Lab sheet 10
Classification and Regression
(Introduction to deep learning)

Linear Classification by Regression

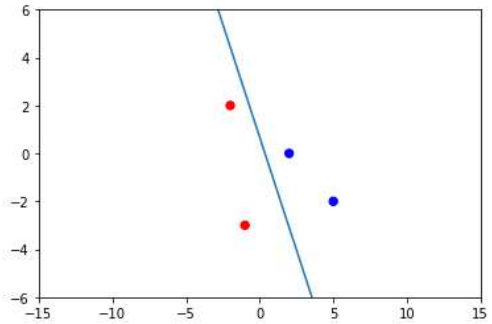
Data

```
X shape: (4, 2)
y shape: (4,)
[[ 2  0]
 [ 5 -2]
 [-2  2]
 [-1 -3]]
```

Architecture

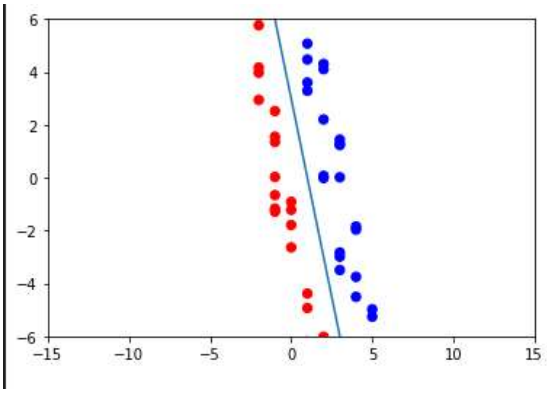
```
Model: "sequential"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
dense (Dense)                (None, 1)                 3
=================================================================
Total params: 3
Trainable params: 3
Non-trainable params: 0
_________________________________________________________________
```

Plot prediction



Linear Binary Classification

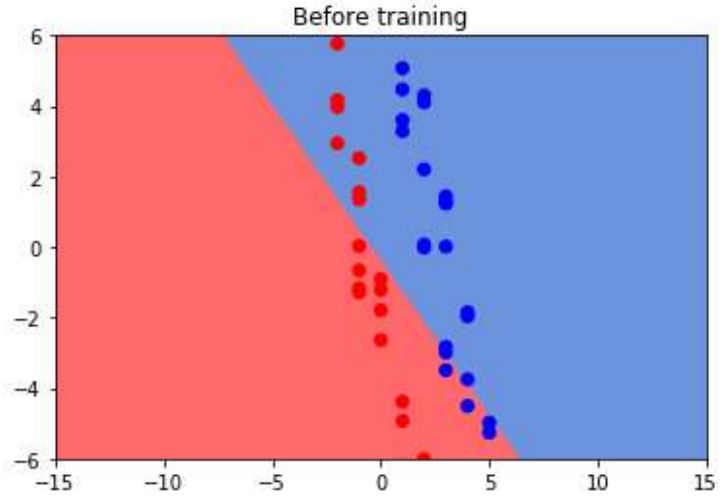
Data setup – Generated random data

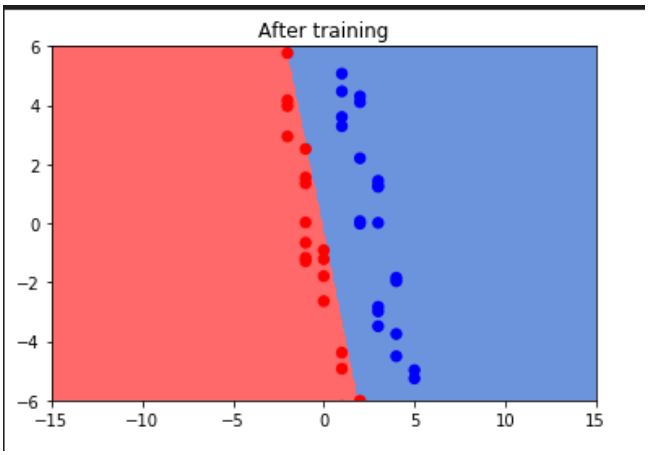


Model

```
Model: "sequential"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
dense (Dense)                (None, 2)                 6
_________________________________________________________________
softmax (Softmax)            (None, 2)                 0
=================================================================
Total params: 6
Trainable params: 6
Non-trainable params: 0
_________________________________________________________________
```

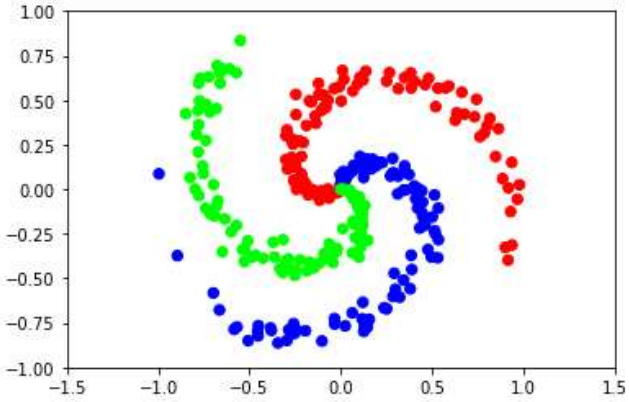
Learning





Linear Classifier with spiral data

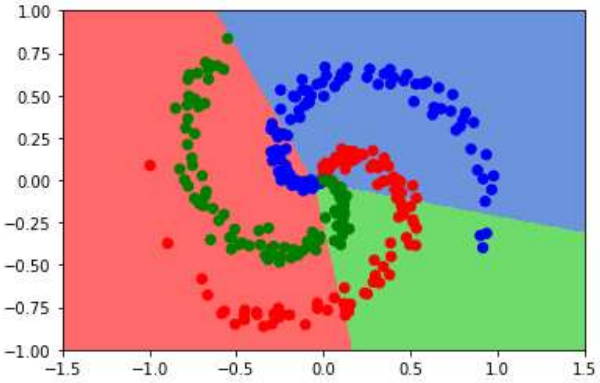
Generated data



Model

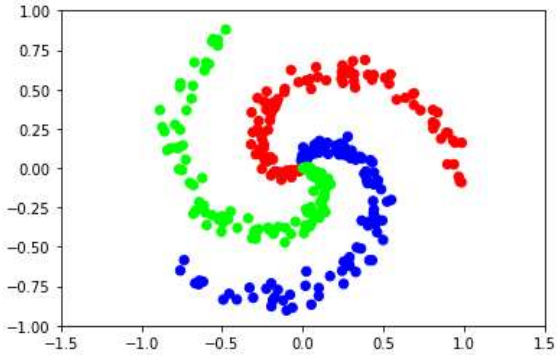
```
Model: "sequential_1"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
dense_1 (Dense)              (None, 3)                 9
_________________________________________________________________
softmax_1 (Softmax)          (None, 3)                 0
=================================================================
Total params: 9
Trainable params: 9
Non-trainable params: 0
_________________________________________________________________
```

Visualize decision boundaries



Neural Network with spiral data

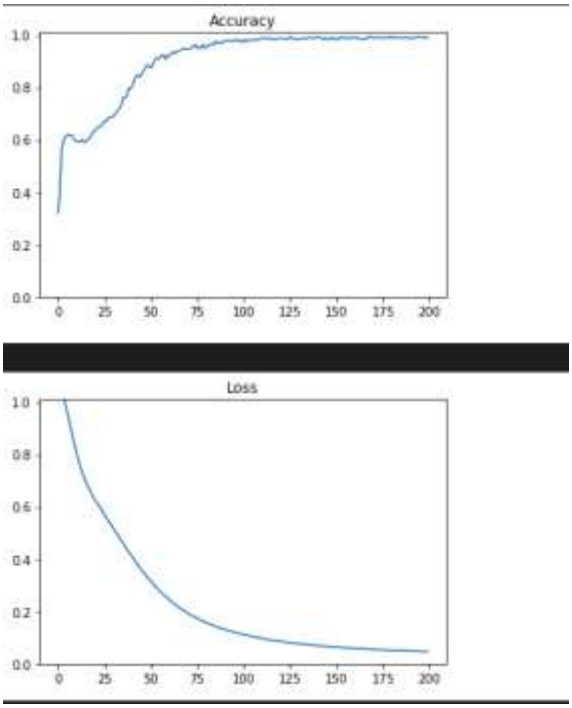
Generated spiral data



Model

```
Model: "sequential"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
dense (Dense)                (None, 100)               300
_________________________________________________________________
dense_1 (Dense)              (None, 10)                1010
_________________________________________________________________
dense_2 (Dense)              (None, 3)                 33
_________________________________________________________________
softmax (Softmax)            (None, 3)                 0
=================================================================
Total params: 1,343
Trainable params: 1,343
Non-trainable params: 0
_________________________________________________________________
```

Result – Accuracy and loss



Visualize decision boundaries