Maji Ndogo Agricultural Innovation Project 3

Overview of Project

The Maji Ndogo farming automation project aims to revolutionize agriculture by leveraging data science to make informed decisions about crop cultivation. The project focuses on analyzing various factors such as rainfall, soil type, climate, and geographical data to optimize farming practices in Maji Ndogo.

Project Goal

The goal of the project is to optimize farming practices, increase crop yields, and contribute to sustainable agriculture in the Maji Ndogo . To achieve this we use the pandas library to import, clean and analyse agricultural related data from an SQLite database.

Key Features of Project

- Analyzing the optimal conditions for crop cultivation.
- Identifying the most fertile soils in Maji Ndogo.
- Studying the relationship between climate, geography, and crop yields to identify suitable areas for different crops.
- Identifying the top-performing crop and analyzing the conditions under which it performs well.
- Applying advanced filtering techniques to analyze the factors contributing to the success of the top-performing crop.

SQLite Database Tables

- **Geographic features:** Contains information about the geographic features of each field, such as its elevation, latitude, longitude, location (province), and slope.

- **Weather features:** Contains weather-related information for each field, such as rainfall, minimum temperature, maximum temperature, and average temperature.

- **Soil and crop features**: Provides information about the soil and crop features of each field, including soil fertility, soil type, pH level, chosen crop for cultivation, and annual yield.

- **Farm management features:** This table contains farm management-related information, such as pollution level in the area, plot size, chosen crop for cultivation, annual yield, and standardized yield expected from the field.

Tools Used

- Python
- Jupyter notebooks/VS code/Google Collab
- Pandas library
- SQLite Database File
- SQLalchemy package

What we did

1. The project began by importing data from an SQLite database into a single DataFrame in Python using pandas and sqlalchemy. A comprehensive dataset was created by joining multiple tables using a single SQL query. The data was then cleaned to address issues such as swapped column names, spelling errors in crop types, and negative elevation values.

2. With our data cleaned, the next step was to focus on uncovering crop preferences, starting with tea, a key crop in Maji Ndogo. A function was created that calculates the mean rainfall and elevation for fields with a specific crop type, such as tea.

3. Next, was to identify the most fertile soils in Maji Ndogo. A function was created to group the data by soil types and calculate the mean soil fertility for each soil type. By grouping the data by soil type, the project identified the most fertile soils in Maji Ndogo. These fertile zones are prime candidates for diverse crop cultivation, maximizing yield.

4. The relationship between climate, geography, and crop yields was also analyzed. The function created for this challenge aggregates the data by a specified column (e.g., location, soil type) and calculates the mean values of Elevation, Min_temperature_C, Max_temperature_C, and Rainfall. This analysis helps us understand how climate and geography influence crop yields and where to deploy farming technology effectively.

5. The project also identified the top-performing crop and analyzed the conditions under which it performs well. To achieve this a function was created to identify the top-performing crop by filtering fields with above-average Standard_yield, grouping by

crop type, and sorting to find the crop type with the highest yield. Understanding the conditions under which this crop performs well is crucial for maximizing yield in Maji Ndogo.

6. Advanced filtering techniques were applied to analyze the factors contributing to the success of the top-performing crop. A function was created that filters the DataFrame to include only rows for a specific crop type (e.g., the top-performing crop) that meet specified conditions such as above-average yield, specific temperature range, and low pollution levels. This analysis helps us understand the factors contributing to the success of the top-performing crop.

Conclusion

The Maji Ndogo Farming Automation Project aims to improve agriculture in the region. By analyzing factors like rainfall, soil type, and climate, the project aims to gain valuable insights into optimizing farming practices and increasing crop yields to make informed decisions about crop cultivation. These efforts are crucial for sustainable agriculture and food security in Maji Ndogo. The project's learnings can serve as a blueprint for other regions seeking to enhance their agricultural practices and improve food production.