02_Train

December 31, 2018

1 Training

```
In [1]: %matplotlib inline
        %config InlineBackend.figure_format = 'retina'
        %load_ext autoreload

        import os, re, json, time, copy, csv, glob, itertools, pickle, warnings, shutil, torch
        import numpy as np, matplotlib.pyplot as plt, seaborn as sns, matplotlib.image as mpimg

        from IPython.display import Image
        from numpy import genfromtxt
        from pandas.tools.plotting import table
        pd.options.display.max_columns = 100
        warnings.simplefilter(action='ignore', category=FutureWarning)
        import helper
```

1.1 Set-up

```
In [2]: gpu, sample = True, False
        data_dir = os.path.join(helper.get_home(), 'N', 'Plants', 'dataset')
        save_dir = os.path.join(helper.get_home(), 'N', 'Plants', 'checkpoint')
        log_dir = os.path.join('.', 'log')
```

```
In [3]: cat_to_name_json = os.path.join(data_dir, 'cat_to_name.json')
        with open(cat_to_name_json, 'r') as f:
            cat_to_name = json.load(f)
        cat_to_name
```

```
Out[3]: {'1': 'Acalypha hispida [EUPHORBIACAE]',
         '2': 'Bauhinia coccinea [FABACEAE]',
         '3': 'Calotropis gigantea [APOCYNACEAE]',
         '4': 'Clitoria ternatea [FABACEAE]',
         '5': 'Dillenia suffruticosa [DILLENIACEAE]',
         '6': 'Ficus deltoidea [MORACEAE]',
         '7': 'Melastoma beccarianum [MELASTOMATACEAE]',
         '8': 'Melastoma malabathricum [MELASTOMATACEAE]',
         '9': 'Melastoma malabathricum var alba [MELASTOMATACEAE]',
```

```
                '10': 'Passiflora foetida [PASSIFLORACEAE]',
                '11': 'Petrea volubilis [VERBENACEAE]'}

In [4]: if not os.path.exists(save_dir):
            os.makedirs(save_dir)
        if not os.path.exists(log_dir):
            os.makedirs(log_dir)
```

1.2 Hyperparameters for Training and Predict

```
In [5]: batch = 32
        arch = 'alexnet'
        hidden_units, epochs, dropout, learning_rate = 4096, 200, 0.5, 0.01

        optim_name, momentum = 'SGD', 0.9
        #optim_name = 'Adam'

        cpt_name = arch + "-" +str(hidden_units) + "-" + str(batch) + "-" + str(epochs) + "-" 

        cpt = os.path.join(save_dir, cpt_name + '-cpt.pt')
        log = os.path.join(log_dir, cpt_name + '-log.csv')
```

1.3 Data Loader

```
In [6]: image_datasets, dataloaders, dataset_sizes, num_labels = helper.get_data(data_dir, bat
        print('Total Labels are {}'.format(num_labels))
        print('Dataset is {}'.format(dataset_sizes))

Total Labels are 11
Dataset is {'train': 596, 'test': 144}
```

1.4 Experiment 1

```
In [7]: # Reset hyperparametrs if required
```

```
In [8]: model = helper.get_model_1(arch, hidden_units, num_labels, dropout) # supports archs = 
        print(model)

        trained_model, train_loss, train_acc, train_time, test_loss, test_acc, test_time = hel

AlexNet(
  (features): Sequential(
    (0): Conv2d(3, 64, kernel_size=(11, 11), stride=(4, 4), padding=(2, 2))
    (1): ReLU(inplace)
    (2): MaxPool2d(kernel_size=3, stride=2, padding=0, dilation=1, ceil_mode=False)
    (3): Conv2d(64, 192, kernel_size=(5, 5), stride=(1, 1), padding=(2, 2))
    (4): ReLU(inplace)
    (5): MaxPool2d(kernel_size=3, stride=2, padding=0, dilation=1, ceil_mode=False)
```

```
    (6): Conv2d(192, 384, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (7): ReLU(inplace)
    (8): Conv2d(384, 256, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (9): ReLU(inplace)
    (10): Conv2d(256, 256, kernel_size=(3, 3), stride=(1, 1), padding=(1, 1))
    (11): ReLU(inplace)
    (12): MaxPool2d(kernel_size=3, stride=2, padding=0, dilation=1, ceil_mode=False)
  )
  (classifier): Sequential(
    (fc1): Linear(in_features=9216, out_features=4096, bias=True)
    (relu1): ReLU(inplace)
    (dropout1): Dropout(p=0.5)
    (fc2): Linear(in_features=4096, out_features=4096, bias=True)
    (relu2): ReLU(inplace)
    (dropout2): Dropout(p=0.5)
    (fc3): Linear(in_features=4096, out_features=4096, bias=True)
    (relu3): ReLU(inplace)
    (dropout3): Dropout(p=0.5)
    (fc4): Linear(in_features=4096, out_features=4096, bias=True)
    (relu4): ReLU(inplace)
    (dropout4): Dropout(p=0.5)
    (fc5): Linear(in_features=4096, out_features=11, bias=True)
    (output): LogSoftmax()
  )
)
Using GPU for training
  Epoch 1 Phase train Loss 0.076 Acc 0.11577181208053691 Time 166.28448939323425
  Epoch 1 Phase test Loss 0.081 Acc 0.14583333333333331 Time 206.91590356826782
  Epoch 2 Phase train Loss 0.076 Acc 0.14093959731543623 Time 163.90456414222717
  Epoch 2 Phase test Loss 0.083 Acc 0.09027777777777778 Time 204.42519903182983
  Epoch 3 Phase train Loss 0.077 Acc 0.11241610738255034 Time 164.79719066619873
  Epoch 3 Phase test Loss 0.081 Acc 0.09027777777777778 Time 205.39207553863525
  Epoch 4 Phase train Loss 0.075 Acc 0.1493288590604027 Time 164.9202218055725
  Epoch 4 Phase test Loss 0.079 Acc 0.20138888888888887 Time 205.46798467636108
  Epoch 5 Phase train Loss 0.075 Acc 0.17281879194630873 Time 164.7154996395111
  Epoch 5 Phase test Loss 0.075 Acc 0.2847222222222222 Time 204.71971035003662
  Epoch 6 Phase train Loss 0.071 Acc 0.20469798657718120 Time 167.39951920509338
  Epoch 6 Phase test Loss 0.065 Acc 0.4097222222222222 Time 208.22741222381592
  Epoch 7 Phase train Loss 0.067 Acc 0.23154362416107382 Time 170.15488719940186
  Epoch 7 Phase test Loss 0.061 Acc 0.4097222222222222 Time 211.44689297676086
  Epoch 8 Phase train Loss 0.061 Acc 0.337248322147651 Time 167.5050287246704
  Epoch 8 Phase test Loss 0.052 Acc 0.5069444444444444 Time 208.50146293640137
  Epoch 9 Phase train Loss 0.059 Acc 0.34395973154362414 Time 167.54200887680054
  Epoch 9 Phase test Loss 0.050 Acc 0.4861111111111111 Time 208.41938471794128
  Epoch 10 Phase train Loss 0.054 Acc 0.40436241610738255 Time 166.0380642414093
  Epoch 10 Phase test Loss 0.044 Acc 0.5 Time 206.76817226409912
  Epoch 11 Phase train Loss 0.053 Acc 0.4513422818791946 Time 167.91672468185425
  Epoch 11 Phase test Loss 0.046 Acc 0.5555555555555556 Time 208.73176527023315
```

```
Epoch 12 Phase train Loss 0.051 Acc 0.44630872483221473 Time 166.76151657104492
Epoch 12 Phase test Loss 0.040 Acc 0.5972222222222222 Time 207.53897333145142
Epoch 13 Phase train Loss 0.047 Acc 0.48825503355704697 Time 167.88890194892883
Epoch 13 Phase test Loss 0.044 Acc 0.5416666666666666 Time 209.08092713356018
Epoch 14 Phase train Loss 0.047 Acc 0.47651006711409394 Time 166.22273707389832
Epoch 14 Phase test Loss 0.040 Acc 0.6041666666666666 Time 207.01117873191833
Epoch 15 Phase train Loss 0.047 Acc 0.4798657718120805 Time 166.11869931221008
Epoch 15 Phase test Loss 0.034 Acc 0.6597222222222222 Time 207.09762477874756
Epoch 16 Phase train Loss 0.045 Acc 0.5201342281879194 Time 166.53275108337402
Epoch 16 Phase test Loss 0.037 Acc 0.6180555555555555 Time 207.72328400611877
Epoch 17 Phase train Loss 0.043 Acc 0.5234899328859061 Time 166.25234365463257
Epoch 17 Phase test Loss 0.035 Acc 0.5972222222222222 Time 207.1320297718048
Epoch 18 Phase train Loss 0.045 Acc 0.5184563758389261 Time 166.5431423187256
Epoch 18 Phase test Loss 0.033 Acc 0.6597222222222222 Time 207.30697464942932
Epoch 19 Phase train Loss 0.043 Acc 0.535234899328859 Time 166.73929858207703
Epoch 19 Phase test Loss 0.035 Acc 0.6458333333333333 Time 207.78232145309448
Epoch 20 Phase train Loss 0.040 Acc 0.5604026845637584 Time 167.06223821640015
Epoch 20 Phase test Loss 0.032 Acc 0.625 Time 207.83715152740479
Epoch 21 Phase train Loss 0.042 Acc 0.5553691275167785 Time 166.9535834789276
Epoch 21 Phase test Loss 0.032 Acc 0.6805555555555555 Time 207.7732744216919
Epoch 22 Phase train Loss 0.040 Acc 0.5771812080536912 Time 166.6562523841858
Epoch 22 Phase test Loss 0.030 Acc 0.6875 Time 207.6227524280548
Epoch 23 Phase train Loss 0.040 Acc 0.5738255033557047 Time 166.27838826179504
Epoch 23 Phase test Loss 0.028 Acc 0.7083333333333333 Time 207.14467191696167
Epoch 24 Phase train Loss 0.036 Acc 0.6157718120805369 Time 166.94947481155396
Epoch 24 Phase test Loss 0.030 Acc 0.673611111111111 Time 207.69460701942444
Epoch 25 Phase train Loss 0.037 Acc 0.6140939597315436 Time 166.62025690078735
Epoch 25 Phase test Loss 0.027 Acc 0.736111111111111 Time 207.42449283599854
Epoch 26 Phase train Loss 0.038 Acc 0.6023489932885906 Time 167.05731582641602
Epoch 26 Phase test Loss 0.027 Acc 0.7083333333333333 Time 208.01313996315002
Epoch 27 Phase train Loss 0.035 Acc 0.6375838926174496 Time 168.28567171096802
Epoch 27 Phase test Loss 0.027 Acc 0.7152777777777778 Time 209.222505569458
Epoch 28 Phase train Loss 0.033 Acc 0.6191275167785235 Time 167.73968362808228
Epoch 28 Phase test Loss 0.035 Acc 0.673611111111111 Time 208.96766662597656
Epoch 29 Phase train Loss 0.039 Acc 0.5838926174496644 Time 167.14283990859985
Epoch 29 Phase test Loss 0.032 Acc 0.673611111111111 Time 208.1272850036621
Epoch 30 Phase train Loss 0.039 Acc 0.5704697986577181 Time 166.78218388557434
Epoch 30 Phase test Loss 0.027 Acc 0.7013888888888888 Time 207.78401160240173
Epoch 31 Phase train Loss 0.035 Acc 0.6090604026845637 Time 166.97690725326538
Epoch 31 Phase test Loss 0.022 Acc 0.7638888888888888 Time 207.8712432384491
Epoch 32 Phase train Loss 0.034 Acc 0.6795302013422818 Time 166.75940608978271
Epoch 32 Phase test Loss 0.025 Acc 0.7291666666666666 Time 207.6302764415741
Epoch 33 Phase train Loss 0.037 Acc 0.6325503355704698 Time 166.42675352096558
Epoch 33 Phase test Loss 0.034 Acc 0.7083333333333333 Time 207.358336687088
Epoch 34 Phase train Loss 0.034 Acc 0.6526845637583892 Time 166.65078163146973
Epoch 34 Phase test Loss 0.025 Acc 0.7638888888888888 Time 207.61446809768677
Epoch 35 Phase train Loss 0.033 Acc 0.639261744966443 Time 166.7207019329071
Epoch 35 Phase test Loss 0.022 Acc 0.75 Time 207.5496542453766
```

```
Epoch 36 Phase train Loss 0.035 Acc 0.6308724832214765 Time 166.5900137424469
Epoch 36 Phase test Loss 0.023 Acc 0.7638888888888888 Time 207.50870823860168
Epoch 37 Phase train Loss 0.034 Acc 0.6493288590604027 Time 166.8376567363739
Epoch 37 Phase test Loss 0.021 Acc 0.798611111111111 Time 207.7474820613861
Epoch 38 Phase train Loss 0.035 Acc 0.6543624161073825 Time 166.97883939743042
Epoch 38 Phase test Loss 0.027 Acc 0.7222222222222222 Time 207.86784100532532
Epoch 39 Phase train Loss 0.034 Acc 0.6342281879194631 Time 166.89376282691956
Epoch 39 Phase test Loss 0.022 Acc 0.7847222222222222 Time 207.9148440361023
Epoch 40 Phase train Loss 0.034 Acc 0.6493288590604027 Time 166.79662227630615
Epoch 40 Phase test Loss 0.023 Acc 0.7569444444444444 Time 207.81073713302612
Epoch 41 Phase train Loss 0.032 Acc 0.6644295302013423 Time 167.01901268959045
Epoch 41 Phase test Loss 0.025 Acc 0.75 Time 208.33615374565125
Epoch 42 Phase train Loss 0.030 Acc 0.6828859060402684 Time 166.71459531784058
Epoch 42 Phase test Loss 0.024 Acc 0.7638888888888888 Time 207.603942155838
Epoch 43 Phase train Loss 0.031 Acc 0.6761744966442953 Time 167.619060754776
Epoch 43 Phase test Loss 0.025 Acc 0.7569444444444444 Time 208.42769956588745
Epoch 44 Phase train Loss 0.032 Acc 0.6694630872483222 Time 166.9055690765381
Epoch 44 Phase test Loss 0.022 Acc 0.7847222222222222 Time 207.9647388458252
Epoch 45 Phase train Loss 0.033 Acc 0.6442953020134228 Time 166.87051963806152
Epoch 45 Phase test Loss 0.022 Acc 0.8194444444444444 Time 208.1322729587555
Epoch 46 Phase train Loss 0.031 Acc 0.6593959731543624 Time 168.43297219276428
Epoch 46 Phase test Loss 0.023 Acc 0.75 Time 209.7329273223877
Epoch 47 Phase train Loss 0.029 Acc 0.7231543624161074 Time 168.2294840812683
Epoch 47 Phase test Loss 0.020 Acc 0.7916666666666666 Time 209.59637784957886
Epoch 48 Phase train Loss 0.031 Acc 0.6912751677852349 Time 167.67519235610962
Epoch 48 Phase test Loss 0.021 Acc 0.8055555555555555 Time 208.70633625984192
Epoch 49 Phase train Loss 0.028 Acc 0.7080536912751678 Time 167.5686810016632
Epoch 49 Phase test Loss 0.021 Acc 0.8125 Time 208.85420989990234
Epoch 50 Phase train Loss 0.029 Acc 0.7080536912751678 Time 167.37260603904724
Epoch 50 Phase test Loss 0.021 Acc 0.7847222222222222 Time 208.51016855239868
Epoch 51 Phase train Loss 0.028 Acc 0.7114093959731543 Time 167.9195830821991
Epoch 51 Phase test Loss 0.018 Acc 0.8125 Time 209.0100073814392
Epoch 52 Phase train Loss 0.026 Acc 0.7365771812080537 Time 168.0602490901947
Epoch 52 Phase test Loss 0.018 Acc 0.8263888888888888 Time 209.27000451087952
Epoch 53 Phase train Loss 0.029 Acc 0.697986577181208 Time 167.9319875240326
Epoch 53 Phase test Loss 0.022 Acc 0.7847222222222222 Time 209.01398420333862
Epoch 54 Phase train Loss 0.026 Acc 0.7197986577181208 Time 167.7225694656372
Epoch 54 Phase test Loss 0.017 Acc 0.8333333333333333 Time 208.83906173706055
Epoch 55 Phase train Loss 0.028 Acc 0.7248322147651006 Time 167.87009239196777
Epoch 55 Phase test Loss 0.022 Acc 0.7708333333333333 Time 209.02788400650024
Epoch 56 Phase train Loss 0.024 Acc 0.7718120805369127 Time 167.84557342529297
Epoch 56 Phase test Loss 0.022 Acc 0.7638888888888888 Time 209.32172083854675
Epoch 57 Phase train Loss 0.032 Acc 0.6795302013422818 Time 167.84970355033875
Epoch 57 Phase test Loss 0.022 Acc 0.8263888888888888 Time 209.04224944114685
Epoch 58 Phase train Loss 0.029 Acc 0.7013422818791946 Time 168.28081488609314
Epoch 58 Phase test Loss 0.023 Acc 0.7777777777777777 Time 209.44510555267334
Epoch 59 Phase train Loss 0.026 Acc 0.7265100671140939 Time 167.9700469970703
Epoch 59 Phase test Loss 0.021 Acc 0.8125 Time 209.57119488716125
```

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Epoch 60 Phase train Loss 0.029 Acc 0.7114093959731543 Time 167.91260027885437
Epoch 60 Phase test Loss 0.018 Acc 0.8402777777777777 Time 209.076429605484
Epoch 61 Phase train Loss 0.029 Acc 0.709731543624161 Time 167.37526845932007
Epoch 61 Phase test Loss 0.019 Acc 0.8055555555555555 Time 208.3689260482788
Epoch 62 Phase train Loss 0.027 Acc 0.7114093959731543 Time 167.85605788230896
Epoch 62 Phase test Loss 0.019 Acc 0.8263888888888888 Time 208.85047054290771
Epoch 63 Phase train Loss 0.026 Acc 0.7432885906040269 Time 167.7202389240265
Epoch 63 Phase test Loss 0.023 Acc 0.8125 Time 208.64018940925598
Epoch 64 Phase train Loss 0.027 Acc 0.7298657718120806 Time 167.355477809906
Epoch 64 Phase test Loss 0.019 Acc 0.8055555555555555 Time 208.51892733573914
Epoch 65 Phase train Loss 0.024 Acc 0.7583892617449665 Time 167.5545620918274
Epoch 65 Phase test Loss 0.021 Acc 0.8055555555555555 Time 208.9540343284607
Epoch 66 Phase train Loss 0.026 Acc 0.7483221476510067 Time 167.1979739665985
Epoch 66 Phase test Loss 0.021 Acc 0.8125 Time 208.20588946342468
Epoch 67 Phase train Loss 0.028 Acc 0.7281879194630873 Time 167.0241768360138
Epoch 67 Phase test Loss 0.019 Acc 0.8194444444444444 Time 208.50624442100525
Epoch 68 Phase train Loss 0.026 Acc 0.7483221476510067 Time 167.4690990447998
Epoch 68 Phase test Loss 0.017 Acc 0.8055555555555555 Time 208.51388216018677
Epoch 69 Phase train Loss 0.028 Acc 0.7080536912751678 Time 167.64113783836365
Epoch 69 Phase test Loss 0.018 Acc 0.7916666666666666 Time 208.6376645565033
Epoch 70 Phase train Loss 0.027 Acc 0.7214765100671141 Time 167.88240694999695
Epoch 70 Phase test Loss 0.017 Acc 0.8263888888888888 Time 209.00298500061035
Epoch 71 Phase train Loss 0.028 Acc 0.7281879194630873 Time 167.44035243988037
Epoch 71 Phase test Loss 0.020 Acc 0.798611111111111 Time 208.50821018218994
Epoch 72 Phase train Loss 0.028 Acc 0.7265100671140939 Time 167.39593195915222
Epoch 72 Phase test Loss 0.017 Acc 0.8472222222222222 Time 208.40880918502808
Epoch 73 Phase train Loss 0.024 Acc 0.7516778523489933 Time 167.38109278678894
Epoch 73 Phase test Loss 0.020 Acc 0.8125 Time 208.4331283569336
Epoch 74 Phase train Loss 0.026 Acc 0.7248322147651006 Time 168.70699405670166
Epoch 74 Phase test Loss 0.015 Acc 0.8680555555555555 Time 209.6389982700348
Epoch 75 Phase train Loss 0.025 Acc 0.7416107382550335 Time 167.55823874473572
Epoch 75 Phase test Loss 0.019 Acc 0.8263888888888888 Time 208.63710856437683
Epoch 76 Phase train Loss 0.025 Acc 0.7567114093959731 Time 166.3140513896942
Epoch 76 Phase test Loss 0.016 Acc 0.8541666666666666 Time 207.41507077217102
Epoch 77 Phase train Loss 0.022 Acc 0.785234899328859 Time 167.6074025630951
Epoch 77 Phase test Loss 0.016 Acc 0.8541666666666666 Time 208.75933933258057
Epoch 78 Phase train Loss 0.021 Acc 0.7902684563758389 Time 167.77812337875366
Epoch 78 Phase test Loss 0.016 Acc 0.8125 Time 208.88011956214905
Epoch 79 Phase train Loss 0.023 Acc 0.7785234899328859 Time 167.7902810573578
Epoch 79 Phase test Loss 0.015 Acc 0.861111111111111 Time 209.0332567691803
Epoch 80 Phase train Loss 0.025 Acc 0.7684563758389261 Time 167.60895252227783
Epoch 80 Phase test Loss 0.018 Acc 0.8333333333333333 Time 208.73323798179626
Epoch 81 Phase train Loss 0.023 Acc 0.7936241610738255 Time 167.68510150909424
Epoch 81 Phase test Loss 0.014 Acc 0.8472222222222222 Time 208.7608380317688
Epoch 82 Phase train Loss 0.025 Acc 0.7332214765100671 Time 167.74364376068115
Epoch 82 Phase test Loss 0.020 Acc 0.798611111111111 Time 208.77451395988464
Epoch 83 Phase train Loss 0.024 Acc 0.7600671140939597 Time 167.60207796096802
Epoch 83 Phase test Loss 0.016 Acc 0.8402777777777777 Time 208.59301829338074
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Epoch 84 Phase train Loss 0.023 Acc 0.7684563758389261 Time 167.09416556358337
Epoch 84 Phase test Loss 0.015 Acc 0.861111111111111 Time 208.08941435813904
Epoch 85 Phase train Loss 0.022 Acc 0.7734899328859061 Time 167.13618850708008
Epoch 85 Phase test Loss 0.016 Acc 0.8472222222222222 Time 208.1161549091339
Epoch 86 Phase train Loss 0.023 Acc 0.7869127516778524 Time 167.30993342399597
Epoch 86 Phase test Loss 0.018 Acc 0.8472222222222222 Time 208.2504801750183
Epoch 87 Phase train Loss 0.022 Acc 0.802013422818792 Time 166.77101755142212
Epoch 87 Phase test Loss 0.015 Acc 0.861111111111111 Time 207.74146699905396
Epoch 88 Phase train Loss 0.021 Acc 0.796979865771812 Time 166.89294123649597
Epoch 88 Phase test Loss 0.017 Acc 0.8055555555555555 Time 207.81140875816345
Epoch 89 Phase train Loss 0.022 Acc 0.7768456375838926 Time 166.8363811969757
Epoch 89 Phase test Loss 0.019 Acc 0.8263888888888888 Time 207.8075726032257
Epoch 90 Phase train Loss 0.023 Acc 0.7701342281879194 Time 167.58398699760437
Epoch 90 Phase test Loss 0.017 Acc 0.8194444444444444 Time 208.98886847496033
Epoch 91 Phase train Loss 0.021 Acc 0.7802013422818792 Time 167.12180733680725
Epoch 91 Phase test Loss 0.017 Acc 0.8472222222222222 Time 208.1141083240509
Epoch 92 Phase train Loss 0.025 Acc 0.7634228187919463 Time 167.4182243347168
Epoch 92 Phase test Loss 0.017 Acc 0.8333333333333333 Time 208.43072271347046
Epoch 93 Phase train Loss 0.022 Acc 0.7936241610738255 Time 167.20737981796265
Epoch 93 Phase test Loss 0.015 Acc 0.8472222222222222 Time 208.23270988464355
Epoch 94 Phase train Loss 0.023 Acc 0.7600671140939597 Time 167.18756461143494
Epoch 94 Phase test Loss 0.018 Acc 0.8263888888888888 Time 208.19363594055176
Epoch 95 Phase train Loss 0.022 Acc 0.7902684563758389 Time 167.1242618560791
Epoch 95 Phase test Loss 0.015 Acc 0.8819444444444444 Time 208.32460689544678
Epoch 96 Phase train Loss 0.022 Acc 0.7651006711409396 Time 167.83329343795776
Epoch 96 Phase test Loss 0.019 Acc 0.7916666666666666 Time 208.9821901321411
Epoch 97 Phase train Loss 0.022 Acc 0.7701342281879194 Time 167.54685759544373
Epoch 97 Phase test Loss 0.019 Acc 0.8263888888888888 Time 208.61394691467285
Epoch 98 Phase train Loss 0.021 Acc 0.8003355704697986 Time 167.56325244903564
Epoch 98 Phase test Loss 0.019 Acc 0.8194444444444444 Time 208.73492646217346
Epoch 99 Phase train Loss 0.023 Acc 0.7818791946308725 Time 167.8375027179718
Epoch 99 Phase test Loss 0.013 Acc 0.8472222222222222 Time 208.9977343082428
Epoch 100 Phase train Loss 0.017 Acc 0.8171140939597316 Time 167.84409928321838
Epoch 100 Phase test Loss 0.014 Acc 0.861111111111111 Time 208.9732575416565
Epoch 101 Phase train Loss 0.020 Acc 0.8003355704697986 Time 167.8009912967682
Epoch 101 Phase test Loss 0.020 Acc 0.8472222222222222 Time 208.92971634864807
Epoch 102 Phase train Loss 0.019 Acc 0.8187919463087248 Time 167.84348130226135
Epoch 102 Phase test Loss 0.016 Acc 0.8680555555555555 Time 208.97988080978394
Epoch 103 Phase train Loss 0.020 Acc 0.7936241610738255 Time 167.42397570610046
Epoch 103 Phase test Loss 0.016 Acc 0.8333333333333333 Time 208.52803778648376
Epoch 104 Phase train Loss 0.021 Acc 0.7986577181208053 Time 168.4868152141571
Epoch 104 Phase test Loss 0.018 Acc 0.8263888888888888 Time 209.68461728096008
Epoch 105 Phase train Loss 0.023 Acc 0.7583892617449665 Time 167.5980327129364
Epoch 105 Phase test Loss 0.014 Acc 0.8541666666666666 Time 208.7134804725647
Epoch 106 Phase train Loss 0.020 Acc 0.7953020134228188 Time 167.6766004562378
Epoch 106 Phase test Loss 0.014 Acc 0.8680555555555555 Time 209.00380110740662
Epoch 107 Phase train Loss 0.021 Acc 0.7902684563758389 Time 167.599907126426697
Epoch 107 Phase test Loss 0.017 Acc 0.8680555555555555 Time 208.6648199558258
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```
Epoch 108 Phase train Loss 0.020 Acc 0.8171140939597316 Time 167.67238116264343
Epoch 108 Phase test Loss 0.014 Acc 0.861111111111111 Time 208.7403814792633
Epoch 109 Phase train Loss 0.022 Acc 0.7919463087248322 Time 167.49854850769043
Epoch 109 Phase test Loss 0.014 Acc 0.8541666666666666 Time 208.9514012336731
Epoch 110 Phase train Loss 0.021 Acc 0.802013422818792 Time 168.05090999603271
Epoch 110 Phase test Loss 0.017 Acc 0.8472222222222222 Time 209.19001817703247
Epoch 111 Phase train Loss 0.022 Acc 0.7802013422818792 Time 167.41785836219788
Epoch 111 Phase test Loss 0.016 Acc 0.8472222222222222 Time 208.51273369789124
Epoch 112 Phase train Loss 0.020 Acc 0.8036912751677853 Time 167.47496581077576
Epoch 112 Phase test Loss 0.015 Acc 0.8402777777777777 Time 208.55199241638184
Epoch 113 Phase train Loss 0.021 Acc 0.8070469798657718 Time 167.33626461029053
Epoch 113 Phase test Loss 0.013 Acc 0.875 Time 208.3501148223877
Epoch 114 Phase train Loss 0.019 Acc 0.8137583892617449 Time 168.0919156074524
Epoch 114 Phase test Loss 0.018 Acc 0.8402777777777777 Time 209.3097050189972
Epoch 115 Phase train Loss 0.020 Acc 0.8338926174496644 Time 167.93476605415344
Epoch 115 Phase test Loss 0.014 Acc 0.8680555555555555 Time 209.1356906890869
Epoch 116 Phase train Loss 0.018 Acc 0.8355704697986577 Time 168.1760823726654
Epoch 116 Phase test Loss 0.016 Acc 0.8333333333333333 Time 209.46035528182983
Epoch 117 Phase train Loss 0.019 Acc 0.8322147651006712 Time 167.69499611854553
Epoch 117 Phase test Loss 0.014 Acc 0.875 Time 208.76234912872314
Epoch 118 Phase train Loss 0.017 Acc 0.8355704697986577 Time 167.51698327064514
Epoch 118 Phase test Loss 0.014 Acc 0.8541666666666666 Time 209.22685194015503
Epoch 119 Phase train Loss 0.020 Acc 0.7953020134228188 Time 168.47289109230042
Epoch 119 Phase test Loss 0.018 Acc 0.8194444444444444 Time 209.55095171928406
Epoch 120 Phase train Loss 0.020 Acc 0.802013422818792 Time 167.5599763393402
Epoch 120 Phase test Loss 0.017 Acc 0.8333333333333333 Time 208.6215398311615
Epoch 121 Phase train Loss 0.021 Acc 0.8003355704697986 Time 167.7559792995453
Epoch 121 Phase test Loss 0.018 Acc 0.8402777777777777 Time 208.84257888793945
Epoch 122 Phase train Loss 0.021 Acc 0.8036912751677853 Time 167.5168731212616
Epoch 122 Phase test Loss 0.017 Acc 0.8472222222222222 Time 208.7442328929901
Epoch 123 Phase train Loss 0.020 Acc 0.785234899328859 Time 168.62354159355164
Epoch 123 Phase test Loss 0.013 Acc 0.8680555555555555 Time 209.90455269813538
Epoch 124 Phase train Loss 0.019 Acc 0.8204697986577181 Time 168.82596039772034
Epoch 124 Phase test Loss 0.016 Acc 0.8472222222222222 Time 209.8596498966217
Epoch 125 Phase train Loss 0.017 Acc 0.837248322147651 Time 168.64780712127686
Epoch 125 Phase test Loss 0.022 Acc 0.798611111111111 Time 210.3113341331482
Epoch 126 Phase train Loss 0.020 Acc 0.8104026845637584 Time 168.32844710350037
Epoch 126 Phase test Loss 0.016 Acc 0.8263888888888888 Time 209.7766077518463
Epoch 127 Phase train Loss 0.018 Acc 0.8221476510067114 Time 168.16936421394348
Epoch 127 Phase test Loss 0.018 Acc 0.8194444444444444 Time 209.20953011512756
Epoch 128 Phase train Loss 0.018 Acc 0.8087248322147651 Time 167.82407665252686
Epoch 128 Phase test Loss 0.015 Acc 0.8402777777777777 Time 208.8813202381134
Epoch 129 Phase train Loss 0.019 Acc 0.8204697986577181 Time 167.52009463310242
Epoch 129 Phase test Loss 0.014 Acc 0.861111111111111 Time 208.6574900150299
Epoch 130 Phase train Loss 0.018 Acc 0.8221476510067114 Time 168.0896782875061
Epoch 130 Phase test Loss 0.014 Acc 0.8472222222222222 Time 209.24872612953186
Epoch 131 Phase train Loss 0.019 Acc 0.7936241610738255 Time 167.87512755393982
Epoch 131 Phase test Loss 0.012 Acc 0.8541666666666666 Time 209.02978229522705
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Epoch 132 Phase train Loss 0.019 Acc 0.8238255033557047 Time 167.65507245063782
Epoch 132 Phase test Loss 0.017 Acc 0.875 Time 208.7483868598938
Epoch 133 Phase train Loss 0.017 Acc 0.8389261744966443 Time 167.81163597106934
Epoch 133 Phase test Loss 0.015 Acc 0.8680555555555555 Time 208.94790959358215
Epoch 134 Phase train Loss 0.020 Acc 0.825503355704698 Time 167.86348056793213
Epoch 134 Phase test Loss 0.014 Acc 0.8680555555555555 Time 209.26796007156372
Epoch 135 Phase train Loss 0.019 Acc 0.8221476510067114 Time 167.44003534317017
Epoch 135 Phase test Loss 0.011 Acc 0.8680555555555555 Time 208.47469401359558
Epoch 136 Phase train Loss 0.017 Acc 0.8204697986577181 Time 167.39103841781616
Epoch 136 Phase test Loss 0.014 Acc 0.8472222222222222 Time 208.4809377193451
Epoch 137 Phase train Loss 0.016 Acc 0.8456375838926175 Time 167.64945816993713
Epoch 137 Phase test Loss 0.012 Acc 0.9097222222222222 Time 208.85015296936035
Epoch 138 Phase train Loss 0.018 Acc 0.8406040268456376 Time 167.80676412582397
Epoch 138 Phase test Loss 0.019 Acc 0.8194444444444444 Time 208.8971495628357
Epoch 139 Phase train Loss 0.019 Acc 0.8154362416107382 Time 167.50983357429504
Epoch 139 Phase test Loss 0.015 Acc 0.8402777777777777 Time 208.60739636421204
Epoch 140 Phase train Loss 0.018 Acc 0.8439597315436241 Time 167.32706499099731
Epoch 140 Phase test Loss 0.015 Acc 0.8402777777777777 Time 208.27992987632751
Epoch 141 Phase train Loss 0.020 Acc 0.8104026845637584 Time 167.2198028564453
Epoch 141 Phase test Loss 0.017 Acc 0.8263888888888888 Time 208.3912651538849
Epoch 142 Phase train Loss 0.018 Acc 0.8137583892617449 Time 168.0315420627594
Epoch 142 Phase test Loss 0.014 Acc 0.861111111111111 Time 208.95276832580566
Epoch 143 Phase train Loss 0.020 Acc 0.8070469798657718 Time 168.49826169013977
Epoch 143 Phase test Loss 0.012 Acc 0.8888888888888888 Time 209.44384860992432
Epoch 144 Phase train Loss 0.019 Acc 0.8204697986577181 Time 167.3619041442871
Epoch 144 Phase test Loss 0.013 Acc 0.8472222222222222 Time 208.38603138923645
Epoch 145 Phase train Loss 0.018 Acc 0.8271812080536912 Time 167.3331789970398
Epoch 145 Phase test Loss 0.016 Acc 0.8680555555555555 Time 208.40629315376282
Epoch 146 Phase train Loss 0.018 Acc 0.8338926174496644 Time 167.6788215637207
Epoch 146 Phase test Loss 0.016 Acc 0.8541666666666666 Time 208.6654829978943
Epoch 147 Phase train Loss 0.017 Acc 0.8271812080536912 Time 167.27716088294983
Epoch 147 Phase test Loss 0.012 Acc 0.875 Time 208.27250289916992
Epoch 148 Phase train Loss 0.016 Acc 0.8204697986577181 Time 167.1512050628662
Epoch 148 Phase test Loss 0.015 Acc 0.861111111111111 Time 208.13065910339355
Epoch 149 Phase train Loss 0.014 Acc 0.8506711409395973 Time 167.30918860435486
Epoch 149 Phase test Loss 0.015 Acc 0.8472222222222222 Time 208.44517397880554
Epoch 150 Phase train Loss 0.017 Acc 0.8355704697986577 Time 167.30206561088562
Epoch 150 Phase test Loss 0.014 Acc 0.8680555555555555 Time 208.35517287254333
Epoch 151 Phase train Loss 0.016 Acc 0.8590604026845637 Time 167.1652500629425
Epoch 151 Phase test Loss 0.014 Acc 0.875 Time 208.16267657279968
Epoch 152 Phase train Loss 0.016 Acc 0.8523489932885906 Time 167.33179545402527
Epoch 152 Phase test Loss 0.015 Acc 0.8958333333333333 Time 208.39637517929077
Epoch 153 Phase train Loss 0.020 Acc 0.8036912751677853 Time 167.19970870018005
Epoch 153 Phase test Loss 0.015 Acc 0.8472222222222222 Time 208.26007676124573
Epoch 154 Phase train Loss 0.016 Acc 0.8389261744966443 Time 167.59101510047913
Epoch 154 Phase test Loss 0.015 Acc 0.8402777777777777 Time 208.63065385818481
Epoch 155 Phase train Loss 0.016 Acc 0.8187919463087248 Time 166.9393937587738
Epoch 155 Phase test Loss 0.012 Acc 0.8680555555555555 Time 209.42219424247742
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Epoch 156 Phase train Loss 0.016 Acc 0.8171140939597316 Time 168.24417209625244
Epoch 156 Phase test Loss 0.012 Acc 0.875 Time 209.22977709770203
Epoch 157 Phase train Loss 0.017 Acc 0.8691275167785235 Time 167.19077324867249
Epoch 157 Phase test Loss 0.012 Acc 0.8680555555555555 Time 208.34929656982422
Epoch 158 Phase train Loss 0.019 Acc 0.7953020134228188 Time 167.91381216049194
Epoch 158 Phase test Loss 0.011 Acc 0.8819444444444444 Time 208.9011242389679
Epoch 159 Phase train Loss 0.019 Acc 0.8238255033557047 Time 170.05912232398987
Epoch 159 Phase test Loss 0.015 Acc 0.8402777777777777 Time 211.1756248474121
Epoch 160 Phase train Loss 0.017 Acc 0.8506711409395973 Time 167.7375283241272
Epoch 160 Phase test Loss 0.012 Acc 0.8888888888888888 Time 208.8063383102417
Epoch 161 Phase train Loss 0.017 Acc 0.8338926174496644 Time 167.56500482559204
Epoch 161 Phase test Loss 0.017 Acc 0.8263888888888888 Time 208.85224628448486
Epoch 162 Phase train Loss 0.016 Acc 0.8288590604026845 Time 167.63524222373962
Epoch 162 Phase test Loss 0.011 Acc 0.8819444444444444 Time 208.66055965423584
Epoch 163 Phase train Loss 0.016 Acc 0.8523489932885906 Time 167.27203345298767
Epoch 163 Phase test Loss 0.013 Acc 0.8472222222222222 Time 208.41438722610474
Epoch 164 Phase train Loss 0.016 Acc 0.8473154362416108 Time 167.277410030365
Epoch 164 Phase test Loss 0.016 Acc 0.8472222222222222 Time 208.26515817642212
Epoch 165 Phase train Loss 0.017 Acc 0.8305369127516778 Time 166.7461440563202
Epoch 165 Phase test Loss 0.015 Acc 0.8680555555555555 Time 207.73195934295654
Epoch 166 Phase train Loss 0.018 Acc 0.8154362416107382 Time 167.0937328338623
Epoch 166 Phase test Loss 0.012 Acc 0.8611111111111111 Time 208.15916633605957
Epoch 167 Phase train Loss 0.013 Acc 0.8741610738255033 Time 167.12566566467285
Epoch 167 Phase test Loss 0.015 Acc 0.8402777777777777 Time 208.38546299934387
Epoch 168 Phase train Loss 0.019 Acc 0.8422818791946308 Time 166.9286913871765
Epoch 168 Phase test Loss 0.013 Acc 0.875 Time 207.91886067390442
Epoch 169 Phase train Loss 0.017 Acc 0.8439597315436241 Time 167.02648067474365
Epoch 169 Phase test Loss 0.013 Acc 0.8611111111111111 Time 207.89087748527527
Epoch 170 Phase train Loss 0.019 Acc 0.8070469798657718 Time 166.9989812374115
Epoch 170 Phase test Loss 0.017 Acc 0.8541666666666666 Time 208.50775003433228
Epoch 171 Phase train Loss 0.017 Acc 0.837248322147651 Time 166.99955201148987
Epoch 171 Phase test Loss 0.013 Acc 0.8819444444444444 Time 208.01159811019897
Epoch 172 Phase train Loss 0.020 Acc 0.8070469798657718 Time 167.71162128448486
Epoch 172 Phase test Loss 0.012 Acc 0.8541666666666666 Time 208.75368356704712
Epoch 173 Phase train Loss 0.015 Acc 0.8557046979865771 Time 167.94012641906738
Epoch 173 Phase test Loss 0.011 Acc 0.8888888888888888 Time 209.04031538963318
Epoch 174 Phase train Loss 0.017 Acc 0.8456375838926175 Time 167.86365175247192
Epoch 174 Phase test Loss 0.013 Acc 0.8611111111111111 Time 208.83654260635376
Epoch 175 Phase train Loss 0.015 Acc 0.8573825503355704 Time 168.0143313407898
Epoch 175 Phase test Loss 0.012 Acc 0.8611111111111111 Time 209.06986904144287
Epoch 176 Phase train Loss 0.017 Acc 0.848993288590604 Time 167.61616206169128
Epoch 176 Phase test Loss 0.014 Acc 0.8472222222222222 Time 208.7991120815277
Epoch 177 Phase train Loss 0.014 Acc 0.8708053691275167 Time 167.51455545425415
Epoch 177 Phase test Loss 0.011 Acc 0.8888888888888888 Time 208.59656023979187
Epoch 178 Phase train Loss 0.014 Acc 0.8590604026845637 Time 166.94763493537903
Epoch 178 Phase test Loss 0.013 Acc 0.8472222222222222 Time 207.81481552124023
Epoch 179 Phase train Loss 0.017 Acc 0.8355704697986577 Time 168.5112109184265
Epoch 179 Phase test Loss 0.014 Acc 0.8611111111111111 Time 209.46848130226135
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Epoch 180 Phase train Loss 0.015 Acc 0.8456375838926175 Time 166.80427646636963
Epoch 180 Phase test Loss 0.009 Acc 0.9027777777777777 Time 209.67094445228577
Epoch 181 Phase train Loss 0.018 Acc 0.8305369127516778 Time 168.56555151939392
Epoch 181 Phase test Loss 0.015 Acc 0.8680555555555555 Time 209.71516919136047
Epoch 182 Phase train Loss 0.017 Acc 0.848993288590604 Time 167.48767161369324
Epoch 182 Phase test Loss 0.012 Acc 0.8958333333333333 Time 208.4425175189972
Epoch 183 Phase train Loss 0.013 Acc 0.87248322147651 Time 166.94966220855713
Epoch 183 Phase test Loss 0.012 Acc 0.8680555555555555 Time 207.98643684387207
Epoch 184 Phase train Loss 0.013 Acc 0.8624161073825504 Time 168.1713089942932
Epoch 184 Phase test Loss 0.014 Acc 0.8541666666666666 Time 209.17824292182922
Epoch 185 Phase train Loss 0.015 Acc 0.8590604026845637 Time 167.39611220359802
Epoch 185 Phase test Loss 0.012 Acc 0.8819444444444444 Time 208.41990303993225
Epoch 186 Phase train Loss 0.016 Acc 0.8422818791946308 Time 167.34147667884827
Epoch 186 Phase test Loss 0.012 Acc 0.861111111111111 Time 208.41332149505615
Epoch 187 Phase train Loss 0.014 Acc 0.8523489932885906 Time 168.31565141677856
Epoch 187 Phase test Loss 0.013 Acc 0.8819444444444444 Time 209.35389161109924
Epoch 188 Phase train Loss 0.014 Acc 0.8657718120805369 Time 167.4508194923401
Epoch 188 Phase test Loss 0.012 Acc 0.8819444444444444 Time 208.67663264274597
Epoch 189 Phase train Loss 0.014 Acc 0.8674496644295302 Time 167.09590697288513
Epoch 189 Phase test Loss 0.012 Acc 0.9166666666666666 Time 208.01840114593506
Epoch 190 Phase train Loss 0.013 Acc 0.8859060402684563 Time 167.05188870429993
Epoch 190 Phase test Loss 0.015 Acc 0.8472222222222222 Time 208.1551158428192
Epoch 191 Phase train Loss 0.016 Acc 0.8305369127516778 Time 166.86084270477295
Epoch 191 Phase test Loss 0.014 Acc 0.875 Time 208.03359174728394
Epoch 192 Phase train Loss 0.016 Acc 0.848993288590604 Time 167.06287741661072
Epoch 192 Phase test Loss 0.016 Acc 0.8472222222222222 Time 208.04938459396362
Epoch 193 Phase train Loss 0.015 Acc 0.8506711409395973 Time 167.07216930389404
Epoch 193 Phase test Loss 0.015 Acc 0.8541666666666666 Time 207.95761585235596
Epoch 194 Phase train Loss 0.017 Acc 0.8640939597315436 Time 167.33600163459778
Epoch 194 Phase test Loss 0.012 Acc 0.8819444444444444 Time 208.39748811721802
Epoch 195 Phase train Loss 0.016 Acc 0.8406040268456376 Time 167.6495020389557
Epoch 195 Phase test Loss 0.011 Acc 0.8958333333333333 Time 209.02878546714783
Epoch 196 Phase train Loss 0.014 Acc 0.8640939597315436 Time 167.25225353240967
Epoch 196 Phase test Loss 0.017 Acc 0.875 Time 208.31738424301147
Epoch 197 Phase train Loss 0.017 Acc 0.8338926174496644 Time 168.35891366004944
Epoch 197 Phase test Loss 0.014 Acc 0.875 Time 209.62789821624756
Epoch 198 Phase train Loss 0.018 Acc 0.8288590604026845 Time 168.50872349739075
Epoch 198 Phase test Loss 0.014 Acc 0.875 Time 209.63844919204712
Epoch 199 Phase train Loss 0.015 Acc 0.8590604026845637 Time 166.95439839363098
Epoch 199 Phase test Loss 0.010 Acc 0.8819444444444444 Time 208.02330660820007
Epoch 200 Phase train Loss 0.015 Acc 0.8573825503355704 Time 167.17430233955383
Epoch 200 Phase test Loss 0.014 Acc 0.8472222222222222 Time 208.2540032863617


Best Accuracy 0.917


In [9]: epoch = [int(idx+1) for idx in range(len(train_acc))]
        stack = (epoch, train_acc, test_acc, train_loss, test_loss, train_time, test_time)
```

```
header = 'epoch,' + 'train_acc,' + 'test_acc,' + 'train_loss,' + 'test_loss,' + 'train_
helper.save_and_plot(stack, header, log)
```

	train_acc	test_acc	train_loss	test_loss	train_time	test_time
epoch						
1	0.116	0.146	0.076	0.081	166.284	206.916
2	0.141	0.090	0.076	0.083	163.905	204.425
3	0.112	0.090	0.077	0.081	164.797	205.392
4	0.149	0.201	0.075	0.079	164.920	205.468
5	0.173	0.285	0.075	0.075	164.715	204.720
6	0.205	0.410	0.071	0.065	167.400	208.227
7	0.232	0.410	0.067	0.061	170.155	211.447
8	0.337	0.507	0.061	0.052	167.505	208.501
9	0.344	0.486	0.059	0.050	167.542	208.419
10	0.404	0.500	0.054	0.044	166.038	206.768
11	0.451	0.556	0.053	0.046	167.917	208.732
12	0.446	0.597	0.051	0.040	166.762	207.539
13	0.488	0.542	0.047	0.044	167.889	209.081
14	0.477	0.604	0.047	0.040	166.223	207.011
15	0.480	0.660	0.047	0.034	166.119	207.098
16	0.520	0.618	0.045	0.037	166.533	207.723
17	0.523	0.597	0.043	0.035	166.252	207.132
18	0.518	0.660	0.045	0.033	166.543	207.307
19	0.535	0.646	0.043	0.035	166.739	207.782
20	0.560	0.625	0.040	0.032	167.062	207.837
21	0.555	0.681	0.042	0.032	166.954	207.773
22	0.577	0.688	0.040	0.030	166.656	207.623
23	0.574	0.708	0.040	0.028	166.278	207.145
24	0.616	0.674	0.036	0.030	166.949	207.695
25	0.614	0.736	0.037	0.027	166.620	207.424
26	0.602	0.708	0.038	0.027	167.057	208.013
27	0.638	0.715	0.035	0.027	168.286	209.223
28	0.619	0.674	0.033	0.035	167.740	208.968
29	0.584	0.674	0.039	0.032	167.143	208.127
30	0.570	0.701	0.039	0.027	166.782	207.784
...	...	...	...	...	...	...
171	0.837	0.882	0.017	0.013	167.000	208.012
172	0.807	0.854	0.020	0.012	167.712	208.754
173	0.856	0.889	0.015	0.011	167.940	209.040
174	0.846	0.861	0.017	0.013	167.864	208.837
175	0.857	0.861	0.015	0.012	168.014	209.070
176	0.849	0.847	0.017	0.014	167.616	208.799
177	0.871	0.889	0.014	0.011	167.515	208.597
178	0.859	0.847	0.014	0.013	166.948	207.815
179	0.836	0.861	0.017	0.014	168.511	209.468
180	0.846	0.903	0.015	0.009	166.804	209.671
181	0.831	0.868	0.018	0.015	168.566	209.715
182	0.849	0.896	0.017	0.012	167.488	208.443

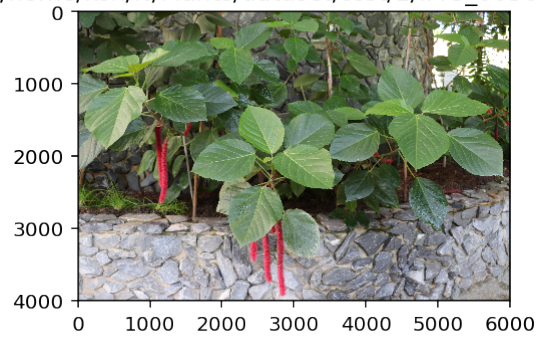|					
183	0.872	0.868	0.013	0.012	166.950	207.986
184	0.862	0.854	0.013	0.014	168.171	209.178
185	0.859	0.882	0.015	0.012	167.396	208.420
186	0.842	0.861	0.016	0.012	167.341	208.413
187	0.852	0.882	0.014	0.013	168.316	209.354
188	0.866	0.882	0.014	0.012	167.451	208.677
189	0.867	0.917	0.014	0.012	167.096	208.018
190	0.886	0.847	0.013	0.015	167.052	208.155
191	0.831	0.875	0.016	0.014	166.861	208.034
192	0.849	0.847	0.016	0.016	167.063	208.049
193	0.851	0.854	0.015	0.015	167.072	207.958
194	0.864	0.882	0.017	0.012	167.336	208.397
195	0.841	0.896	0.016	0.011	167.650	209.029
196	0.864	0.875	0.014	0.017	167.252	208.317
197	0.834	0.875	0.017	0.014	168.359	209.628
198	0.829	0.875	0.018	0.014	168.509	209.638
199	0.859	0.882	0.015	0.010	166.954	208.023
200	0.857	0.847	0.015	0.014	167.174	208.254

[200 rows x 6 columns]
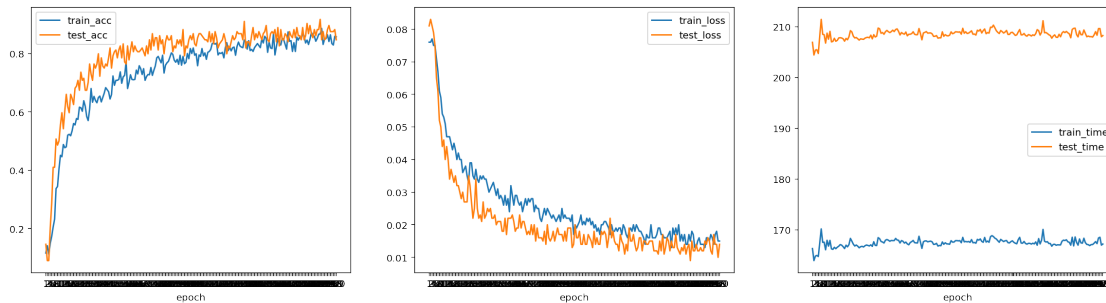
1.5 Predict

```
In [11]: image_path = os.path.join(data_dir, 'test', '1', 'IMG_0050.JPG')
         probs, classes = helper.predict(image_path, cpt, top_k=3, gpu=True)
         cats = [cat_to_name[c] for c in classes]
         #print(probs, classes)
         helper.display_classes(image_path, probs, classes, cats)
         print(cats)
```

['Acalypha hispida [EUPHORBIACAE]', 'Melastoma malabathricum var alba [MELASTOMATACEAE]', 'Pass

/home/ksn/N/Plants/dataset/test/1/IMG_0050.JPG

Class Probabilities