areas. Current interventions often arrive too late or fail to prioritize the most vulnerable children.

Project Description:

This project focuses on developing a data-driven system for the early detection of malnutrition risk in children under five. By analyzing community-level data, the project will help identify at-risk children and guide targeted nutrition and healthcare interventions. It aims to provide actionable insights for local healthcare workers, NGOs, and policymakers to combat malnutrition effectively.

Project Objectives:

1. To identify the key socioeconomic, dietary, and environmental factors contributing to malnutrition risk in children under five.
2. Answer the given KPIs.
3. To develop an early warning system using predictive analytics for malnutrition detection.
4. To empower healthcare workers with tools for early identification and intervention.
5. To reduce malnutrition prevalence by guiding targeted resource allocation.

Methodology:

1. **Data Collection:**
    - Collect anthropometric data such as height, weight, and age of children.
    - Survey household food security, dietary diversity, and feeding practices.
    - Include socioeconomic data such as income, education, and parental occupation.
    - Gather environmental data, including access to clean water, sanitation, and healthcare facilities.
2. **Exploratory Data Analysis (EDA):**
    - Analyze correlations between nutritional status and contributing factors.
    - Identify patterns in malnutrition prevalence across regions.
3. **Model Development:**
    - Develop a classification model to predict malnutrition risk (e.g., underweight, stunting, wasting).
    - Test algorithms such as Decision Trees, Support Vector Machines, and Neural Networks.
    - Address data imbalance, as malnutrition cases might be fewer in some regions.
4. **Validation and Deployment:**
    - Validate the model using data from multiple regions or communities.
    - Develop a mobile application or dashboard for field workers to input data and receive risk assessments.

5. **Community Interventions:**
    - Design and implement nutrition programs targeted at high-risk children.
    - Work with local governments and NGOs to improve food distribution and healthcare accessibility.

Features:

1. **Child Demographics:**
    - Age, gender, and birth order.
2. **Anthropometric Measurements:**
    - Weight-for-age, height-for-age, and weight-for-height ratios.
3. **Household Characteristics:**
    - Family size, parental education, and household income.
4. **Dietary and Feeding Practices:**
    - Frequency of meals, dietary diversity, and breastfeeding duration.
5. **Health and Environmental Factors:**
    - Access to healthcare services, clean water, and sanitation facilities.
6. **Food Security:**
    - Availability of food at the household level, seasonal variations, and market access.

Target Variable:

- **Malnutrition Risk (Categorical):**
    - **Low Risk**: Child is unlikely to suffer from malnutrition.
    - **Moderate Risk**: Child shows early signs of malnutrition.
    - **High Risk**: Child is at significant risk of malnutrition and requires immediate intervention.

Impact

1. **Improved Child Health Outcomes:** Enables early detection and intervention for at-risk children.
2. **Resource Efficiency:** Focuses limited healthcare and nutritional resources on the most vulnerable.
3. **Data-Driven Policy Design:** Informs government and NGO efforts to tackle malnutrition at the community level.
4. **Scalable Solution:** Can be adapted to other regions facing similar challenges.

KPIs

1. Child Demographics KPIs

- Distribution of Children by Age Group
- Gender Ratio of Children
- Percentage of First-Born Children
- Average Birth Order

2. Anthropometric Measurement KPIs

- Average Weight-for-Age Ratio

- Average Height-for-Age Ratio
- Average Weight-for-Height Ratio
- Percentage of Children with Underweight Status
- Percentage of Children with Stunted Growth (Low Height-for-Age)
- Percentage of Children with Wasting (Low Weight-for-Height)

3. Household Characteristics KPIs

- Average Family Size
- Percentage of Households with Low Parental Education
- Percentage of Households Below Poverty Line
- Average Household Income

4. Dietary and Feeding Practice KPIs

- Average Number of Meals Per Day
- Percentage of Children Meeting Dietary Diversity Standards
- Average Breastfeeding Duration
- Percentage of Children Still Breastfeeding Beyond Recommended Age

5. Health and Environmental Factor KPIs

- Percentage of Households with Access to Healthcare Services
- Percentage of Households with Access to Clean Water
- Percentage of Households with Improved Sanitation Facilities
- Percentage of Children Who Experienced Illness in the Past Month

6. Food Security KPIs

- Percentage of Households with Food Availability Year-Round
- Percentage of Households Affected by Seasonal Food Shortages
- Average Distance to Nearest Market
- Percentage of Households with Inadequate Market Access

7. Malnutrition Risk KPIs

- Percentage of Children in Low-Risk Category
- Percentage of Children in Moderate-Risk Category
- Percentage of Children in High-Risk Category
- Correlation Between Malnutrition Risk and Dietary Practices
- Correlation Between Malnutrition Risk and Household Income
- Correlation Between Malnutrition Risk and Healthcare Access