

RICE LEAF DISEASES RECOGNITION

DEEP LEARNING FOR AI

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THE DATASET

The dataset contains 5932 images of 4 different categories of rice leaves diseases.

4 CATEGORIES:

Bacterial Blight



Blast



Brown Spots



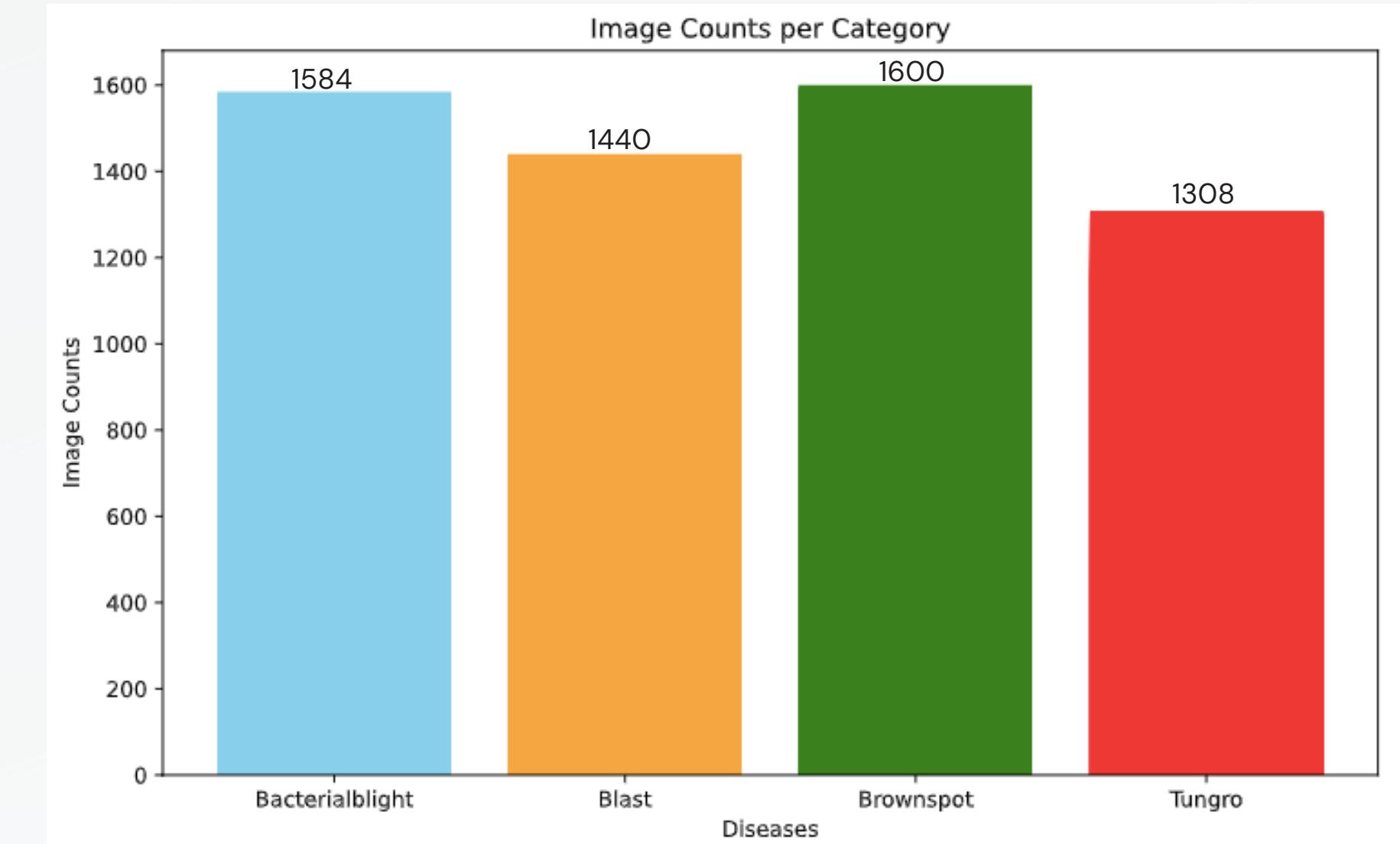
Tungro



BALANCED SETS CREATION

The **distribution** of the 4 classes is balanced, ensuring a fair representation. Indeed, the ratios between each class and the total number of images are aligned.

The least frequent class is **Tungro**, with 1308 observations, while the most frequent one is **Brownspot**, with 1600 observations.



BALANCED SETS CREATION

ORIGINAL DATASET (100%)

TRAINING SET (70%)

915 images for each rice leaf disease.

The images have been randomly picked from the original dataset.

Total of 3660 images.

VALIDATION SET (15%)

195 images for each rice leaf disease.

The images have been randomly picked from the original dataset.

Total of 780 images.

TEST SET (15%)

195 images for each rice leaf disease.

The images have been randomly picked from the original dataset.

Total of 780 images.



IMAGE SIZE

Images are of different dimensions, therefore they need to be **resized**.

IMAGE RESIZE

`transforms.Resize(224,224)`

After the transformation, images have the same dimension of $3 \times 224 \times 224$.

MODEL APPLICATION

ALEXNET ARCHITECTURE

8-LAYER CNN:

- 5 Convolutional layers
- 3 MaxPooling layers

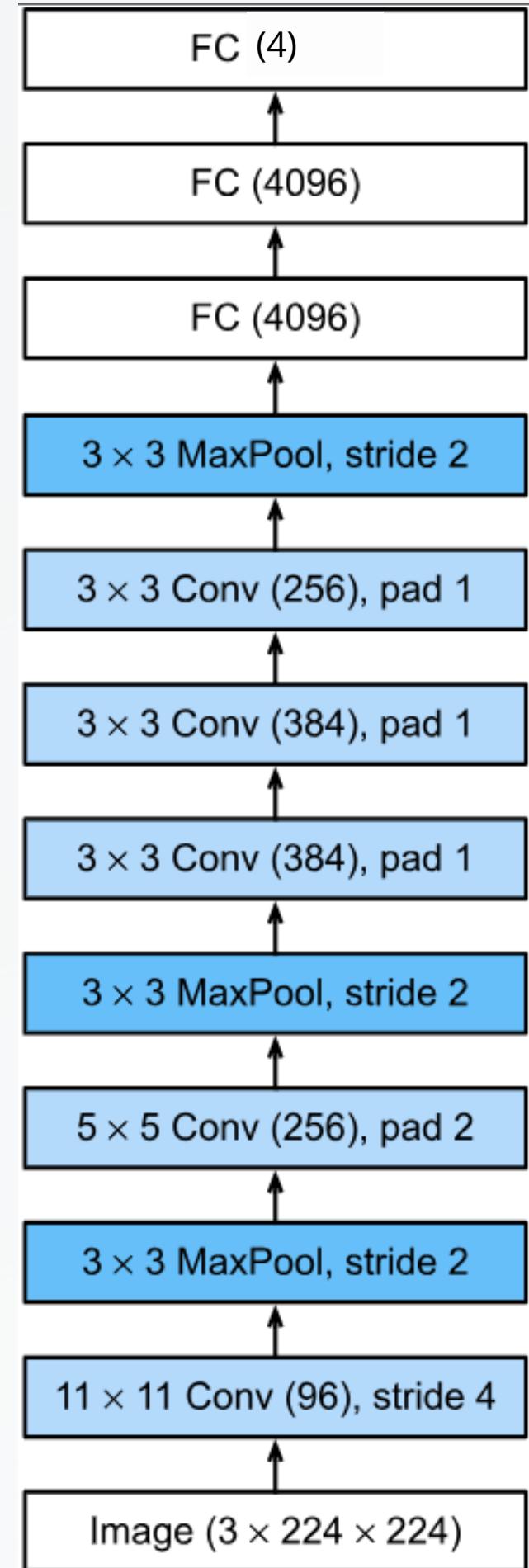
2 Fully Connected hidden layers 4096 neurons.

1 Fully Connected final layer of 4 neurons.

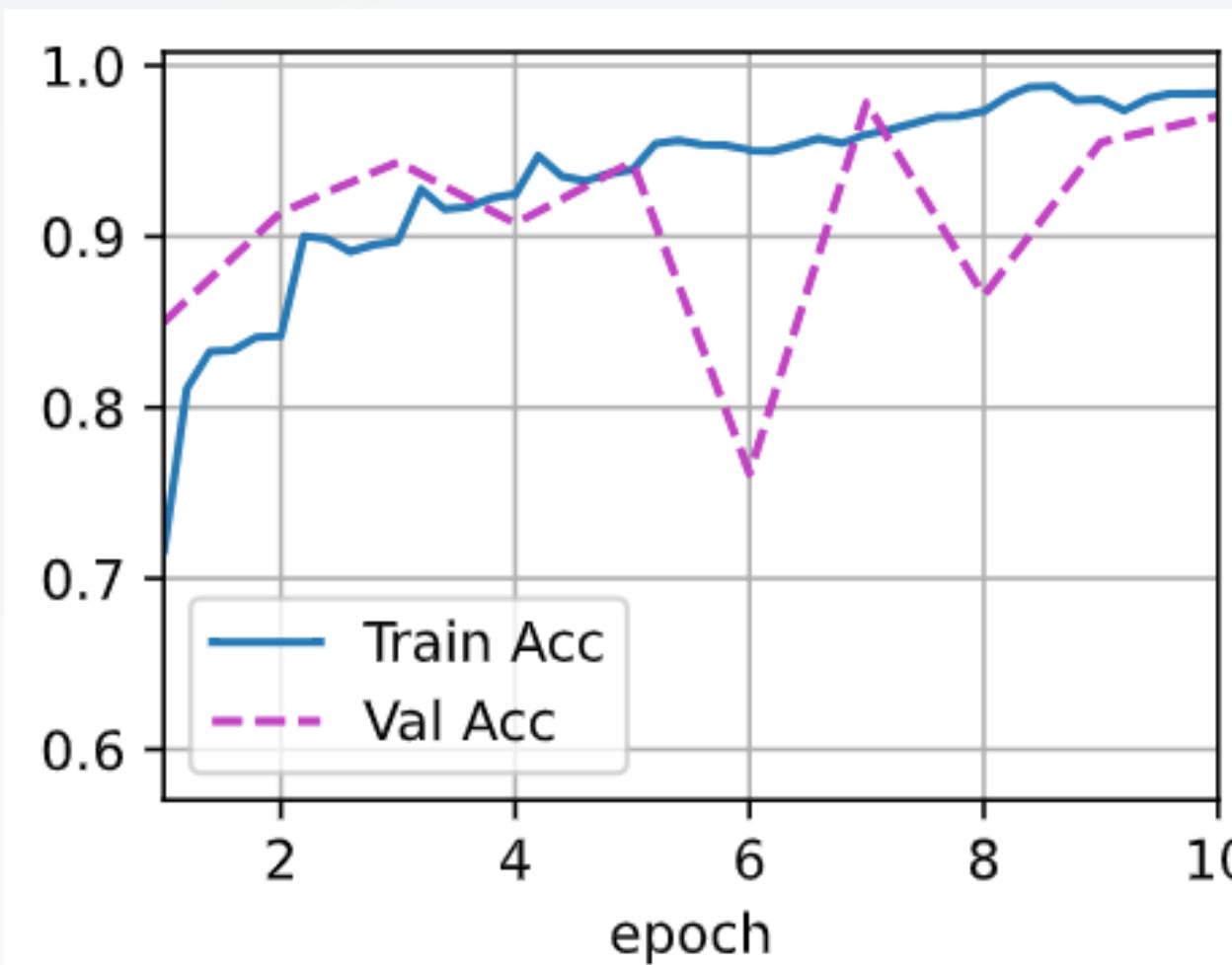
Batch Normalization after each convolutional and fully connected layer.

INPUT: Colored (RGB, 3) images of 224×224 pixels.

ACTIVATION FUNCTION: ReLU, easier computation.



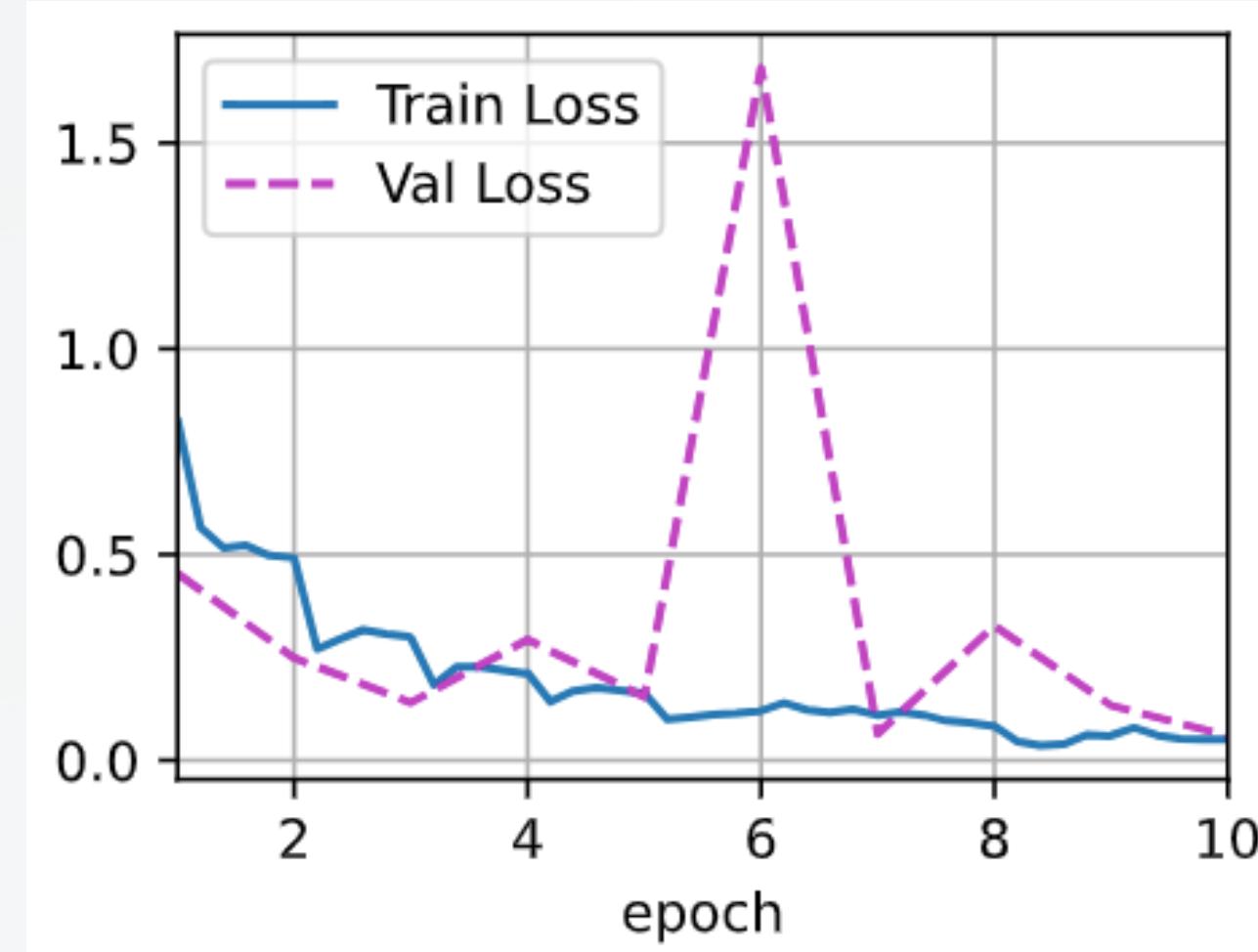
TRAINING AND VALIDATION ACCURACY



Train Acc 0.984, Val Acc 0.971

- The Training Process with Batch Normalization applied has demonstrated significant improvements in both training and validation metrics.
- The Training Accuracy increases gradually, reaching 98.4%.
- The Validation Accuracy exhibits a brief decline and subsequent recovery.

TRAINING AND VALIDATION LOSS

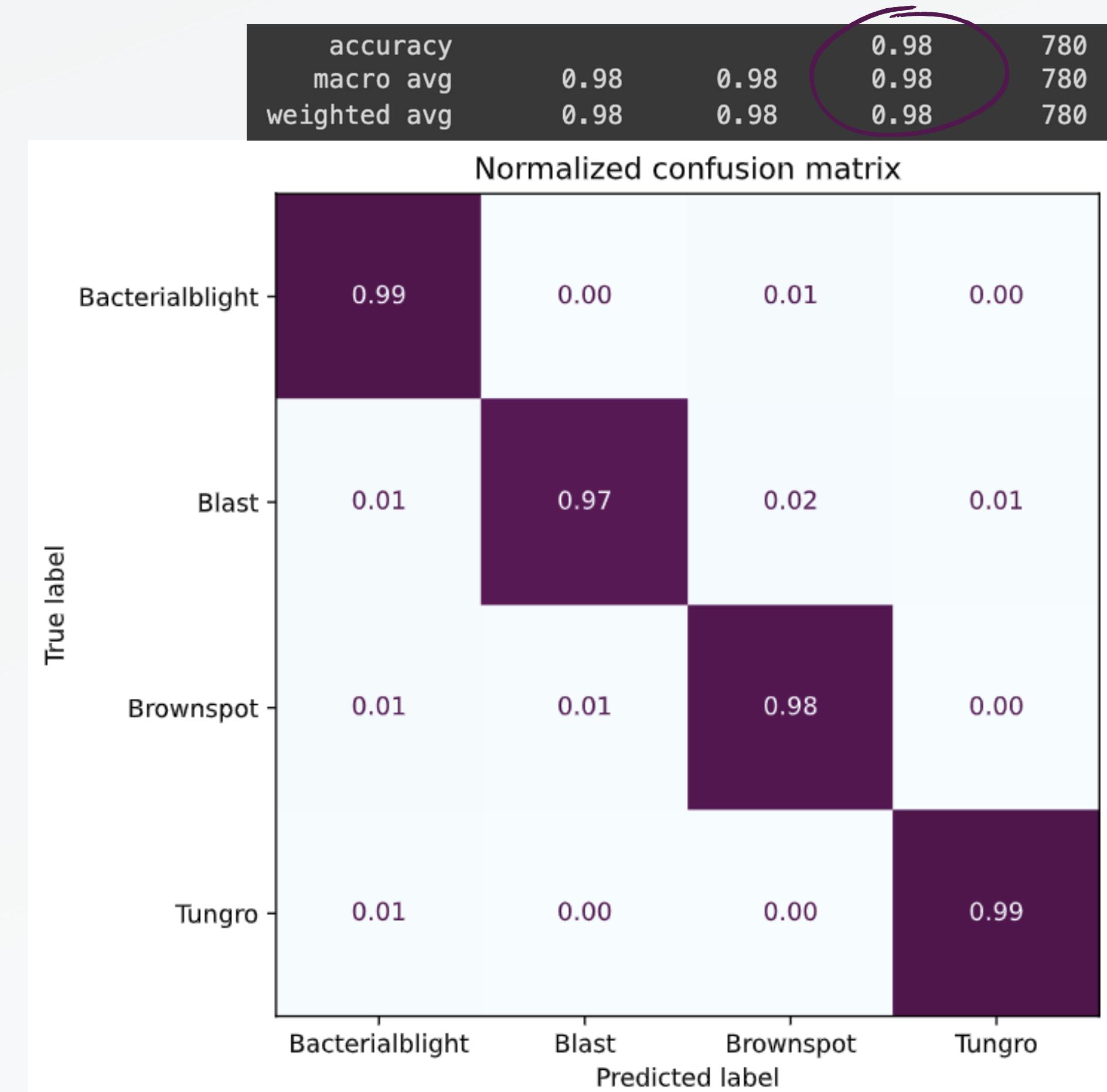


Train Loss 0.051, Val Loss 0.060

- The Training Loss steadily decreases over epochs, reaching a value of 0.051
- The Validation Loss increases at epoch 6, followed by a notable decline, indicating some adjustments in the model's generalization
- The Validation Accuracy exhibits a brief decline and subsequent recovery. These trends suggest that the model, with the aid of batch normalization, adapts to the validation data characteristics, leading to improved generalization.

CONFUSION MATRIX

- The overall accuracy of 98% underscores the model's ability to make correct predictions across all classes. Both macro and weighted averages, also at 98%, emphasize the model's consistent and reliable performance.
- For what concerns the confusion matrix, strong diagonal elements can be observed for all the categories, while off-diagonal elements are low.
- The model exhibits robust classification capabilities for various plant diseases.



SUMMARY

➡ Accuracy of test images: 98 %

- **OVERALL ACCURACY:** the model achieved an overall test accuracy of 98%, showcasing strong performance across all classes.
- **CLASS PERFORMANCE:** precision, recall, and F1-score metrics for each individual class consistently float around 97–99%, indicative of the model's excellent performance in making accurate positive predictions, capturing actual positive instances, and maintaining a harmonious balance between precision and recall.
- **BALANCE and CONSISTENCY:** the high values across all metrics suggest that the model is well-balanced and consistent across different classes. This balance implies that the model does not favor specific classes over others and it maintains a robust ability to generalize well to diverse patterns within the dataset.

