

Testing & Training of FFNN on IRIS Data Set

Results & Observations

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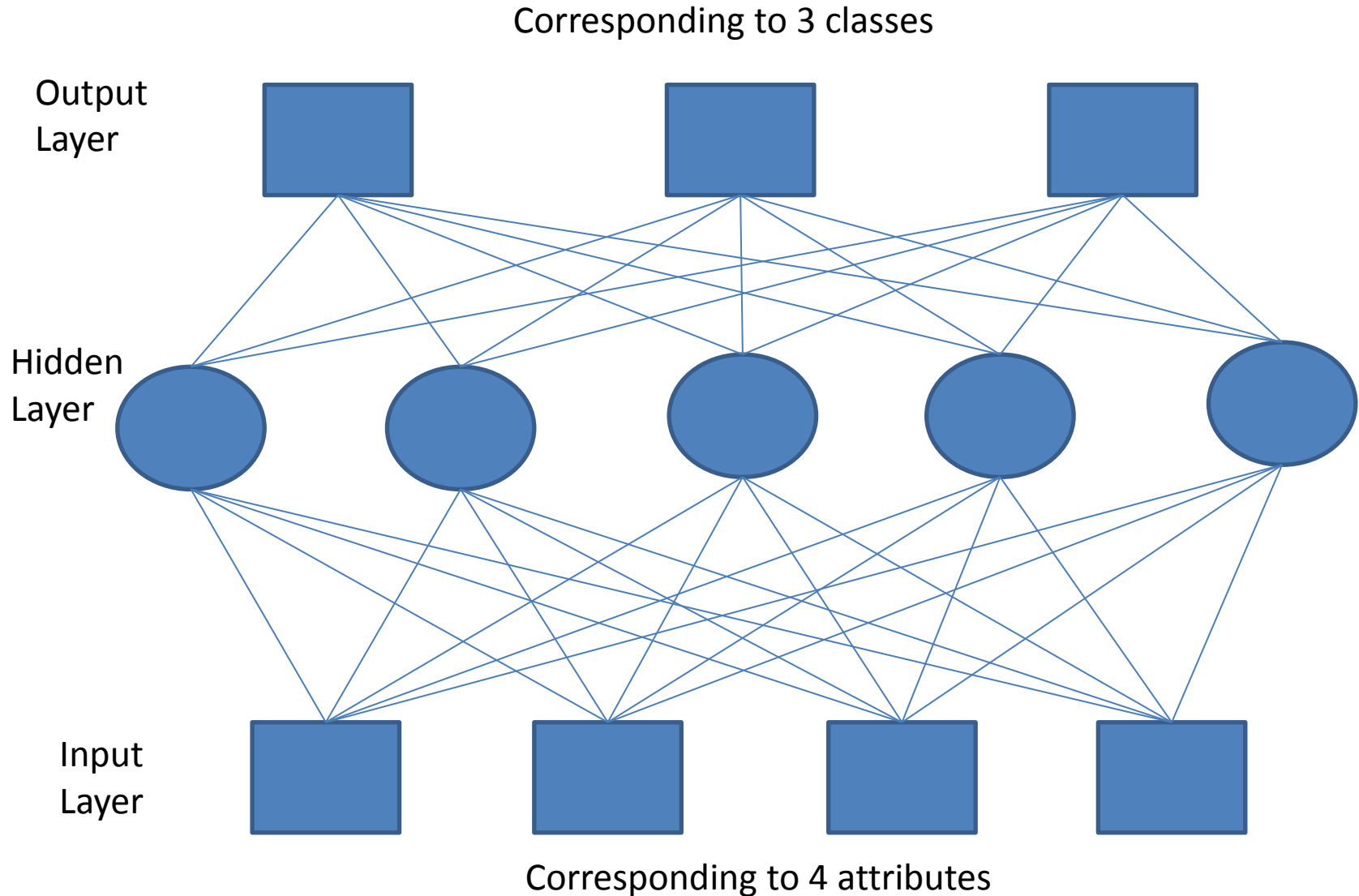
Assignment Specifications

- Download any classification benchmark data from ML repositories (University of California at Irvine).
- Train and test FFNN on such data. Of particular note is a classic problem called IRIS data.

Data Set Specifications

- Number of Instances: 150
- Classes:
 - Iris Setosa
 - Iris Versicolour
 - Iris Virginica
- Number of Attributes: 4 numeric, predictive attributes
- Class Distribution: 33.3% for each of 3 classes

Neural Network Structure



Testing & Training Methodology

- We performed N-fold cross validation with $N=5$.
- We divided our classification data into 5 partitions & used 4 partitions for training the neural network and the remaining one for measuring accuracy.
- We also observed the effect of changing the order of data set elements i.e. we shuffled the elements of training data set so that instances of data belonging to a single class do not occur together.

Result-Using 5 Fold Validation

Data Partition-1

- Initialization - random between -0.5 to 0.5

Momentum Factor : 0.1

- Accuracy – 1 (30/30)

Learning Rate : 0.1

Threshold Error: 50%

- Snapshot of Result →

```
abhishekgupta@osl-80: ~/Desktop/IRIS
No of patterns iterated on 113 error:1.64576
No of patterns iterated on 113 error:1.64557
No of patterns iterated on 113 error:1.62536
No of patterns iterated on 113 error:1.59694
No of patterns iterated on 113 error:1.57587
No of patterns iterated on 113 error:1.57408
No of patterns iterated on 113 error:1.57382
No of patterns iterated on 113 error:1.57323
No of patterns iterated on 113 error:1.56924
No of patterns iterated on 113 error:1.56884
No of patterns iterated on 113 error:1.55462
No of patterns iterated on 113 error:1.54476
No of patterns iterated on 113 error:1.53734
No of patterns iterated on 113 error:1.51177
No of patterns iterated on 117 error:1.50023
No of patterns iterated on 118 error:1.52273
No of patterns iterated on 118 error:1.51377
No of patterns iterated on 118 error:1.513
No of patterns iterated on 118 error:1.50026
1.5,545994
Enter check file
iris.check1
Accuracy is 1
abhishekgupta@osl-80:~/Desktop/IRIS$
```

Result-Using 5 Fold Validation

Data Partition-2

- Initialization - random between -0.5 to 0.5
- Accuracy – 0.96667 (29/30)
- Snapshot of Result →

Momentum Factor : 0.1

Learning Rate : 0.1

Threshold Error: 50%

```
abhishekgupta@osl-80: ~/Desktop/IRIS
No of patterns iterated on 60 error:1.74938
No of patterns iterated on 60 error:1.7494
No of patterns iterated on 60 error:1.74942
No of patterns iterated on 60 error:1.74932
No of patterns iterated on 60 error:1.74896
No of patterns iterated on 60 error:1.7478
No of patterns iterated on 60 error:1.65919
No of patterns iterated on 60 error:1.64639
No of patterns iterated on 60 error:1.40647
No of patterns iterated on 60 error:1.3798
No of patterns iterated on 60 error:1.37946
No of patterns iterated on 60 error:1.3792
No of patterns iterated on 60 error:1.36783
No of patterns iterated on 60 error:1.36527
No of patterns iterated on 60 error:1.36446
No of patterns iterated on 60 error:1.36418
No of patterns iterated on 60 error:1.31362
No of patterns iterated on 60 error:1.30857
No of patterns iterated on 60 error:1.30851
0.9,31858
Enter check file
iris.check2
Accuracy is 0.96667
abhishekgupta@osl-80:~/Desktop/IRIS$
```

Result-Using 5 Fold Validation

Data Partition-3

- Initialization - random between -0.5 to 0.5
- Accuracy – 0.96667 (29/30)
- Snapshot of Result →

Momentum Factor : 0.1

Learning Rate : 0.1

Threshold Error: 50%

```
abhishekgupta@osl-80: ~/Desktop/IRIS
No of patterns iterated on 53 error:1.56699
No of patterns iterated on 53 error:1.56703
No of patterns iterated on 53 error:1.56706
No of patterns iterated on 53 error:1.56712
No of patterns iterated on 53 error:1.56718
No of patterns iterated on 53 error:1.56723
No of patterns iterated on 53 error:1.56727
No of patterns iterated on 53 error:1.56743
No of patterns iterated on 53 error:1.56749
No of patterns iterated on 53 error:1.56757
No of patterns iterated on 53 error:1.56766
No of patterns iterated on 53 error:1.56773
No of patterns iterated on 53 error:1.56777
No of patterns iterated on 53 error:1.56783
No of patterns iterated on 53 error:1.56787
No of patterns iterated on 53 error:1.56791
No of patterns iterated on 53 error:1.5662
No of patterns iterated on 53 error:1.54766
No of patterns iterated on 56 error:2.43657
1.5,31605
Enter check file
iris.check3
Accuracy is 0.96667
abhishekgupta@osl-80:~/Desktop/IRIS$
```

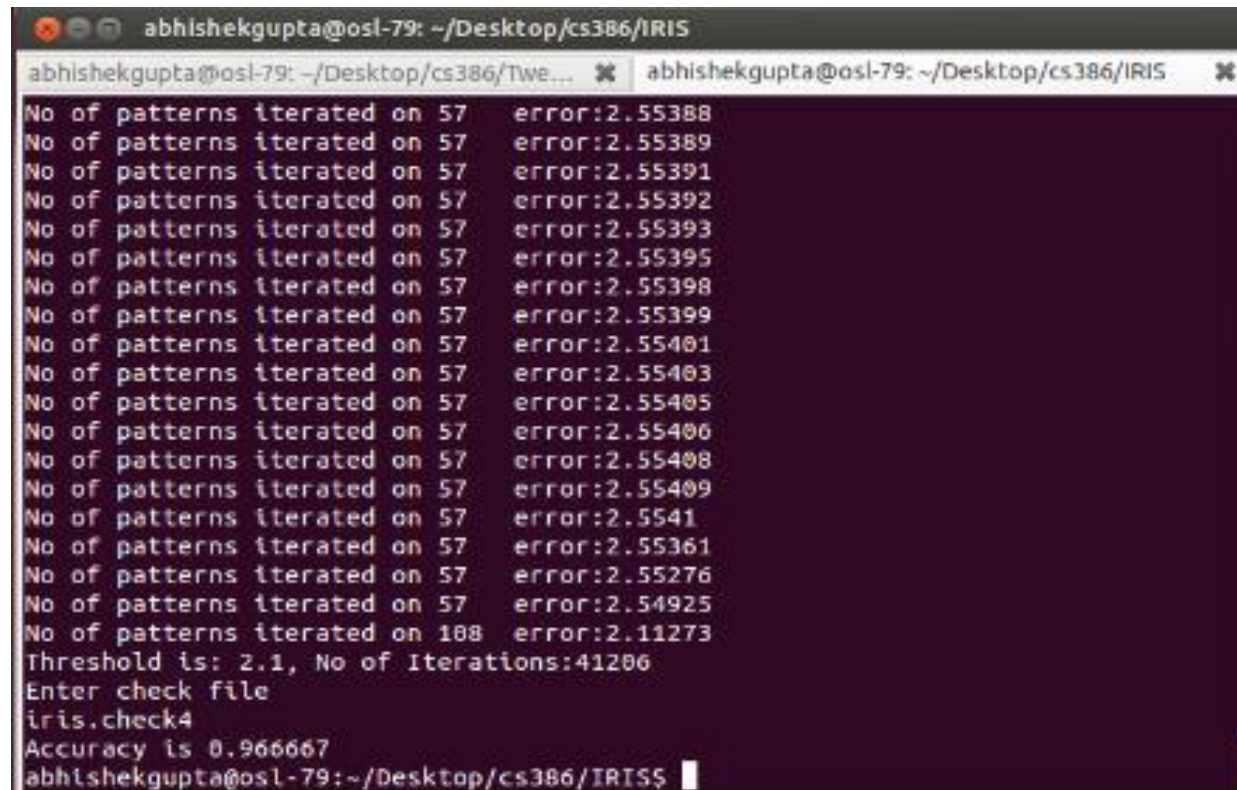

Result-Using 5 Fold Validation Data Partition-4

- Initialization - random
between -0.5 to 0.5
- Accuracy – 0.96667 (29/30)
- Snapshot of
Result →

Momentum Factor : 0.1

Learning Rate : 0.1

Threshold Error: 50%



```
abhishekgupta@osl-79: ~/Desktop/cs386/IRIS
abhishekgupta@osl-79: ~/Desktop/cs386/Twe...  abhishekgupta@osl-79: ~/Desktop/cs386/IRIS
No of patterns iterated on 57 error:2.55388
No of patterns iterated on 57 error:2.55389
No of patterns iterated on 57 error:2.55391
No of patterns iterated on 57 error:2.55392
No of patterns iterated on 57 error:2.55393
No of patterns iterated on 57 error:2.55395
No of patterns iterated on 57 error:2.55398
No of patterns iterated on 57 error:2.55399
No of patterns iterated on 57 error:2.55401
No of patterns iterated on 57 error:2.55403
No of patterns iterated on 57 error:2.55405
No of patterns iterated on 57 error:2.55406
No of patterns iterated on 57 error:2.55408
No of patterns iterated on 57 error:2.55409
No of patterns iterated on 57 error:2.5541
No of patterns iterated on 57 error:2.55361
No of patterns iterated on 57 error:2.55276
No of patterns iterated on 57 error:2.54925
No of patterns iterated on 108 error:2.11273
Threshold is: 2.1, No of Iterations:41206
Enter check file
iris.check4
Accuracy is 0.96667
abhishekgupta@osl-79:~/Desktop/cs386/IRIS$
```

Result-Using 5 Fold Validation

Data Partition-5

- Initialization - random between -0.5 to 0.5
- Accuracy – 1 (30/30)
- Snapshot of Result →

Momentum Factor : 0.1

Learning Rate : 0.1

Threshold Error: 50%

```
abhishekgupta@osl-80: ~/Desktop/IRIS
No of patterns iterated on 101 error:1.70963
No of patterns iterated on 101 error:1.70963
No of patterns iterated on 103 error:2.19497
No of patterns iterated on 103 error:2.1621
No of patterns iterated on 103 error:2.14959
No of patterns iterated on 103 error:2.14853
No of patterns iterated on 103 error:2.14853
No of patterns iterated on 103 error:2.14802
No of patterns iterated on 103 error:2.11097
No of patterns iterated on 103 error:2.10214
No of patterns iterated on 103 error:2.1017
No of patterns iterated on 103 error:2.0981
No of patterns iterated on 103 error:2.09779
No of patterns iterated on 103 error:2.09778
No of patterns iterated on 103 error:2.09778
No of patterns iterated on 103 error:2.07553
No of patterns iterated on 103 error:2.07267
No of patterns iterated on 103 error:2.01906
No of patterns iterated on 103 error:1.933
1.5,663819
Enter check file
iris.check5
Accuracy is 1
abhishekgupta@osl-80:~/Desktop/IRIS$
```

Shuffled Data Set Partition-1

- Initialization - random between -0.25 to 0.25
- Accuracy – 1 (30/30)
- Snapshot of Result →

Momentum Factor : 0.1

Learning Rate : 0.1

Threshold Error: 50%

```
abhishekgupta@osl-80: ~/Desktop/IRIS
No of patterns iterated on 79 error:1.54384
No of patterns iterated on 79 error:1.54391
No of patterns iterated on 79 error:1.54394
No of patterns iterated on 79 error:1.54397
No of patterns iterated on 79 error:1.54434
No of patterns iterated on 79 error:1.54475
No of patterns iterated on 79 error:1.54479
No of patterns iterated on 79 error:1.54467
No of patterns iterated on 79 error:1.54435
No of patterns iterated on 79 error:1.5444
No of patterns iterated on 79 error:1.54443
No of patterns iterated on 79 error:1.54444
No of patterns iterated on 79 error:1.54205
No of patterns iterated on 79 error:1.54182
No of patterns iterated on 79 error:1.5372
No of patterns iterated on 79 error:1.53718
No of patterns iterated on 79 error:1.53725
No of patterns iterated on 79 error:1.53728
No of patterns iterated on 79 error:1.53767
1.5,224721
Enter check file
iris.check1
Accuracy is 1
abhishekgupta@osl-80:~/Desktop/IRIS$
```

Shuffled Data Set Partition-2

- Initialization - random
between -0.25 to 0.25
- Accuracy – 0.93333 (28/30)
- Snapshot of
Result →

Momentum Factor : 0.1

Learning Rate : 0.1

Threshold Error: 50%

```
abhishekgupta@osl-80: ~/Desktop/IRIS
No of patterns iterated on 27 error:1.50422
No of patterns iterated on 27 error:1.50896
No of patterns iterated on 60 error:1.50127
No of patterns iterated on 61 error:1.55455
No of patterns iterated on 61 error:1.55095
No of patterns iterated on 114 error:1.50144
No of patterns iterated on 105 error:1.50173
No of patterns iterated on 105 error:1.5017
No of patterns iterated on 105 error:1.50087
No of patterns iterated on 105 error:1.50075
No of patterns iterated on 105 error:1.50368
No of patterns iterated on 105 error:1.50355
No of patterns iterated on 104 error:1.50125
No of patterns iterated on 104 error:1.50147
No of patterns iterated on 105 error:1.50217
No of patterns iterated on 105 error:1.50174
No of patterns iterated on 105 error:1.50144
No of patterns iterated on 111 error:1.50117
No of patterns iterated on 111 error:1.50061
1.5,24797
Enter check file
iris.check2
Accuracy is 0.93333
abhishekgupta@osl-80:~/Desktop/IRIS$
```

Shuffled Data Set Partition-3

- Initialization - random between -0.25 to 0.25
- Accuracy – 0.966667 (29/30)
- Snapshot of Result →

Momentum Factor : 0.1

Learning Rate : 0.1

Threshold Error: 50%

```
abhishekgupta@osl-80: ~/Desktop/IRIS
No of patterns iterated on 71 error:1.99863
No of patterns iterated on 71 error:1.9987
No of patterns iterated on 71 error:1.99869
No of patterns iterated on 71 error:1.9987
No of patterns iterated on 71 error:1.99871
No of patterns iterated on 71 error:1.99891
No of patterns iterated on 71 error:1.99891
No of patterns iterated on 71 error:1.99802
No of patterns iterated on 71 error:1.9979
No of patterns iterated on 71 error:1.99791
No of patterns iterated on 71 error:1.99428
No of patterns iterated on 71 error:1.99393
No of patterns iterated on 71 error:1.99269
No of patterns iterated on 71 error:1.98739
No of patterns iterated on 34 error:1.7247
No of patterns iterated on 34 error:2.01174
No of patterns iterated on 34 error:2.01172
No of patterns iterated on 34 error:2.01174
No of patterns iterated on 34 error:2.01167
1.5,29229
Enter check file
iris.check3
Accuracy is 0.966667
abhishekgupta@osl-80: Desktop/IRIS$
```

Shuffled Data Set Partition-4

- Initialization - random between -0.25 to 0.25
- Accuracy – 1 (30/30)
- Snapshot of Result →

Momentum Factor : 0.1

Learning Rate : 0.1

Threshold Error: 50%

```
abhishekgupta@osl-80: ~/Desktop/IRIS
No of patterns iterated on 84 error:1.52888
No of patterns iterated on 84 error:1.52868
No of patterns iterated on 84 error:1.52866
No of patterns iterated on 84 error:1.52793
No of patterns iterated on 84 error:1.52784
No of patterns iterated on 84 error:1.52784
No of patterns iterated on 84 error:1.52768
No of patterns iterated on 84 error:1.52767
No of patterns iterated on 84 error:1.52595
No of patterns iterated on 84 error:1.52578
No of patterns iterated on 84 error:1.52558
No of patterns iterated on 84 error:1.52557
No of patterns iterated on 84 error:1.52557
No of patterns iterated on 84 error:1.52558
No of patterns iterated on 84 error:1.52556
No of patterns iterated on 108 error:1.50116
No of patterns iterated on 118 error:1.50048
No of patterns iterated on 118 error:1.50017
No of patterns iterated on 118 error:1.5
1.5,611101
Enter check file
iris.check4
Accuracy is 1
abhishekgupta@osl-80:~/Desktop/IRIS$
```


Shuffled Data Set Partition-5

- Initialization - random between -0.25 to 0.25
- Accuracy – 1 (30/30)
- Snapshot of Result →

Momentum Factor : 0.1

Learning Rate : 0.1

Threshold Error: 50%

```
abhishekgupta@osl-80: ~/Desktop/IRIS
No of patterns iterated on 100 error:1.50051
No of patterns iterated on 99 error:1.50018
No of patterns iterated on 76 error:1.50601
No of patterns iterated on 76 error:1.50784
No of patterns iterated on 76 error:1.50792
No of patterns iterated on 76 error:1.508
No of patterns iterated on 76 error:1.50802
No of patterns iterated on 76 error:1.50804
No of patterns iterated on 76 error:1.50812
No of patterns iterated on 76 error:1.50813
No of patterns iterated on 76 error:1.50814
No of patterns iterated on 76 error:1.50806
No of patterns iterated on 89 error:1.50003
No of patterns iterated on 100 error:1.50042
No of patterns iterated on 100 error:1.50043
No of patterns iterated on 98 error:1.50001
No of patterns iterated on 97 error:1.50001
No of patterns iterated on 97 error:1.50002
No of patterns iterated on 116 error:1.502
1.5,272096
Enter check file
iris.check5
Accuracy is 1
abhishekgupta@osl-80:~/Desktop/IRIS$
```

Observations

- A shuffled data sets usually leads to better learning than cyclic, fixed orders of training patterns. However, it also takes more time to train the Network.
- An ordered presentation of the training cases to the network can cause weights/error to move very erratically over the error surface.
- Any given series of an individual class' training patterns potentially causes the network to move in weight-space in a direction that is very different from the overall desired direction