```
1 !pwd
```

```
/content
```

1 Import Libraries

```
[ ]  ↳ 1 Zelle ausgeblendet
```

Import the usual suspects ... 🧛🧟🧟

```
[ ]  ↳ 2 Zellen ausgeblendet
```

And some new friends ... 🐝🦋🦄

```
1 import os
2 from fastai.metrics import error_rate, accuracy
```

2 Getting the Data

```
1 destination = Path("/content/gdrive/My Drive/fastai/unpackai/flowers")
2 path = destination
3 path
```

```
Path('/content/gdrive/My Drive/fastai/unpackai/flowers')
```

```
1 for flower in os.listdir("/content/gdrive/My Drive/fastai/unpackai/flowers"):
2   x = os.listdir("/content/gdrive/My Drive/fastai/unpackai/flowers/"+flower)
3   print(flower,": ",len(x))
```

```
rose :  784
tulip :  984
dandelion :  983
daisy :  769
sunflower :  732
```

3 Prepare for Training

```
1 fns = get_image_files(path)
2 fns
```

```
(#4249) [Path('/content/gdrive/My Drive/fastai/unpackai/flowers/rose/4503599544_3822e7d1be.jpg'),Path('/conten
```

```
1 failed = verify_images(fns)
2 failed
```

```
(#0) []
```

DataBlock

```
1 flowers = DataBlock(
2     blocks=(ImageBlock, CategoryBlock),
```

```
3    get_items=get_image_files,
4    splitter=RandomSplitter(valid_pct=0.25, seed=42),
5    get_y=parent_label,
6    item_tfms=Resize(128))
```

DataLoader

```
1 dls = flowers.dataloaders(path)
```

Investigate Dataset

```
1 #Show labels
2 dls.vocab
```

```
['daisy', 'dandelion', 'rose', 'sunflower', 'tulip']
```

```
1 # Size of Datasets
2 print("Total: ", dls.n)
3 print("Train: ", dls.train.n)
4 print("Val: ", dls.valid.n)
```

```
Total:  3187
Train:  3187
Val:  1062
```

```
1 dls.valid.show_batch(max_n=8, nrows=1)
```


4 Train

Metrics = Accuracy, because all groups ca same size

First Training Cycle: resnet18

```
1 learn = cnn_learner(dls, resnet18, metrics=accuracy) #metrics=error_rate
2 learn.fit_one_cycle(3)
```

epoch	train_loss	valid_loss	accuracy	time
0	1.392805	0.571848	0.807910	00:18
1	0.853526	0.459137	0.846516	00:18
2	0.635307	0.453260	0.853107	00:19

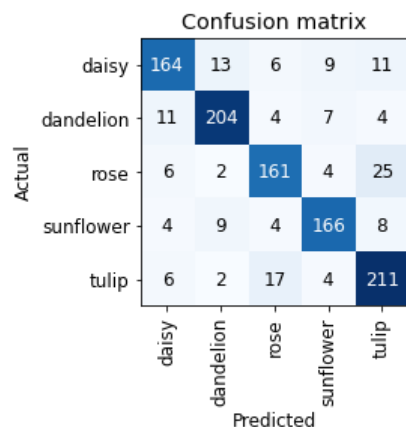Zum Bearbeiten doppelklicken (oder Eingabe)

```
1 # Save the model
2 learn.save('flower-stage-1')
3 # Load the Model
4 #learn.load('flower-stage-1')
```

```
Path('models/flower-stage-1.pth')
```

```
1 interp = ClassificationInterpretation.from_learner(learn)
2 interp.plot_confusion_matrix()
```


Confusion matrix

Actual \ Predicted	daisy	dandelion	rose	sunflower	tulip
daisy	164	13	6	9	11
dandelion	11	204	4	7	4
rose	6	2	161	4	25
sunflower	4	9	4	166	8
tulip	6	2	17	4	211

```
1 interp.plot_top_losses(5, nrows=1)
```


Prediction/Actual/Loss/Probability

sunflower/daisy / 8.33 / 0.97 tulip/sunflower / 7.73 / 0.90 sunflower/dandelion / 6.62 / 0.98 rose/daisy / 6.33 / 0.84 tulip/daisy / 5.98 / 0.52

▾ Second Training Cycle: resnet34

```
1 learn2 = cnn_learner(dls, resnet34, metrics=accuracy) #metrics=error_rate
2 learn2.fit_one_cycle(3)
```

epoch	train_loss	valid_loss	accuracy	time
0	1.326460	0.524526	0.811676	00:19
1	0.811511	0.443112	0.856874	00:19
2	0.573068	0.423657	0.864407	00:20

`resnet34` might be better -> lets check with more epochs:

```
1 learn2 = cnn_learner(dls, resnet34, metrics=accuracy) #metrics=error_rate
2 learn2.fit_one_cycle(5)
```

epoch	train_loss	valid_loss	accuracy	time
0	1.595519	0.601521	0.791902	00:19
1	0.929540	0.455939	0.842750	00:20
2	0.635990	0.422809	0.860640	00:20
3	0.472622	0.385019	0.881356	00:19
4	0.391803	0.379211	0.875706	00:19

```
1 # Save the model
2 learn2.save('flower-stage-2')
```

```
Path('models/flower-stage-2.pth')
```

👉 **Fazit:** `resnet34` scores a little bit higher accuracy score than `resnet18`

Third Training Cycle: Find optimal Learning Rate

```
1 # load resnet34 model
2 learn2.load('flower-stage-2')
```

```
<fastai.learner.Learner at 0x7f928c948c90>
```

```
1 # Unfreeze all layers of the CNN
2 learn.unfreeze()
3
4 # Find the optimal learning rate and plot a visual
5 learn.lr_find()
6 learn.recorder.plot(suggestion=True)
```

```
---------------------------------------------------------------------------
AttributeError                            Traceback (most recent call last)
<ipython-input-236-c4ae56d23eda> in <module>()
      4 # Find the optimal learning rate and plot a visual
      5 learn.lr_find()
----> 6 learn.recorder.plot(suggestion=True)

                          2 frames
/usr/local/lib/python3.7/dist-packages/torch/nn/modules/module.py in __getattr__(self, name)
    946                 return modules[name]
    947             raise AttributeError("'{}' object has no attribute '{}'".format(
--> 948                 type(self).__name__, name))
    949
    950     def __setattr__(self, name: str, value: Union[Tensor, 'Module']) -> None:

AttributeError: 'Sequential' object has no attribute 'plot'
```
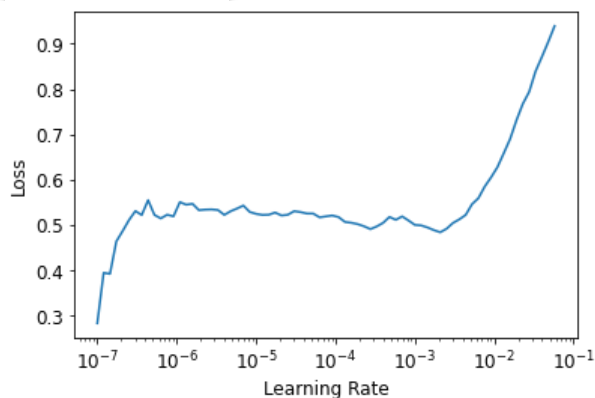

👉 **Fazit:** Learning rate between 10e-6 and 10e-3 optimal

```
1 10e-5
```

```
0.0001
```

```
1 # Learning Rate = 10e-5
2 learn3 = cnn_learner(dls, resnet34, metrics=accuracy) #metrics=error_rate
3 learn3.fit_one_cycle(n_epoch=4,
```

```
 4                        lr_max=0.0001)
```

epoch	train_loss	valid_loss	accuracy	time
0	2.366771	1.342375	0.473635	00:19
1	1.703686	0.866668	0.676083	00:20
2	1.319494	0.767494	0.717514	00:20
3	1.143158	0.756628	0.716573	00:19

```
 1 ??learn.fit_one_cycle()
```

```
 1 learn3.save('flower-stage-3')
```

```
   Path('models/flower-stage-3.pth')
```

👉 Don't know why the accuracy is lower 🥴

Forth Training Cycle: Random Resize Crop

```
 1 learn2.load('flower-stage-2')
```

```
   <fastai.learner.Learner at 0x7f928c948c90>
```

```
 1 flowers = flowers.new(item_tfms=RandomResizedCrop(128, min_scale=0.4))
 2 dls = flowers2.dataloaders(path)
 3 dls.train.show_batch(max_n=4, nrows=1, unique=True)
```


rose   rose   rose   rose

```
 1 learn4 = cnn_learner(dls, resnet34, metrics=accuracy) #metrics=error_rate
 2 learn4.fit_one_cycle(4)
```

epoch	train_loss	valid_loss	accuracy	time
0	1.439501	0.610579	0.782486	00:20
1	0.902160	0.450160	0.838041	00:19
2	0.666545	0.407429	0.852166	00:20
3	0.546984	0.389173	0.865348	00:19

```
 1 learn4.save('flower-stage-4')
```

```
   Path('models/flower-stage-4.pth')
```

👉 **Fazit:** Random Resize Crop slightly improve accuracy

Fifth Training Cycle: Delete bad Images manually

```
1 interp.plot_top_losses(10, nrows=2)
```

Prediction/Actual/Loss/Probability

sunflower/daisy / 8.33 / 0.97 tulip/sunflower / 7.73 / 0.90 sunflower/dandelion / 6.62 / 0.98 rose/daisy / 6.33 / 0.84 tulip/daisy / 5.98 / 0.52

rose/sunflower / 5.98 / 0.74 tulip/daisy / 5.86 / 0.99 daisy/tulip / 5.63 / 0.84 dandelion/rose / 5.35 / 0.69 dandelion/daisy / 5.24 / 0.99


```
1 cleaner = ImageClassifierCleaner(learn4)
2 cleaner
```

tulip

Train

<Keep>   <Keep>   <Delete>   <Keep>   <Delete>   <K

```
1 n=0
2 for idx in cleaner.delete():
3   n+=1
4   cleaner.fns[idx].unlink()
```

```
1 n
```

9

```
1 learn5 = cnn_learner(dls, resnet34, metrics=accuracy) #metrics=error_rate
2 learn5.fit_one_cycle(4)
```

epoch	train_loss	valid_loss	accuracy	time

0.00% [0/49 00:00<00:00]

```
---------------------------------------------------------------------------
OSError                                   Traceback (most recent call last)
<ipython-input-250-d7a560e6c53a> in <module>()
      1 learn5 = cnn_learner(dls, resnet34, metrics=accuracy) #metrics=error_rate
----> 2 learn5.fit_one_cycle(4)
```

⇕ 13 frames

```
/usr/local/lib/python3.7/dist-packages/torch/_utils.py in reraise(self)
    427                 # have message field
    428                 raise self.exc_type(message=msg)
--> 429         raise self.exc_type(msg)
    430
    431
```

```
OSError: Caught OSError in DataLoader worker process 0.
Original Traceback (most recent call last):
  File "/usr/local/lib/python3.7/dist-packages/torch/utils/data/_utils/worker.py", line 202, in _worker_loop
    data = fetcher.fetch(index)
  File "/usr/local/lib/python3.7/dist-packages/torch/utils/data/_utils/fetch.py", line 34, in fetch
    data = next(self.dataset_iter)
  File "/usr/local/lib/python3.7/dist-packages/fastai/data/load.py", line 118, in create_batches
    yield from map(self.do_batch, self.chunkify(res))
  File "/usr/local/lib/python3.7/dist-packages/fastcore/basics.py", line 216, in chunked
    res = list(itertools.islice(it, chunk_sz))
  File "/usr/local/lib/python3.7/dist-packages/fastai/data/load.py", line 133, in do_item
    try: return self.after_item(self.create_item(s))
  File "/usr/local/lib/python3.7/dist-packages/fastai/data/load.py", line 140, in create_item
    if self.indexed: return self.dataset[s or 0]
  File "/usr/local/lib/python3.7/dist-packages/fastai/data/core.py", line 333, in __getitem__
    res = tuple([tl[it] for tl in self.tls])
  File "/usr/local/lib/python3.7/dist-packages/fastai/data/core.py", line 333, in <listcomp>
    res = tuple([tl[it] for tl in self.tls])
  File "/usr/local/lib/python3.7/dist-packages/fastai/data/core.py", line 299, in __getitem__
    return self._after_item(res) if is_indexer(idx) else res.map(self._after_item)
  File "/usr/local/lib/python3.7/dist-packages/fastai/data/core.py", line 261, in _after_item
    def _after_item(self, o): return self.tfms(o)
  File "/usr/local/lib/python3.7/dist-packages/fastcore/transform.py", line 200, in __call__
    def __call__(self, o): return compose_tfms(o, tfms=self.fs, split_idx=self.split_idx)
  File "/usr/local/lib/python3.7/dist-packages/fastcore/transform.py", line 150, in compose_tfms
    x = f(x, **kwargs)
  File "/usr/local/lib/python3.7/dist-packages/fastcore/transform.py", line 73, in __call__
    def __call__(self, x, **kwargs): return self._call('encodes', x, **kwargs)
  File "/usr/local/lib/python3.7/dist-packages/fastcore/transform.py", line 83, in _call
```

1

```
    return retain_type(f(x, **kwargs), x, ret)
  File "/usr/local/lib/python3.7/dist-packages/fastcore/dispatch.py", line 118, in __call__
    return f(*args, **kwargs)
  File "/usr/local/lib/python3.7/dist-packages/fastai/vision/core.py", line 110, in create
    return cls(load_image(fn, **merge(cls._open_args, kwargs)))
  File "/usr/local/lib/python3.7/dist-packages/fastai/vision/core.py", line 85, in load_image
    im = Image.open(fn)
  File "/usr/local/lib/python3.7/dist-packages/PIL/Image.py", line 2843, in open
    fp = builtins.open(filename, "rb")
OSError: [Errno 107] Transport endpoint is not connected: '/content/gdrive/My
Drive/fastai/unpackai/flowers/tulip/6934951920_d43ff8b78d.jpg'
```

SEARCH STACK OVERFLOW