Classification

Now that we have done analysis over globular clusters , weh know the distribution of flux from globular cluster x-ray sources , we can use that to indentify the quiscent sources , or at least say with certain confidance which sources (or which observation) are not in burst state.

We will feed only those observation for training data.

we have the confirmed classification of sources which are both in quiscent state , for those sources , we will pick out the catalogue in which observations are made when the fluxs are less than certain threshold (mean of globular cluster sources flux)

We can consider each observation as distinct source for training.

Classes Considered

```
LMXRB Black Holes
LMXRB Neutron Star
CV
Pulsars
```

LMXRB BH

All classes - LMXRB x-ray binary Black Hole

```
Number of sources - 123
Number of Observations - 1100
observation Meeting critrion - 824
```

Catalogues

```
RITTERLMXB
NGC3115CXO
INTREFCAT
XRBCAT
WGACAT
SAXWFCCAT
SAXWFCCAT2
```

LMXRB NS

All classes - LMXRB X-ray binary pulsars

```
Number ofsources - 229
Number of Observations - 1268
observations meeting criteria - 971
```

Catalogues

```
XMMSSCLWBS
IBISCAT
RITTERLMXB
INTREFCAT
RASS2MASS
XRBCAT
WGACAT
SMCWINGCXO
SAXWFCCAT
```

CV

```
Number of sources - 322
Number of observations - 3609
observation meeting criteria - 2604
```

Catalogues

```
GC47TUCCXO
XMMSLEWCLN
M31CFCXO
RASS2MASS
XMMSSCLWBS
IBISCAT
INTREFCAT
WGACAT
NGC6791CXO
CHICAGOCXO
M31CXO2
INTVARCAT
INTIBISASS
INTIBISGAL
RASS6DFGS
RASSUSNOID
RBS
M83XMM
RASSCNDINS
```

Data Pre-procesing

> All filters are average combined for flux

> Dropped all empty rows and all empty columns

> $-log_{10}{flux}$ is used

> All data columns are normalised

> Data columns distributions are normalised $(x_i-mean)/var$

> Nan Values are imputed with 0

Data Filtering

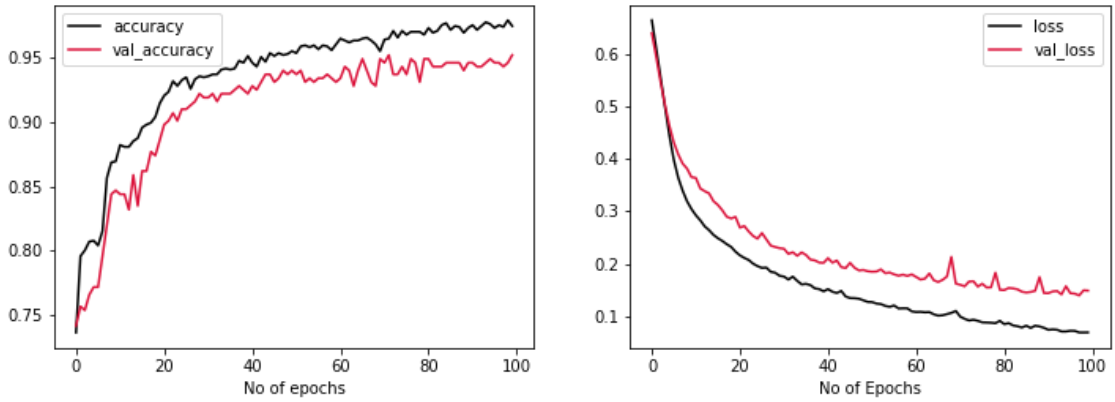
Filter	**criteria**
streak_src_flag	False
pileup_flag	False
mstr_streak_src_flag	False
Flux value	< $10^{-12} erg/cm^2/s$
Significance	> 20

Parameters Used

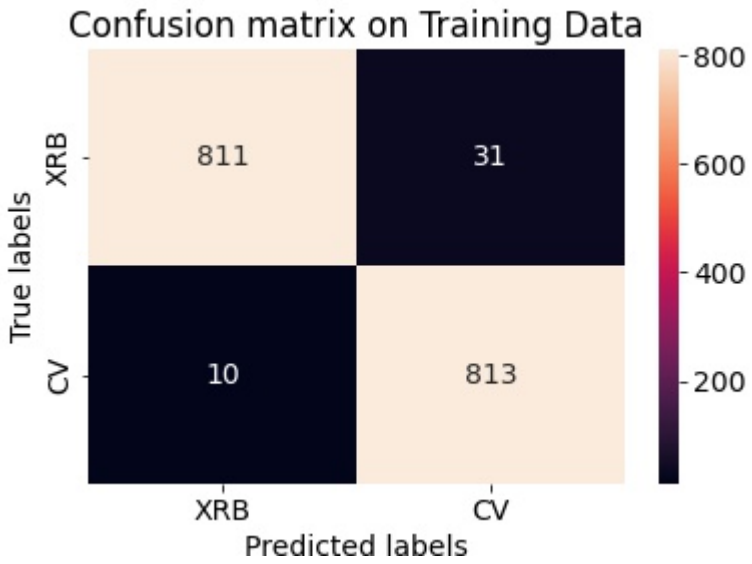
- FLux
- Variability
- Hardness
- Model Fit

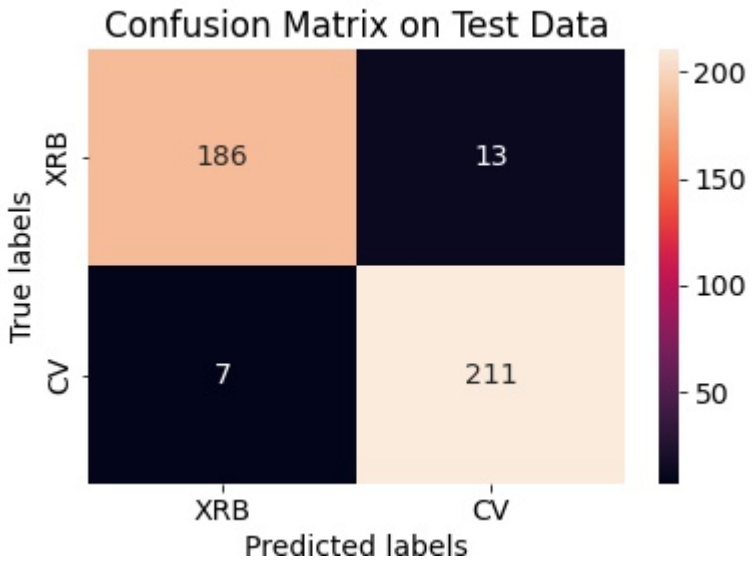
Result

X-ray binary (NS+BH) Vs CV

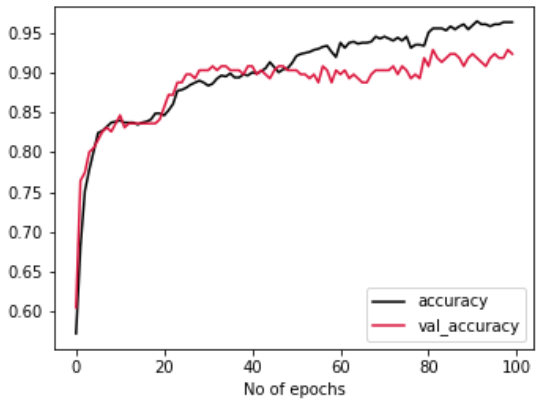


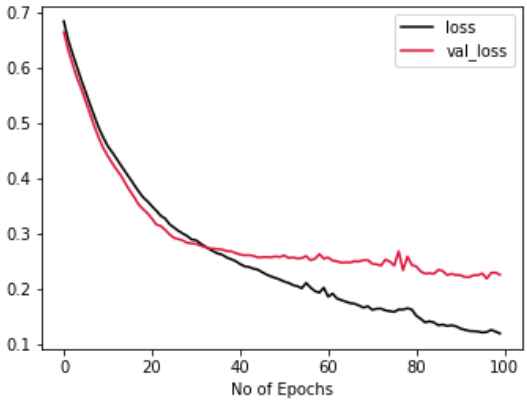

```
Training Accuracy - 97.9 %
Test Accuracy - 95.20 %
```



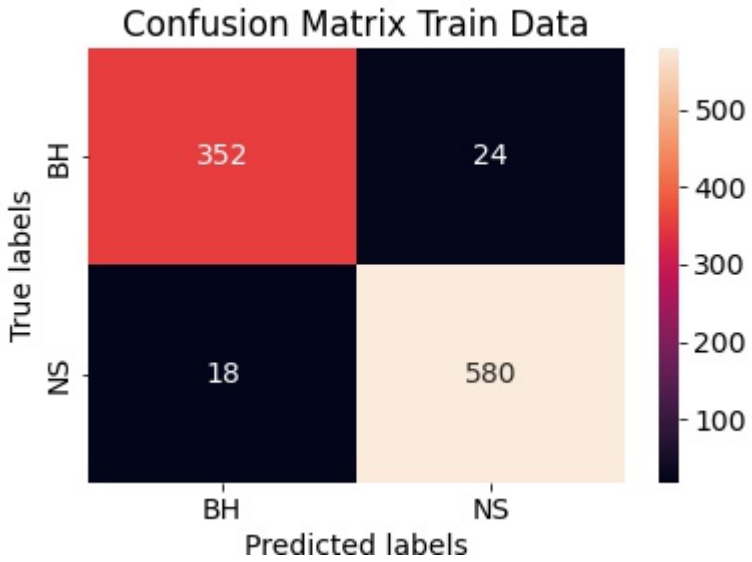


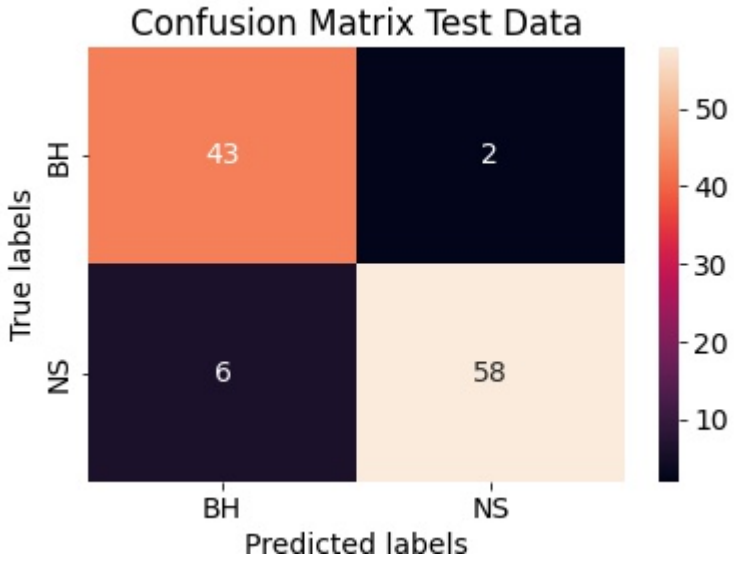
NS vs BH



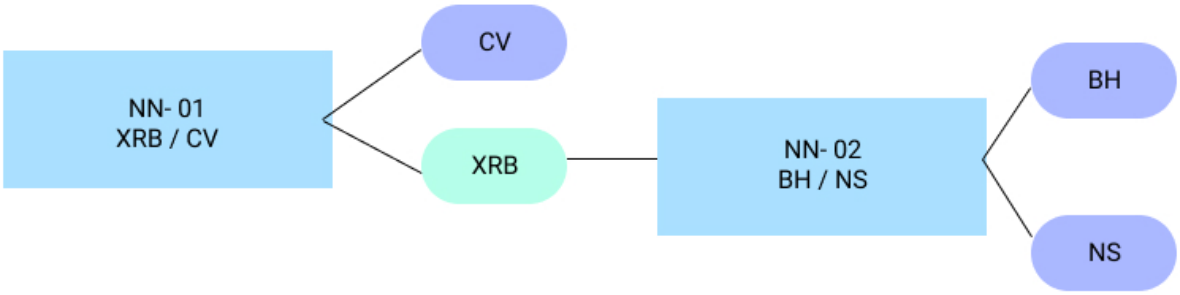



```
Training Accuracy - 96.5 %
Test Accuracy - 92.3 %
```





Combined NN



Test data

```
Total Examples - 417
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CV    218
NS    131
BH     68
```