spiral

December 15, 2017

In [14]:
```
import csv
import numpy as np
import torch
import matplotlib
import matplotlib.pyplot as plt
from torch.autograd import Variable
from torch.utils.data import Dataset, DataLoader
```

In [15]:
```
# use provided supplementary load function
from supp import pytorch_nn_spiral as iai
```

In [16]:
```
class ToyDataset(Dataset):
    """ A toy dataset class which implements the abstract class torch.utils.data.Data
    (for reference see http://pytorch.org/docs/master/data.html#torch.utils.data.Data
    """
    def __init__(self, root_dir, txt_filename):
        super(ToyDataset, self).__init__()

        with open(root_dir + "/" + txt_filename) as txt_file:
            content = csv.reader(txt_file, delimiter = ' ')
            x = []
            y = []
            truth = np.array([],dtype=int)
            for row in content:
                x_i = row[0]
                y_i = row[1]
                t_i = row[2]

                x.append(x_i)
                y.append(y_i)
                truth = np.append(truth,t_i)
        self.raw = torch.from_numpy(np.transpose(np.array((x[:], y[:]), dtype=float)))
        truth = truth.astype(np.int)
        self.type = torch.from_numpy(self.one_hot_encode(truth))

    # write ground truth as one hot vector
    def one_hot_encode(self, x):
```

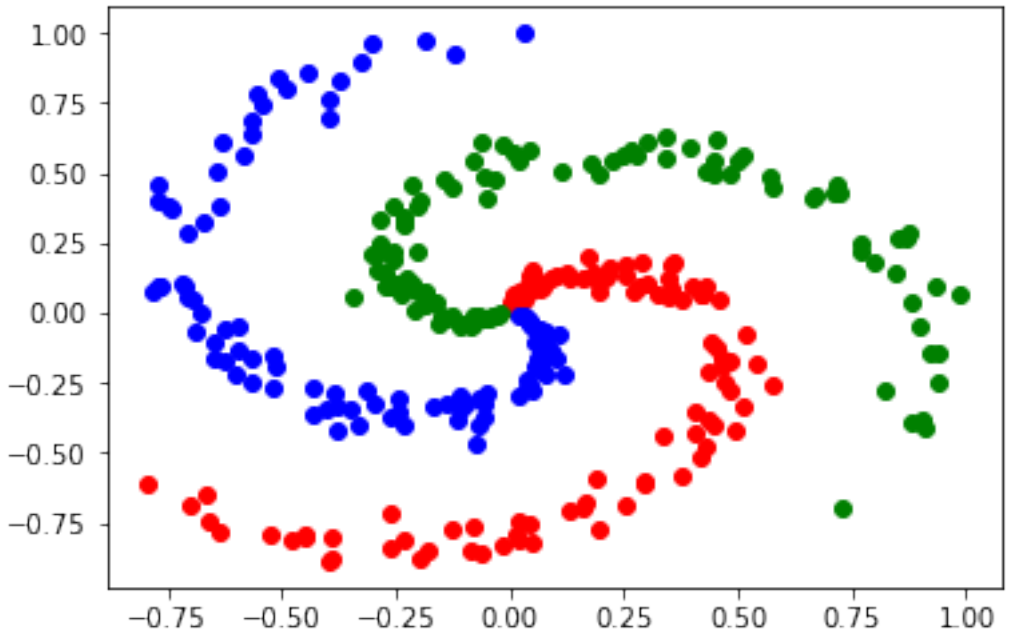
```
            n_values = np.max(x) + 1
            return np.eye(n_values, dtype=float)[x]

        def __getitem__(self, index):
            return self.raw[index], self.type[index]

        def __len__(self):
            return self.raw.__len__()
```

1 Load triple junction example

In [17]:
```
x,y = iai.load_dataset('supp/spiral_data_training.txt')
iai.visualize_toy_dataset(x, y)
plt.show()
```



In [18]:
```
toy = ToyDataset(root_dir='supp', txt_filename='spiral_data_training.txt')
#dir(toy)

def pred_quality(y1, y2):
    y1, y2 = y1.data.numpy(), y2.data.numpy()
    ix1 = y1.argmax(1)
    ix2 = y2.argmax(1)
    return float(np.sum(ix1 == ix2)) / y1.shape[0]
```

In [23]:
```
#labels = Variable(torch.FloatTensor([1, 2, 3])).view(1,-1)
```

```
N, D_in, H, D_out = toy.__len__(), toy.raw.shape[1], 100, 4

x = Variable(toy.raw)
y = Variable(toy.type)
x,y = x.type(torch.FloatTensor), y.type(torch.FloatTensor)

model = torch.nn.Sequential(
    torch.nn.Linear(D_in, H),
    torch.nn.Tanh(),
    torch.nn.Linear(H, H),
    torch.nn.Tanh(),
    torch.nn.Linear(H, H),
    torch.nn.Tanh(),
    torch.nn.Linear(H, D_out),
    torch.nn.Softmax(),
)
loss_fn = torch.nn.MultiLabelSoftMarginLoss()
```

In [24]:
```
learning_rate = 1e-4
optimizer = torch.optim.SGD(model.parameters(), lr=0.01) #torch.optim.Adam(model.para
loss = Variable(torch.FloatTensor([1000]))
#while float(loss.data) > 1:
for t in range(5000):
    # Forward pass: compute predicted y by passing x to the model.
    y_pred = model(x)

    # Compute and print loss.
    loss = loss_fn(y_pred, y)
    if t % 1000 == 0:
        print('Training acceptance: ', pred_quality(y_pred, y))
        print('Loss: ', loss.data)

    optimizer.zero_grad()

    # Backward pass: compute gradient of the loss with respect to model
    # parameters
    loss.backward()

    optimizer.step()
torch.save(model.state_dict(), 'net2.pk1')
```

```
/Users/lucasmueller/anaconda/lib/python3.6/site-packages/torch/nn/modules/container.py:67: User
  input = module(input)


Training acceptance:  0.3333333333333333
Loss:
```

```
 0.7650
[torch.FloatTensor of size 1]

Training acceptance:  0.47
Loss:
 0.7479
[torch.FloatTensor of size 1]

Training acceptance:  0.49666666666666665
Loss:
 0.7378
[torch.FloatTensor of size 1]

Training acceptance:  0.5466666666666666
Loss:
 0.7279
[torch.FloatTensor of size 1]

Training acceptance:  0.5766666666666667
Loss:
 0.7179
[torch.FloatTensor of size 1]
```

2 Training Success

```
In [25]: print('Training acceptance: ', pred_quality(y_pred, y))
```

```
Training acceptance:  0.51
```

3 Test Success

```
In [26]: toyTest = ToyDataset(root_dir='supp', txt_filename='spiral_data_test.txt')

         xt = Variable(toyTest.raw)
         yt = Variable(toyTest.type)
         xt,yt = xt.type(torch.FloatTensor), yt.type(torch.FloatTensor)
         y_predt = model(xt)
         print('Testing acceptance: ', pred_quality(y_predt, yt))
```

```
Testing acceptance:  0.5233333333333333


/Users/lucasmueller/anaconda/lib/python3.6/site-packages/torch/nn/modules/container.py:67: User
  input = module(input)
```