Project Title: Potato Disease Classification Using Deep Learning

Objective:
The aim of this project is to develop a deep learning model capable of accurately classifying images of potato leaves into three categories: "Potato___Early_blight", "Potato___Late_blight", and "Potato___healthy". This classification is crucial for early detection and management of potato plant diseases.

Dataset:
The dataset used for this project is sourced from PlantVillage and consists of 2152 images distributed across the three classes. The dataset is split into training, validation, and test sets, with appropriate proportions for each.

Methodology:

1. **Data Preprocessing:** The images are resized to 256x256 pixels and rescaled to have pixel values in the range [0, 1]. Data augmentation techniques such as random flipping and rotation are applied to increase the diversity of the training dataset and improve model generalization.
2. **Model Architecture:** The model architecture comprises several convolutional layers followed by max-pooling layers to extract features from the input images. A flatten layer is used to convert the 2D feature maps into a 1D vector, which is then passed through fully connected layers with ReLU activation functions. The final layer uses softmax activation to output the predicted probabilities for each class.
3. **Training:** The model is trained using the Adam optimizer and Sparse Categorical Crossentropy loss function. Training is conducted over 5 epochs with a batch size of 32.
4. **Evaluation:** The trained model achieves an accuracy of approximately 88.67% on the test dataset, indicating its effectiveness in classifying potato diseases.

Results:

- **Training and Validation Accuracy:** The training accuracy increases steadily over the epochs, reaching approximately 85.88% by the fifth epoch. Similarly, the validation accuracy improves, reaching around 87.50% by the final epoch.
- **Training and Validation Loss:** The training loss decreases consistently with each epoch, indicating that the model is learning effectively from the training data. The validation loss also decreases, demonstrating that the model generalizes well to unseen data.

Sample Predictions:
The model successfully predicts the classes of potato leaf images from the test dataset with high confidence levels. Visualizations of the predicted and actual classes along with confidence scores are provided for a subset of the test images.

Conclusion:
The developed deep learning model shows promising results in classifying potato diseases based on leaf images. Further refinement and optimization of the model architecture and

hyperparameters could potentially enhance its performance. This project highlights the potential of deep learning techniques in agricultural applications, particularly in disease detection and crop management.