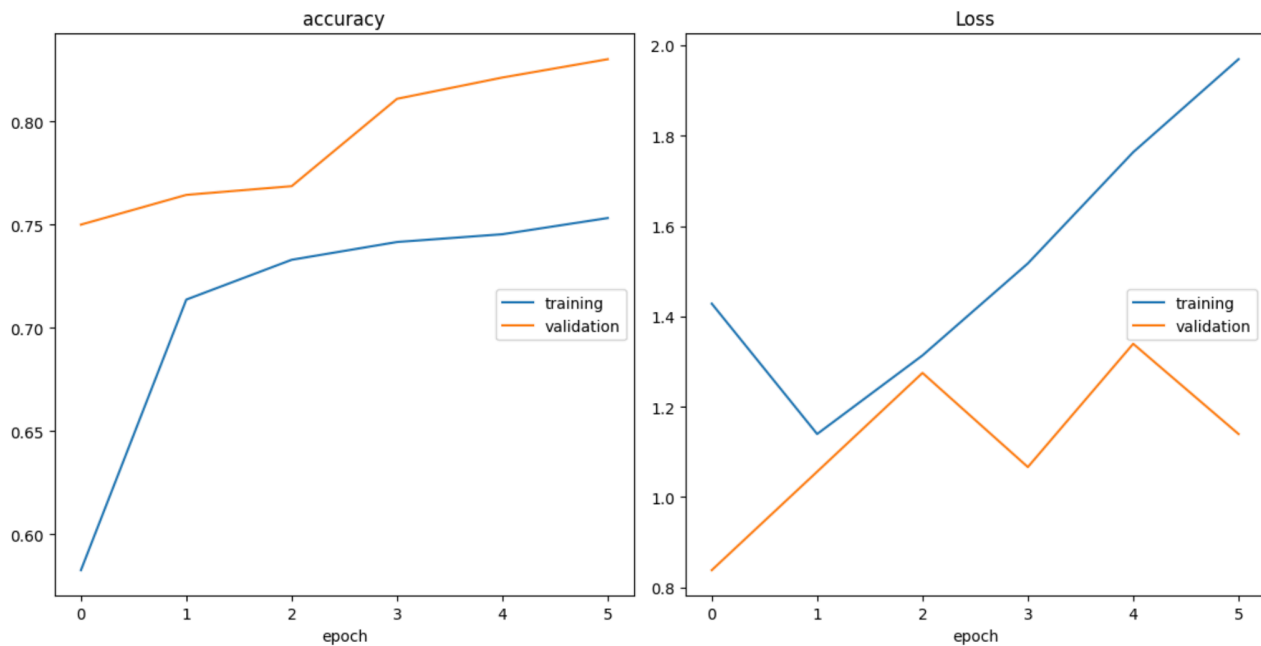


Transfer Learning with VGG16 base line

1. FEATURE EXTRACTION (FROZEN BASE LINE):

1st training

- augmented
- batch_size = 32
- EarlyStopping monitors val_loss

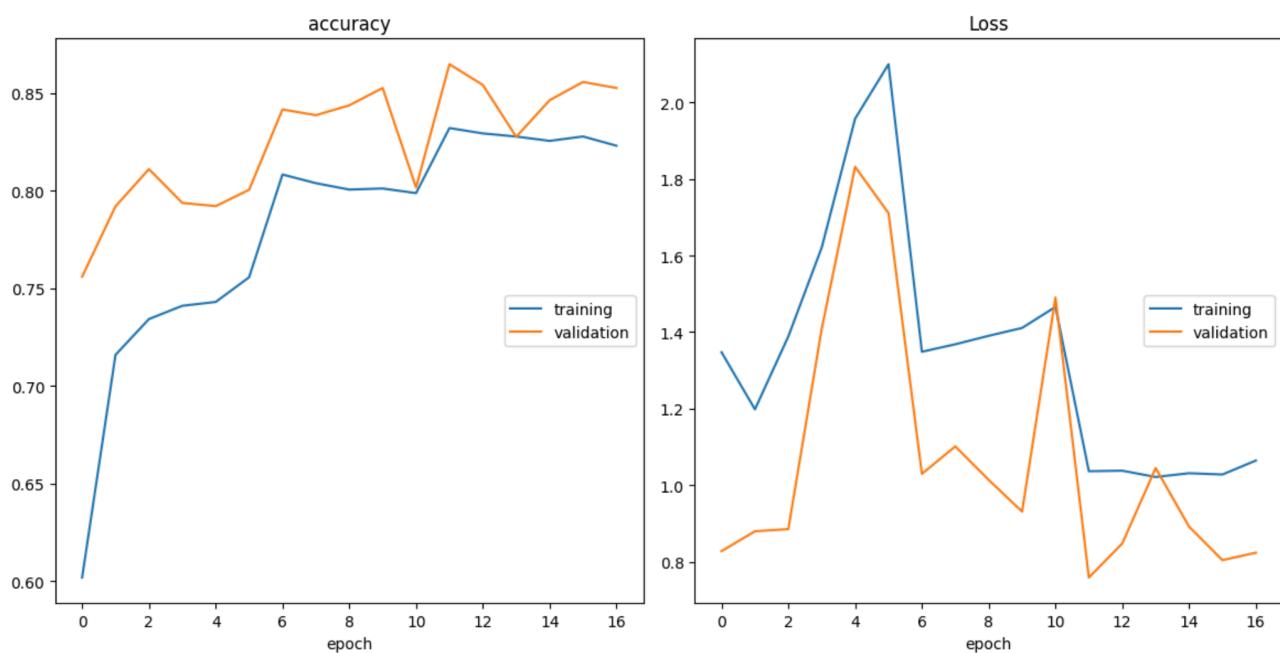


Observations:

- val_loss is going up from the beginning, therefore early stopping after epoch 6.

2nd training

- augmented
- batch_size = 32
- EarlyStopping monitors val_accuracy

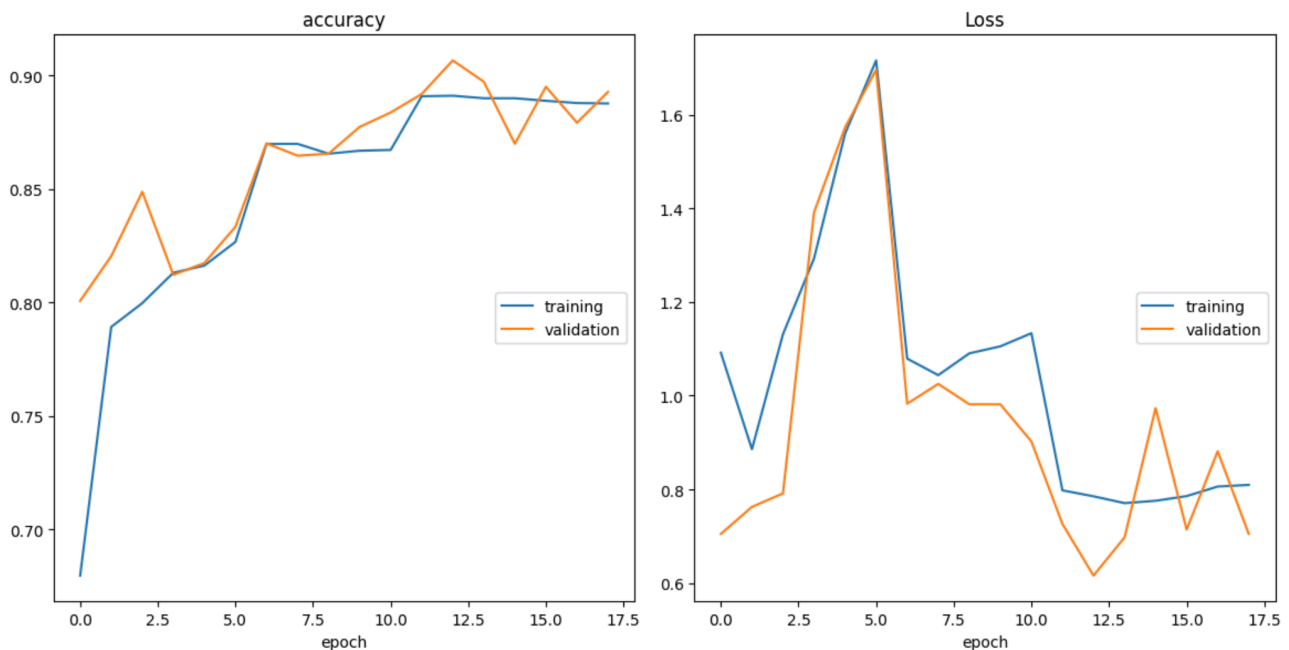


Observations:

- training stopped early again due to no improvement of the val_accuracy after it peaked in epoch 11 at 0.865.
- I continued training but this also terminated early after 6 epochs. val_accuracy is plateauing around 0.86 (fluctuation of 0.3-0.4 - can this be considered converged?).

3rd training

- non-augmented
- batch_size = 32
- EarlyStopping monitors val_accuracy



Observations:

- Early stopping after 18 epochs.
- The train accuracy is plateauing at around 0.88, val_accuracy is still fluctuating but close to training_accuracy
- The learning rate went down from 0.001 to 3e-4, which is already quite small. With this small LR, probably there won't be any improvement in terms of convergency. I will apply augmentations to the training set and continue training to see if val_accuracy improves or remains stable

4th training

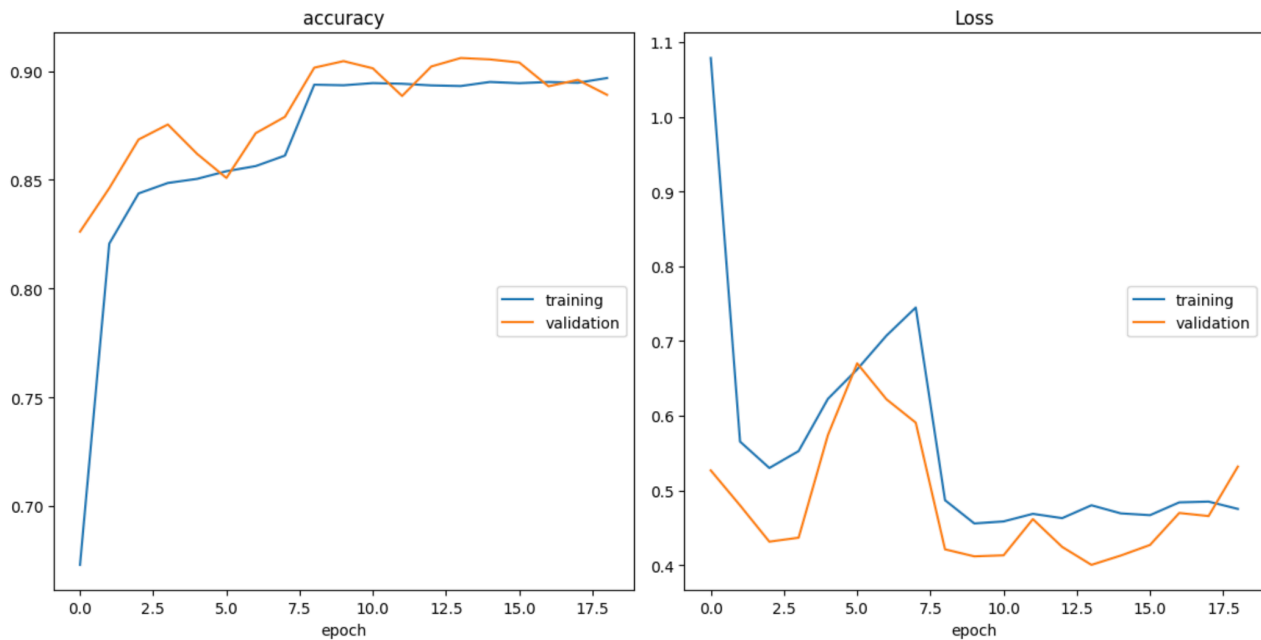
- augmented
- batch_size = 32
- EarlyStopping monitors val_accuracy

Observations:

- After applying augmentations, there is a drop in the accuracies and an increases in the losses. The val_accuracy is now plateauing around 0.86 which corresponds to the training performance where I applied augmentations right from the beginning. This leads me to the conclusion that, for this model, it does not make a difference wether I apply augmentations directly or I first train the model without it and apply it later on.
- In my view, the LR is going down quite early with the effect that there is not much progress after some epochs.

5th training

- non-augmented
- batch_size = 64
- EarlyStopping monitors val_accuracy

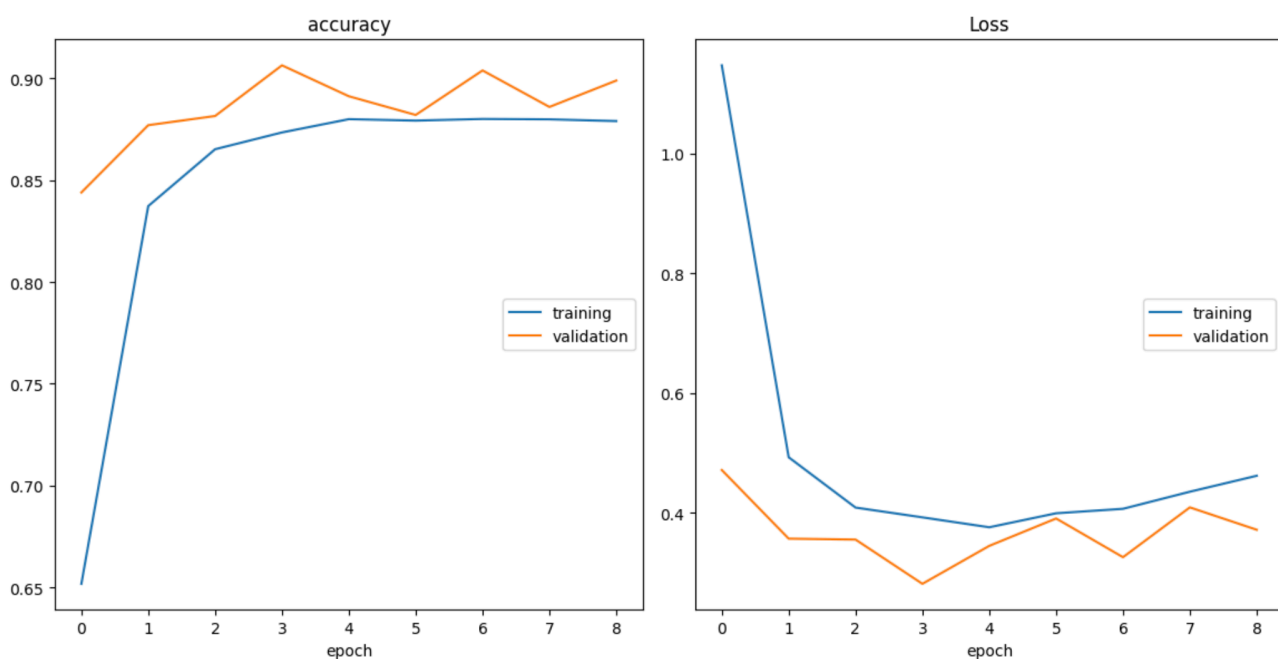


Observations:

- compared to the training with batch_size=32, accuracies are higher and better converged, and losses are also lower.
- LR reduces (only) to 0.0005 after 7 epochs. This reduction seems to improve the accuracies (observable kink in the training_accuracy at epoch 8)

6th training

- non-augmented
- batch_size = 128
- EarlyStopping monitors val_accuracy

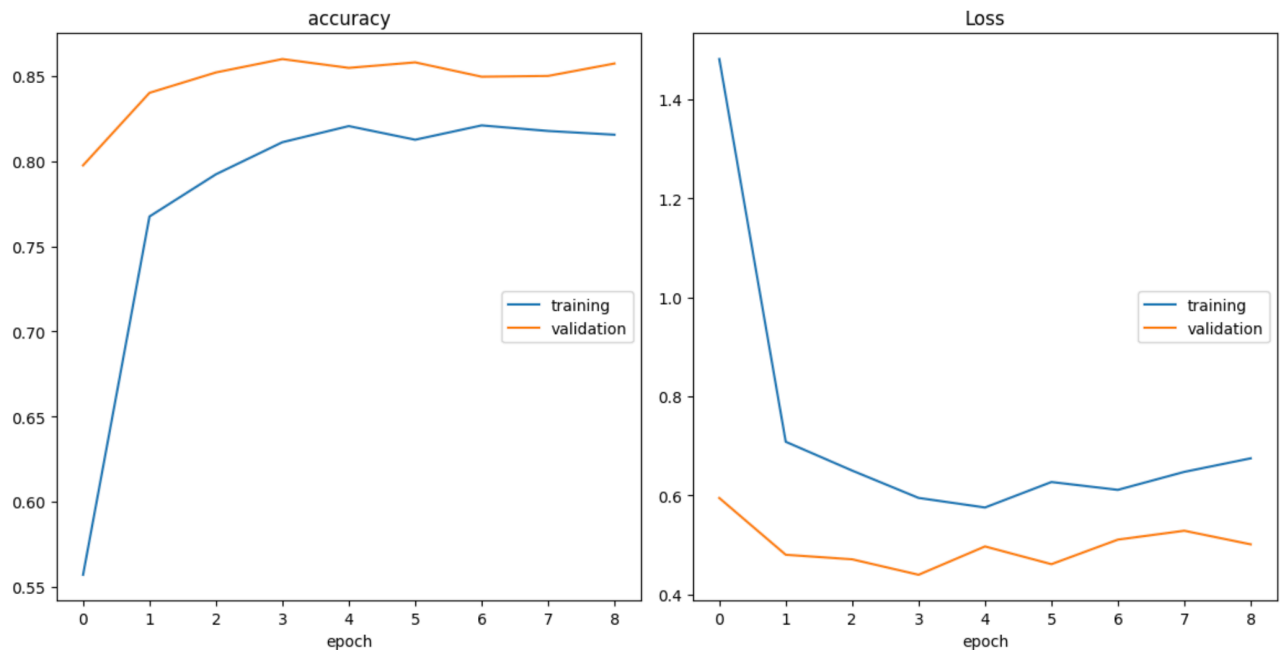


Observations:

- Early stopping after 8 epochs probably because the accuracies are quite converged after some epochs
- Same maximal val_accuracy (0.906) than for the training before with batch_size=64

7th training

- augmented
- batch_size = 128
- EarlyStopping monitors val_accuracy



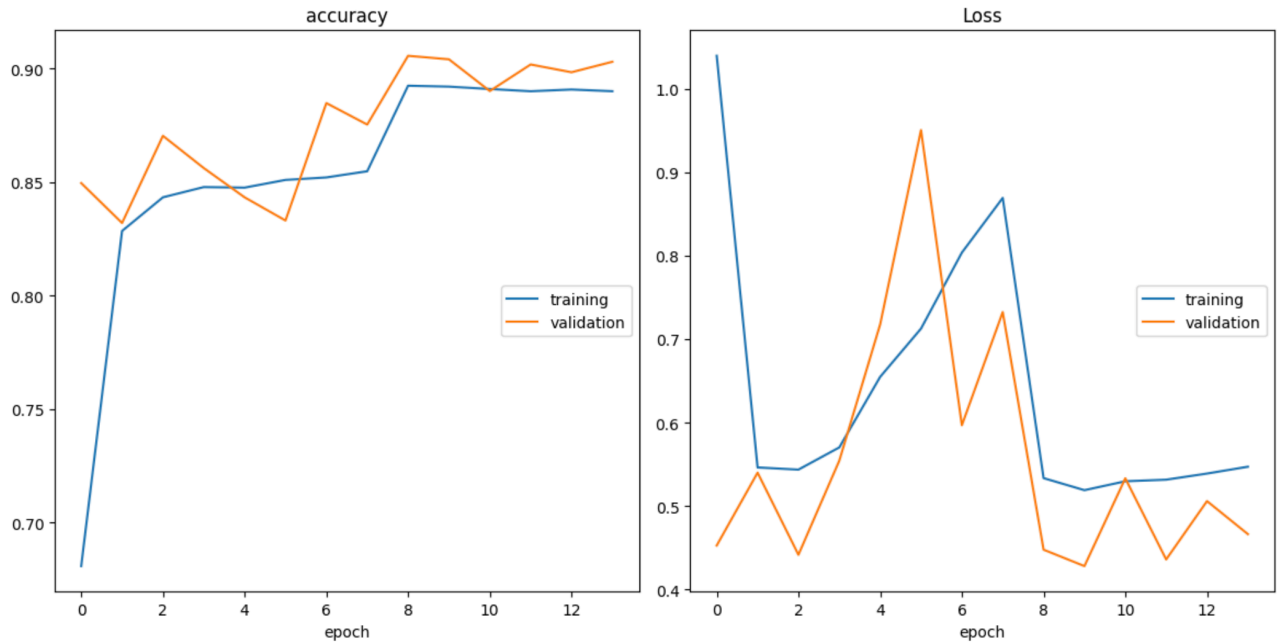
Observations:

- Again early stopping after 8 epochs since the val_accuracy is plateauing very early.
- Maximum val_accuracy of 0.86 (again comparable with the augmented/batch_size=32 training run)

2. EXTRACTION AND FINE-TUNING:

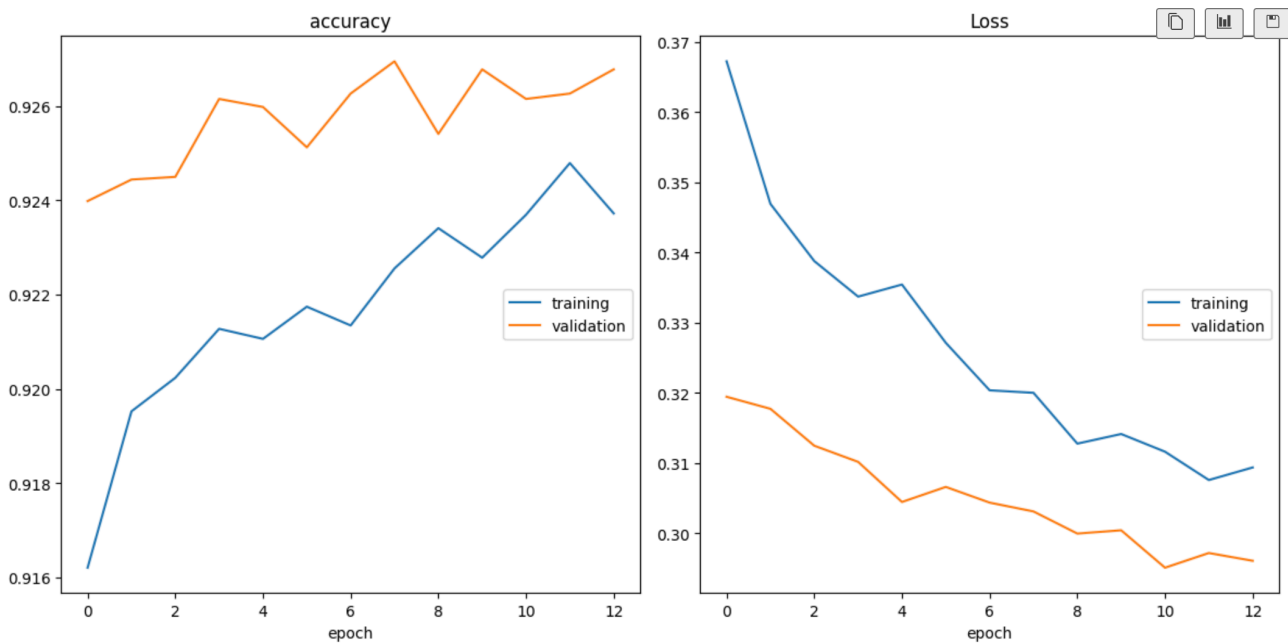
Base training

- non-augmented
- batch_size = 64
- EarlyStopping monitors val_accuracy
- All base layers frozen



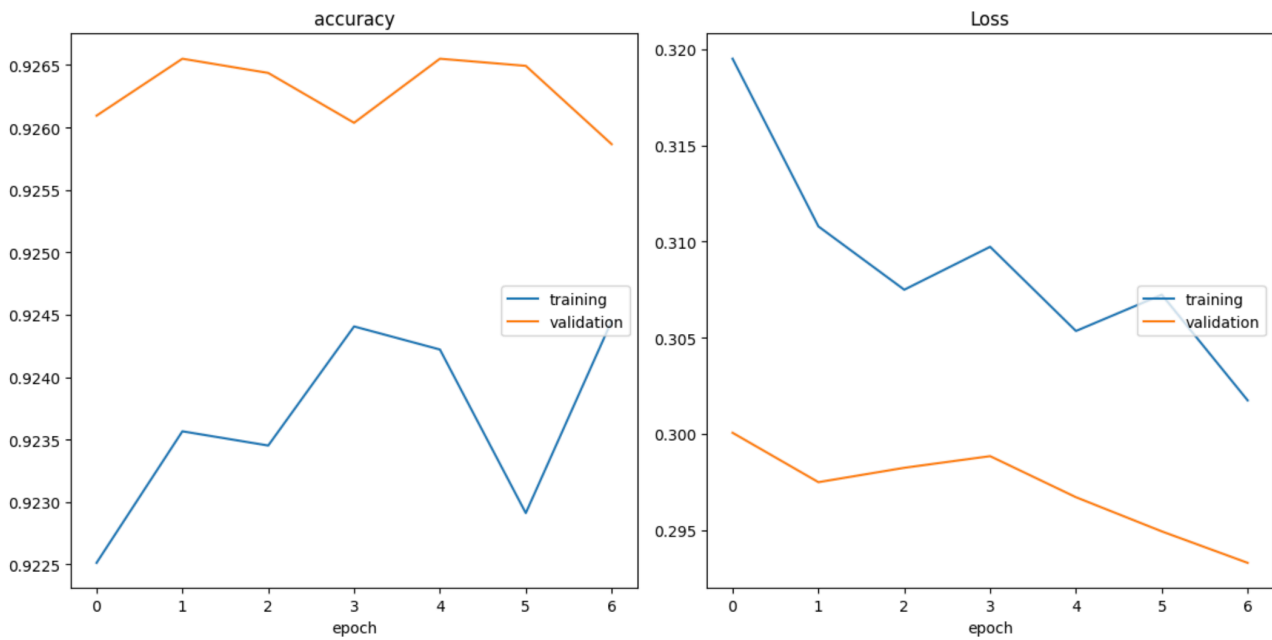
Fine-tuning 1:

- Start from saved model with the best val_accuracy during the base training
- Unfreeze last 3 base layers
- Set small LR ($1e-5$)



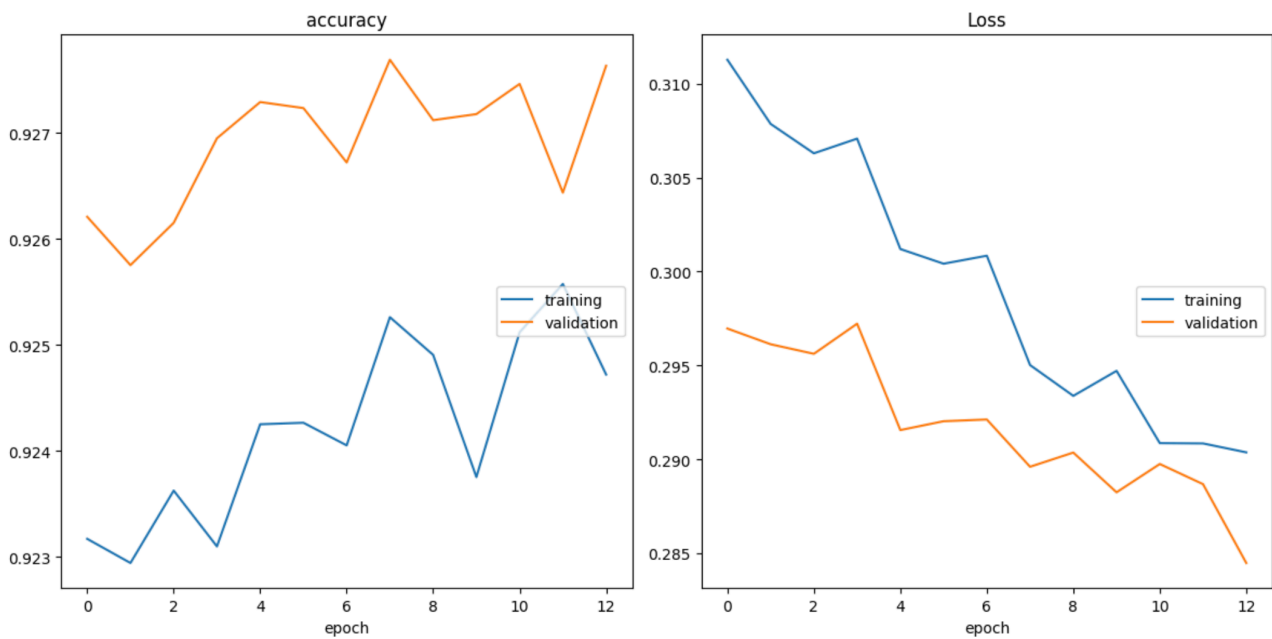
Fine-tuning 2:

- Unfreeze last 6 base layers



Fine-tuning 3:

- Unfreeze last 20 base layers



Observations:

- Early Stopping after epoch 12
- The val_accuracy peaked at 0.928
- One could try a continuation with a completely unfrozen base model but a stopped here for now.

Test set predictions:

Correct

1 0.878788

0 0.121212

	Predictions	True_classes	Correct
0	Squash___Powdery_mildew	AppleScab3.JPG	0
1	Tomato___Late_blight	TomatoEarlyBlight2.JPG	1
2	Tomato___Target_Spot	TomatoEarlyBlight3.JPG	0
3	Potato___healthy	PotatoHealthy1.JPG	1
4	Apple___Apple_scab	AppleScab2.JPG	1
5	Tomato___Early_blight	TomatoEarlyBlight1.JPG	1
6	Potato___healthy	PotatoHealthy2.JPG	1
7	Apple___Apple_scab	AppleScab1.JPG	1
8	Tomato___Early_blight	TomatoEarlyBlight4.JPG	1
9	Tomato___Target_Spot	TomatoEarlyBlight5.JPG	0
10	Tomato___Early_blight	TomatoEarlyBlight6.JPG	1
11	Potato___Early_blight	PotatoEarlyBlight4.JPG	1
12	Potato___Early_blight	PotatoEarlyBlight5.JPG	1
13	Potato___Early_blight	PotatoEarlyBlight2.JPG	1
14	Potato___Late_blight	PotatoEarlyBlight3.JPG	0
15	Potato___Early_blight	PotatoEarlyBlight1.JPG	1
16	Tomato___Tomato_Yellow_Leaf_Curl_Virus	TomatoYellowCurlVirus2.JPG	1
17	Tomato___Tomato_Yellow_Leaf_Curl_Virus	TomatoYellowCurlVirus3.JPG	1
18	Tomato___Tomato_Yellow_Leaf_Curl_Virus	TomatoYellowCurlVirus1.JPG	1
19	Tomato___healthy	TomatoHealthy4.JPG	1
20	Tomato___Tomato_Yellow_Leaf_Curl_Virus	TomatoYellowCurlVirus4.JPG	1
21	Tomato___healthy	TomatoHealthy1.JPG	1
22	Tomato___Tomato_Yellow_Leaf_Curl_Virus	TomatoYellowCurlVirus5.JPG	1
23	Tomato___healthy	TomatoHealthy3.JPG	1
24	Tomato___healthy	TomatoHealthy2.JPG	1
25	Tomato___Tomato_Yellow_Leaf_Curl_Virus	TomatoYellowCurlVirus6.JPG	1
26	Apple___Cedar_apple_rust	AppleCedarRust2.JPG	1
27	Corn_(maize)___Common_rust_	CornCommonRust1.JPG	1
28	Apple___Cedar_apple_rust	AppleCedarRust3.JPG	1
29	Apple___Cedar_apple_rust	AppleCedarRust1.JPG	1
30	Corn_(maize)___Common_rust_	CornCommonRust2.JPG	1
31	Corn_(maize)___Common_rust_	CornCommonRust3.JPG	1
32	Apple___Cedar_apple_rust	AppleCedarRust4.JPG	1