

Plant Disease Classification:

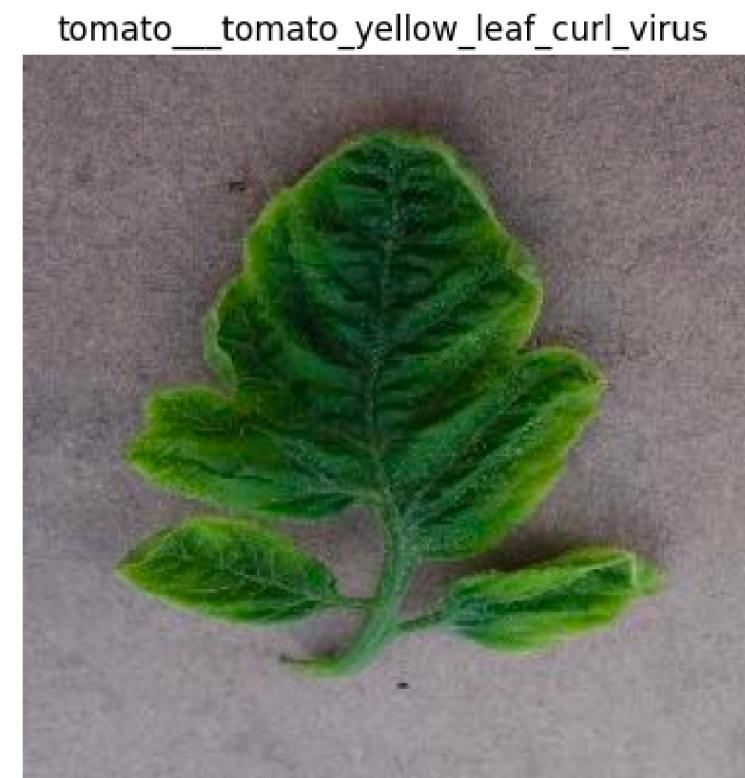
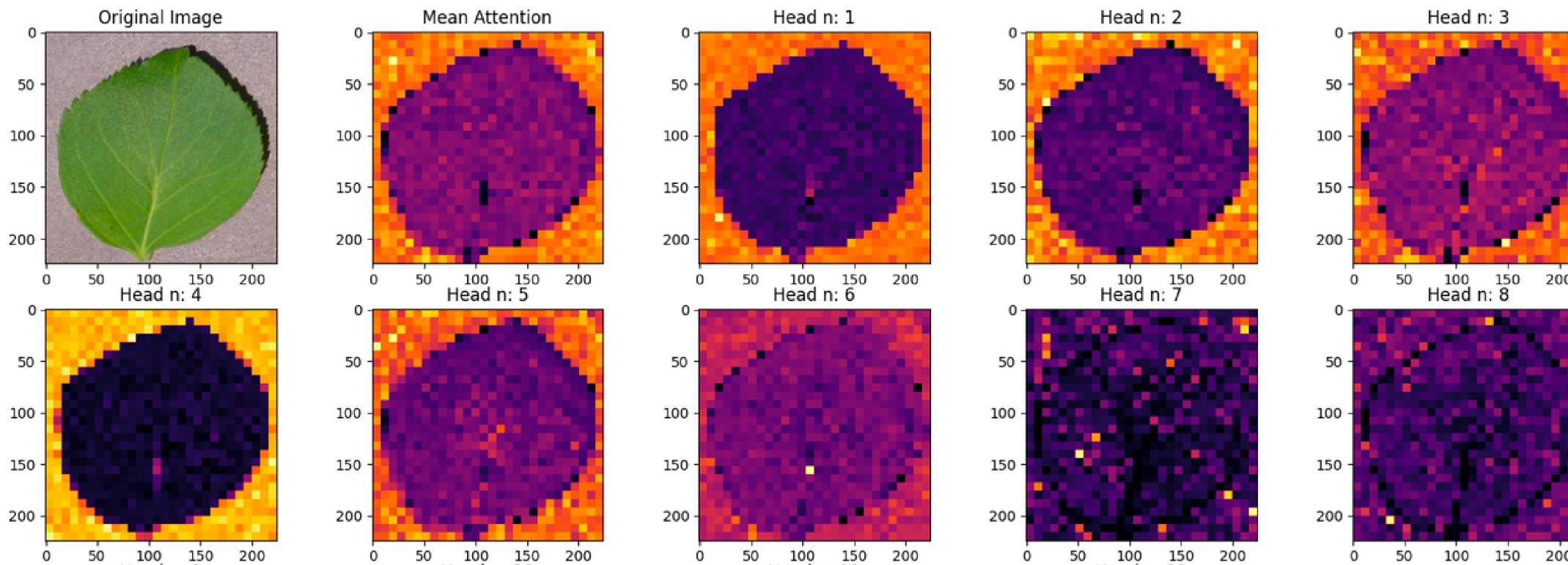
Increasing Models robustness with Combined Datasets, Data Augmentation
and Insightful Attention Map Visualization

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Advanced Computational Techniques for Big Imaging and Signal Data

PlantVillage dataset

- 55 448 leaf images captured in lab conditions
- 39 classes
- Each class determines both leaf and disease
- The bias problem

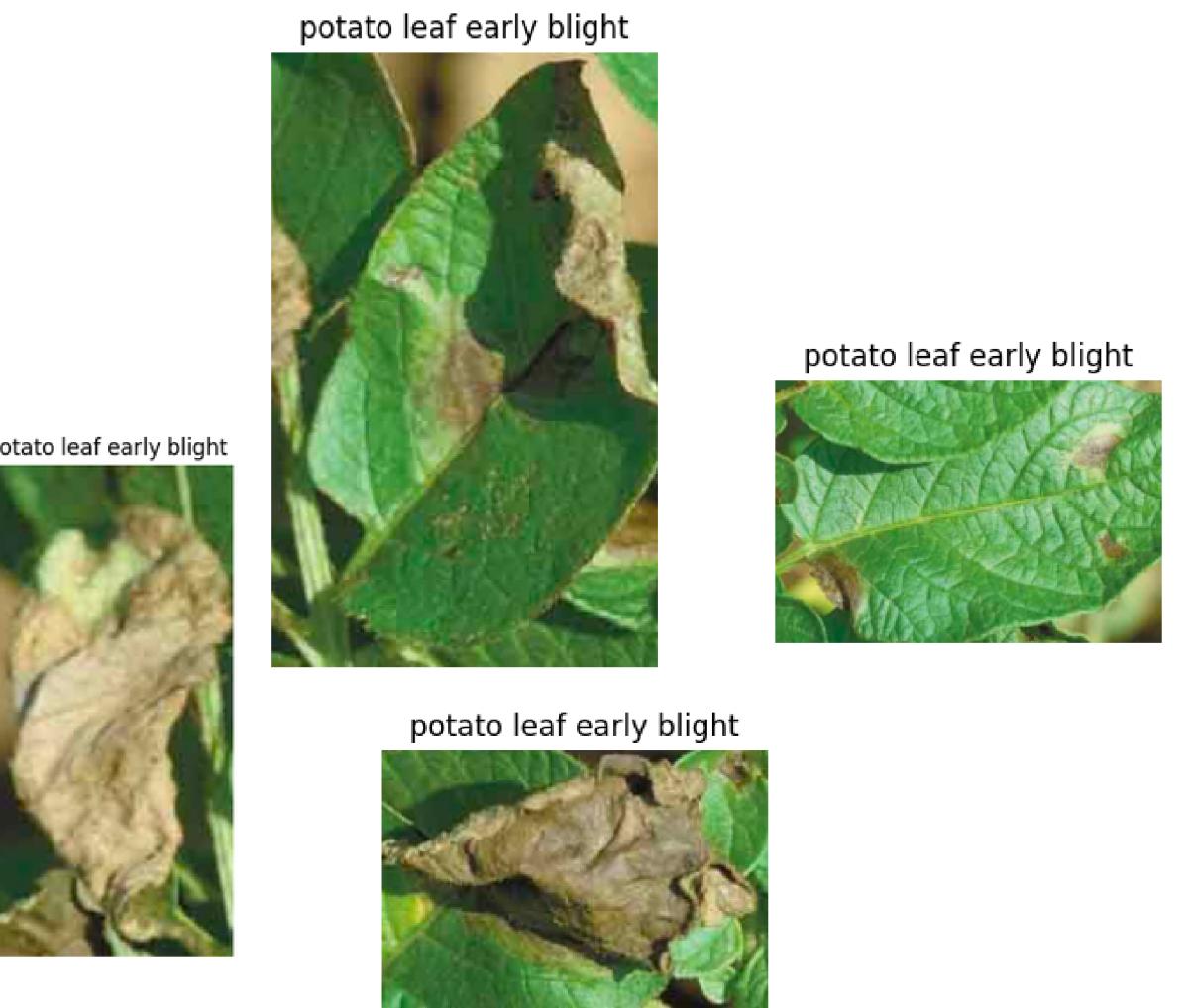
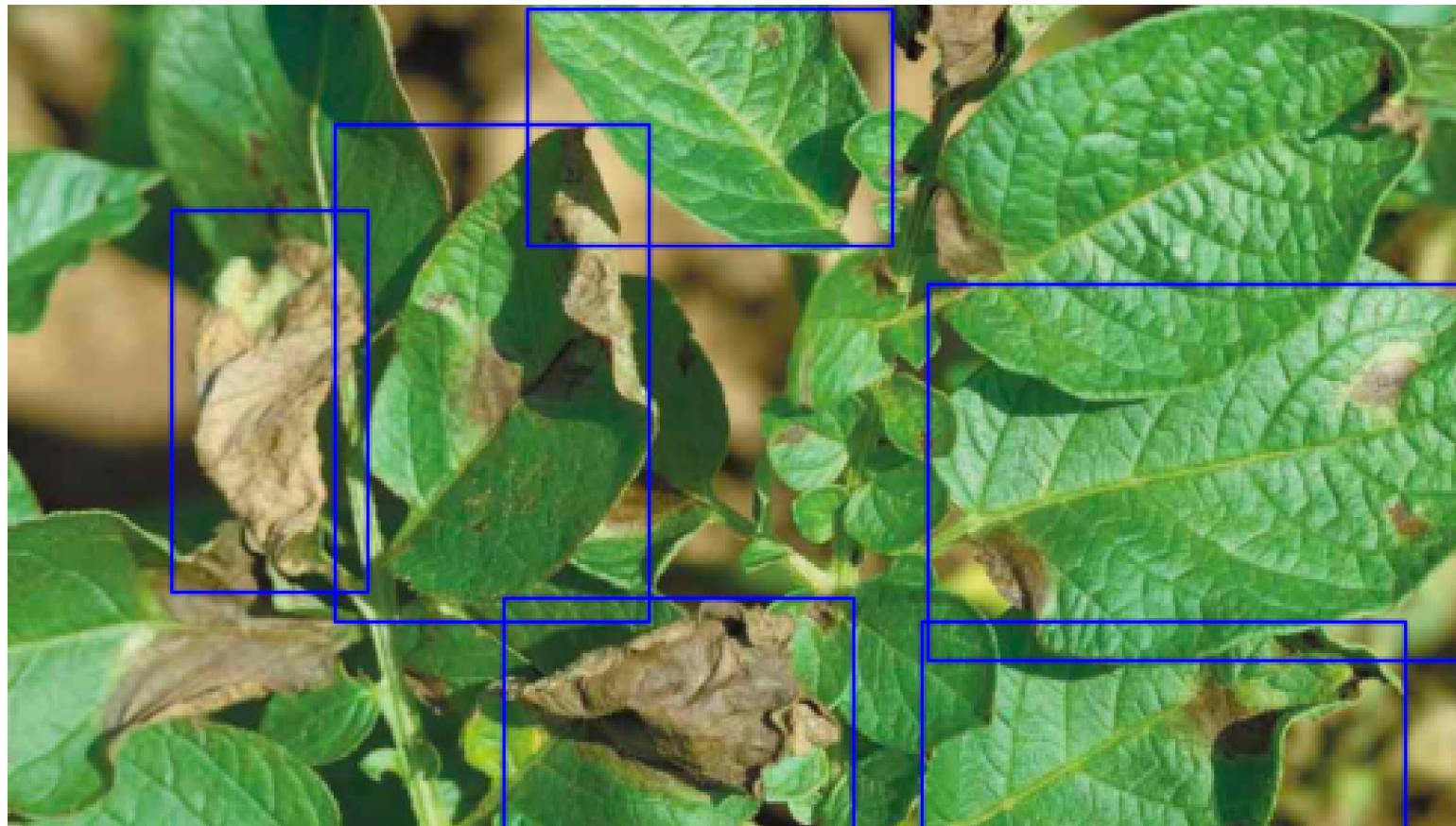


- 100% | | 373/373

Accuracy: 97.20%
Precision: 96.87%
Recall: 96.63%
F1: 96.73%

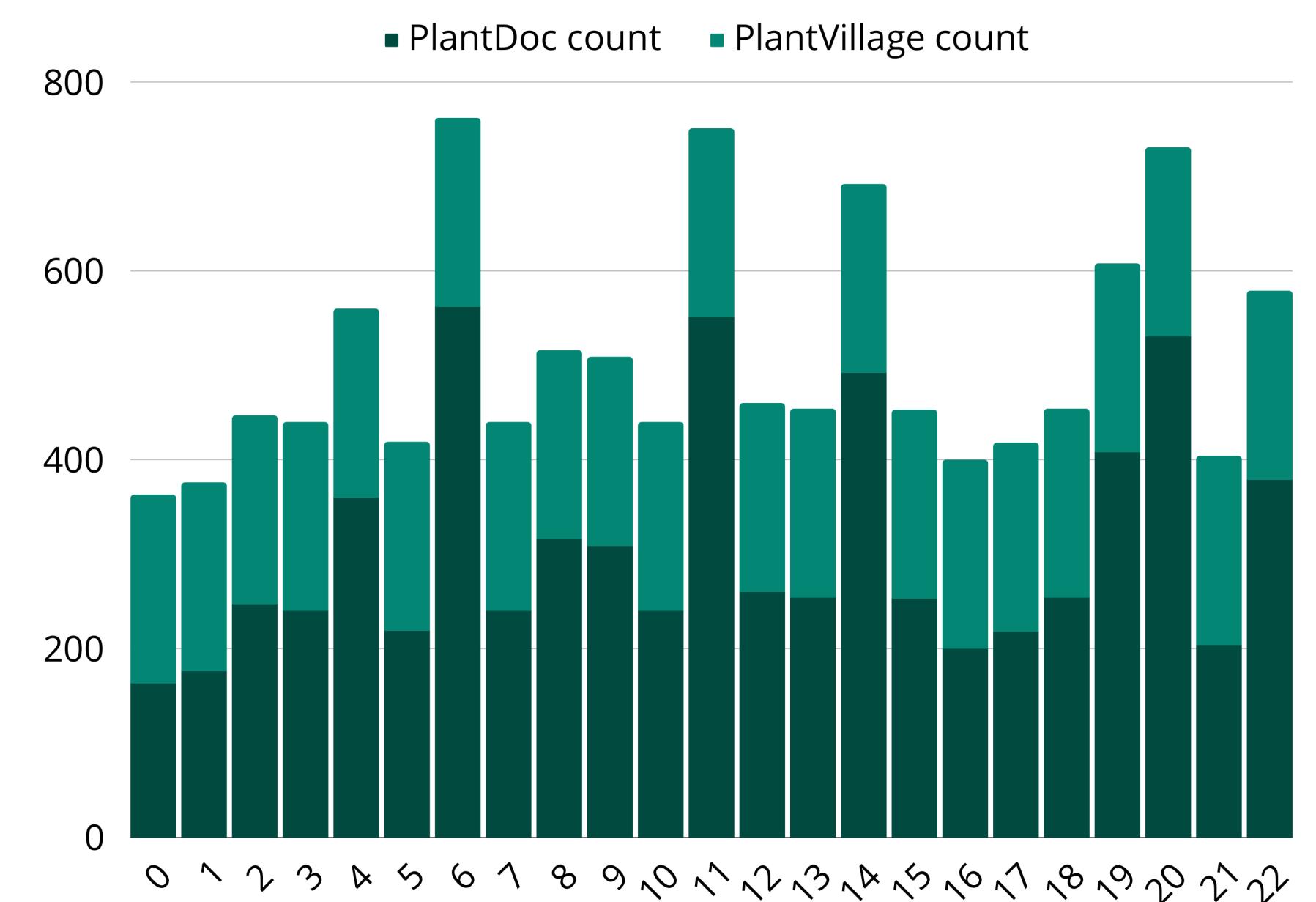
PlantDoc dataset

- Object detection dataset in common environments
- 2558 images
- 8242 leaf instances
- 29 classes



Datasets Unification

- Classes: **intersection** between the two class sets discarding classes that contains less than 150 samples (per dataset)
- All instances of PlantDoc
- Randomly sampled instances from PlantVillage
- Data balancing through joint consideration of **class distribution** and **sample comparability** from each source.
- **23 leaf classes** + 1 for background



Data Transformations

To mitigate the plantVillage bias problem, due to different capturing conditions only for different classes, some particular image transformations are defined:

Brightness and contrast



Random Shadows



Central Cropping

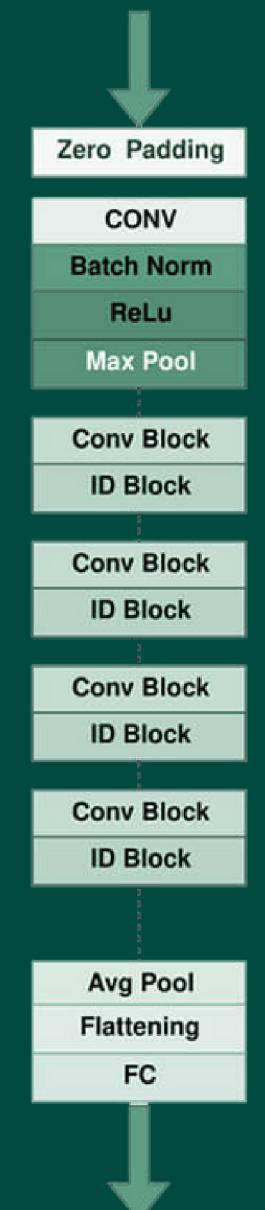


Other implemented transformations include Normalization, Flipping and Resize

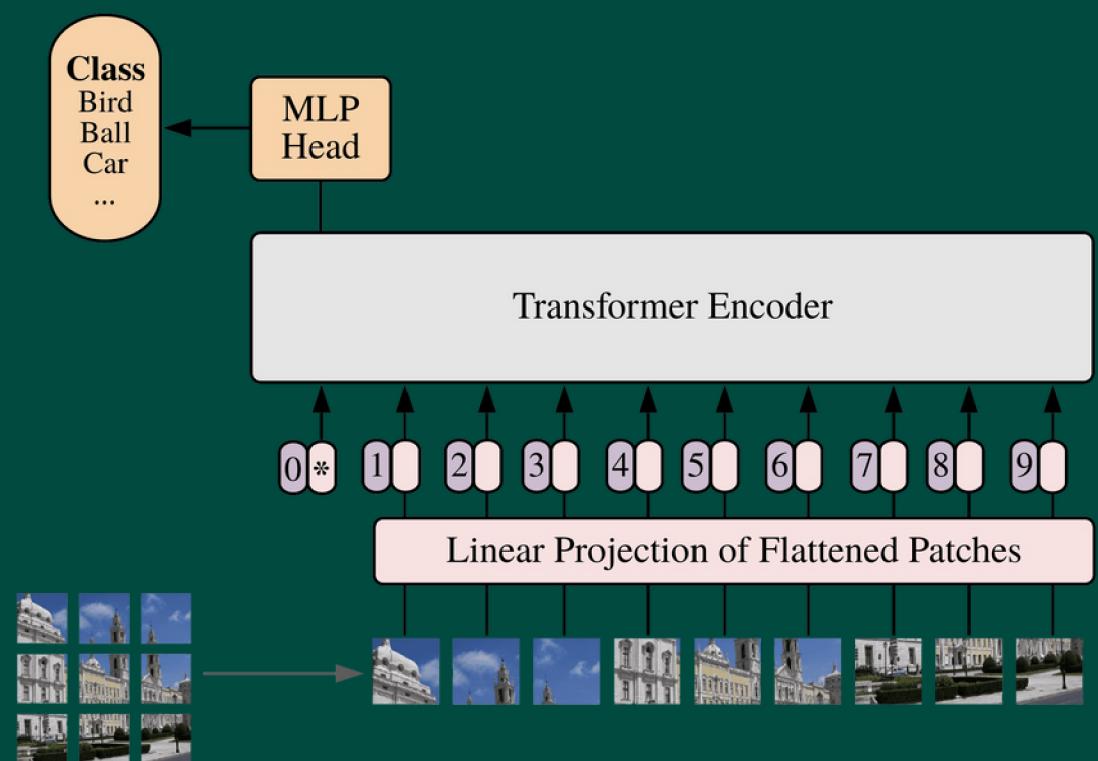
Models

- ViT: Pretrained and finetuned on PlantVillage Dataset
- Resnet50: Pretrained and finetuned on Unified dataset
- ViT: From scratch on Unified dataset
- ViT: Pretrained and finetuned on Unified dataset

Resnet50



Vision Transformer (ViT)



Performances

Measured firstly on the unified dataset, then, a comparison between the ViTs trained on different datasets is made to assess models generalization.

Performances on Unified TestSet

	Resnet finetuned on unified	ViT from scratch	TorchVit finetuned on unified
accuracy	0.849844	0.632995	0.875975
precision	0.852919	0.639149	0.882261
recall	0.849844	0.632995	0.875975
f1	0.848647	0.631537	0.875821

Performances on PlantDoc dataset

	TorchVit finetuned on plantVillage	TorchVit finetuned on Unified
accuracy	0.130564	0.824332
precision	0.201302	0.833649
recall	0.130564	0.824332
f1	0.122916	0.822552

Set of Images scraped from the web

A comparison is conducted between a ViT model finetuned on PlantVillage and another ViT model finetuned on the unified dataset using a small set of images obtained from the web. Those images represent the typical upload of a final user.

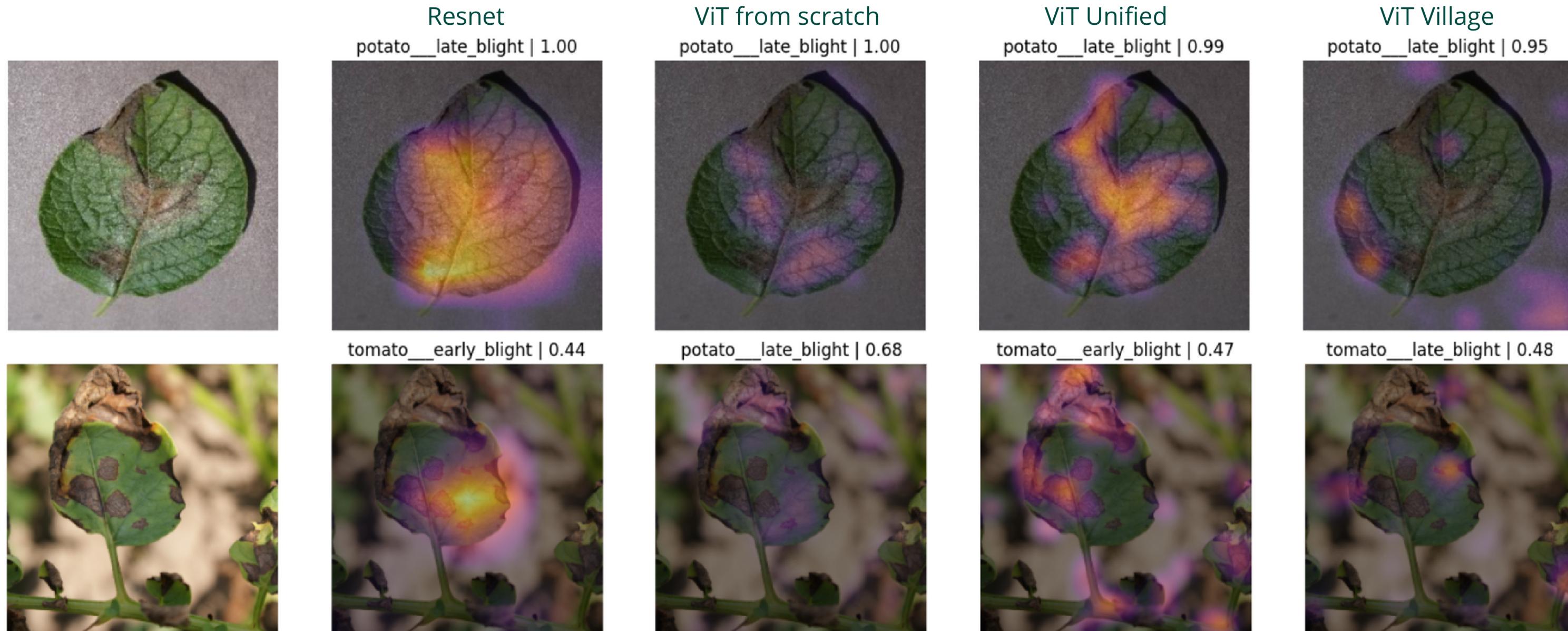
	TorchVit finetuned on plantVillage	TorchVit finetuned on Unified
accuracy	0.285714	0.678571
precision	0.281548	0.629762
recall	0.285714	0.678571
f1	0.237570	0.617007



The ViT finetuned on the unified dataset scored **38 out of 56** while the other just **16 out of 56**. This result, together with the ones taken from the plantDoc test set, shows that the model is now able to generalize better.

Attention Maps and GradCam

Now the models focuses more on the leaf and on the disease rather than on the background or the capturing conditions.



Platform: Home Page

Developed with streamlit the platform consists of 3 pages:

Home Page: contains a **description** of the **functionalities** provided by the platform (GPT generated)



Welcome to LeafCare AI: Empowering Plant Health 🌱

At LeafCare AI, we bring cutting-edge technology to your fingertips to revolutionize the way you care for your plants. Our innovative service combines the power of artificial intelligence with a vast database of plant images to diagnose and address potential diseases in your beloved green companions.

Discover and Learn: Scroll Through Our Test Images 🌎🌿

Embark on a visual journey through our extensive database of test images. Witness firsthand how our advanced model accurately classifies various plants and identifies potential diseases. Explore the intricate world of plant health, and gain insights into the fascinating realm of botany.

Empowering Plant Parents: Disease Descriptions and Cures 📚🌿

For each disease prediction, we provide detailed descriptions and curated guides on how to effectively treat and prevent the identified plant ailments. Knowledge is power, and LeafCare AI is here to empower you with the information needed to nurture vibrant and healthy plants.

Unleash the Power of Your Photos: Upload and Predict 📸🌿

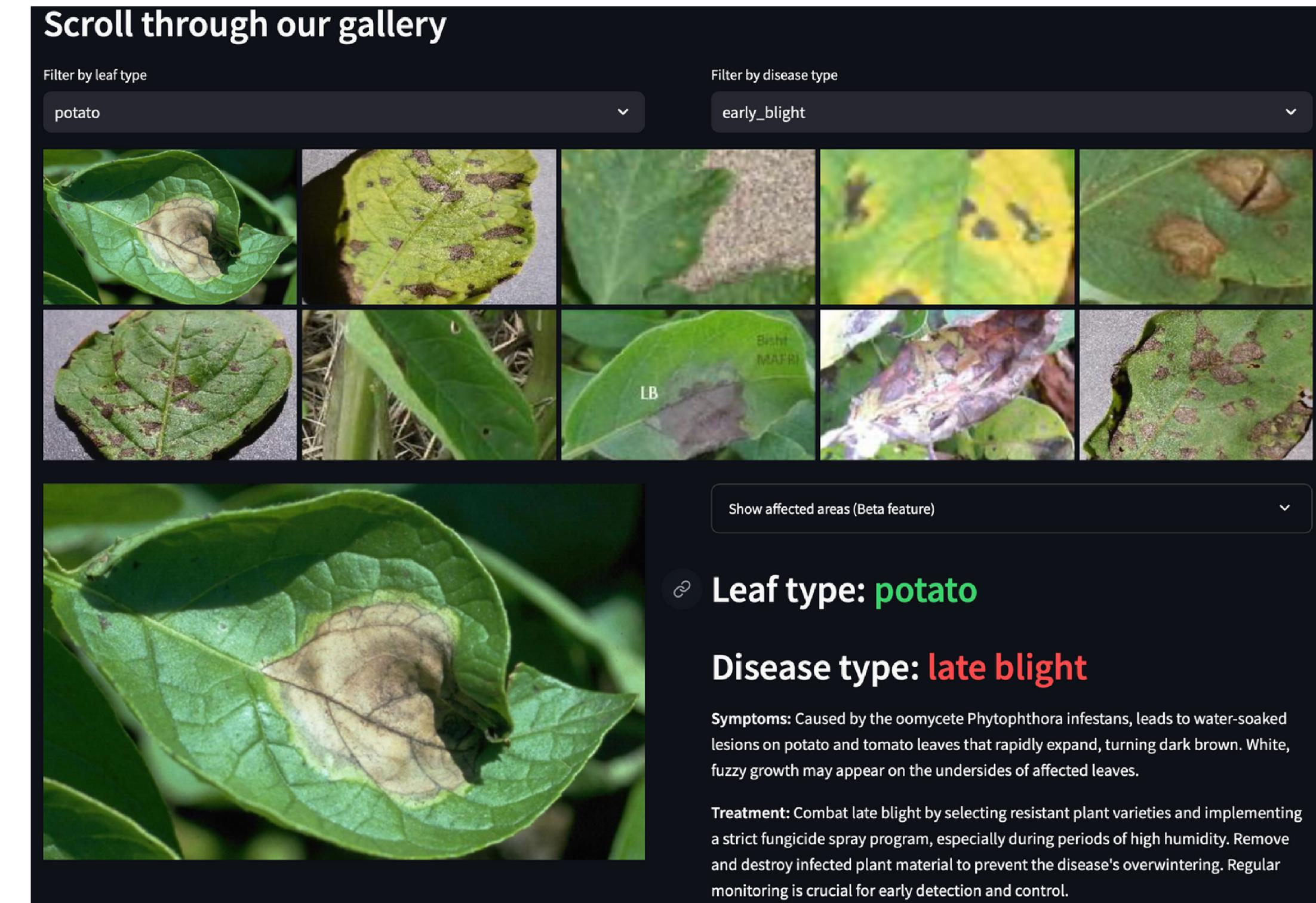
Experience the magic of personalized plant care by uploading your own leaf images. Receive instant predictions from our state-of-the-art model, unraveling the mysteries of your plant's health. Whether you are a seasoned gardener or just starting your green journey, LeafCare AI is your reliable companion in fostering lush, thriving greenery.

Platform: Scroll our Gallery

Developed with streamlit the platform consists of 3 pages:

Scroll Through our Gallery:

- Allows users to **visit images** from the test set of the unified dataset.
- **Filter** images based on leaf and disease type.
- Model **prediction** which correctness is color coded (red, green)
- Symptoms and Treatment **suggestions** based on model prediction
- **Attention Map**



Platform: Upload your images

Our model can recognize plants and diseases as shown in the table below

leaf	disease
apple	apple scab cedar apple rust healthy
background	background
cherry	healthy
corn	northern leaf blight
grape	healthy
peach	healthy
pepper_bell	bacterial spot healthy
potato	early blight late blight
raspberry	healthy
soybean	healthy

Upload your image here

Drag and drop files here
Limit 200MB per file • PNG, JPG, JPEG

Browse files

tomato__septoria_leaf_spot.jpg 230.4KB

tomato__early_blight.jpg 205.8KB

potato__early_blight.png 432.5KB

Leaf type: tomato, Disease: early blight

Confidence: 47.03%



Show affected areas (Beta feature)



Symptoms:

Caused by the fungus *Alternaria solani*, presents as dark concentric rings on tomato and potato leaves. Lesions start as small, dark spots and can enlarge to cause widespread foliage damage.

Treatment:

Manage early blight by practicing proper plant spacing and applying fungicides, particularly those containing chlorothalonil. Remove and destroy infected lower leaves to reduce the pathogen's presence. Crop rotation is essential for long-term control.

Developed with streamlit the platform consists of 3 pages:

Upload your images:

- Shows to the user **which diseases** can be recognised for each leaf type
- Allow to upload **multiple images**
- Shows leaf disease **prediction**, confidence score and treatment **suggestions**



Thank you!