**A logo with text on it

Description automatically generatedUSKUDAR UNIVERSITY**

**FACULTY OF ENGINEERING AND NATURAL SCIENCES**

**PROGRAMMING WITH PYHTON (SE307)**

**POTATO LEAF DISEASE IDENTIFIER**

**PROJECT REPORT**

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# **Project Introduction**

Potato Leaf Disease Identifier is an end-to-end deep learning Python project in agriculture field that aims to address the challenges faced by farmers in identifying and managing diseases in potato plants. In this documentation, we will delve into the problem statement, motivation, proposed solution, tools used in the project, and the technical architecture to create an end-to-end application beneficial for the agriculture domain.

## **Problem statement**

Potato plants are sensitive to various diseases, namely early blight caused by a fungus and late blight attributed to specific microorganisms. Detecting these diseases early and accurately is pivotal in implementing suitable treatments, thereby reducing waste and preventing economic losses for farmers.

## **Motivation**

This project embarks on an innovative journey in the field of agriculture, using deep learning methodologies to tackle economic losses incurred by potato farmers due to diseases such as early blight and late blight. The motivation behind this endeavor stems from the profound impact diseases have on potato yields, resulting in substantial financial setbacks for farmers annually.

## **Proposed solution**

This application is designed to empower farmers by enabling them to capture images of their potato plants using a mobile device. The application, powered by deep learning and convolutional neural networks, will analyze these images to determine the health status of the plants, specifically identifying whether they suffer from early blight, late blight, or are healthy.

## **Roles of Members**

In this project, the roles of the members are the following:

Soufiane Mdaghri: Data collection and the cleaning of the data,Documentation

Tahri Mohammed: Model building, FASTAPI SERVER, REACT JS EDIT.

Burak Gülçiçeği: Model building, documentation

**Tools**

## **Tools for Model Building:**

**TensorFlow:** TensorFlow is a free and open-source software library for machine learning and artificial intelligence. It can be used across a range of tasks but has a particular focus on training and inference of deep neural networks.

**CNN(Convolutional Neural Network):** Convolutional neural network (CNN) is a regularized type of feed-forward neural network that learns feature engineering by itself via filters (or kernel) optimization.

**Data Augmentation:** Data augmentation is a technique in machine learning used to reduce overfitting when training a machine learning model, by training models on several slightly modified copies of existing data.

**TensorFlow(TF) Dataset:** TensorFlow Datasets is a collection of datasets ready to use, with TensorFlow or other Python ML frameworks, such as Jax. All datasets are exposed as tf. data. Datasets , enabling easy-to-use and high-performance input pipelines. To get started see the guide and our list of datasets.

## **Tools for Backend Server:**

**FastAPI:** FastAPI is a modern, fast (high-performance), web framework for building APIs with Python 3.8+ based on standard Python type hints.

## **Tools for Model Optimization:**

**Quantization:** Quantization, in mathematics and digital signal processing, is the process of mapping input values from a large set to output values in a smaller set, often with a finite number of elements. Rounding and truncation are typical examples of quantization processes.

## **Tools for Frontend and Deployment:**

**React JS:** React is a free and open-source front-end JavaScript library for building user interfaces based on components.

# **Description of the Project**

The Potato Leaf Disease Identifier is a comprehensive project that leverages the power of deep learning to assist farmers in diagnosing diseases in potato plants. The project is divided into several key components, each playing a crucial role in the overall functionality of the application.

The first component is the **data collection and cleaning** process. This involves gathering images of potato plants, which are then cleaned and preprocessed for further use. The images are categorized into three classes: healthy, early blight, and late blight.

The second component is the **model building** process. This involves using TensorFlow and Convolutional Neural Networks (CNN) to train a model that can accurately classify the images into the aforementioned categories. Techniques such as data augmentation are used to increase the diversity and amount of training data, improving the model’s performance.

The third component is the **backend server**, which uses TensorFlow Serving and FastAPI. This server hosts the trained model and provides an interface for the frontend application to interact with the model.

The fourth component is the **frontend application**, developed using React Native. This application allows farmers to upload images of their potato plants and receive a diagnosis from the model. The application is designed to be user-friendly, providing clear and concise results to the farmers.

The final component is the **deployment** of the application, which is done using Google Cloud Platform. This ensures that the application is accessible to farmers around the world, providing them with a valuable tool in their fight against potato diseases.

# **Working Principles**

The project uses a Convolutional Neural Network (CNN), a type of Deep Learning model, to classify potato leaf diseases. The CNN is trained on preprocessed leaf image data and then evaluated on a test set.

## **Preprocessing**

The first step involves preprocessing the leaf image data. This is a crucial step as the quality and quantity of the data determine how well the Deep Learning model can learn and predict. The preprocessing stage typically involves cleaning the data, normalizing it, handling missing values, and sometimes augmenting the data to create a more robust dataset.

## **Model Training**

The preprocessed data is then used to train the CNN model. During training, the model learns to identify patterns and features in the images that are indicative of specific diseases. This is done by adjusting the model’s parameters to minimize a loss function, which is a measure of the model’s prediction error.

## **Model Evaluation**

After the model has been trained, its success is assessed on a test set. This involves using the model to predict the diseases in images it has not seen during training and comparing these predictions to the true disease labels. Metrics such as accuracy, precision, recall are often used to quantify the model’s performance.

The experimental findings show that the CNN model, with an overall accuracy of 99.1%, is highly accurate in identifying two kinds of potato leaf diseases, including Early Blight, Late Blight, and Healthy. The model can accurately recognize the various disease types even when there are severe infections present.

This work highlights the potential of deep learning methods for categorizing potato diseases, which can help with effective and automated disease management in potato farming1.

# **Outputs and Screenshots**

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A green leaf on a computer screen

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# **References**

<https://www.youtube.com/playlist?list=PLeo1K3hjS3utJFNGyBpIvjWgSDY0eOE8S>

<https://www.kaggle.com/datasets/arjuntejaswi/plant-village?resource=download>

<https://en.wikipedia.org/wiki/TensorFlow>

<https://en.wikipedia.org/wiki/Convolutional_neural_network>

<https://en.wikipedia.org/wiki/Data_augmentation>

<https://www.tensorflow.org/datasets>

<https://www.tensorflow.org/tfx/guide/serving>

[https://fastapi.tiangolo.com](https://fastapi.tiangolo.com/)

<https://en.wikipedia.org/wiki/Quantization_(signal_processing)>

<https://www.tensorflow.org/lite/guide>

<https://en.wikipedia.org/wiki/React_(software)>

<https://en.wikipedia.org/wiki/React_Native>

<https://en.wikipedia.org/wiki/Google_Cloud_Platform>