

POTATO LEAF DISEASE DETECTION DL MODEL

DATA COLLECTION | MODEL BUILDING | WEB PAGE | GCP
EMULATOR APP



Problem Statement

HARNESSING INNOVATIVE TECHNOLOGY,
THE PROJECT AIMS TO PROTECT FARMERS FROM
ECONOMIC LOSSES CAUSED BY POTATO DISEASES LIKE
EARLY AND LATE BLIGHT.

THIS AGRO-TECH SOLUTION USES DEEP LEARNING,
AKIN TO FINANCIAL PREDICTIVE MODELS, TO DETECT
DISEASES EARLY, ENSURING CROP HEALTH AND
FINANCIAL PROSPERITY IN THE AGRICULTURAL
LANDSCAPE.

Data Collection & Model Building

Dataset : Kaggle Dataset | Plant Village

...

Data Preprocessing | Resizing, Augmentation

Dataset Partitioning | Splitting for subsets

Model Architecture | CNN with ReLU

Model Compilation | Compile with settings.

Model Training | Train for learning

Model Evaluation | Assess model performance

...

Results Visualization | Display training results

Image Prediction | Make predictions on images

Model Export | Save the trained model

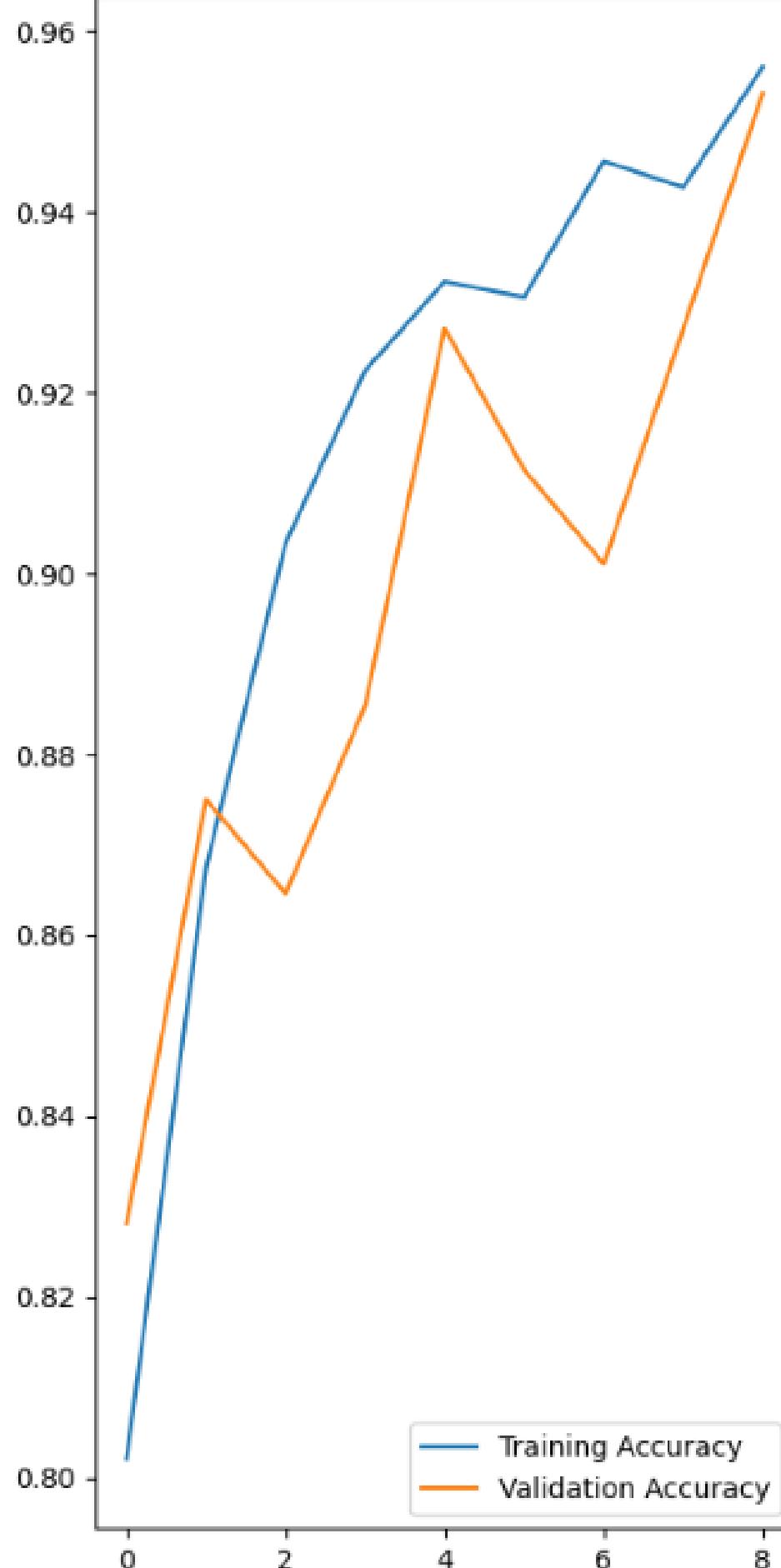
FAST API | Create a user interface

Load Trained Model | Load the saved model

Make Predictions | Use the model for predictions

...

Training and Validation Accuracy



Training & Validation Accuracy

Actual Image : Potato_Early_blight
Predicted Image : Potato_Early_blight
Confidence : 99.99%



Actual Image : Potato_Late_blight
Predicted Image : Potato_Late_blight
Confidence : 92.75%

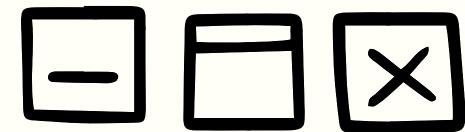


Model Prediction

Actual Image : Potato_Early_blight
Predicted Image : Potato_Early_blight
Confidence : 99.93%



CNN (Convolutional Neural Network) | Deep learning architecture for image processing.
ReLU (Rectified Linear Unit) | Activation function that introduces non-linearity.
Softmax | Activation function for multi-class classification.
Data Augmentation | Expands training data with image transformations.



Back End - FAST API

FastAPI for Building APIs

FastAPI is a Python web framework designed for building APIs quickly and efficiently. It allows developers to create RESTful web services with minimal code while maintaining high performance.

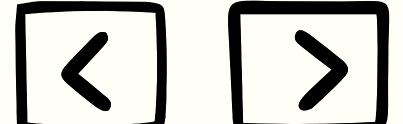
Automatic Data Validation

FastAPI provides automatic data validation and serialization, reducing the risk of common API errors. It uses Python-type hints to validate incoming data and generate accurate API documentation.

Async Support

FastAPI fully supports asynchronous programming, making it suitable for handling concurrent requests and I/O-bound operations. This feature enhances the scalability and responsiveness of web applications built with FastAPI.

Front End React



Material-UI for UI Components

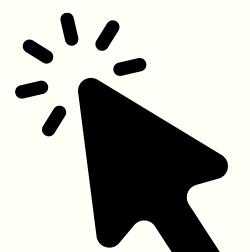
The script employs Material-UI, a UI framework for React, integrating components like AppBar, Toolbar, and Card to create a modern and visually appealing user interface.

Image Processing with Axios

It utilizes Axios, a promise-based HTTP client, to send image data to a local server for image classification, showcasing an asynchronous approach to handling data.

Responsive Design Principles

The script follows responsive design principles, ensuring the web application's adaptability to various screen sizes, enhancing user experience across devices.



State Management with useState

React's useState hook manages component state, enabling dynamic updates of image data, previews, and loading indicators as users interact with the application.

Potato Leaf Disease Classification Model | TANSAM



FRONT END REACT UI

Drag and drop an image of a
potato plant leaf to process



Potato Leaf Disease Classification Model | TANSAM



SAMPLE : EARLY BLIGHT DISEASE
AFFECTED LEAF

CONFIDENCE PERCENTAGE OF 98.99%
RETURNED

MODEL PREDICTION IS GOOD



Label: Early Blight Confidence: 98.99%

X CLEAR



GCP Cluod Deployment & Testing

Project ID | GCP Bucket | .h5 Model

GCP | Google Cloud Platform | Setting up the environment

Started creating a GCP account and project, setting up a unique bucket for model storage, and installing the Google Cloud SDK.

Code Development

A Python script for a cloud function that downloads the pre-trained ML model, preprocesses input images and performs predictions using TensorFlow/Keras.

Deployment

Deployed the cloud function using the Google Cloud SDK, ensuring necessary libraries were included, and enabled the Google Cloud API whenever prompted.

Testing

Used Postman to send image data as form data to the deployed function, analyze the response for predictions, and ensure the function works correctly.

Function & URL

predict & <https://us-central1-leaf-disease-classification-1.cloudfunctions.net/predict>

GCP Deployment

Google Cloud leaf-disease-classification-1 Search (/) for resources, docs, products, and more Search ⚡ 2 ? :

Cloud Functions Function details ⚡ EDIT DELETE COPY LEARN C

predict 1st gen Version Version 3, deployed at Sep 15, 2023, 3:38:26P...

METRICS DETAILS SOURCE VARIABLES TRIGGER PERMISSIONS LOGS TESTING

Severity Logs Default Filter Search all fields and values

SEVERITY	TIMESTAMP	SUMMARY
> *	2023-09-20 16:11:09.534 IST	predict c30ymqw2acil 2023-09-20 10:41:09.534482: W tensorflow/tsl/framework/cpu_allocator_impl.cc:83] Allocation of 7741920 exceeds 10% of free system memory.
> *	2023-09-20 16:11:09.938 IST	predict c30ymqw2acil 2023-09-20 10:41:09.938411: W tensorflow/tsl/framework/cpu_allocator_impl.cc:83] Allocation of 1935480 exceeds 10% of free system memory.
> *	2023-09-20 16:11:09.945 IST	predict c30ymqw2acil 2023-09-20 10:41:09.945615: W tensorflow/tsl/framework/cpu_allocator_impl.cc:83] Allocation of 3125000 exceeds 10% of free system memory.
> *	2023-09-20 16:11:10.015 IST	predict c30ymqw2acil 1/1 [=====] - ETA: 0s
> *	2023-09-20 16:11:10.015 IST	predict c30ymqw2acil 1/1 [=====] - 1s 990ms/step
> *	2023-09-20 16:11:10.018 IST	predict c30ymqw2acil Predictions: [[8.9807725e-01 1.0126907e-01 6.5367791e-04]]
▼	2023-09-20 16:11:10.020 IST	predict c30ymqw2acil Function execution took 6485 ms, finished with status code: 200

{ insertId: "tf3cajf4r8nco" labels: {1} logName: "projects/leaf-disease-classification-1/logs/cloudfunctions.googleapis.com%2Fcloud-functions" receiveTimestamp: "2023-09-20T10:41:10.039430680Z" resource: {2} severity: "DEBUG" textPayload: "Function execution took 6485 ms, finished with status code: 200" timestamp: "2023-09-20T10:41:10.020954911Z" trace: "projects/leaf-disease-classification-1/traces/1be01b49b365bc5b7675eef34555edc6" }

No newer entries found matching current filter. Open in Logs Explorer

Postman Invoke

HTTP <https://us-central1-leaf-disease-classification-1.cloudfunctions.net/predict> Save Edit

POST <https://us-central1-leaf-disease-classification-1.cloudfunctions.net/predict> Send

Params Authorization Headers (8) Body Pre-request Script Tests Settings Cookies

none form-data x-www-form-urlencoded raw binary GraphQL

Key	Value	Description	...	Bulk Edit
<input checked="" type="checkbox"/> file	early_blight_1.jpg X ⚠	Description		
Key	Value	Description		

Body Cookies Headers (7) Test Results Status: 200 OK Time: 34.54 s Size: 332 B Save as Example ...

Pretty Raw Preview Visualize JSON Copy Find Search

```
1 {  
2   "class": "Early Blight",  
3   "confidence": 89.81  
4 }
```



Mobile App Deployment

React Native Setup

Prepare your development environment by installing the necessary tools and dependencies for React Native, ensuring you follow platform-specific instructions.

Configuring Mobile App

Clone the mobile app repository from GitHub, configure environment variables (like your Google Cloud Functions link), and install required Node.js modules using "yarn install."

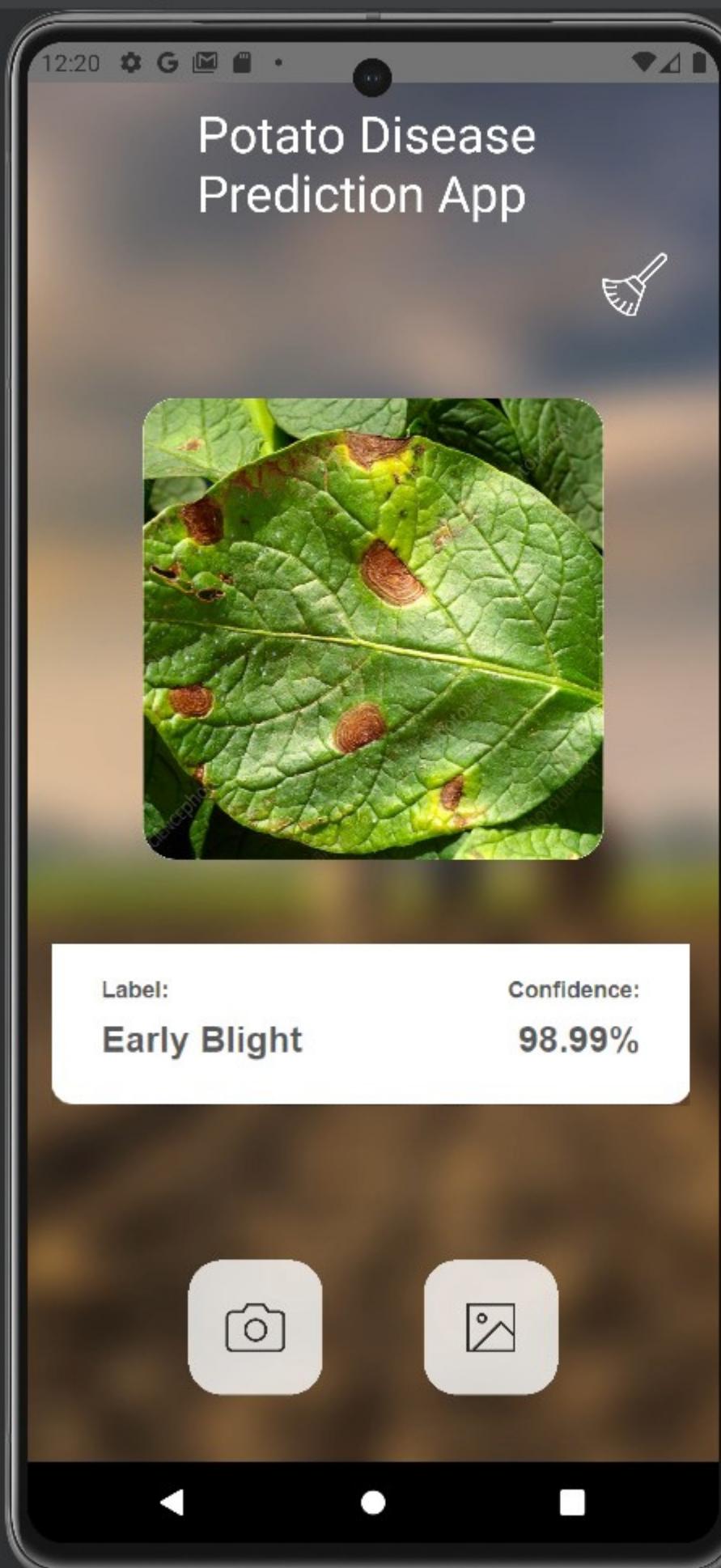
Emulator Setup

Create a virtual Android device using Android Studio's AVD Manager (for Windows users) and run the emulator.

Mobile App Testing

Launch your React Native mobile app on the emulator, which will communicate with your deployed Google Cloud Function for image prediction, enabling real-time testing and interaction.

Running Devices: Pixel 7 Pro API 29



MOBILE APP DEPLOYMENT IN ANDROID EMULATOR

```
npm run android
```

```
info Starting JS server...
info Installing the app...

> Task :app:installDebug
Installing APK 'app-debug.apk' on 'Pixel_7_Pro_API_29(AVD) - 10' for :app:debug
Installed on 1 device.

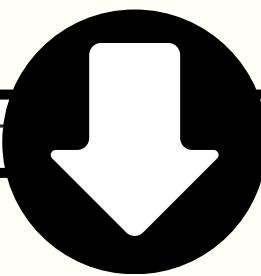
BUILD SUCCESSFUL in 1m 14s
89 actionable tasks: 2 executed, 87 up-to-date
info Connecting to the development server...
8081
info Starting the app on "emulator-5554"...
Starting: Intent { act=android.intent.action.MAIN cat=[android.intent.category.LAUNCHER] cmp=com.mlde demo/.MainActivity }
```

```
node "C:\Users\SIVA SRINIVASAN" + -
```

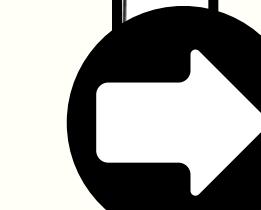
```
> Task :react-native-config:copyDebugJniLibsProjectOnly UP-TO-DATE
> Task :react-native-image-picker:mergeDebugJniLibFolders UP-TO-DATE
> Task :react-native-image-picker:mergeDebugNativeLibs NO-SOURCE
> Task :react-native-image-picker:copyDebugJniLibsProjectOnly UP-TO-DATE
> Task :react-native-permissions:mergeDebugJniLibFolders UP-TO-DATE
> Task :react-native-permissions:mergeDebugNativeLibs NO-SOURCE
> Task :react-native-permissions:copyDebugJniLibsProjectOnly UP-TO-DATE
> Task :app:mergeDebugNativeLibs UP-TO-DATE
> Task :app:stripDebugDebugSymbols UP-TO-DATE
> Task :app:validateSigningDebug UP-TO-DATE
> Task :app:writeDebugAppMetadata UP-TO-DATE
> Task :app:writeDebugSigningConfigVersions UP-TO-DATE
> Task :app:packageDebug UP-TO-DATE
> Task :app:createDebugApkListingFileRedirect UP-TO-DATE

> Task :app:installDebug
Installing APK 'app-debug.apk' on 'Pixel_7_Pro_API_29(AVD) - 10' for :app:debug
```

Data Collection - Preprocessing - Cleansing



Model Building using CNN



Data Prep: Gather, clean, label, and preprocess a diverse leaf image dataset.

Model Design: Craft a CNN architecture with convolutional and pooling layers.

Hyperparameter Tuning: Fine-tune settings like learning rate and batch size.

Transfer Learning: Leverage pre-trained CNN models and adapt them.

Loss & Metrics: Define appropriate loss functions and evaluation metrics.

Regularization: Combat overfitting with dropout and L2 regularization.

Optimizers: Choose optimizers and learning rate strategies.

Deployment: Scale, optimize, and integrate the model into applications.

Monitoring: Continuously assess model performance in production.

Interpretability: Employ techniques to explain model decisions, enhancing the trust

FAST API

GCP

POSTMAN

REACT NATIVE

HAIL AI



Resources Involved

Android Studio | Postman | React | React Native | Jupyter Notebook | PyCharm
Microsoft Visual Studio Code | Chatgpt

