

## Experiments

- 1] Shuffle in the read\_csv is turned off as it was shuffling each feature
- 2] using “sparse\_categorical\_crossentropy” instead of “categorical\_crossentropy” for loss  
as our data has integer encoding and not one hot  
<https://jovianlin.io/cat-crossentropy-vs-sparse-cat-crossentropy/>
- 3] Reduced number of epochs to under 200 as it didn't improve the results beyond this point
- 4] AdamOptimizer works better than GradientDescentOptimizer
- 5] Sigmoid gives better results than using just ReLU layers
- 6] Dropouts and regularisations make little difference

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## Results

- 1] wdbc : always above 0.62 Accuracy  
sometimes reaching around 0.9 Accuracy

```
Home:final kartikkalamadi$ python3 wdbc.py
Epoch 1/20
- 0s - loss: 0.7650 - acc: 0.1842
Epoch 2/20
- 0s - loss: 0.6340 - acc: 0.7456
Epoch 3/20
- 0s - loss: 0.6155 - acc: 0.7632
Epoch 4/20
- 0s - loss: 0.5704 - acc: 0.9035
Epoch 5/20
- 0s - loss: 0.5757 - acc: 0.9035
Epoch 6/20
- 0s - loss: 0.5618 - acc: 0.8947
Epoch 7/20
- 0s - loss: 0.5462 - acc: 0.6228
Epoch 8/20
- 0s - loss: 0.5496 - acc: 0.6228
Epoch 9/20
- 0s - loss: 0.5349 - acc: 0.8684
Epoch 10/20
- 0s - loss: 0.5299 - acc: 0.9298
Epoch 11/20
- 0s - loss: 0.5299 - acc: 0.9035
Epoch 12/20
- 0s - loss: 0.5209 - acc: 0.9123
Epoch 13/20
- 0s - loss: 0.5113 - acc: 0.9211
```

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Epoch 14/20
- 0s - loss: 0.5040 - acc: 0.9211
Epoch 15/20
- 0s - loss: 0.4990 - acc: 0.9211
Epoch 16/20
- 0s - loss: 0.4949 - acc: 0.9211
Epoch 17/20
- 0s - loss: 0.4924 - acc: 0.9035
Epoch 18/20
- 0s - loss: 0.4897 - acc: 0.9123
Epoch 19/20
- 0s - loss: 0.4876 - acc: 0.9123
Epoch 20/20
- 0s - loss: 0.4856 - acc: 0.9211
114/114 [=====] - 0s 78us/step
evaluation on training data [0.47502277085655614,
0.9035087844781708]
569/569 [=====] - 0s 31us/step
evaluation on test data [0.4772005935440164, 0.9103690651891939]

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2] wdbc : always around 0.6 Accuracy  
sometimes reaching around 0.9 Accuracy

```

Home:final kartikkalamadi$ python3 wdbc-small.py
Epoch 1/50
- 0s - loss: 0.7488 - acc: 0.4912
Epoch 2/50
- 0s - loss: 0.7344 - acc: 0.4912
Epoch 3/50
- 0s - loss: 0.7205 - acc: 0.4912
Epoch 4/50
- 0s - loss: 0.7078 - acc: 0.4912
Epoch 5/50
- 0s - loss: 0.7046 - acc: 0.4912
Epoch 6/50
- 0s - loss: 0.7062 - acc: 0.4912
Epoch 7/50
- 0s - loss: 0.6998 - acc: 0.5088
Epoch 8/50
- 0s - loss: 0.6978 - acc: 0.5263
Epoch 9/50
- 0s - loss: 0.6938 - acc: 0.5614
Epoch 10/50
- 0s - loss: 0.6960 - acc: 0.4912
Epoch 11/50
- 0s - loss: 0.6995 - acc: 0.5088
Epoch 12/50
- 0s - loss: 0.7002 - acc: 0.5088
Epoch 13/50
- 0s - loss: 0.7016 - acc: 0.5088
Epoch 14/50

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- 0s - loss: 0.6994 - acc: 0.5088  
Epoch 15/50  
- 0s - loss: 0.7076 - acc: 0.5088  
Epoch 16/50  
- 0s - loss: 0.7021 - acc: 0.5088  
Epoch 17/50  
- 0s - loss: 0.6981 - acc: 0.5088  
Epoch 18/50  
- 0s - loss: 0.7013 - acc: 0.5088  
Epoch 19/50  
- 0s - loss: 0.6990 - acc: 0.5088  
Epoch 20/50  
- 0s - loss: 0.6938 - acc: 0.5088  
Epoch 21/50  
- 0s - loss: 0.6934 - acc: 0.5263  
Epoch 22/50  
- 0s - loss: 0.6972 - acc: 0.4737  
Epoch 23/50  
- 0s - loss: 0.6915 - acc: 0.5439  
Epoch 24/50  
- 0s - loss: 0.6951 - acc: 0.5614  
Epoch 25/50  
- 0s - loss: 0.6909 - acc: 0.5439  
Epoch 26/50  
- 0s - loss: 0.6979 - acc: 0.4211  
Epoch 27/50  
- 0s - loss: 0.6928 - acc: 0.5614  
Epoch 28/50  
- 0s - loss: 0.6930 - acc: 0.7018  
Epoch 29/50  
- 0s - loss: 0.6938 - acc: 0.6491  
Epoch 30/50  
- 0s - loss: 0.6899 - acc: 0.5965  
Epoch 31/50  
- 0s - loss: 0.6899 - acc: 0.5614  
Epoch 32/50  
- 0s - loss: 0.6876 - acc: 0.5088  
Epoch 33/50  
- 0s - loss: 0.6920 - acc: 0.5439  
Epoch 34/50  
- 0s - loss: 0.6902 - acc: 0.5439  
Epoch 35/50  
- 0s - loss: 0.6892 - acc: 0.5965  
Epoch 36/50  
- 0s - loss: 0.6866 - acc: 0.6667  
Epoch 37/50  
- 0s - loss: 0.6857 - acc: 0.8421  
Epoch 38/50  
- 0s - loss: 0.6882 - acc: 0.6316  
Epoch 39/50  
- 0s - loss: 0.6819 - acc: 0.7193  
Epoch 40/50  
- 0s - loss: 0.6857 - acc: 0.7193  
Epoch 41/50

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- 0s - loss: 0.6792 - acc: 0.7544
Epoch 42/50
- 0s - loss: 0.6771 - acc: 0.7018
Epoch 43/50
- 0s - loss: 0.6830 - acc: 0.5789
Epoch 44/50
- 0s - loss: 0.6786 - acc: 0.7018
Epoch 45/50
- 0s - loss: 0.6786 - acc: 0.7193
Epoch 46/50
- 0s - loss: 0.6725 - acc: 0.7368
Epoch 47/50
- 0s - loss: 0.6766 - acc: 0.7193
Epoch 48/50
- 0s - loss: 0.6712 - acc: 0.7544
Epoch 49/50
- 0s - loss: 0.6749 - acc: 0.7018
Epoch 50/50
- 0s - loss: 0.6706 - acc: 0.7018
57/57 [=====] - 0s 67us/step
evaluation on training data [0.6668297052383423, 0.8421052694320679]
569/569 [=====] - 0s 66us/step
evaluation on test data [0.6572777479101358, 0.9103690592182542]
```

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3] wine : always around 0.4 to 0.65 Accuracy

```
Home:final kartikkalamadi$ python3 wine.py
Epoch 1/20
- 0s - loss: 1.1184 - acc: 0.3803
Epoch 2/20
- 0s - loss: 1.0997 - acc: 0.3803
Epoch 3/20
- 0s - loss: 1.0899 - acc: 0.3803
Epoch 4/20
- 0s - loss: 1.0844 - acc: 0.3803
Epoch 5/20
- 0s - loss: 1.0864 - acc: 0.3803
Epoch 6/20
- 0s - loss: 1.0817 - acc: 0.3803
Epoch 7/20
- 0s - loss: 1.0764 - acc: 0.3803
Epoch 8/20
- 0s - loss: 1.0736 - acc: 0.3803
Epoch 9/20
- 0s - loss: 1.0675 - acc: 0.3803
Epoch 10/20
- 0s - loss: 1.0584 - acc: 0.3803
Epoch 11/20
- 0s - loss: 1.0536 - acc: 0.3803
Epoch 12/20
- 0s - loss: 1.0450 - acc: 0.3803
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Epoch 13/20
- 0s - loss: 1.0366 - acc: 0.3803
Epoch 14/20
- 0s - loss: 1.0255 - acc: 0.3803
Epoch 15/20
- 0s - loss: 1.0136 - acc: 0.3803
Epoch 16/20
- 0s - loss: 0.9987 - acc: 0.3803
Epoch 17/20
- 0s - loss: 0.9813 - acc: 0.3803
Epoch 18/20
- 0s - loss: 0.9611 - acc: 0.6338
Epoch 19/20
- 0s - loss: 0.9423 - acc: 0.6338
Epoch 20/20
- 0s - loss: 0.9187 - acc: 0.6761
71/71 [=====] - 0s 207us/step
evaluation on training data [0.9019982353062697, 0.6619718486154583]
178/178 [=====] - 0s 112us/step
evaluation on test data [0.9335997486382388, 0.6516853895749939]

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4] wine-small : always around 0.4 to 0.7 Accuracy

```

Home:final kartikkalamadi$ python3 wine-small.py
Epoch 1/50
- 0s - loss: 1.1748 - acc: 0.3774
Epoch 2/50
- 0s - loss: 1.1649 - acc: 0.3774
Epoch 3/50
- 0s - loss: 1.1518 - acc: 0.3774
Epoch 4/50
- 0s - loss: 1.1366 - acc: 0.3774
Epoch 5/50
- 0s - loss: 1.1296 - acc: 0.3774
Epoch 6/50
- 0s - loss: 1.1127 - acc: 0.3774
Epoch 7/50
- 0s - loss: 1.1126 - acc: 0.3774
Epoch 8/50
- 0s - loss: 1.1040 - acc: 0.3774
Epoch 9/50
- 0s - loss: 1.0912 - acc: 0.3774
Epoch 10/50
- 0s - loss: 1.0953 - acc: 0.3774
Epoch 11/50
- 0s - loss: 1.0846 - acc: 0.3774
Epoch 12/50
- 0s - loss: 1.0889 - acc: 0.3774
Epoch 13/50
- 0s - loss: 1.0814 - acc: 0.3774
Epoch 14/50

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- 0s - loss: 1.0847 - acc: 0.3774  
Epoch 15/50  
- 0s - loss: 1.0826 - acc: 0.3774  
Epoch 16/50  
- 0s - loss: 1.0829 - acc: 0.4528  
Epoch 17/50  
- 0s - loss: 1.0880 - acc: 0.3962  
Epoch 18/50  
- 0s - loss: 1.0866 - acc: 0.3585  
Epoch 19/50  
- 0s - loss: 1.0871 - acc: 0.3774  
Epoch 20/50  
- 0s - loss: 1.0858 - acc: 0.3774  
Epoch 21/50  
- 0s - loss: 1.0841 - acc: 0.3774  
Epoch 22/50  
- 0s - loss: 1.0820 - acc: 0.3774  
Epoch 23/50  
- 0s - loss: 1.0811 - acc: 0.3585  
Epoch 24/50  
- 0s - loss: 1.0849 - acc: 0.3774  
Epoch 25/50  
- 0s - loss: 1.0815 - acc: 0.3774  
Epoch 26/50  
- 0s - loss: 1.0851 - acc: 0.3585  
Epoch 27/50  
- 0s - loss: 1.0863 - acc: 0.3774  
Epoch 28/50  
- 0s - loss: 1.0856 - acc: 0.3774  
Epoch 29/50  
- 0s - loss: 1.0838 - acc: 0.3774  
Epoch 30/50  
- 0s - loss: 1.0827 - acc: 0.3396  
Epoch 31/50  
- 0s - loss: 1.0783 - acc: 0.3585  
Epoch 32/50  
- 0s - loss: 1.0802 - acc: 0.3585  
Epoch 33/50  
- 0s - loss: 1.0792 - acc: 0.3962  
Epoch 34/50  
- 0s - loss: 1.0771 - acc: 0.4151  
Epoch 35/50  
- 0s - loss: 1.0788 - acc: 0.4340  
Epoch 36/50  
- 0s - loss: 1.0746 - acc: 0.6415  
Epoch 37/50  
- 0s - loss: 1.0741 - acc: 0.6792  
Epoch 38/50  
- 0s - loss: 1.0764 - acc: 0.6981  
Epoch 39/50  
- 0s - loss: 1.0732 - acc: 0.6792  
Epoch 40/50  
- 0s - loss: 1.0752 - acc: 0.7170  
Epoch 41/50

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- 0s - loss: 1.0704 - acc: 0.6981
Epoch 42/50
- 0s - loss: 1.0807 - acc: 0.6038
Epoch 43/50
- 0s - loss: 1.0699 - acc: 0.6981
Epoch 44/50
- 0s - loss: 1.0745 - acc: 0.6792
Epoch 45/50
- 0s - loss: 1.0761 - acc: 0.6792
Epoch 46/50
- 0s - loss: 1.0700 - acc: 0.7358
Epoch 47/50
- 0s - loss: 1.0802 - acc: 0.5849
Epoch 48/50
- 0s - loss: 1.0754 - acc: 0.6038
Epoch 49/50
- 0s - loss: 1.0764 - acc: 0.6415
Epoch 50/50
- 0s - loss: 1.0721 - acc: 0.6038
53/53 [=====] - 0s 133us/step
evaluation on training data [1.07082200050354, 0.7169811129570007]
178/178 [=====] - 0s 64us/step
evaluation on test data [1.0830995185991352, 0.6853932644544023]
```