

Plant Leaf Disease Detection Using ResNet-50

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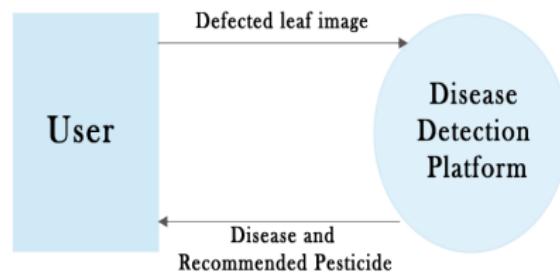


Introduction

Early disease detection is crucial for improved crop yield and quality. Due to a decline in the quality of the agricultural produce, diseased plants can cause large financial losses for individual farmers. In a nation like India, where a substantial section of the population relies on agriculture for a living, it is essential to spot the disease at its earliest stages. A precise diagnosis of the plant disease might reduce losses. The objective of this research is to develop a model that can correctly forecast whether a leaf is disease-infected or not. The main objectives of this study include identifying plant disease and suggesting pesticides that can help to reduce the crop loss.

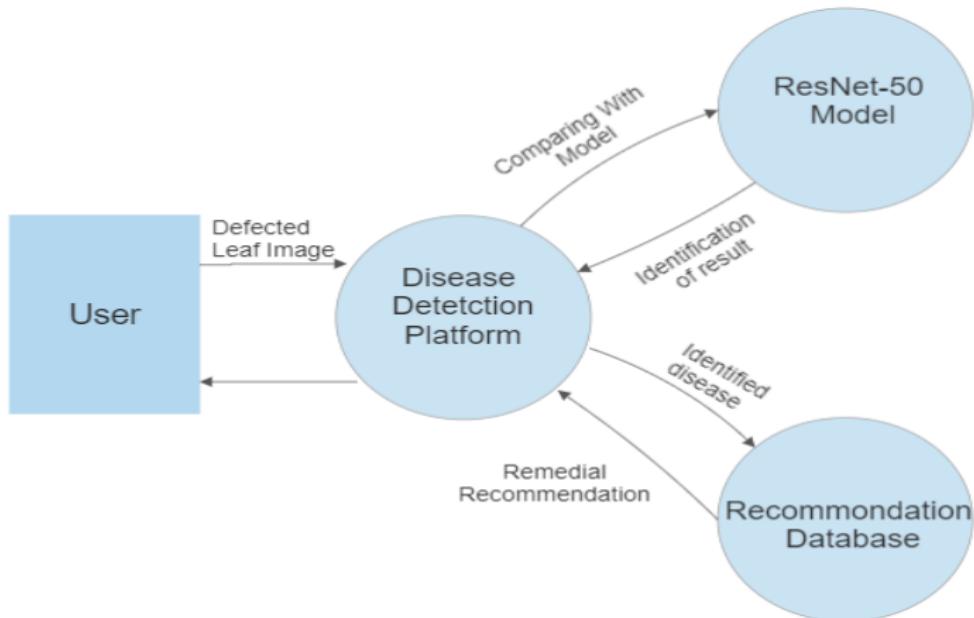


DFD Level 0



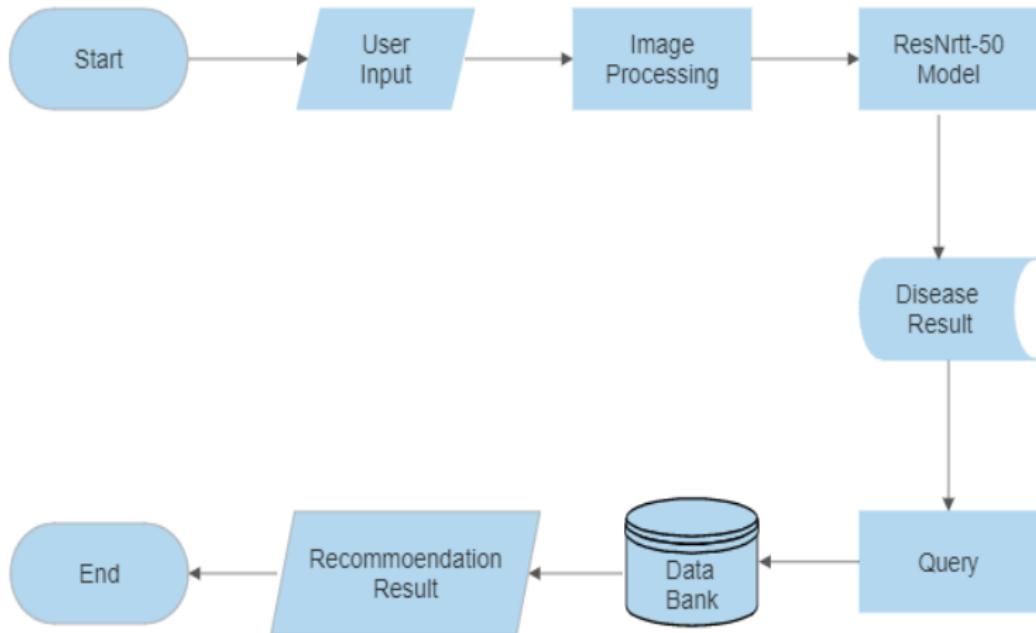


DFD Level 1



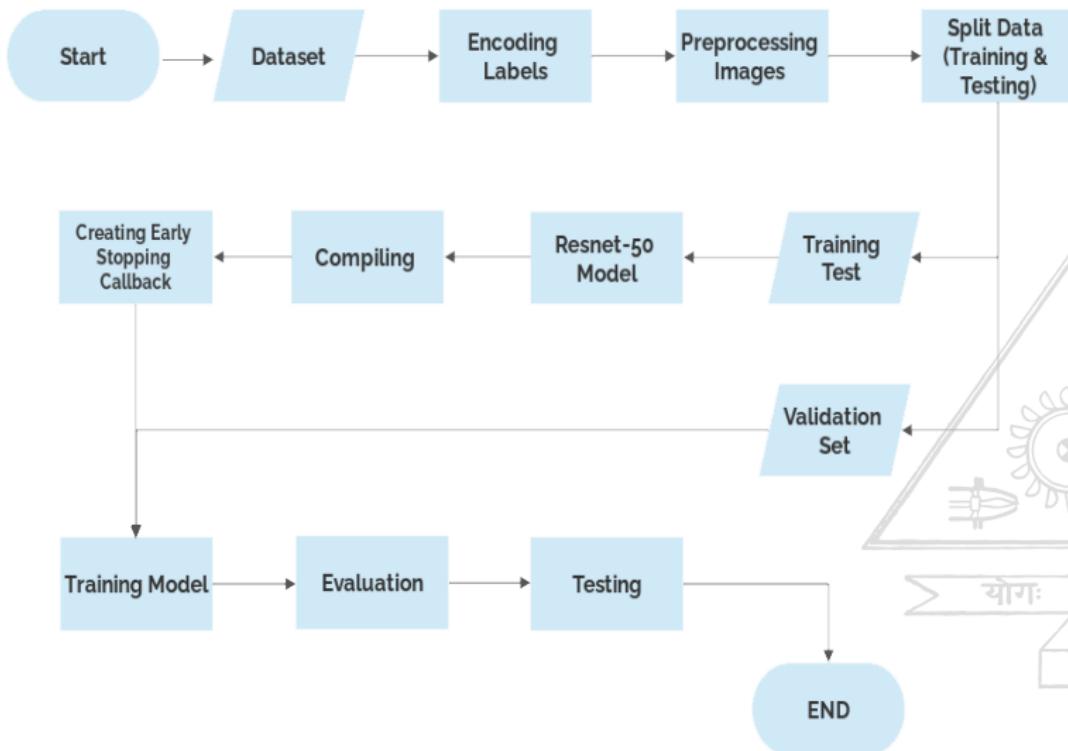


System Architecture





Block Diagram of Model Creation





Input image

The leaf image of paddy and maize is to be taken from Kaggle dataset. The dataset selected for Paddy contains,

- 523 Brown Spot
- 1488 Healthy
- 565 Hispa
- 779 Leaf Blast images

and maize dataset contains

- 1146 blight
- 1306 common rust
- 574 Grey leaf spot
- 1162 Healthy images

For this project we are taking **523 images** from every datasets.





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Dataset Collection and Pre-processing

The dataset is collected from Kaggle and imported to colab.

Steps involved in data pre-processing are,

- Encoding
- Turn into tensor set
- reshaping and normalising

```
# read, turn image into number, normalize, resize
def preprocess_image(image_path, labels=None):
    # read image
    image = tf.io.read_file(image_path)
    # turn jpeg into numbers
    image = tf.image.decode_jpeg(image, channels=3)
    # scaling / normalize (0,255) becomes (0,1)
    image = tf.image.convert_image_dtype(image, dtype=tf.float32)
    # resize to (224,224)
    image = tf.image.resize(image, size=[IMAGE_SIZE, IMAGE_SIZE])
    # return
    return image, labels
```





Model Building

Model for the project is being built using ResNet-50 model

```
model = tf.keras.Sequential([
    # transfer learning model
    hub.KerasLayer("https://tfhub.dev/tensorflow/resnet_50/feature_vector/1"),
    # output layer
    tf.keras.layers.Dense(units=num_unique_label, activation='softmax')
])
```

After creating the model it is complied and a early stopping callback is created before training the model in order to prevent overfitting.

```
# EARLYSTOPPING CALLBACK
# monitor the val loss (prevent overfitting)

early_stopping = tf.keras.callbacks.EarlyStopping(monitor='val_loss', patience=3)
```



Model Building

Model is then trained with 50 epochs

```
▶ history_train = model.fit(train_set, epochs=50,  
                           validation_data = val_set,  
                           callbacks=[early_stopping]))
```

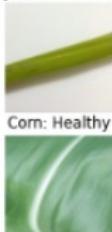
The model is saved fro further processing.



Labelled Images

Here are some images that are labelled for training

Paddy: Brown Leaf Spots



Corn: Healthy



Corn: Leaf Rust

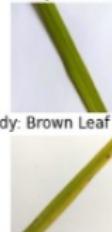


Corn: Leaf Blight



Corn: Healthy

Paddy: Healthy



Paddy: Brown Leaf Spots



Corn: Leaf Gray Spots



Paddy: Healthy



Corn: Leaf Gray Spots

Paddy: Healthy



Paddy: Leaf Blast



Corn: Leaf Gray Spots



Paddy: Leaf Blast



Corn: Leaf Rust

Paddy: Leaf Blast



Paddy: Leaf Blast



Paddy: Healthy



Corn: Healthy

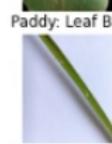


Corn: Healthy

Paddy: Brown Leaf Spots



Corn: Leaf Rust



Paddy: Leaf Blast



Corn: Healthy



Corn: Healthy





Testing

```
# upload files
uploaded=files.upload()

filename = []
test_images = []

for fn in uploaded.keys():
    filename.append(fn)
    path='./content/' + fn
    test_images.append(path)

# turn into set
test_set = tf.data.Dataset.from_tensor_slices(( tf.constant(test_images) ))

# preprocess
test_set = test_set.map(preprocess_image)

# batching
test_set = test_set.batch(batch_size=32)

# predict
test_predictions = model.predict(test_set)

label_prediction = []
for i in range(len(test_predictions)):
    label_prediction.append(unique_label[np.argmax(test_predictions[i])])

# show prediction results
for i in range(len(test_images)):
    print(label_prediction[i])
    pil_img = Image(filename=test_images[i], width=150, height=150)
    display(pil_img)
```

Choose Files 3 files

- Brown_leaf_spot_of_rice-min.jpg(image/jpeg) - 298948 bytes, last modified: 9/18/2022 - 100% done
 - brown-spot-1.jpg(image/jpeg) - 86292 bytes, last modified: 9/18/2022 - 100% done
 - download (1).jpg(image/jpeg) - 9944 bytes, last modified: 10/12/2022 - 100% done
- Saving Brown_leaf_spot_of_rice-min.jpg to Brown_leaf_spot_of_rice-min.jpg
Saving brown-spot-1.jpg to brown-spot-1.jpg
Saving download (1).jpg to download (1).JPG
1/1 [=====] - 2s 2s/step



Paddy: Leaf Blast



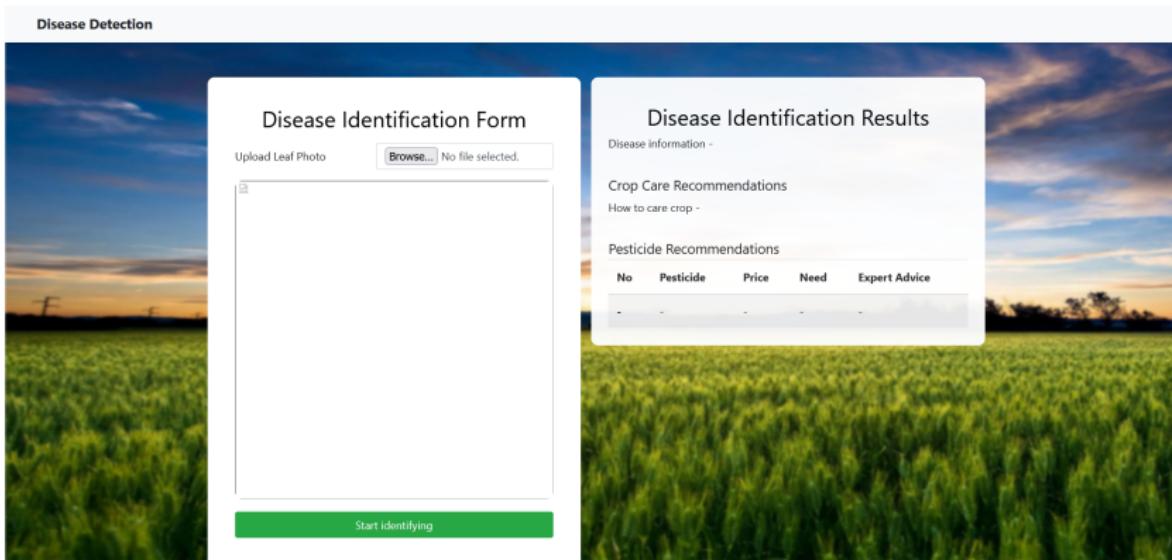
Paddy: Brown Leaf Spots



Corn: Leaf Gray Spots



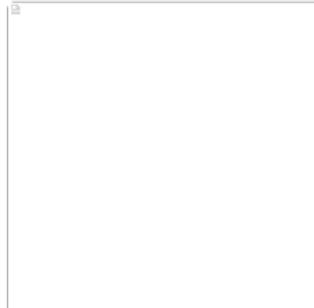
User Interface



Disease Detection

Disease Identification Form

Upload Leaf Photo No file selected.



Disease Identification Results

Disease information -

Crop Care Recommendations

How to care crop -

Pesticide Recommendations

No	Pesticide	Price	Need	Expert Advice
-	-	-	-	-

कौशलम्



Results

Disease Detection

Disease Identification Form

Upload Leaf Photo Corn leaf ...t (1).jpeg



Start identifying

Leaf Blight - Corn

Caused by a fungus or fungus, it can be said that the main disease of corn plants cannot be underestimated. Leaf blight attacks like moist and wet environments. This disease is known to have a fairly high destructive power because it can cause severe damage to crop failure.

Crop Care Recommendations

1. Do not cut the seedlings before planting.
2. Do not plant too tightly.
3. Do not use excessive N fertilizer.
4. Keep clean and remove weeds.
5. Use a bactericide.

Pesticide Recommendations

No	Pesticide	Price	Need	Expert Advice
1	Hexaconazole 5 % SC	480/ltr	10 ml/ltr	Crop Science
2	Mancozeb 64% WP + Metalaxyl 8%	1366/kg	2 gm/ltr	Crop Science



Results

127.0.0.1:5000

Disease Identification Form

Upload Leaf Photo Brown spot rice.jpg

Start identifying

Brown Leaf Spots - Paddy

This disease can attack at the time of nursery and can cause plants to die due to rot in coleoptiles, stems and roots. Attacks can also occur on leaves and grains, if the rice grains are attacked, the quality will decrease.

Crop Care Recommendations

1. Adjust the spacing between plants so that it is not too tight especially during the rainy season.
2. Use enough urea and balance it with K elements.
3. Use varieties resistant seeds in future.

Pesticide Recommendations

No	Pesticide	Price	Need	Expert Advice
1	Captan	790/kg	2 gm/kg of sed	Agritech
2	Mancozeb	445/kg	2 gm/ltr	Agritech



Expert Opinion

Leaf Disease Crop Protection

www.agritech.tnau.ac.in/expert_system/paddy/cppests_ricehispa.html

EXPERT SYSTEM FOR PADDY

HOME ABOUT US CONTACT US

Symptom of Damage

Identification of pest

Management Strategies

Spiny Beetle / Rice Hispa

Symptom of Damage :

- The mining of the grubs will be clearly seen on the leaves.
- Scraping of the upper surface of the leaf blade leaving only the lower epidermis as white streaks parallel to the midrib.
- Tunneling of larvae through leaf tissue causes irregular translucent white patches that are parallel to the leaf veins.
- Damaged leaves wither off.
- Rice field appears burnt when severely infested.

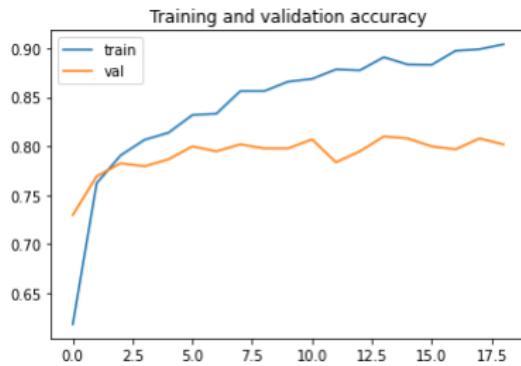
Nature of Damage :

- The grub mines into the leaf blade and feed on the green tissue between the veins.
- Adults also feed in the green tissue; they scrape green matter of the tender leaves.
- Generally the plants are affected in the young stage.

Mining of leaves by grubs Presence of beetles with scraping on leaves



Accuracy



The model has a Validation Accuracy of 79.20%



Conclusion

The project is proposed to find the leaf disease on corn and paddy plants. The project build a model using ResNet-50 convolutional neural network.

As proposed the system can find various disease affected on these plants. Farmer can now upload the image of leaf which is affected by diseases. The model will predict the disease and produce recommendations based on the result. The model has validation accuracy of 79.20%.



Gantt Chart

ID	Name	Timeline											
		Aug, 2022			Sep, 2022			Oct, 2022			Nov, 2022		
2..	28 Aug	04 Sep	11 Sep	18 Sep	25 Sep	02 Oct	09 Oct	16 Oct	23 Oct	30 Oct	06 Nov	13 Nov	
1	Topic Selection and Reviews												
2	Dataset Collection												
3	Pre-processing												
4	Dataset Creation												
5	Disease and Remedy research												
6	U I Design												



Reference

- ① G. Zhou, W. Zhang, A. Chen, M. He, and X. Ma, "*Rapid detection of rice disease based on FCM-KM and faster R-CNN fusion,*" IEEE Access, vol. 7, pp. 143190-143206, Sep. 2019.
- ② P. Sharma ; P. Hans ; S. C. Gupta, "*Classification Of Plant Leaf Diseases Using Machine Learning And Image Preprocessing Techniques,*" in Int. Conf. on Cloud Com., Data Sc. Eng., Noida, INDIA, 2020
- ③ U. Shafi, R. Mumtaz, N. Iqbal, S. M. H. Zaidi, S. A. R. Zaidi, I. Hussain,Z. Mahmood, "*A multi-modal approach for crop health mapping using low altitude remote sensing, Internet of Things (IoT) and machine learning,*" IEEE Access, vol. 8, pp. 112708-112724, Jun. 2020



Thank you!

