

# A small flowers classifier from a little dataset to 102 categories

Advanced Machine Learning Final Project



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# Goals

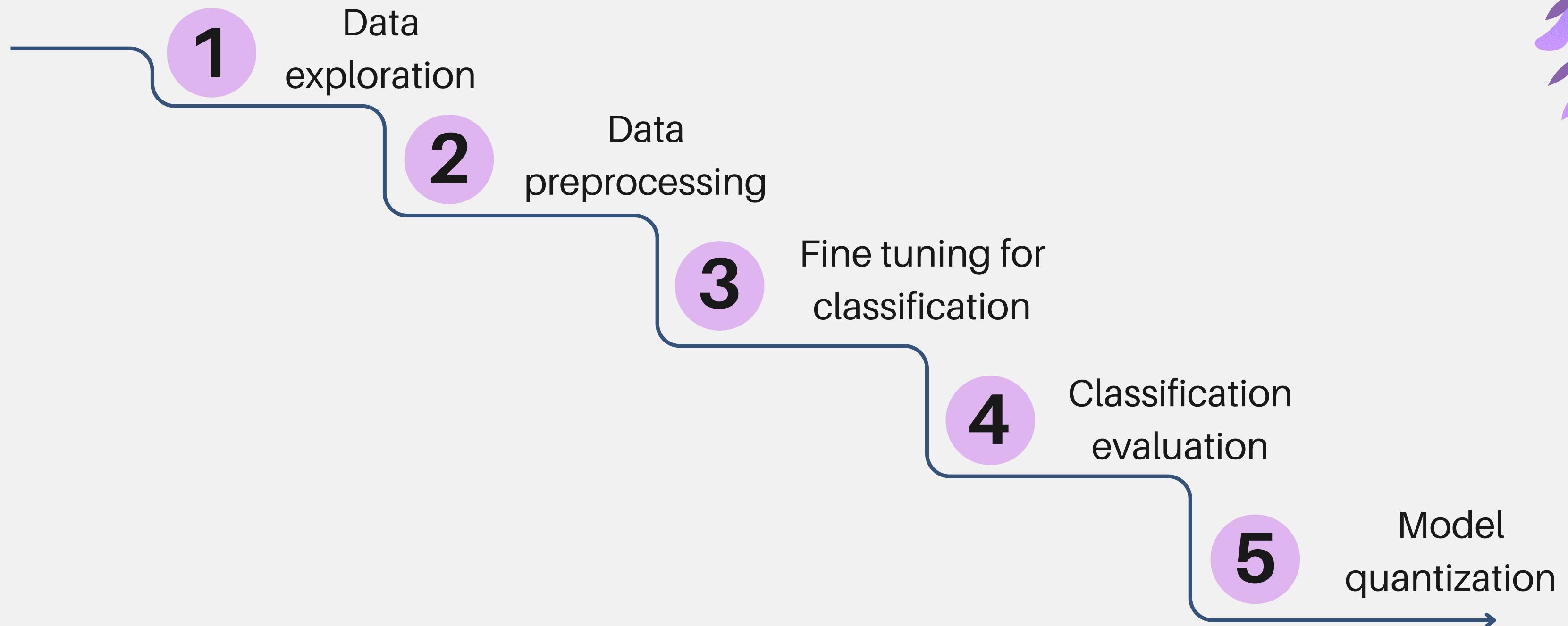
1

Training of a high-performance model for  
*102 Category Flower Dataset*

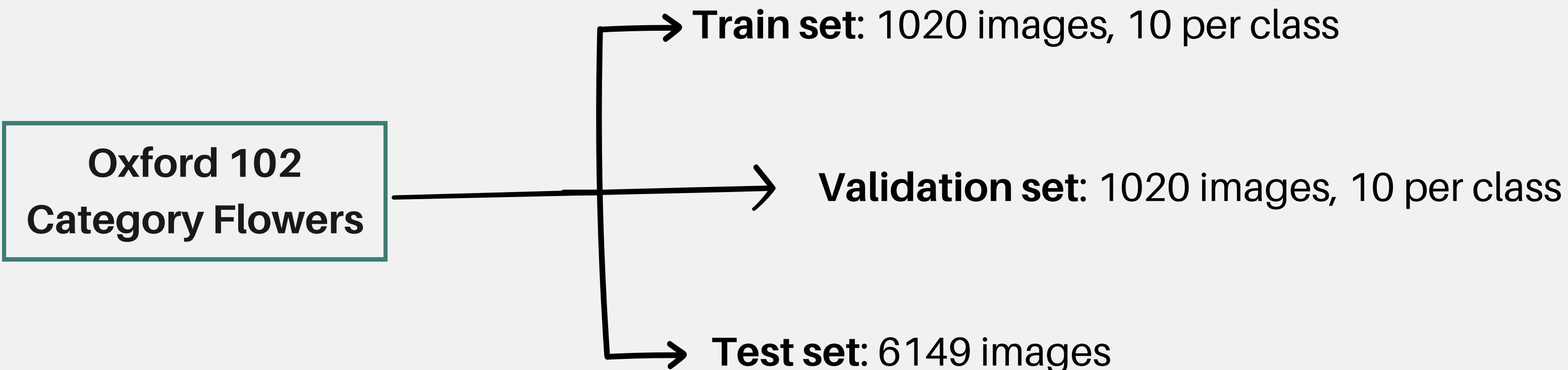
2

Training a high-performance model for 102 Category  
Flower Dataset with a small size

# The pipeline

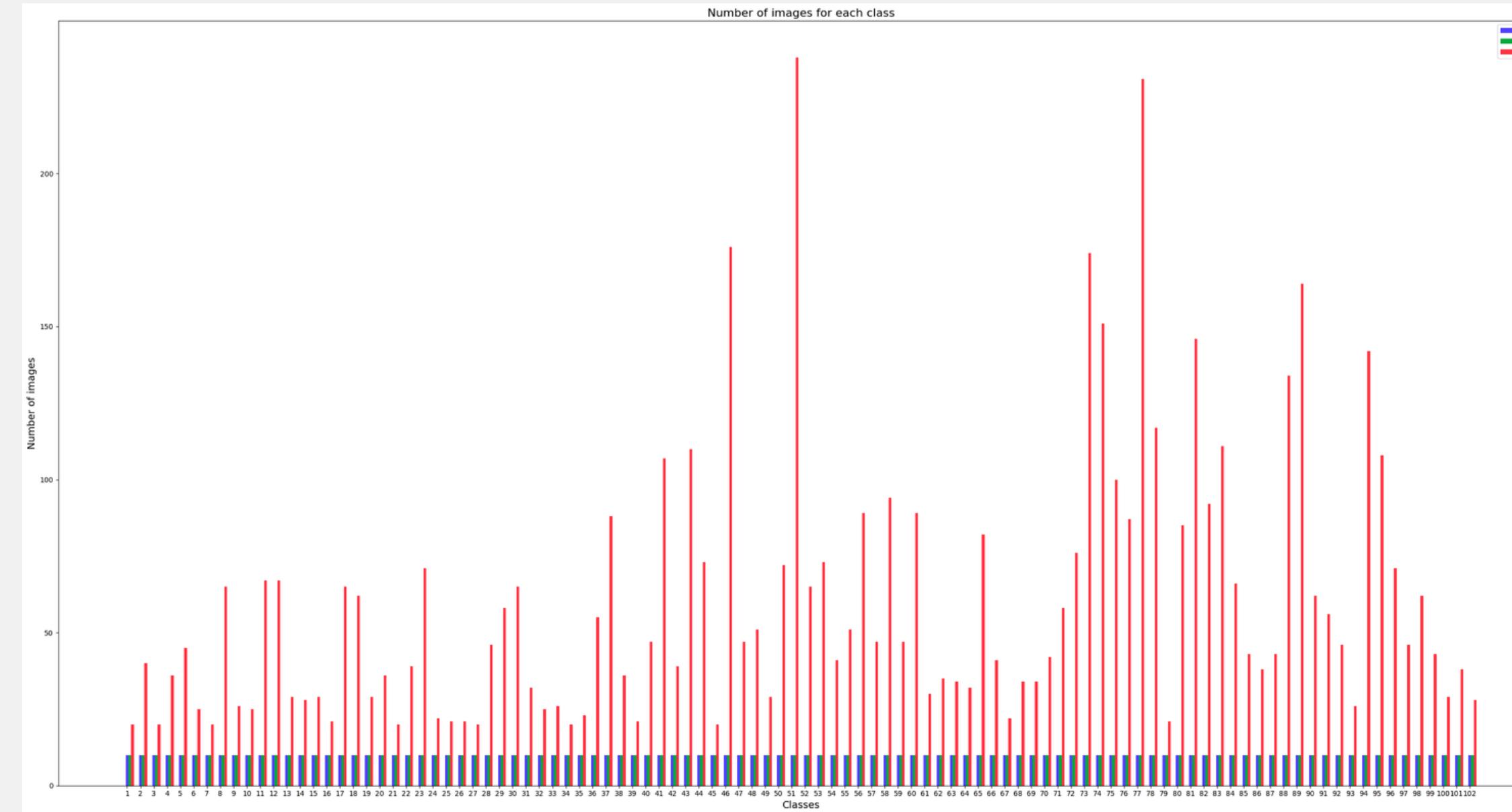


# ➤ Data exploration



**Test set size >> Train set size**

# ➤ Data exploration



# ➤ Data preprocessing

1

## **Preprocess function**

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Preprocess input function for all pre trained model used.

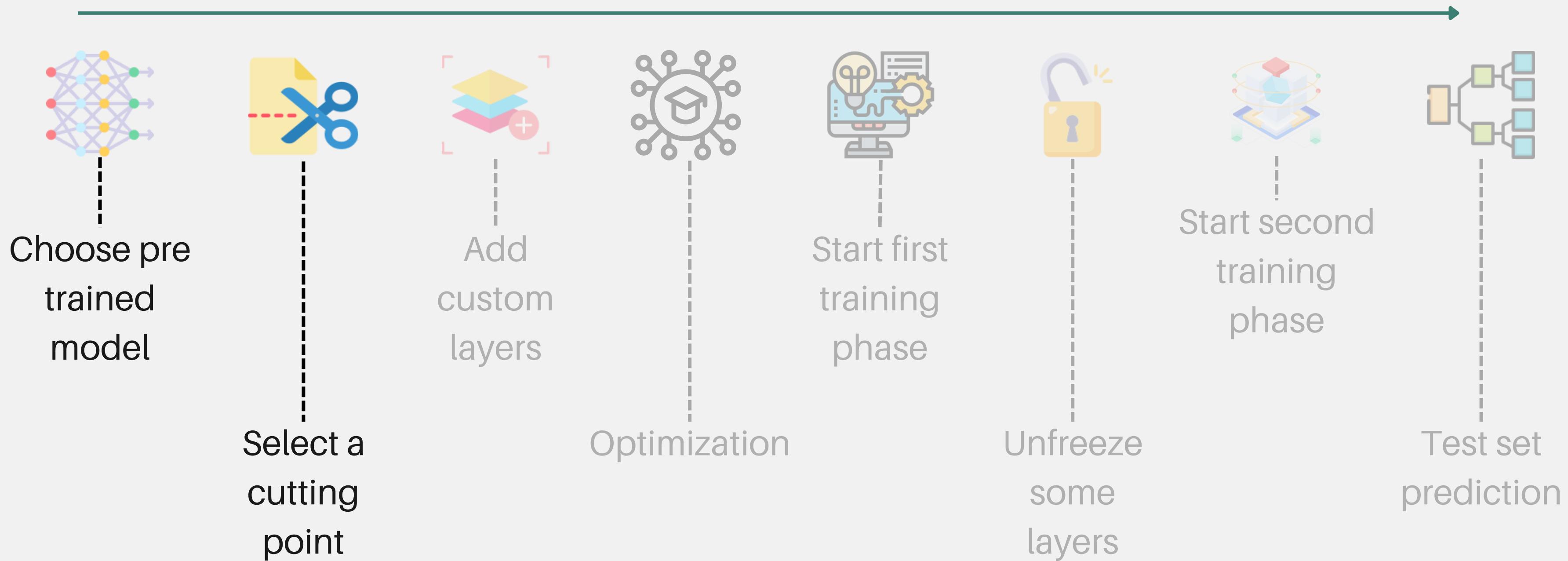
2

## **Data augmentation**

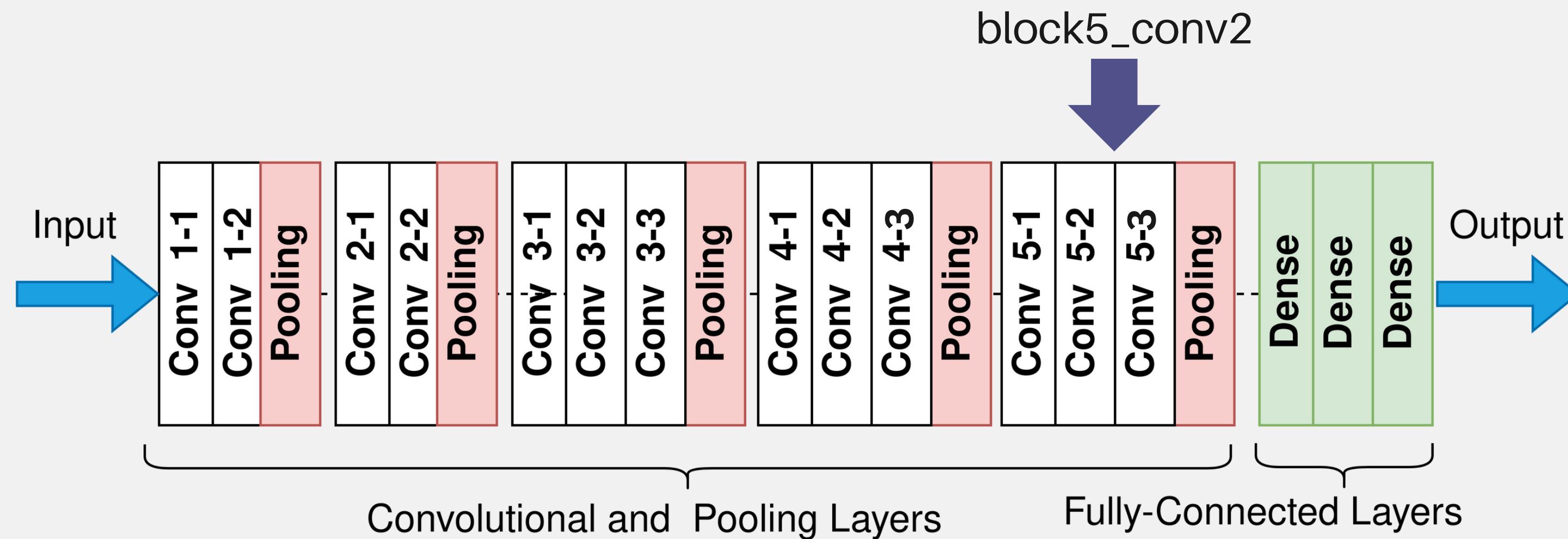
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- rotation range of 20
- brightness range [0.7, 1.3]
- zoom range [0.8, 1.2]
- orizontal flip

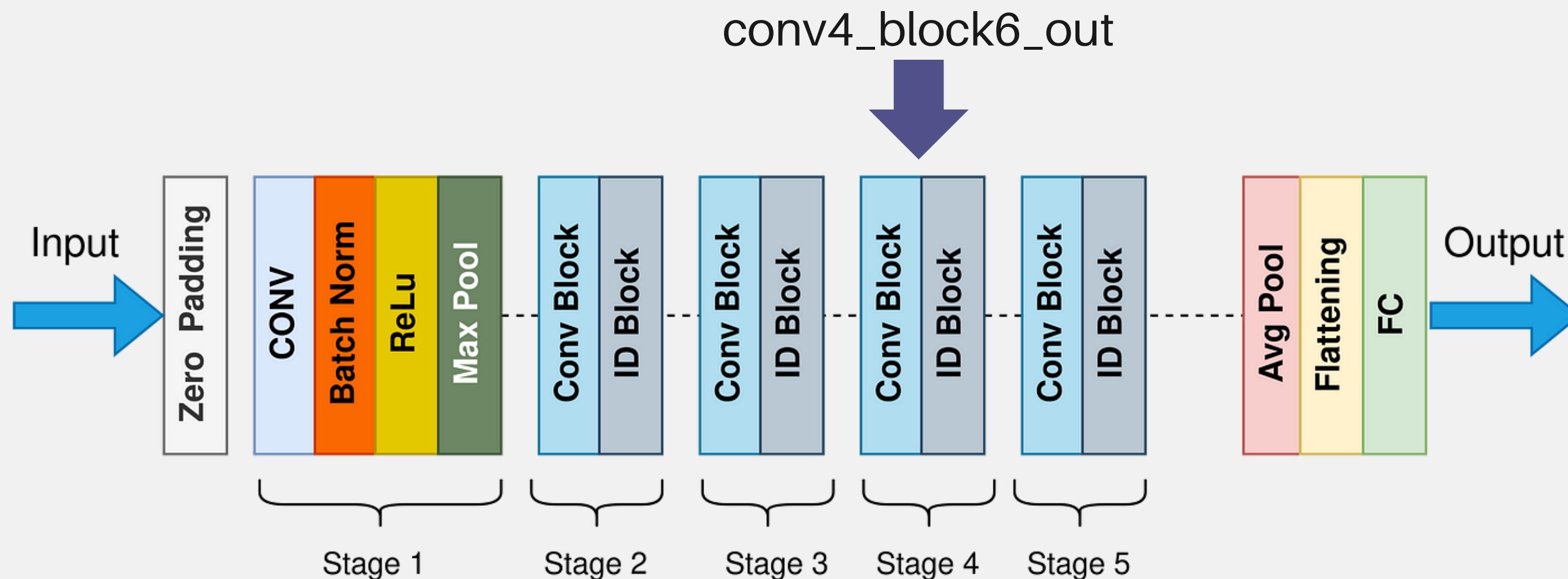
# ➤ Transfer learning: Fine tuning



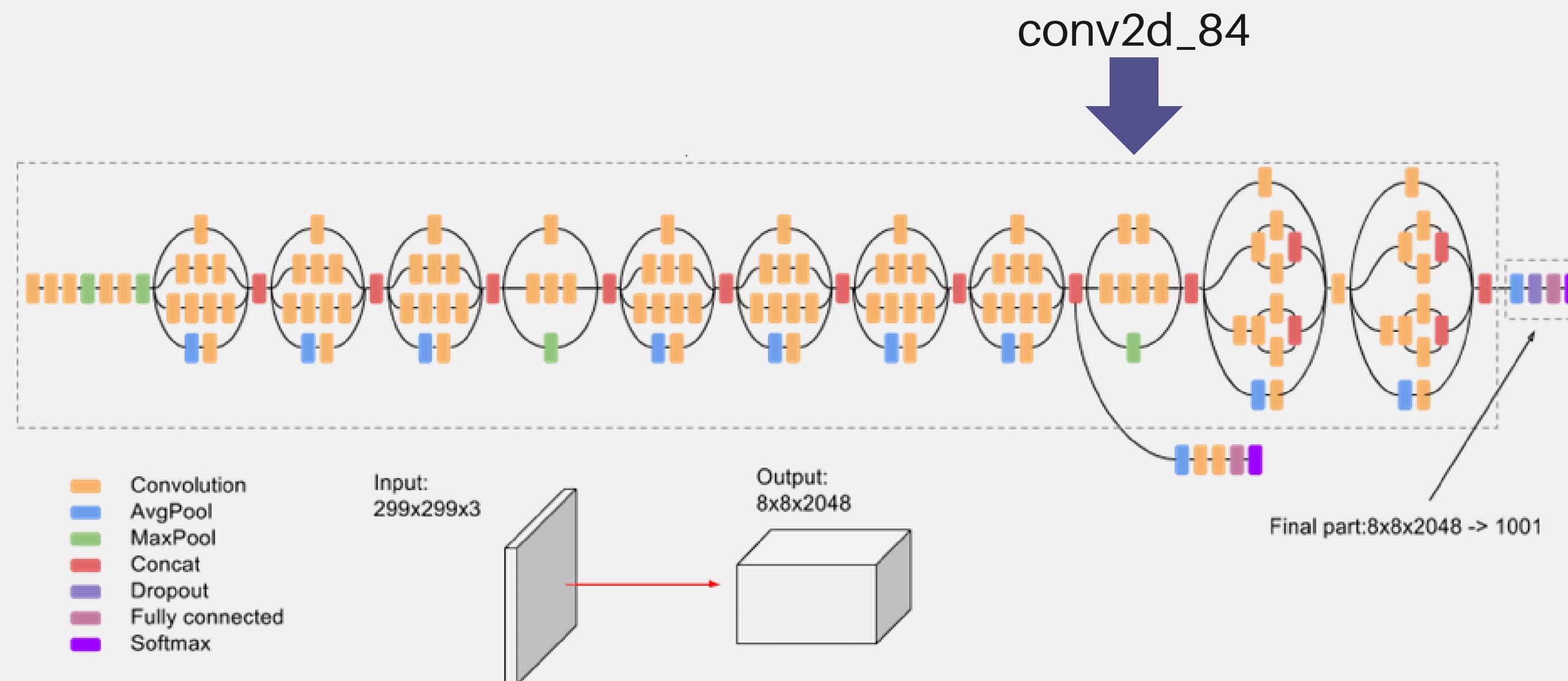
# ► Pre trained models: VGG16



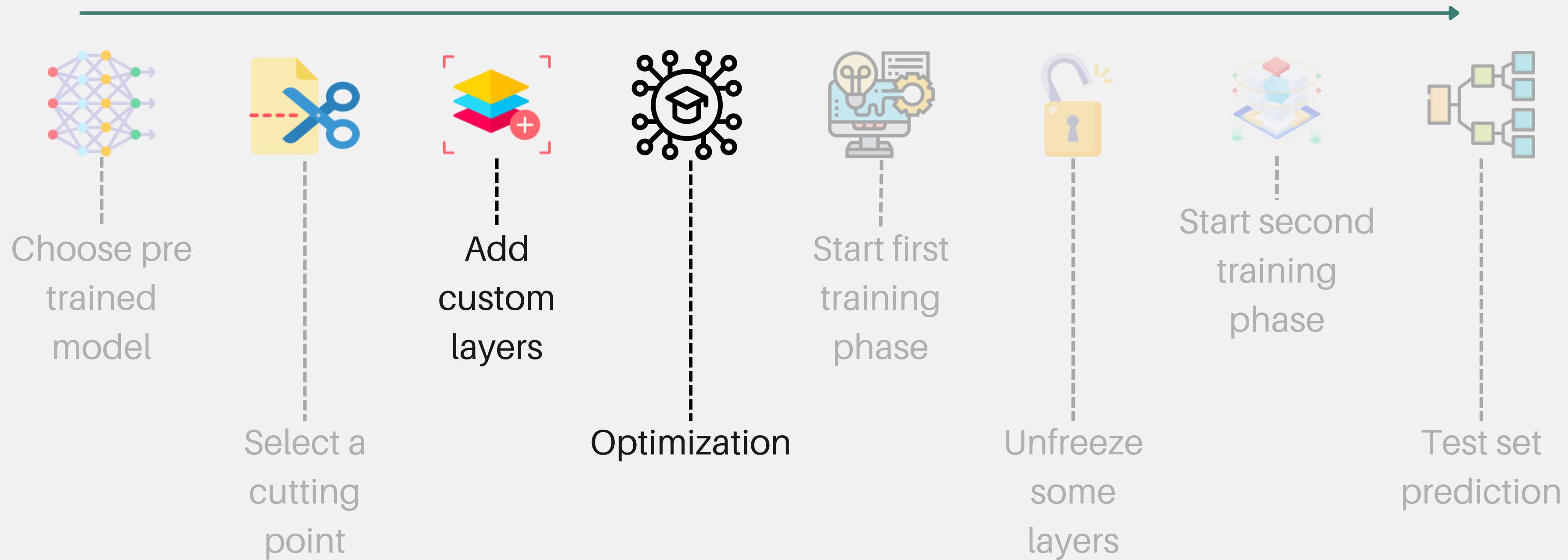
# ► Pre trained models: ResNet50



# ► Pre trained models: InceptionV3



# ➤ Transfer learning: Fine tuning



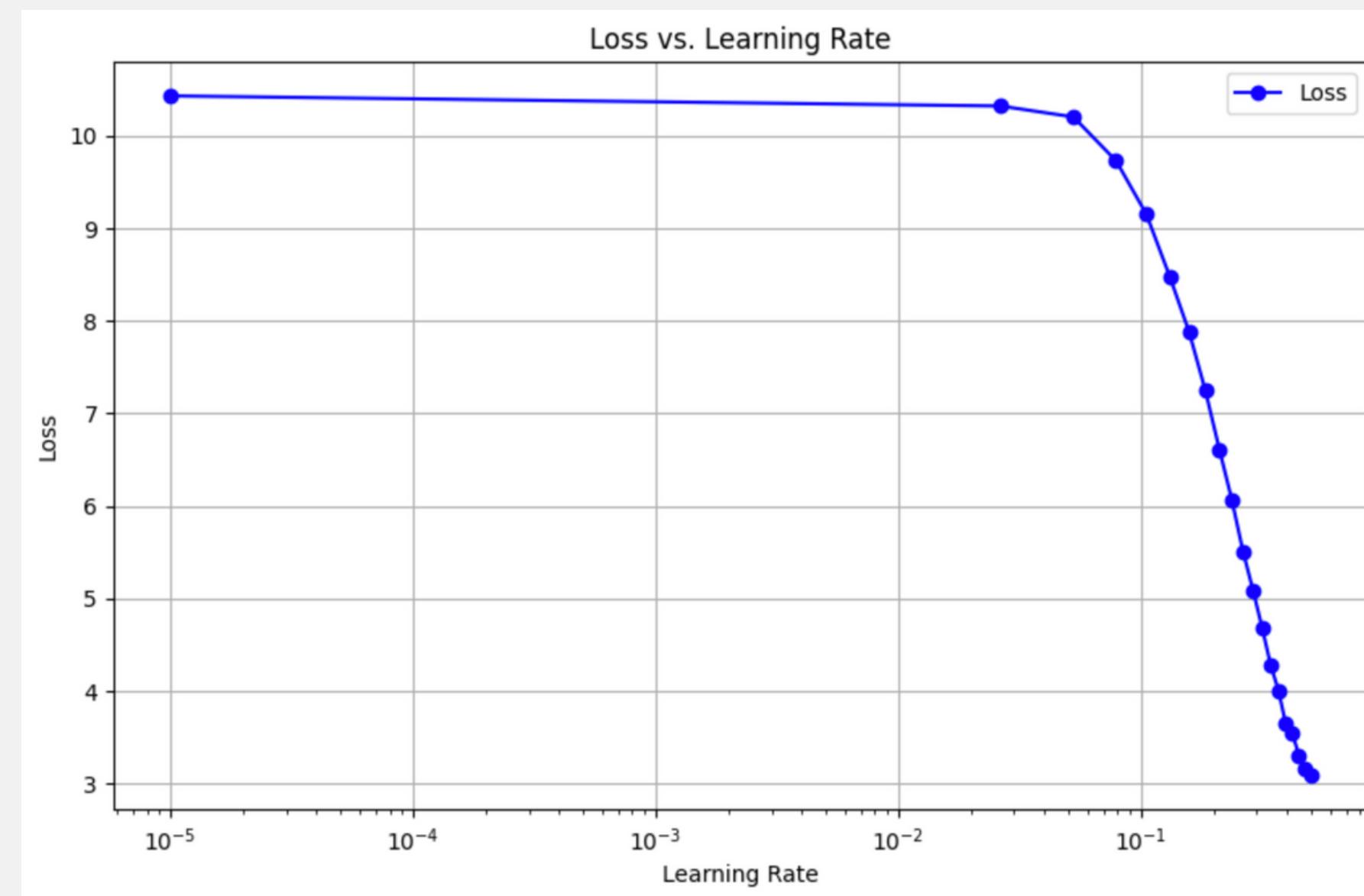
# ► Optimization: to counteract overfitting



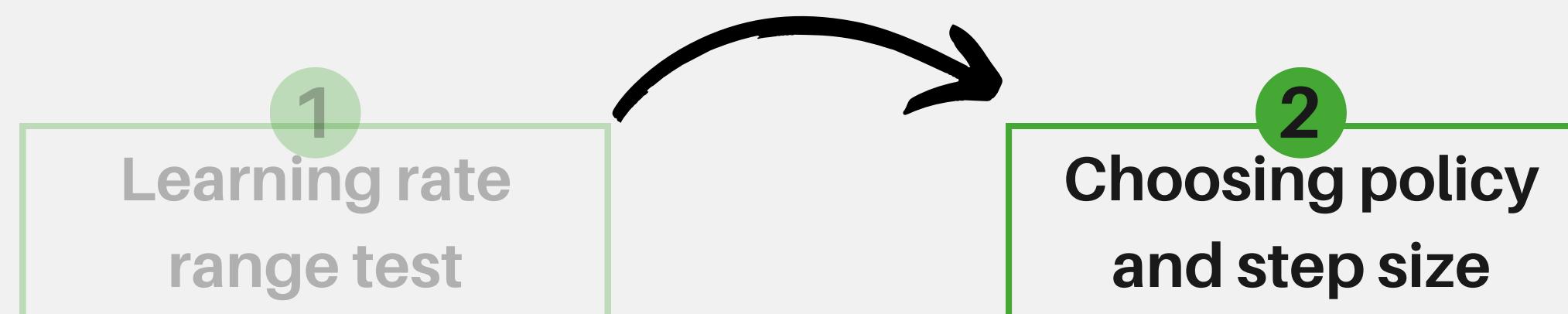
# ► Optimization: Cyclic learning rate scheduler

1

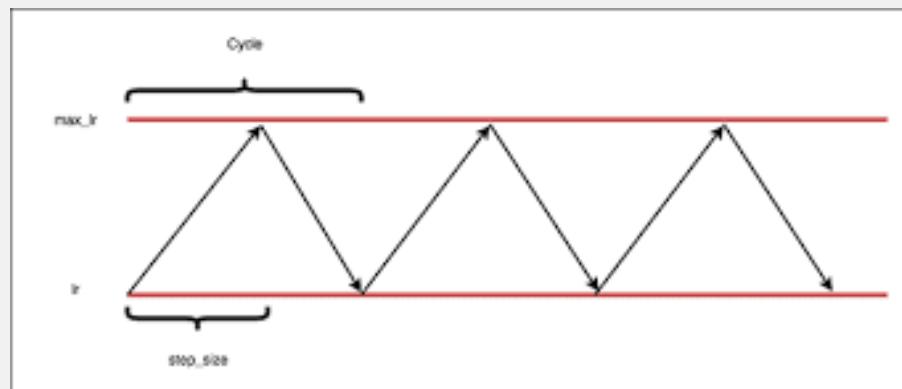
Learning rate range test



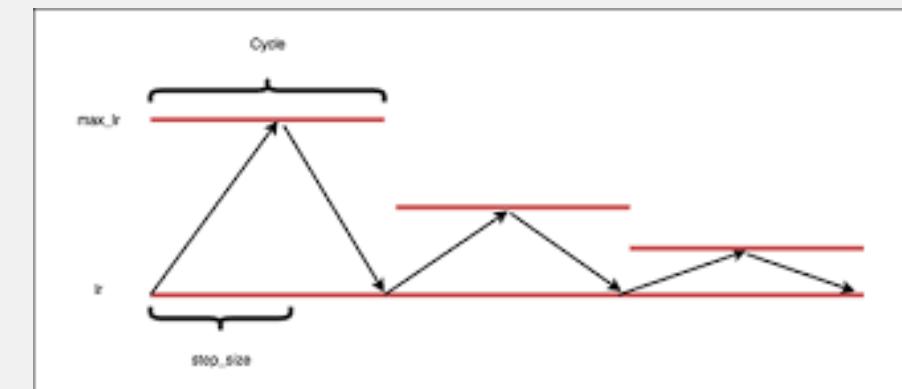
# ► Optimization: Cyclic learning rate scheduler



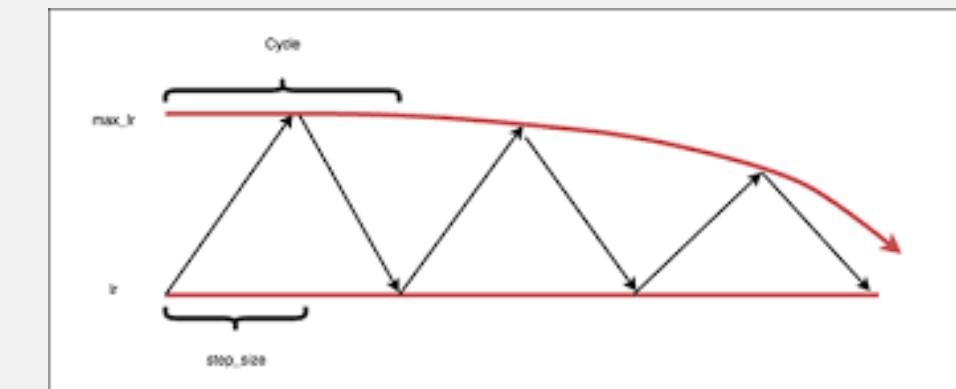
Triangular



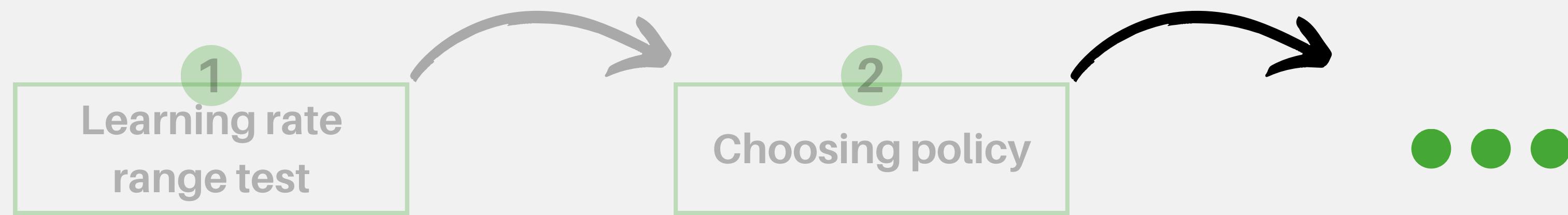
Triangular2



Exp\_range



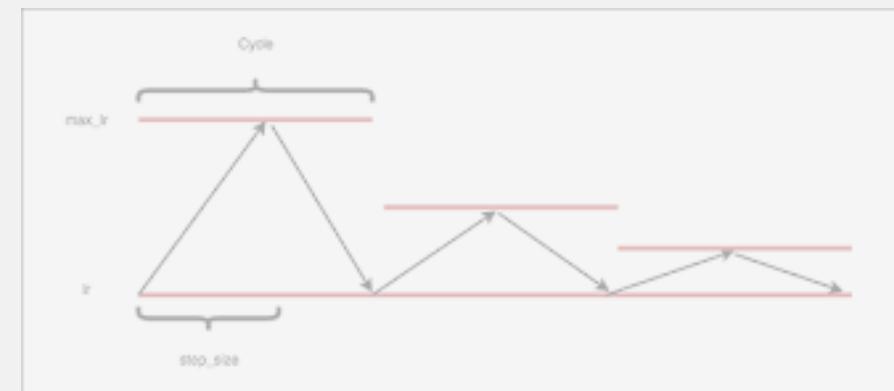
# ► Optimization: Cyclic learning rate scheduler



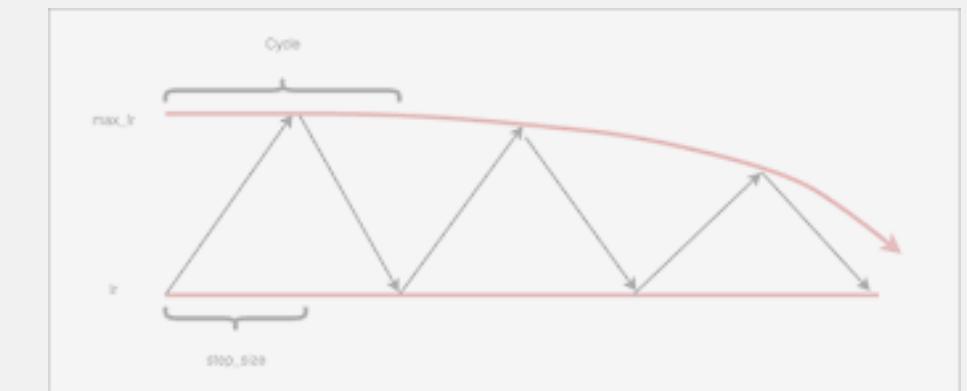
Triangular



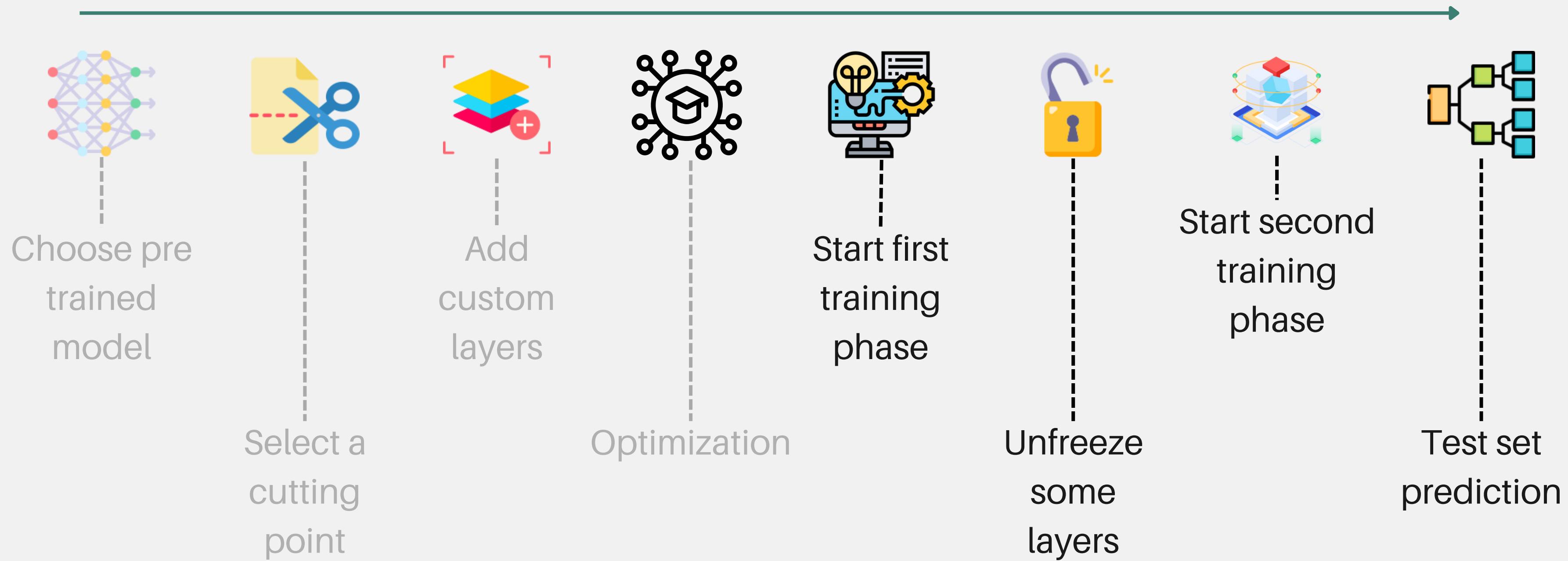
Triangular2



Exp\_range



# ➤ Transfer learning: Fine tuning



# ➤ Fine tuning results: performance

MODEL	Batch size	Step size	Policy	Optimizer	Test loss before unfreeze	Test accuracy before unfreeze	Unfreeze layers	Test loss post unfreeze	Test accuracy after unfreeze
VGG16	64	16	triangular2	SGD	0.7686	0.8037	5	0.6731	0.8291
ResNet50	64	4	triangular	SGD	2.0619	0.7441	20	1.2464	0.8446
Inception V3	64	2	triangular	SGD	0.6209	0.8333	10	0.5154	0.8614

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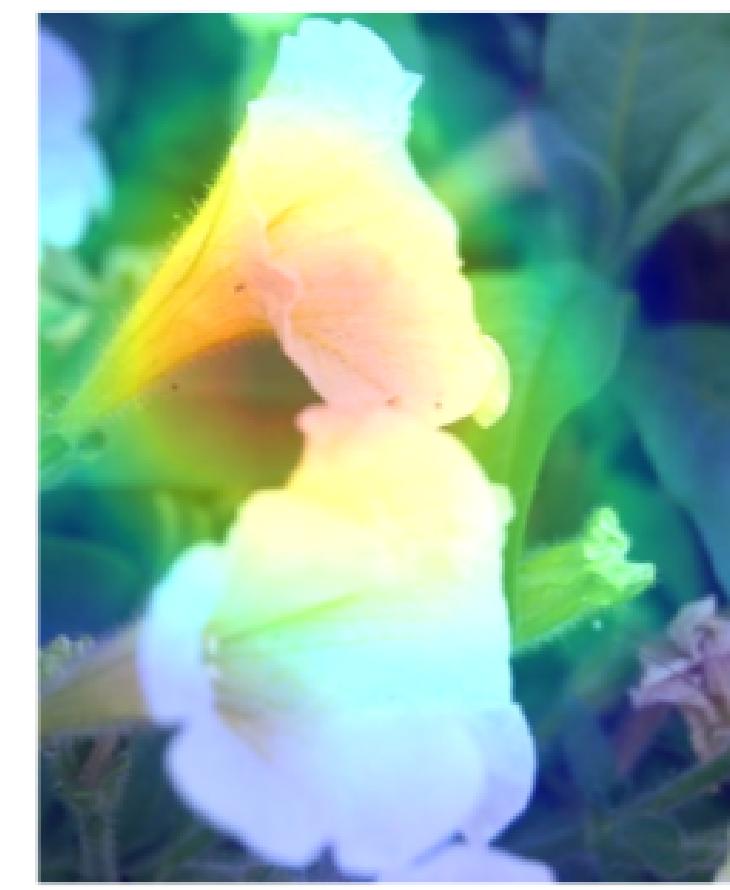
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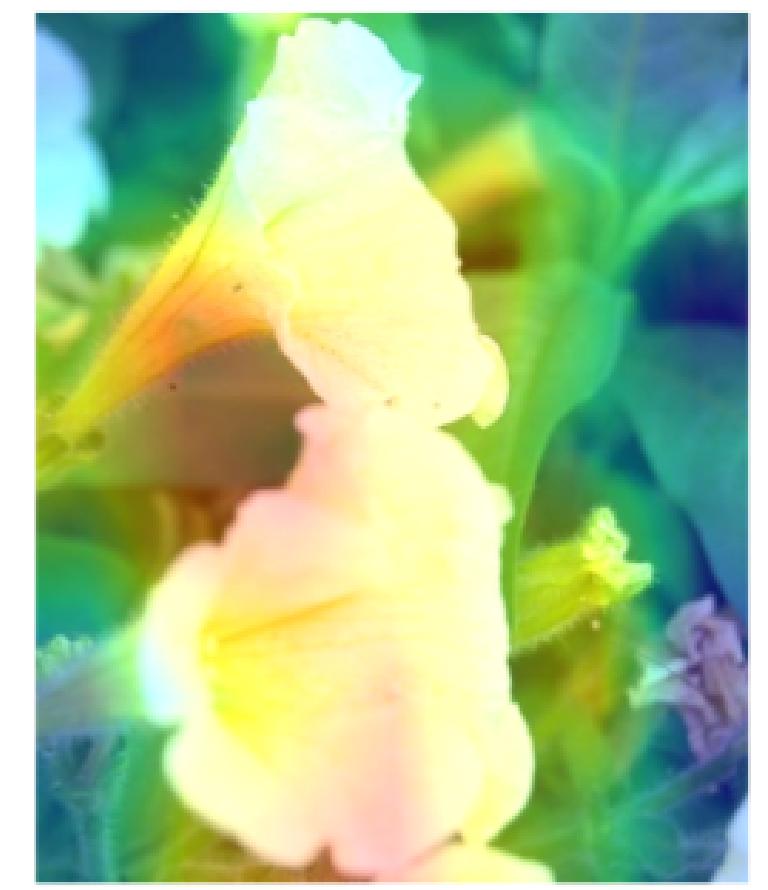
# ➤ Training evaluation: grad-CAM



VGG16



InceptionV3



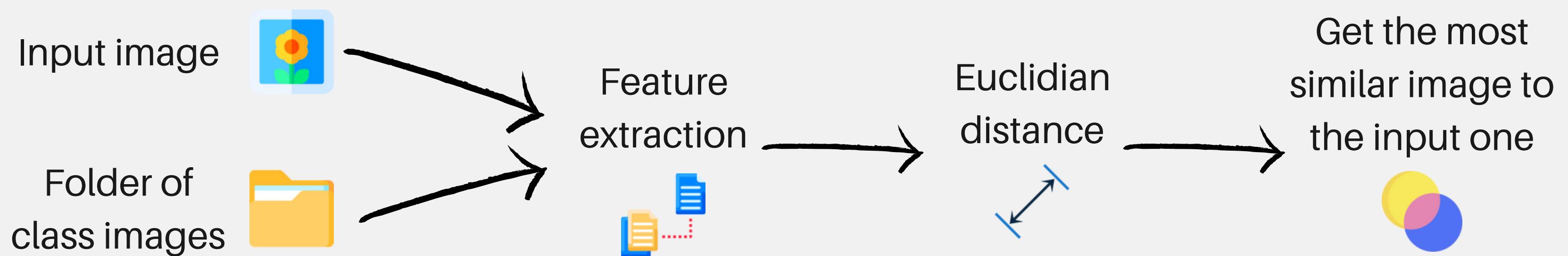
ResNet50

# ► Classification evaluation: misclassification



From the skearn report it was possible to identify  
the worse prediction classes of the model

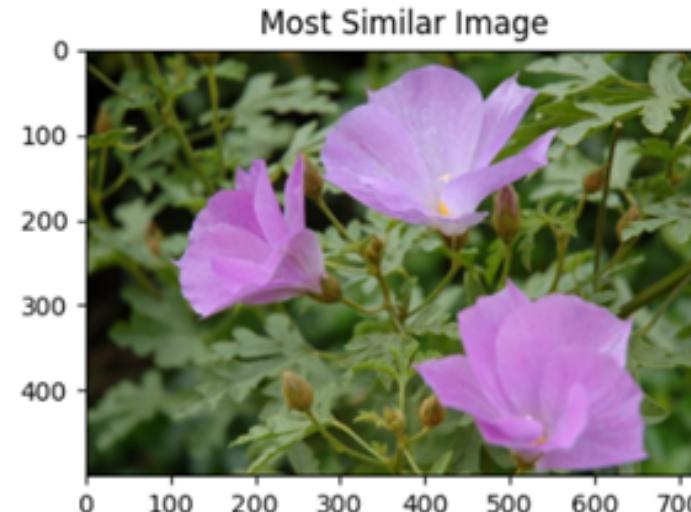
# ► Classification evaluation: image-similarity-search



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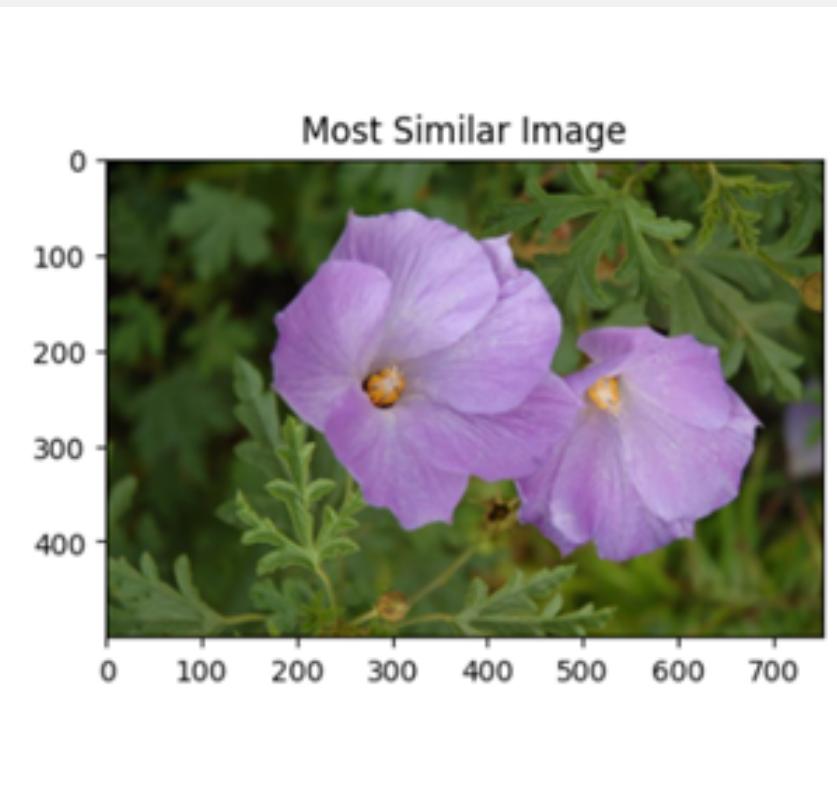
True label: 3



Predicted label: 55

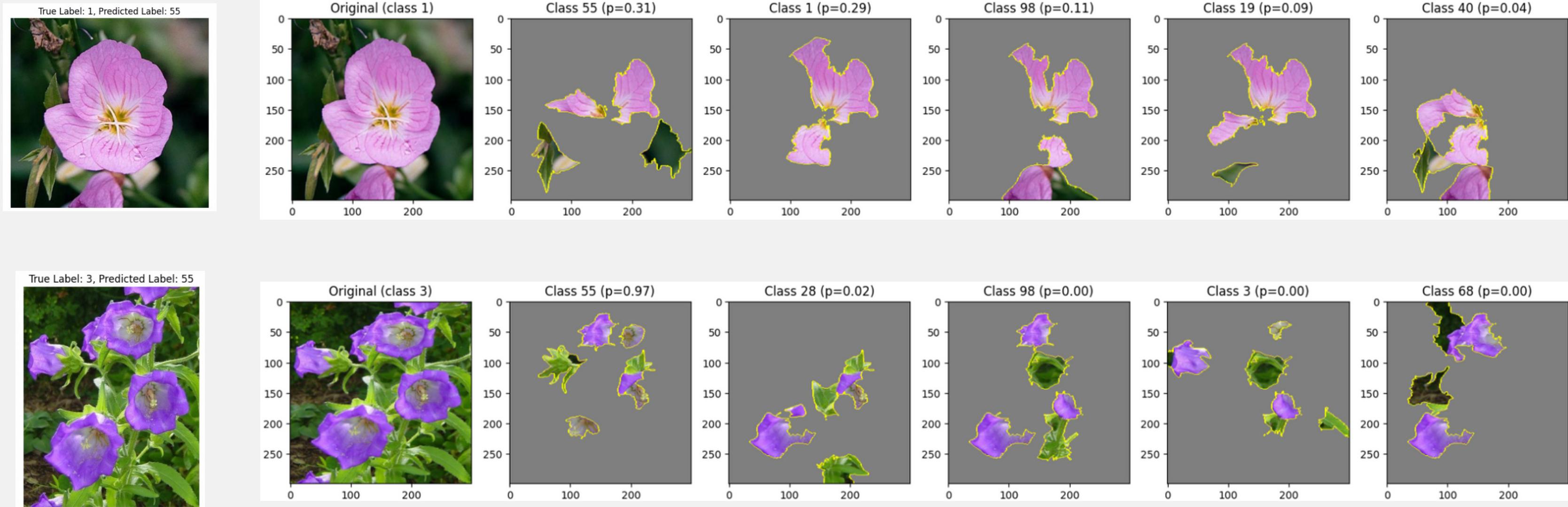


True label: 1



Predicted label: 55

# ➤ Classification evaluation: LIME model explanation



# ➤ Model quantization



## Why?

- Small size
- Same performances

→ Model can be used on devices with limited computational resources



## How?

- Post training quantization
- TensorFlow Lite Converter

- TensorFlow Lite model
- 16-bit floating-point (FP16)
- 8-bit integer (INT8)



## Result

	Keras	TF Lite	Float-16	Int-8
SIZE	80.6 MB	42.2 MB	21.1 MB	10.9 MB
ACCURACY	0.8614	0.8614	0.8612	0.8611

# ➤ Conclusion



Training of a high-performance model for  
*102 Category Flower Dataset*



***InceptionV3:***  
86.14 % accuracy



Training a high-performance model for 102  
Category Flower Dataset with a small size



***InceptionV3 with INT8  
quantization:***  
10.9 MB  
86.11 % accuracy



# Future works

1

Experimentation with more pre-trained models

2

Increasing performance with emsebled techniques

3

Creation of a GAN model for generating new flower  
images



**Thanks for  
your attention**

Eleonora Cicalla  
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