Experiments

All our experiments are developed in the notebooks in the `./experiments` folder.

We did the following experiments:

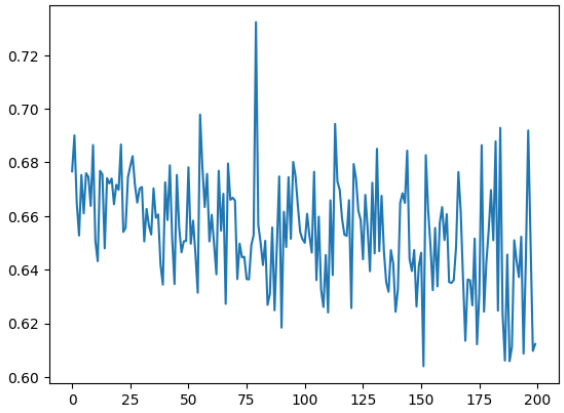
- **Modify the improved and dropout parameters in GCNConv:**
  after trying all the possible combinations, we obtained the best result setting *improved=False* and *dropout = 0*, differently from the Paper instructions.
- **Changing the learning rate:**
  trying to stabilize the shapes, we tried to modify the starting learning rate in Adam, having worse results in increasing and decreasing the number.
- **Changing the convolutional method:**
  we tried to apply other two different libraries for convolution: *GraphConv* and *GeneralConv*.
  We had the best result applying the ***GeneralConv*** method.
- **Trying different parameters within GeneralConv:**
  we tried different configurations of parameters applying l2 normalization, attention, both types of attention (dot_product and additive), and multi-head attention.
  We had the best result with ***attention= True, attention_type= 'dot_product',*** without multi-head attention or normalization.
- **Trying adding residual connections:**
  we had really bad results.
- **Trying using a different type of activation function:**
  we tried using both ReLU and LeakyReLU, having worse results.
- **Changing the batch size = 32:**
  Changing the batch size, we had test loss and accuracy a little bit worse than our best case but we had smoother shapes. Nevertheless, we have bad shapes in validation tests, which seem to tend toward overfitting.

Improved and dropout experiments

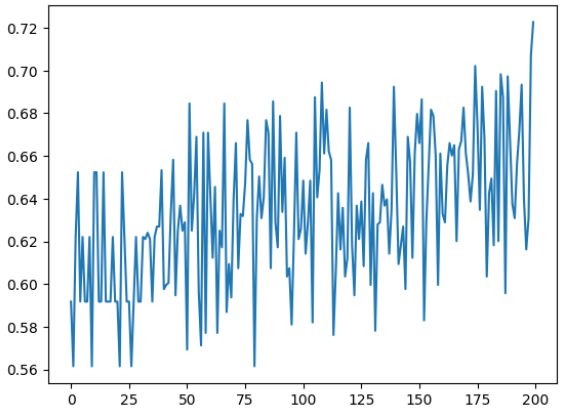
Improved=True, con dropout

```
Test loss epoch 199:  0.6707518696784973
Test accuracy epoch 199:  0.5892857142857143
```

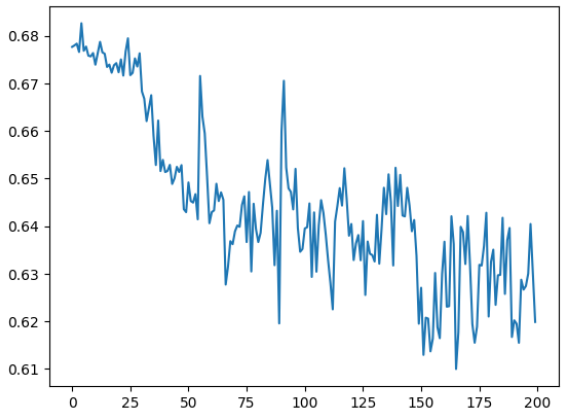
Train Losses



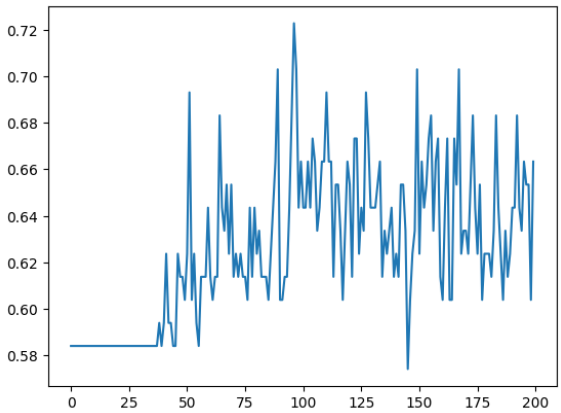
Train Accuracies



Validation Losses



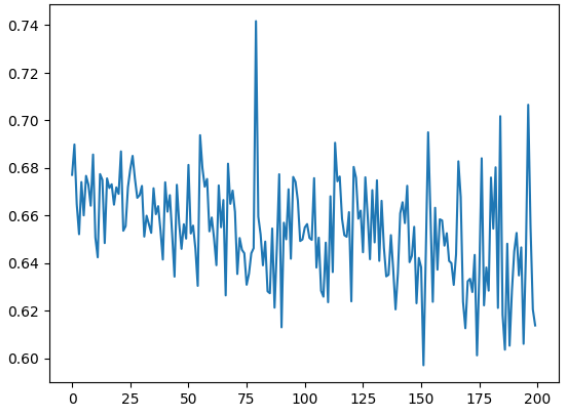
Validation Accuracies



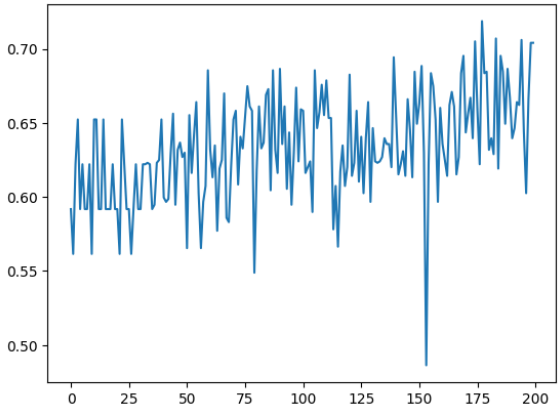
Improved=True, senza dropout

```
Test loss epoch 199:  0.6591243147850037
Test accuracy epoch 199:  0.6428571428571429
```

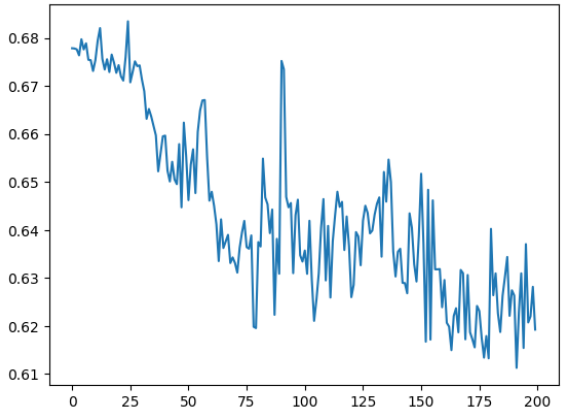
Train Losses



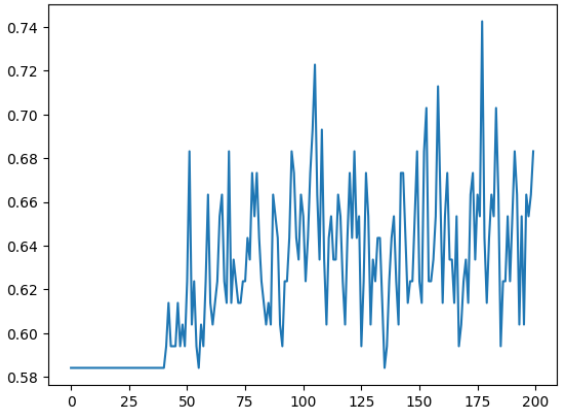
Train Accuracies



Validation Losses



Validation Accuracies

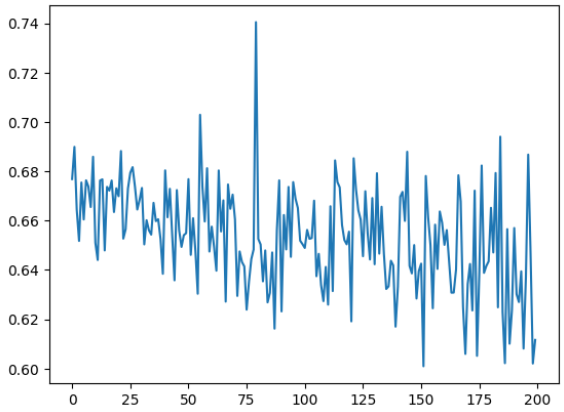


Improved=False, senza dropout (best result)

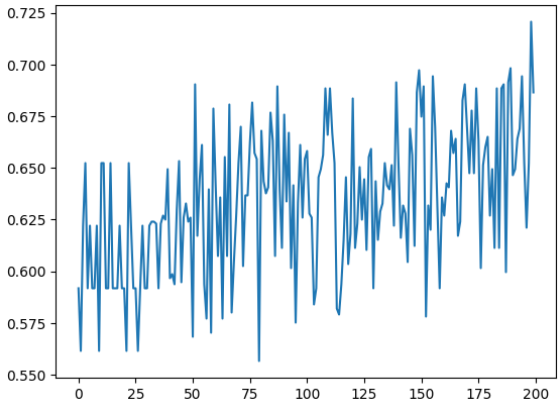
```
Test loss epoch 199:  0.631967306137085
Test accuracy epoch 199:  0.6696428571428571
```

Train Losses

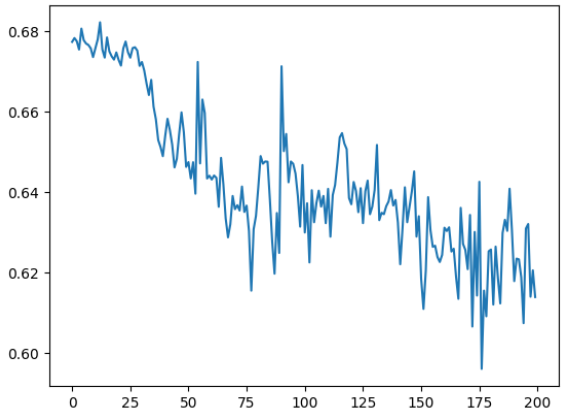
Train Accuracies

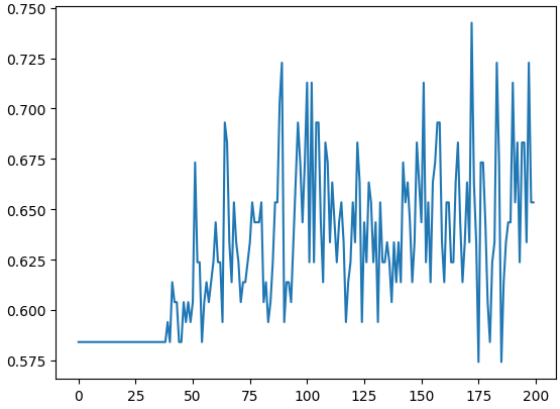


Validation Losses



Validation Accuracies



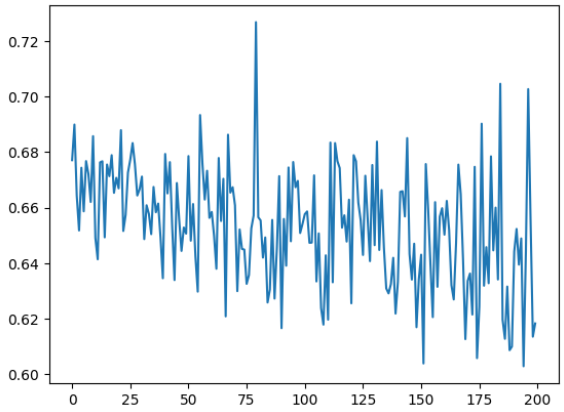


Improved=False, con dropout (Paper)

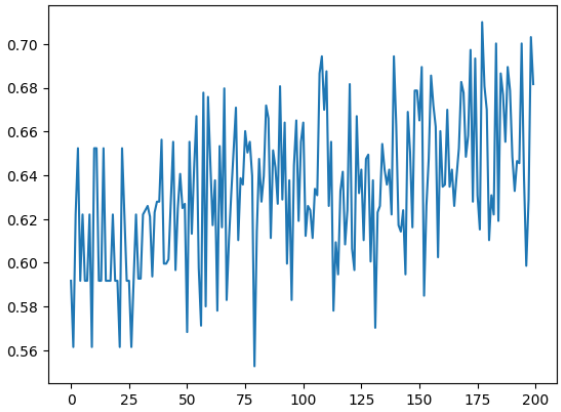
```
Test loss epoch 199:  0.6583368182182312
Test accuracy epoch 199:  0.6517857142857143
```

Train Losses

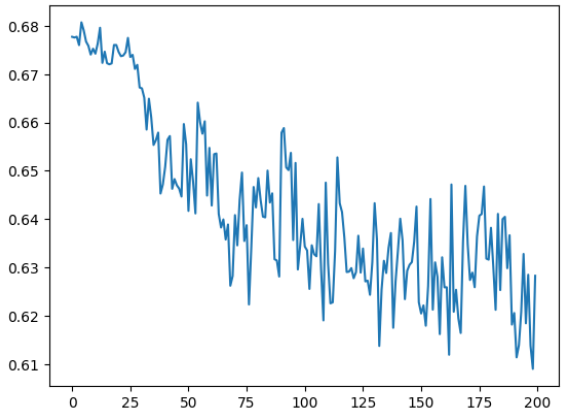
Train Accuracies

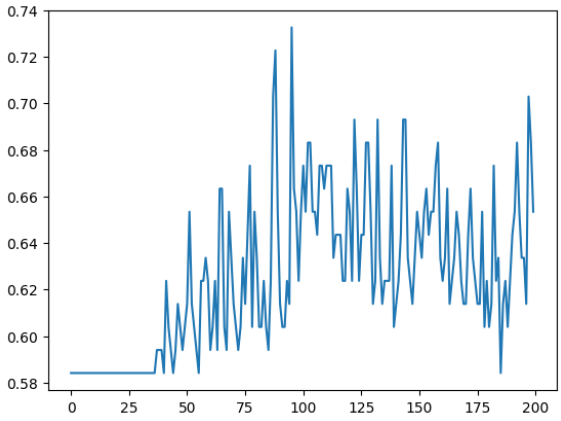


Validation Losses



Validation Accuracies





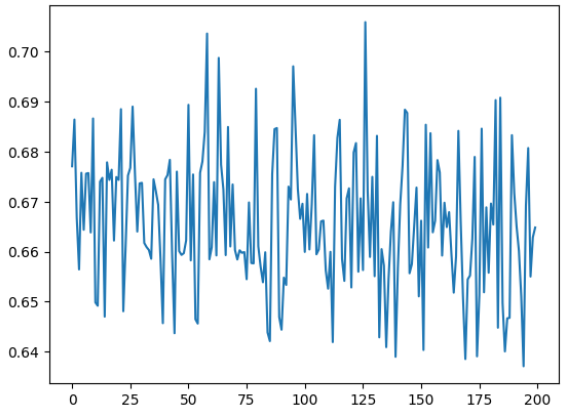
Learning rate experiments

Adam starting at 0,0001

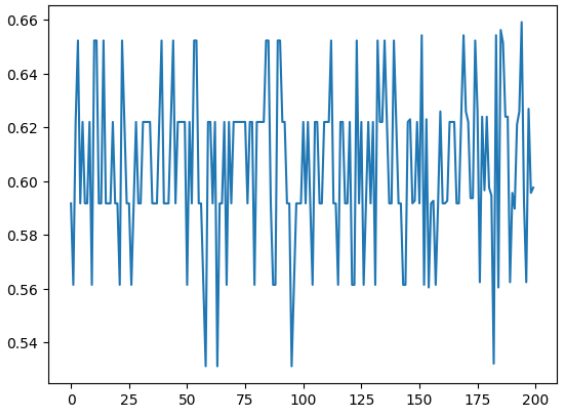
```
Test loss epoch 199:  0.6822512745857239
Test accuracy epoch 199:  0.5446428571428571
```

Train Losses

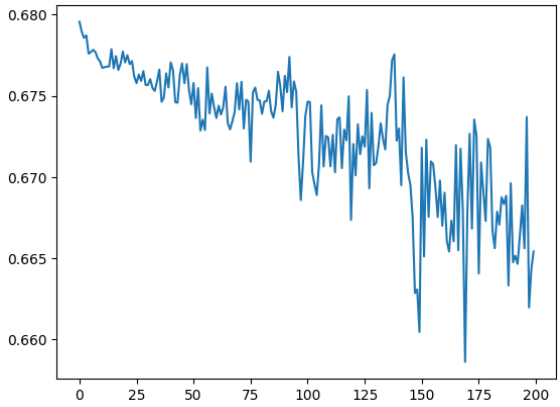
Train Accuracies

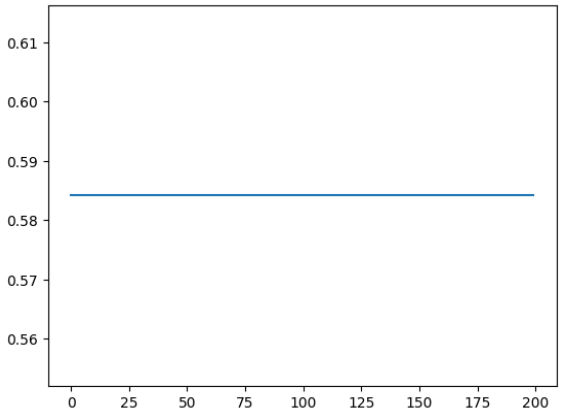


Validation Losses



Validation Accuracies



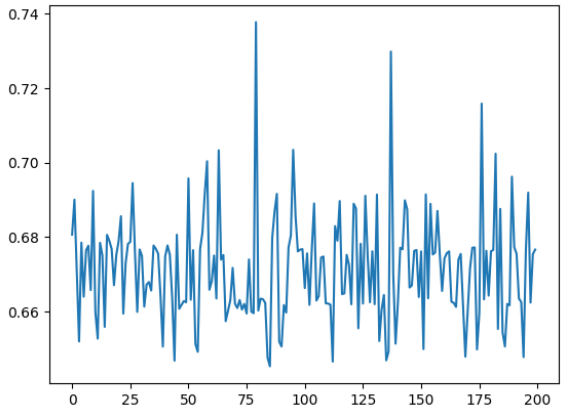


Adam starting at 0,01

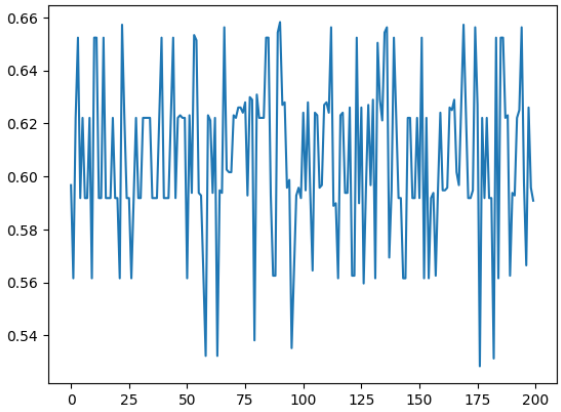
```
Test loss epoch 199:  0.6921302676200867
Test accuracy epoch 199:  0.5446428571428571
```

Train Losses

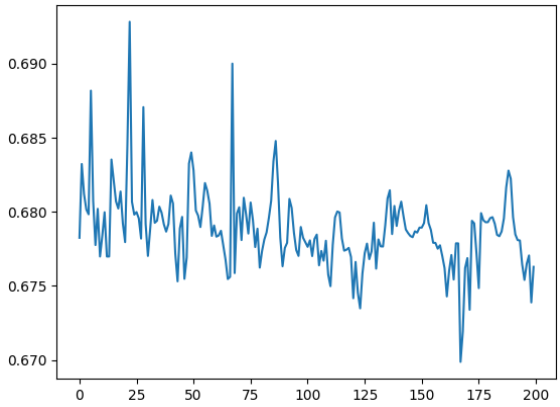
Train Accuracies

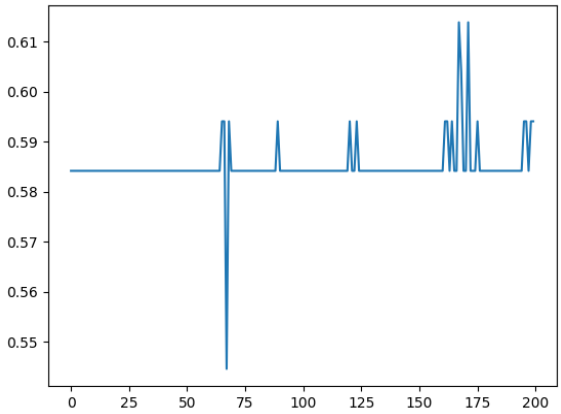


Validation Losses



Validation Accuracies



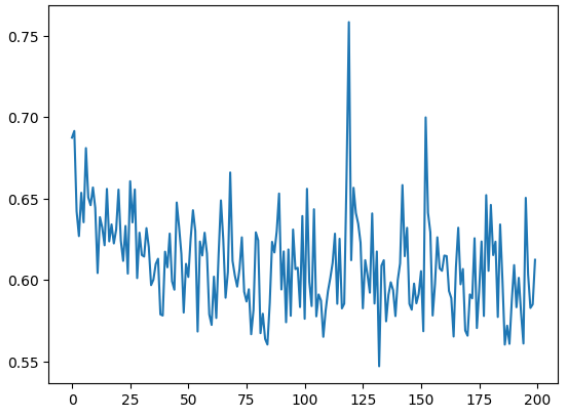


Trying GraphConv

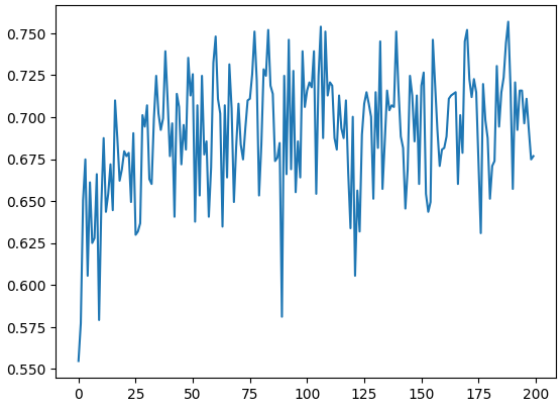
```
Test loss epoch 199:  0.6018216013908386
Test accuracy epoch 199:  0.6964285714285714
```

Train Losses

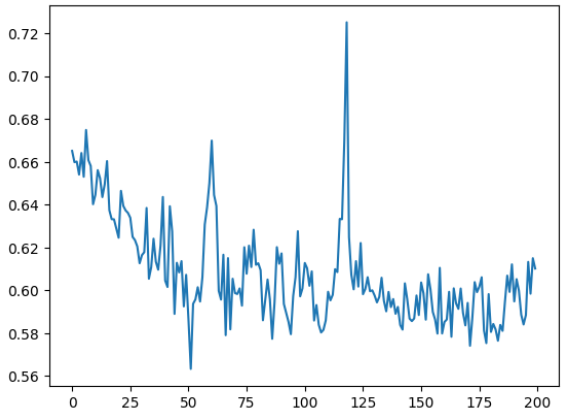
Train Accuracies

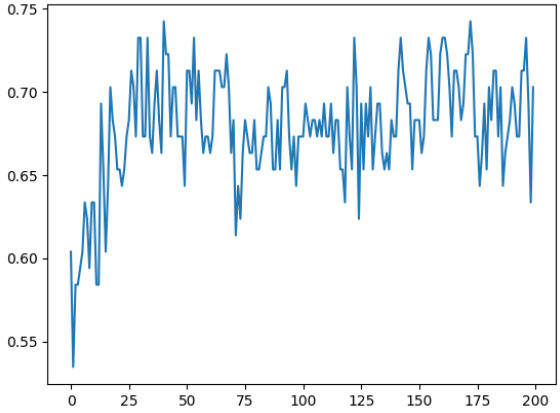


Validation Losses



Validation Accuracies





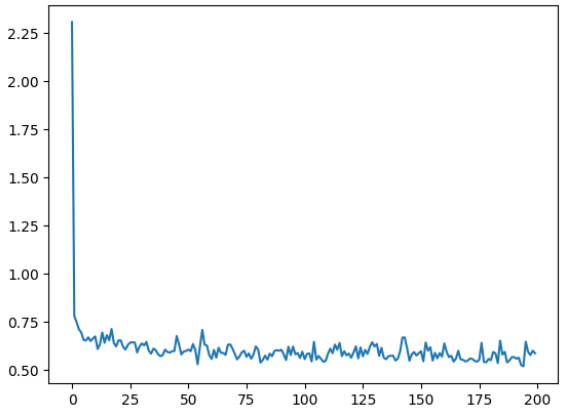
Trying GeneralConv

GeneralConv(dataset.num_features, 16, directed_msg = False, attention_type= 'dot_product')

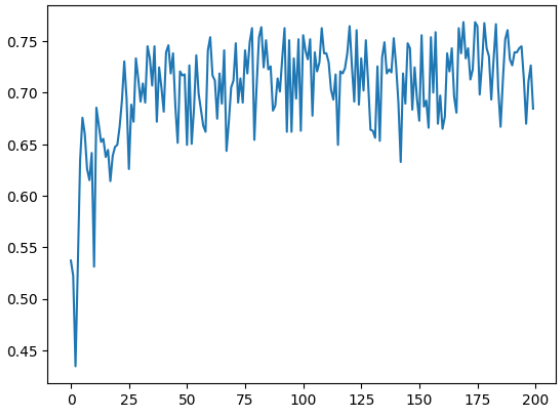
```
Test loss epoch 199:  0.5975242853164673
Test accuracy epoch 199:  0.6696428571428571
```

Train Losses

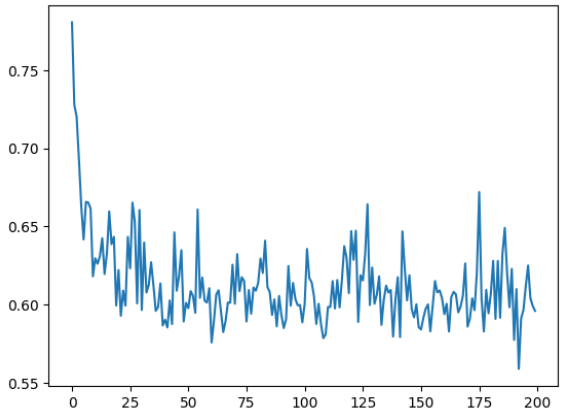
Train Accuracies

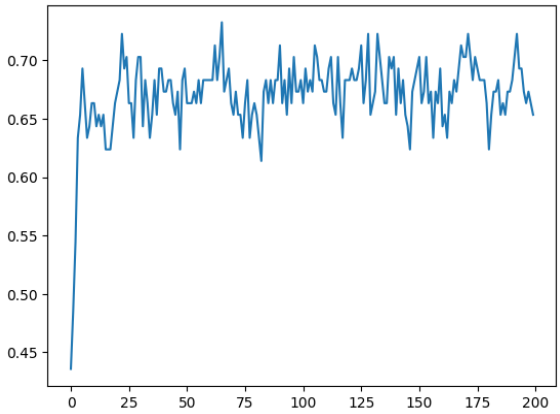


Validation Losses



Validation Accuracies



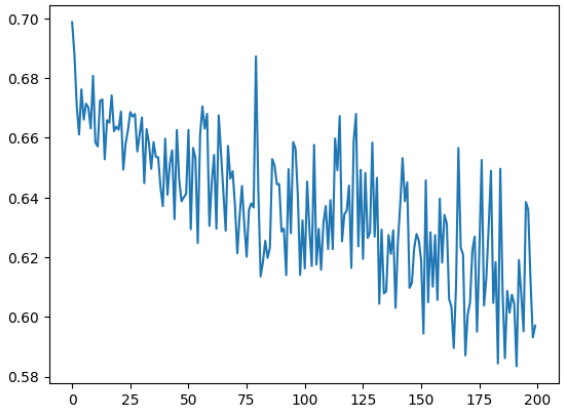


GeneralConv(dataset.num_features, 16, directed_msg = False,l2_normalize=True, attention_type= 'dot_product')

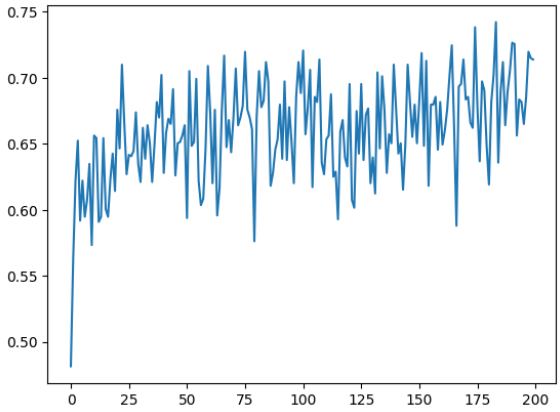
```
Test loss epoch 199:  0.6247297525405884
Test accuracy epoch 199:  0.6875
```

Train Losses

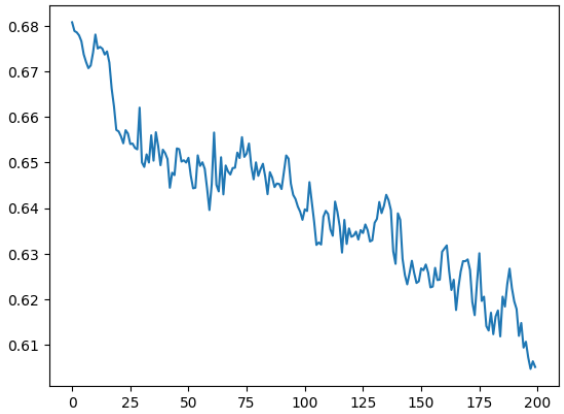
Train Accuracies

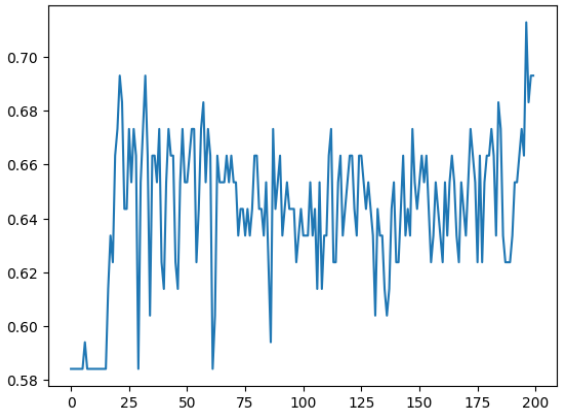


Validation Losses



Validation Accuracies



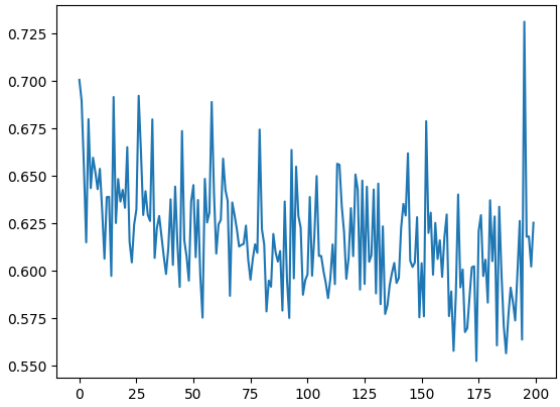


GeneralConv(dataset.num_features, 16, directed_msg = False,attention= True, attention_type= 'dot_product') (best result)

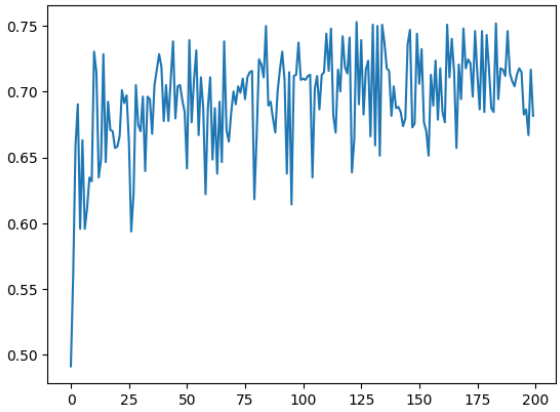
```
Test loss epoch 199:  0.6134846806526184
Test accuracy epoch 199:  0.7232142857142857
```

Train Losses

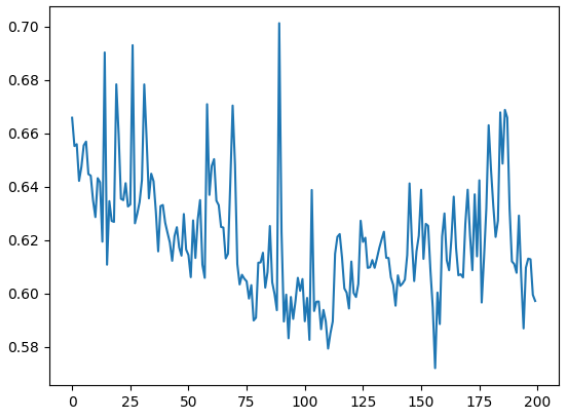
Train Accuracies

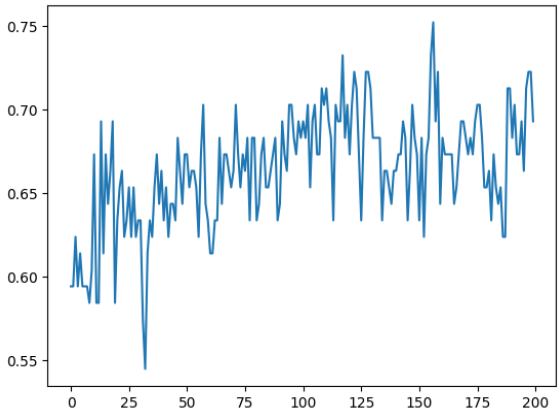


Validation Losses



Validation Accuracies



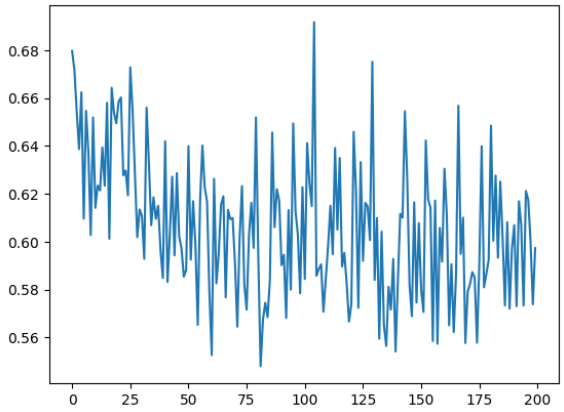


GeneralConv(dataset.num_features, 16, directed_msg = False,attention= True, attention_type= 'additive')

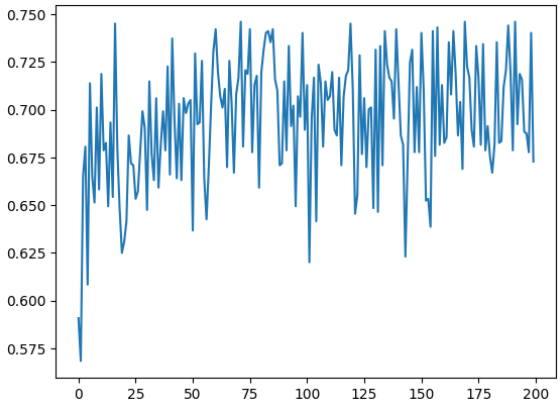
```
Test loss epoch 199:  0.6249549984931946
Test accuracy epoch 199:  0.6875
```

Train Losses

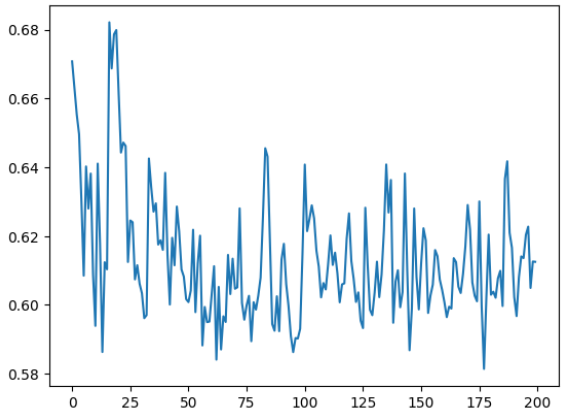
Train Accuracies

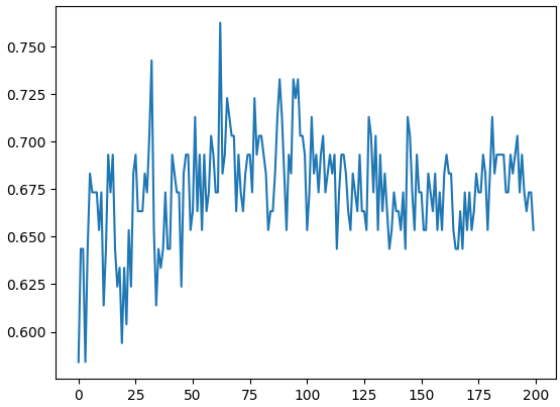


Validation Losses



Validation Accuracies



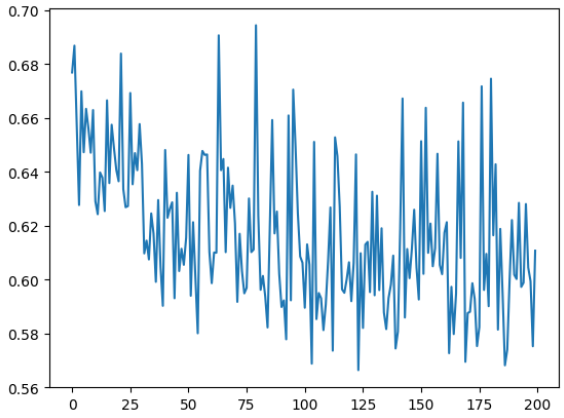


GeneralConv(dataset.num_features, 16, directed_msg = False,heads = 4,attention= True, attention_type= 'additive')

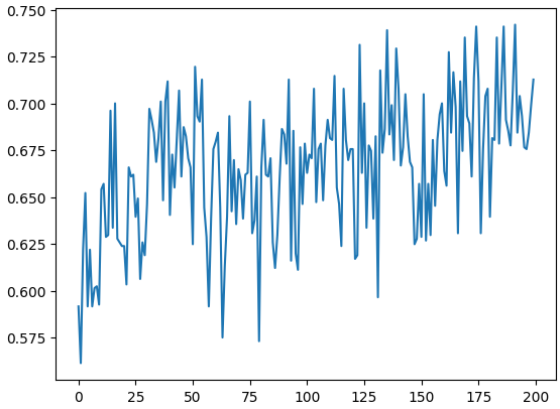
```
Test loss epoch 199:  0.7227734327316284
Test accuracy epoch 199:  0.6339285714285714
```

Train Losses

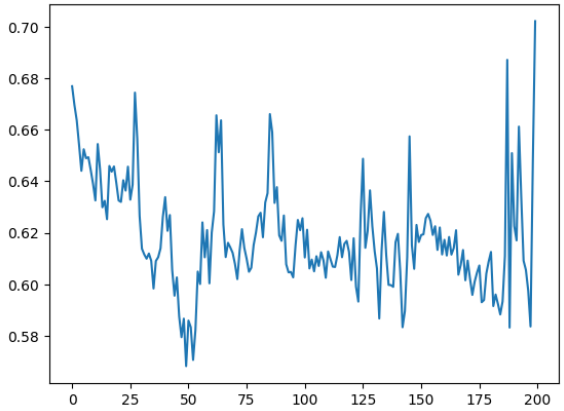
Train Accuracies

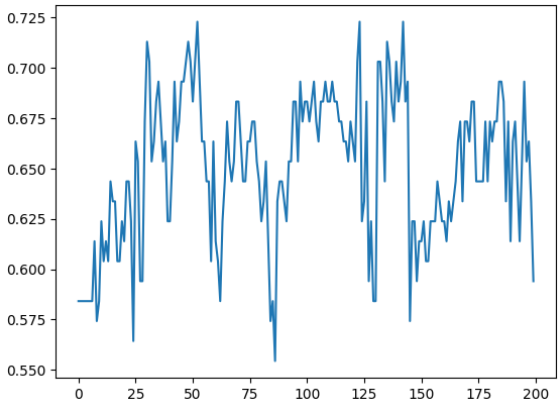


Validation Losses



Validation Accuracies



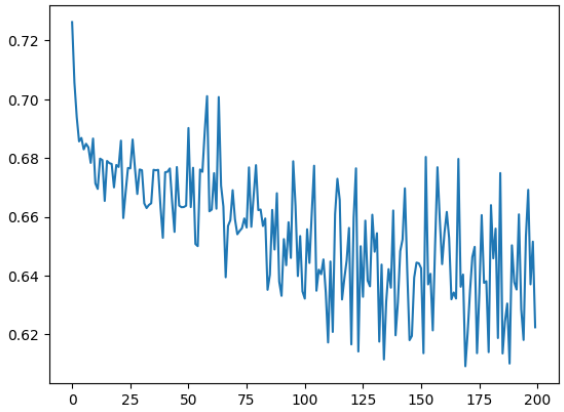


GeneralConv(dataset.num_features, 16, directed_msg = False,heads = 8,attention= True, attention_type= 'additive')

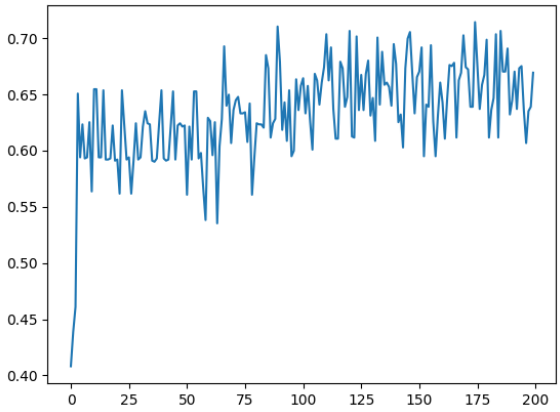
```
Test loss epoch 199:  0.7227734327316284
Test accuracy epoch 199:  0.6339285714285714
```

Train Losses

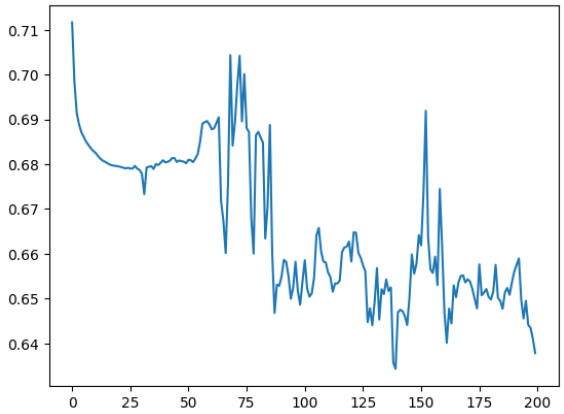
Train Accuracies

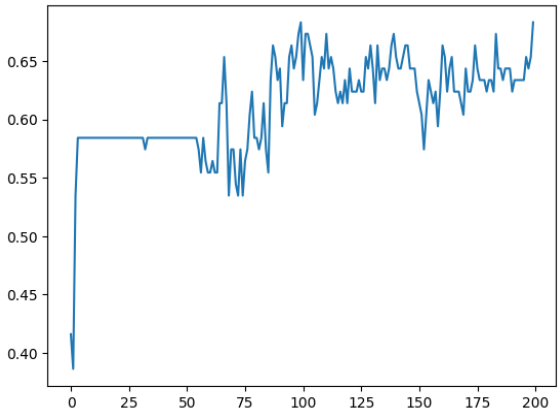


Validation Losses



Validation Accuracies



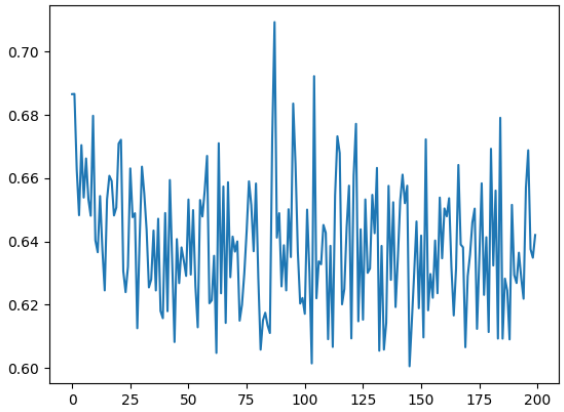


GeneralConv(dataset.num_features, 16, directed_msg = False,heads = 4,attention= True, attention_type= 'dot_product')

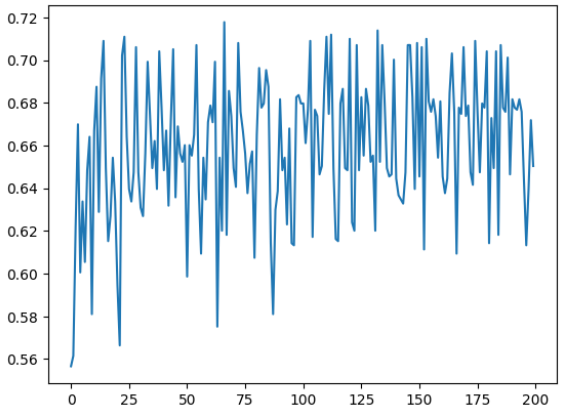
```
Test loss epoch 199:  0.6792422533035278
Test accuracy epoch 199:  0.6071428571428571
```

Train Losses

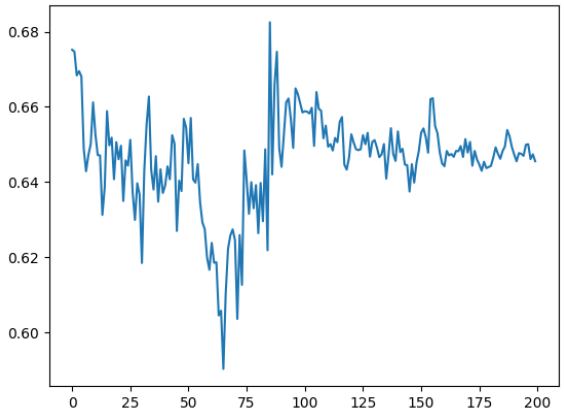
Train Accuracies

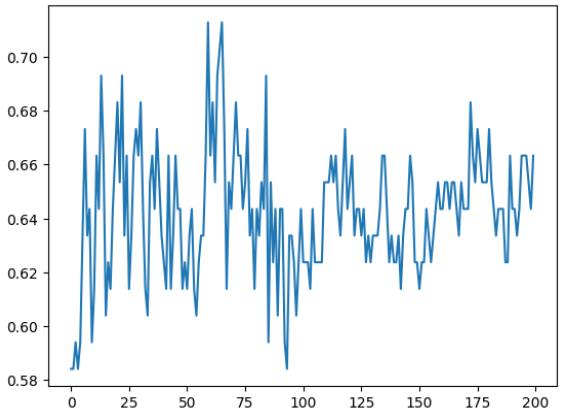


Validation Losses



Validation Accuracies



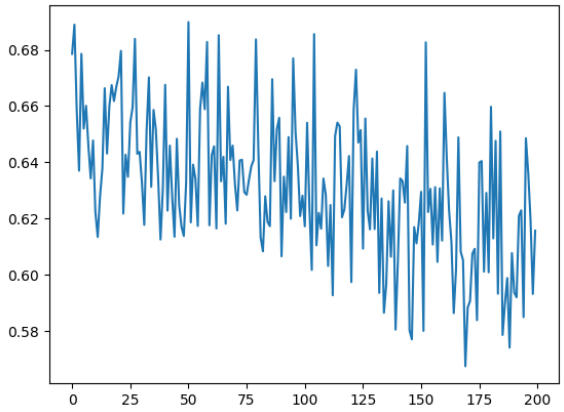


GeneralConv(dataset.num_features, 16, directed_msg = False,heads = 8,attention= True, attention_type= 'dot_product')

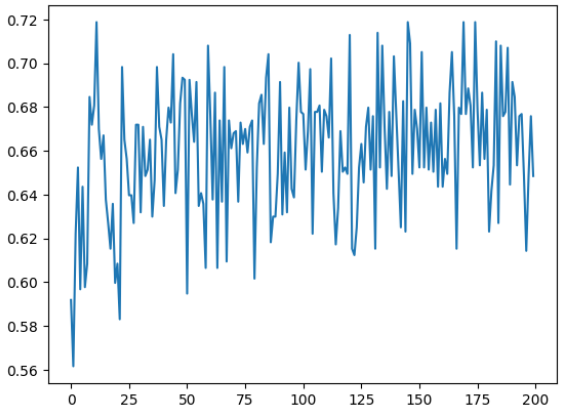
```
Test loss epoch 199:  0.6555837392807007
Test accuracy epoch 199:  0.5714285714285714
```

Train Losses

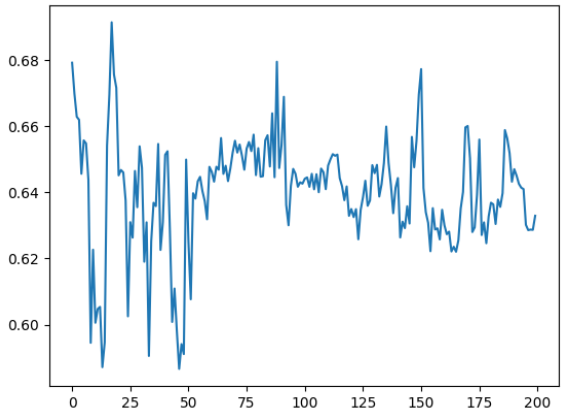
Train Accuracies

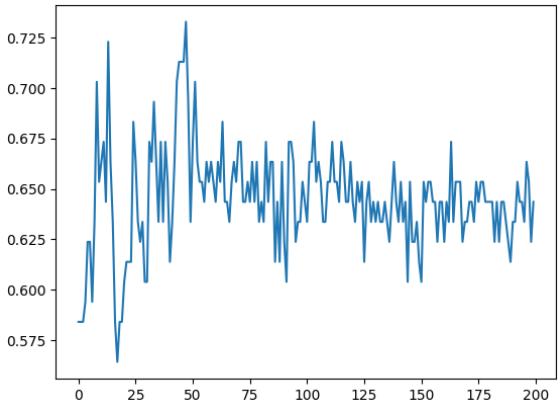


Validation Losses



Validation Accuracies



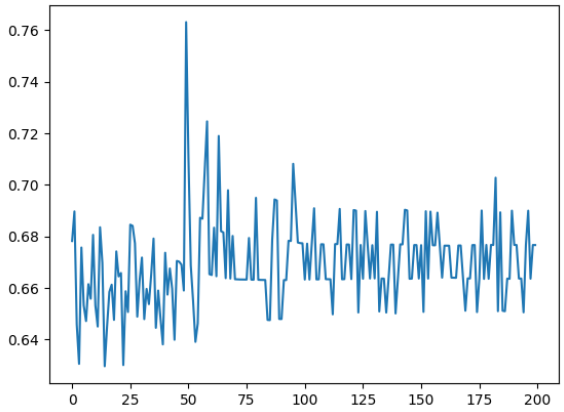


Add residual connections

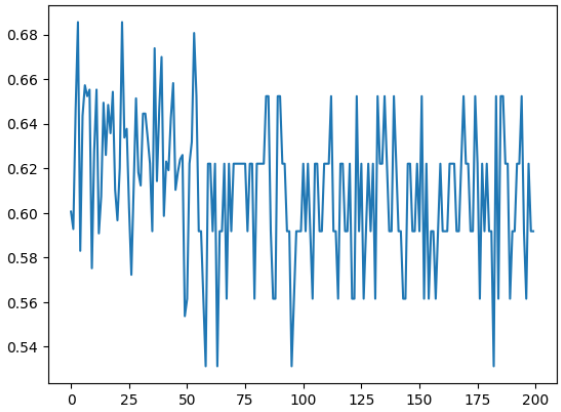
```
Test loss epoch 199:  0.7007536292076111
Test accuracy epoch 199:  0.5357142857142857
```

Train Losses

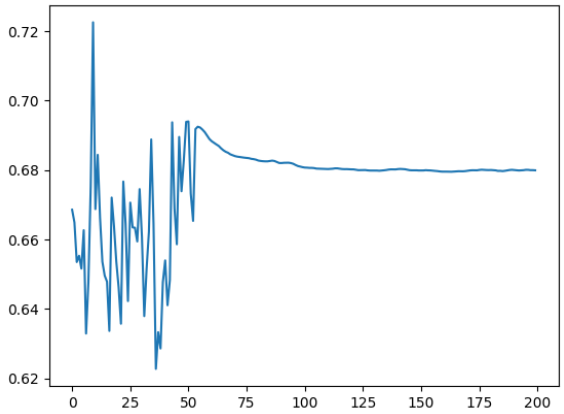
Train Accuracies

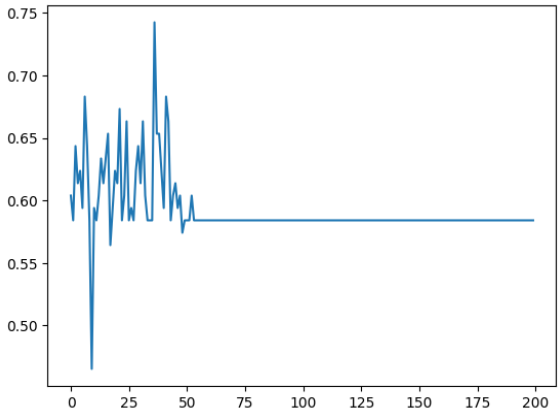


Validation Losses



Validation Accuracies



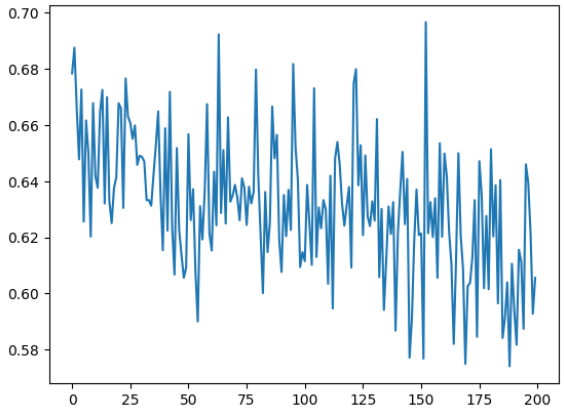


Use ReLU

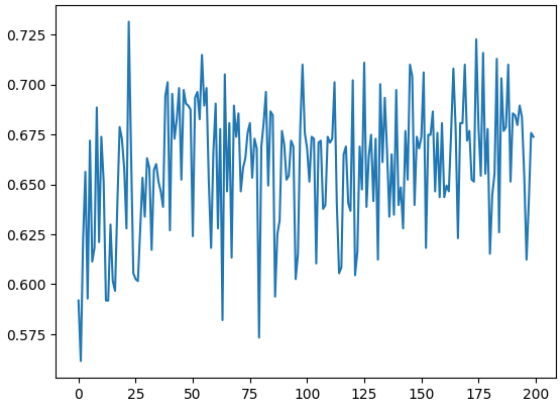
```
Test loss epoch 199:  0.6443879008293152
Test accuracy epoch 199:  0.6339285714285714
```

Train Losses

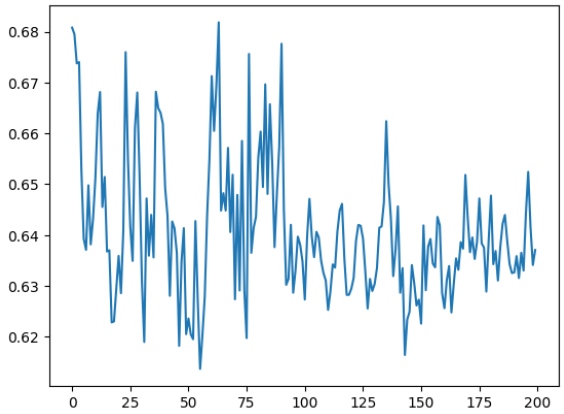
Train Accuracies

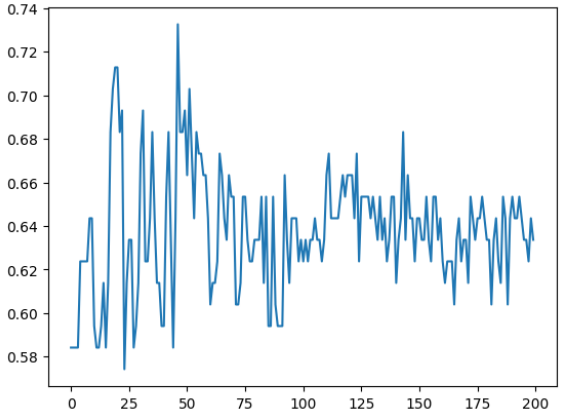


Validation Losses



Validation Accuracies



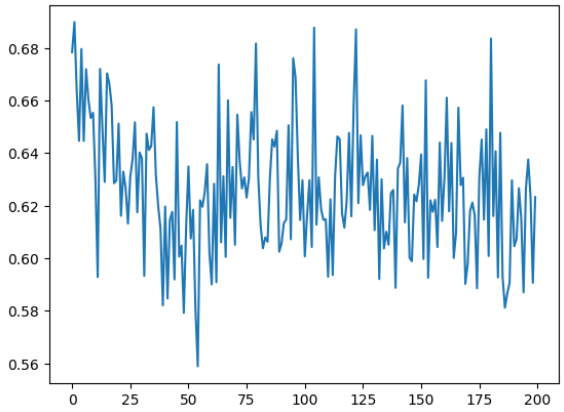


Use LeakyReLU

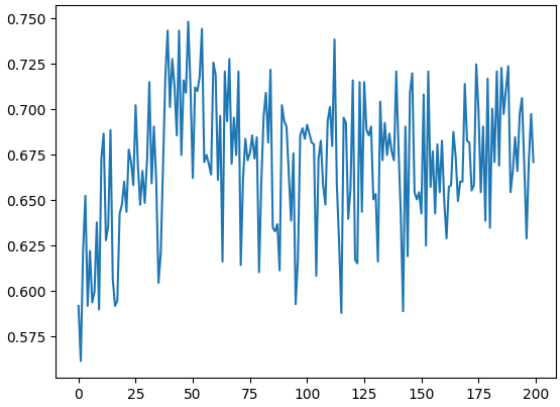
```
Test loss epoch 199:  0.6375139355659485
Test accuracy epoch 199:  0.6517857142857143
```

Train Losses

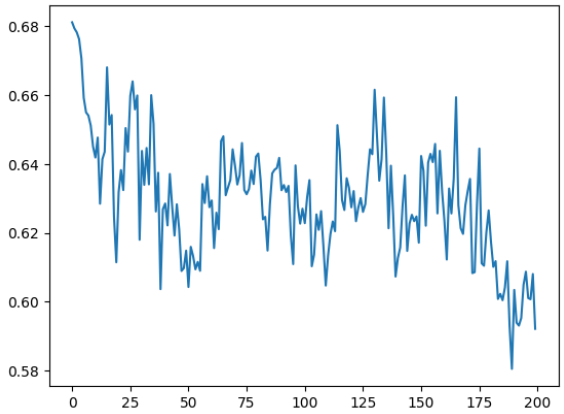
Train Accuracies

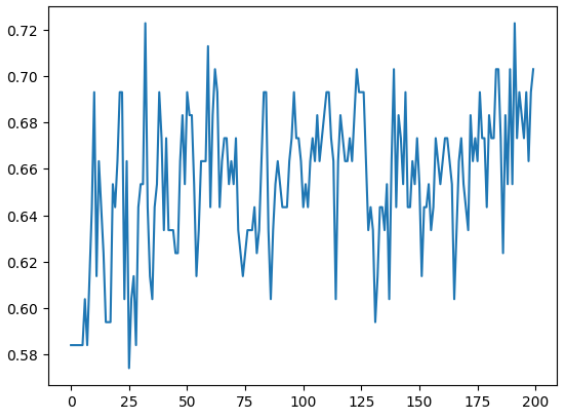


Validation Losses



Validation Accuracies



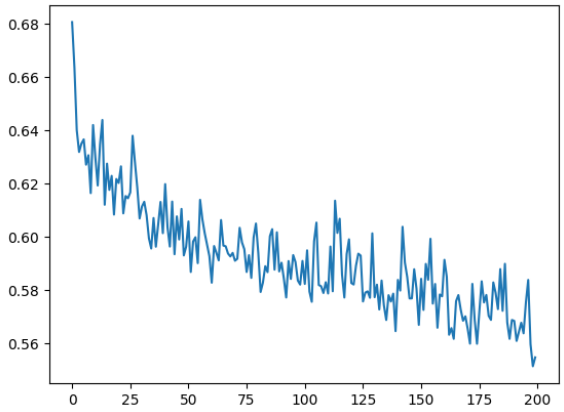


Changing the batch size = 32

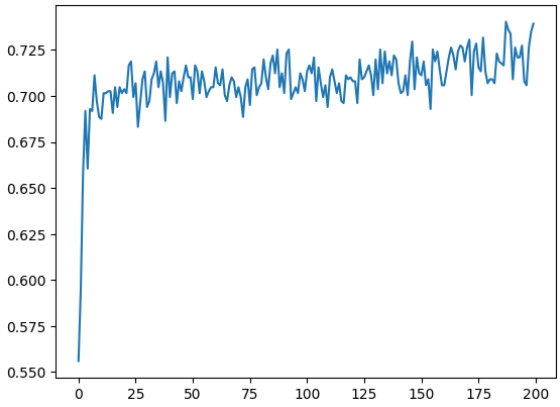
```
Test loss epoch 199:  0.6346642673015594
Test accuracy epoch 199:  0.7109375
```

Train Losses

Train Accuracies



Validation Losses



Validation Accuracies