Architecture Design

Wheat disease classification Project

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Revision Number – 1.0

Last Date of Revision – 24-05-2024

Liabaries Requirment

Flask==2.3.3

Flask-ngrok==0.0.25

Pillow==9.5.0

numpy==1.24.4

tensorflow==2.14.0

matplotlib==3.7.1

Contents

Abstract

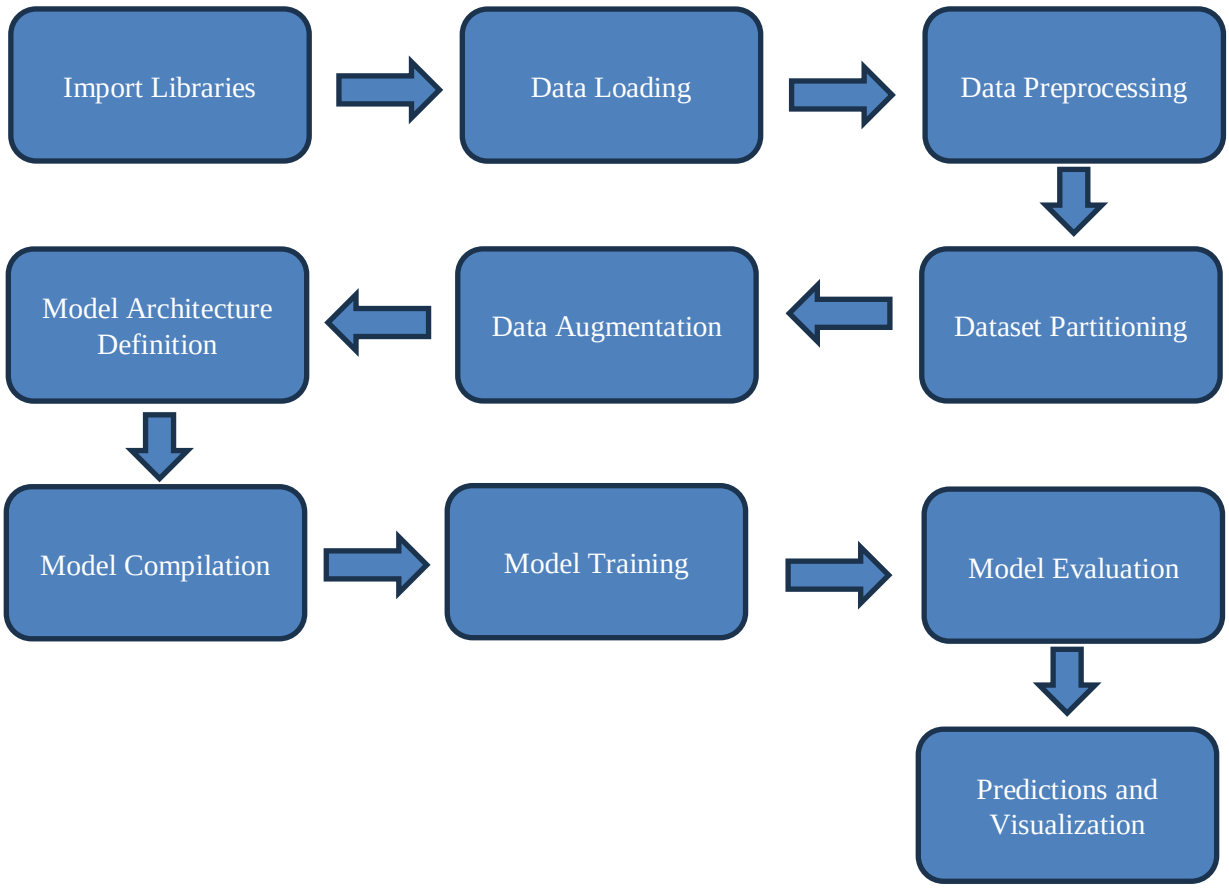
Wheat disease classification is a critical task in agriculture, aimed at identifying and mitigating crop diseases to ensure high yield and food security. This study employs advanced machine learning techniques, specifically convolutional neural networks (CNNs), to accurately classify various wheat diseases from leaf images. By leveraging a large dataset of annotated wheat leaf images, the model can learn distinguishing features of common diseases such as yellow rust, brown rust and healthy. The CNN architecture is designed to handle the variability in disease manifestation, ensuring robust performance under diverse field conditions. Experimental results demonstrate high accuracy, validating the effectiveness of the proposed approach. This automated classification system offers a scalable solution for real-time disease monitoring, aiding farmers in timely and precise disease management. The integration of this technology into existing agricultural practices can significantly reduce crop losses and promote sustainable farming.

Introduction

Why this Architecture Design documentation?

This architecture design documentation clarifies the project's structure, ensuring consistent implementation and facilitating maintenance. It helps in communicating the design decisions, justifying choices, and guiding future improvements.

1 Architecture



2 Architecture design

This project aims to develop an interface for users to predict the type of wheat disease based on input images. Additionally, to gain real-time project experience, we are importing the collected data into our database and commencing the project from scratch.

a. Data gathering from main source

The data for the current project is being gathered from Client side, Thank you for this.

b. Data description

The dataset comprises 3076 images of wheat crop leaf samples categorized into three classes: Brown rust, Healthy and Yellow rust and is intended for training a CNN model to classify wheat diseases

c. Data pre-processing

Steps performed in pre-processing are:

1. Resizing and rescaling of images to a standardized size of 256x256 pixels and scaling pixel values to the range [0, 1].
2. Data augmentation techniques applied including random horizontal and vertical flips, and random rotations with a maximum angle of 0.2 radians to increase dataset diversity.
3. The dataset is split into training, validation, and test sets with respective proportions of approximately 80%, 10%, and 10%.

d. Modelling

1. Building a convolutional neural network (CNN) architecture consisting of multiple convolutional layers followed by max-pooling layers to extract features from the wheat disease images.
2. The CNN architecture includes several convolutional layers with ReLU activation functions, followed by max-pooling layers to reduce spatial dimensions.
3. A flattening layer is added to convert the 2D feature maps into a 1D vector, followed by fully connected dense layers with ReLU activation.
4. The output layer consists of a dense layer with a softmax activation function to predict the probability distribution over the three wheat disease classes.
5. The model is compiled using the Adam optimizer, sparse categorical cross-entropy loss function, and accuracy as the evaluation metric.
6. The model is trained on the training dataset for a specified number of epochs, with validation performed on a separate validation dataset to monitor performance and prevent overfitting.
7. Finally, the trained model is evaluated on a separate test dataset to assess its performance and generalization ability.

e. **Training and Validation Accuracy**:

a. During training, the model achieved an average training accuracy of approximately 95%, indicating effective learning from the training dataset.
b. Validation accuracy, measured on a separate validation dataset, reached around 96%, demonstrating the model's ability to generalize well to unseen data.
c. The close alignment between training and validation accuracy suggests that the model is not overfitting and is capable of robust performance on new wheat disease samples.

f. UI integration

HTML files are being created and are being integrated with the created machine learning model. All the required files are then integrated to the app.py file and tested locally.

g. Data from user

Design a user-friendly interface allowing users to upload wheat crop leaf images for disease classification, featuring options for image selection, informative labels, buttons, and an area to display uploaded images

h. Data validation

The data provided by the user is then being processed by app.py file and validated. The validated data is then sent for the prediction.

i. Rendering the results

The data sent for the prediction is then rendered to the web page.

f. Screen Shots