



Experiments

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

We did the following experiments:

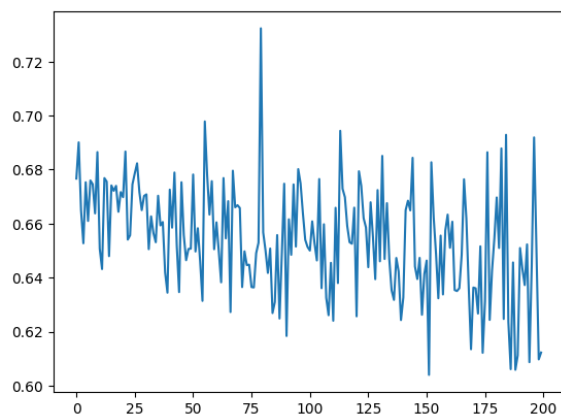
- **Modify the improved and dropout parameters in GCNConv:**
after trying all the possible combinations, we obtained the best result setting *improved=False* and *dropout = 0*, differently from the Paper instructions.
- **Changing the learning rate:**
trying to stabilize the shapes, we tried to modify 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.
- **Removing the decoder:**
We did three versions:
 1. Paper implementation without decoder
 2. Best results we had in the past without decoder
 3. Paper implementation without decoder with residual connections (the best result we ever had)

Improved and dropout experiments

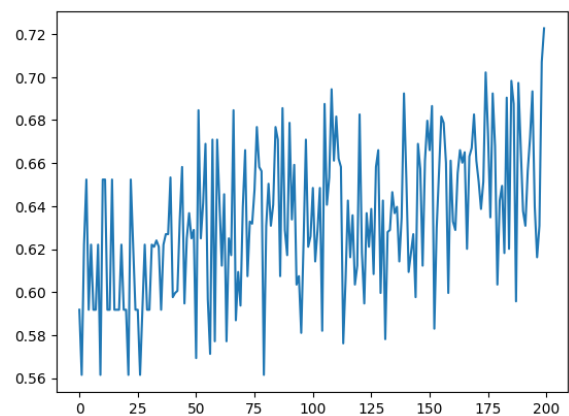
Improved=True, con dropout

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

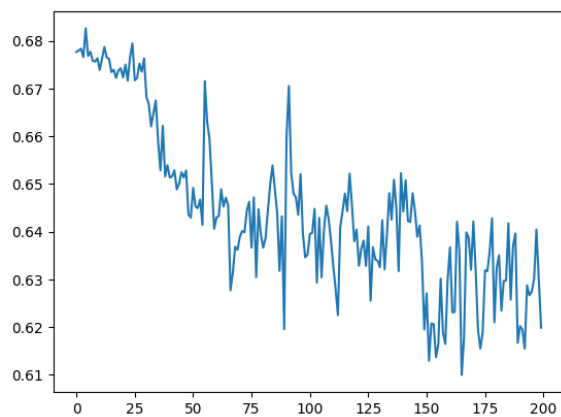
Train Losses



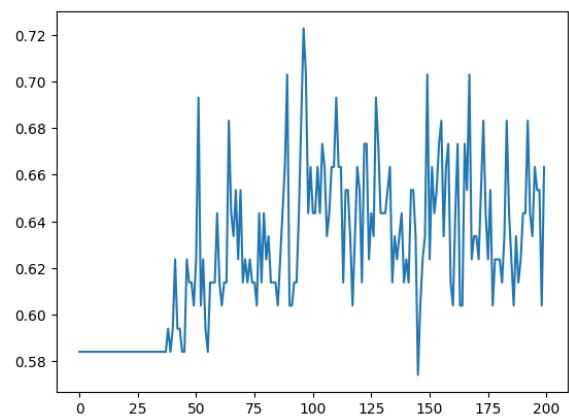
Train Accuracies



Validation Losses



Validation Accuracies

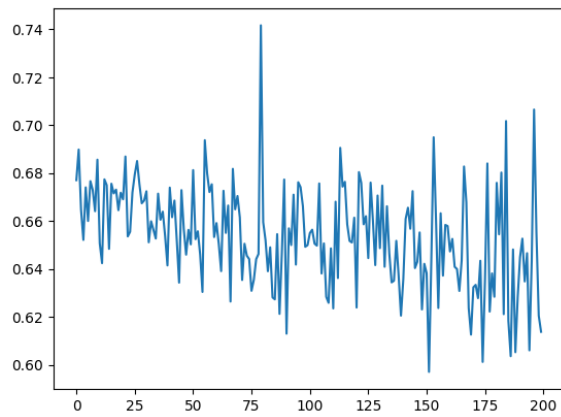


Improved=True, senza dropout

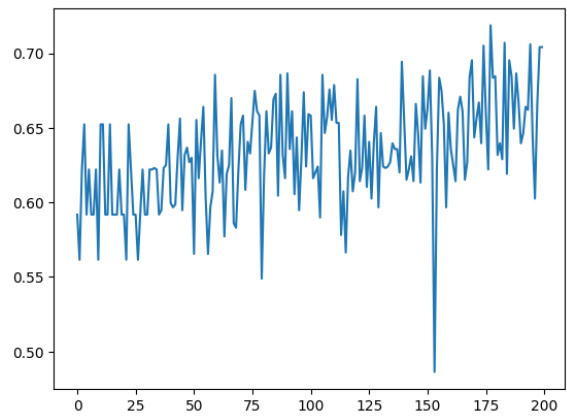
```
Test loss epoch 199: 0.6591243147850037
Test accuracy epoch 199: 0.6428571428571429
```

Train Losses

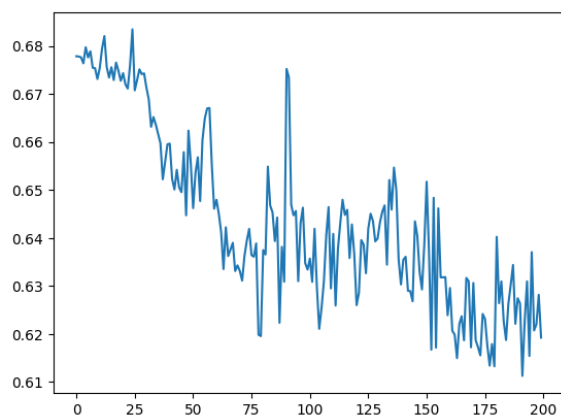
Train Accuracies



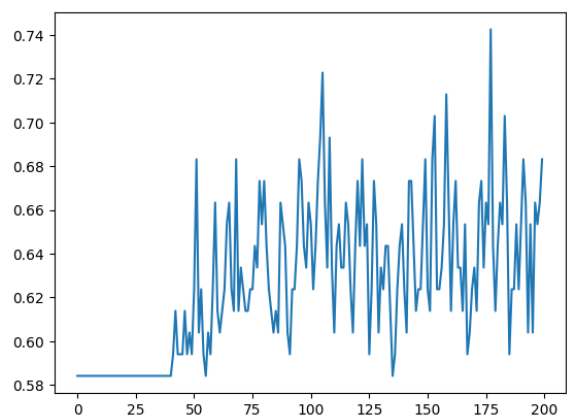
Validation Losses



Validation Accuracies



Train Losses

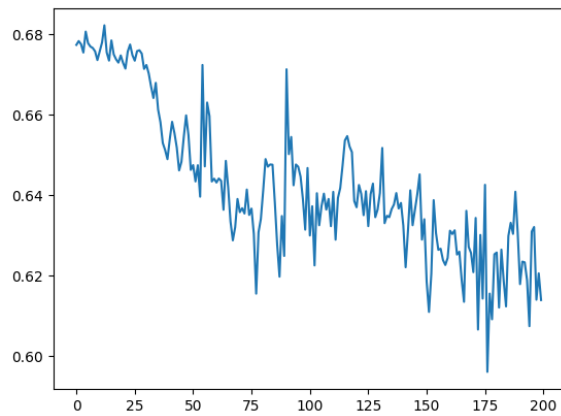


Train Accuracies

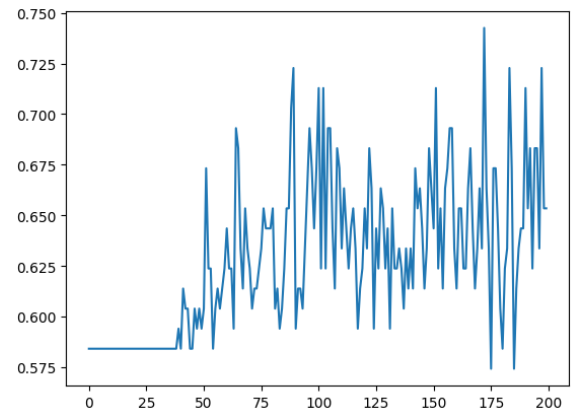
Improved=False, senza dropout

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

Validation Losses



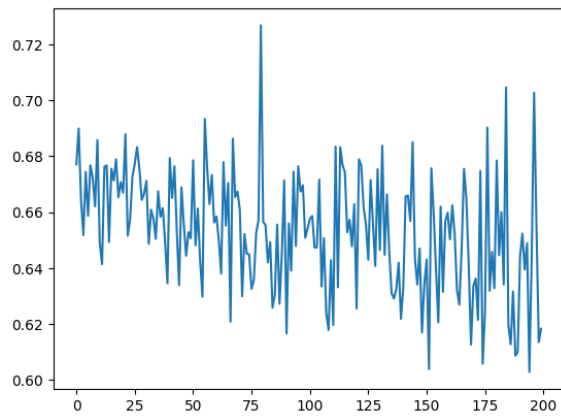
Validation Accuracies



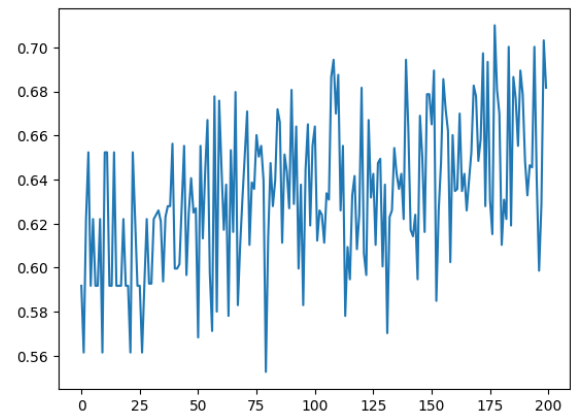
Improved=False, con dropout (Paper)

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

Train Losses

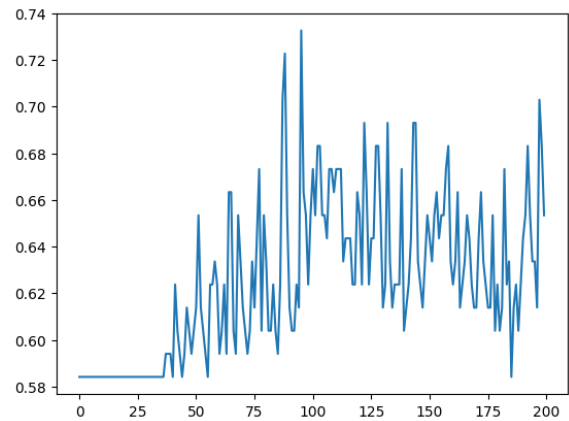
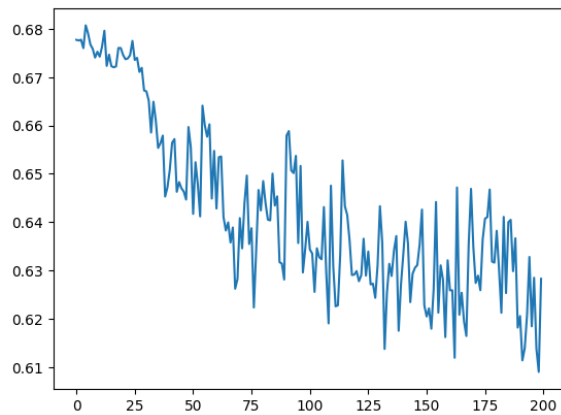


Train Accuracies



Validation Losses

Validation Accuracies

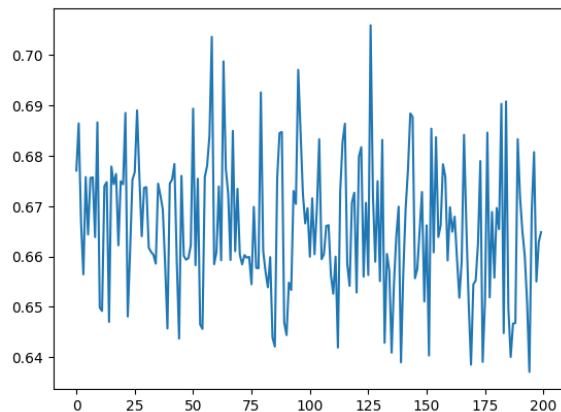


Learning rate experiments

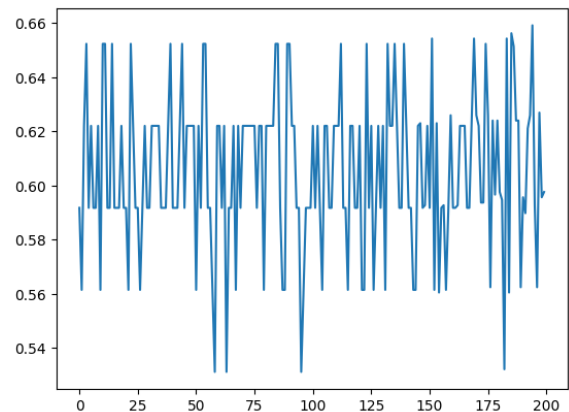
Adam starting at 0,0001

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

Train Losses

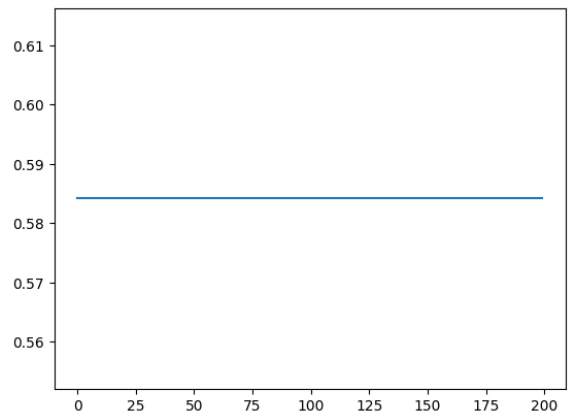
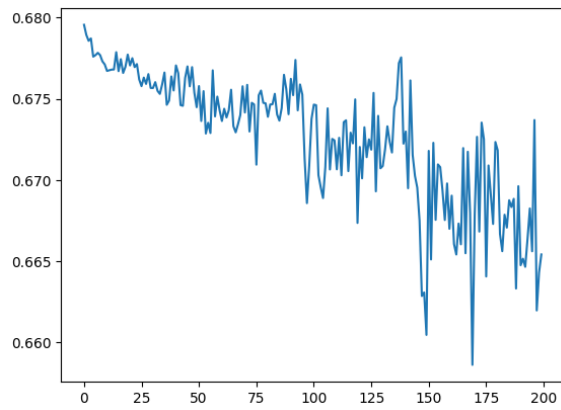


Train Accuracies



Validation Losses

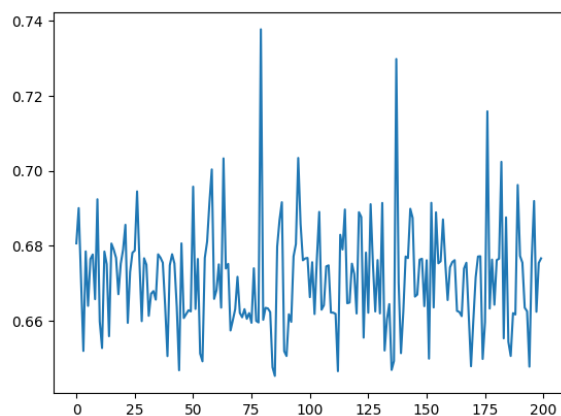
Validation Accuracies



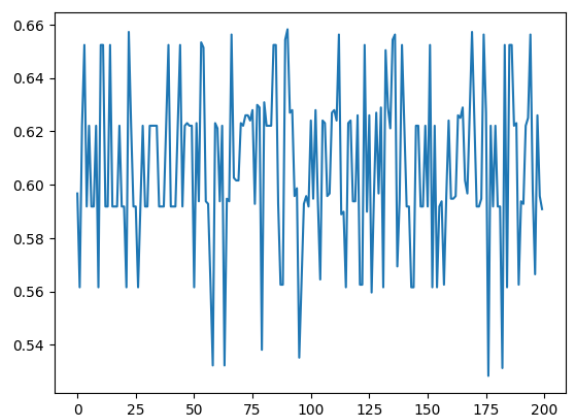
Adam starting at 0,01

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

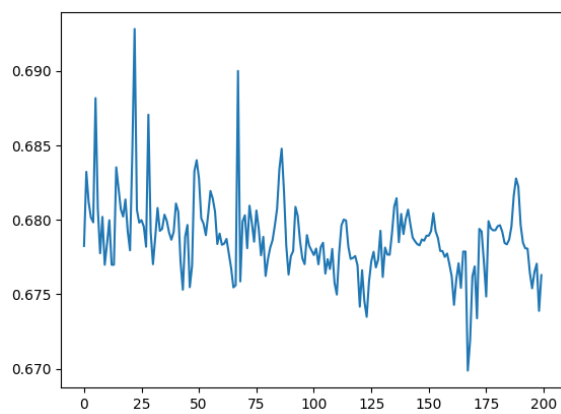
Train Losses



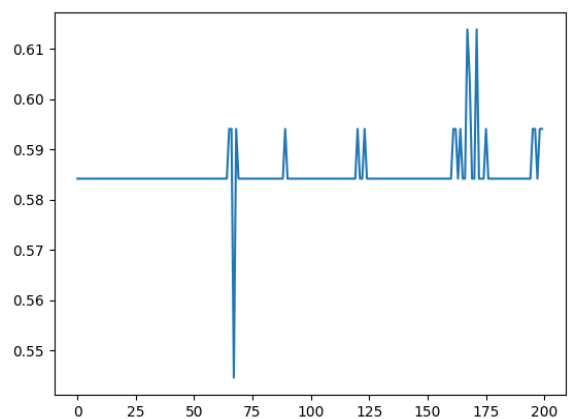
Train Accuracies



Validation Losses



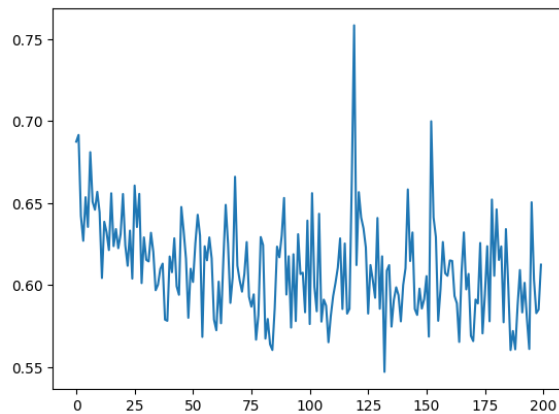
Validation Accuracies



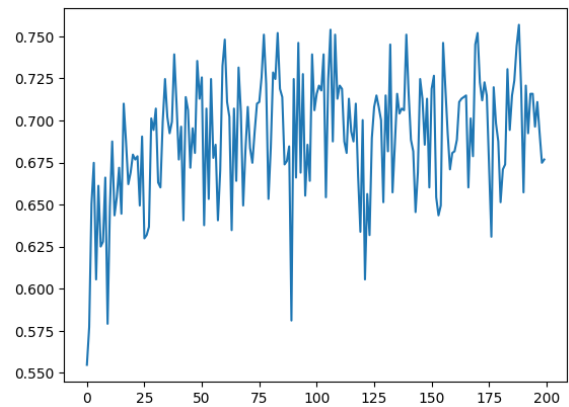
Try GraphConv

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

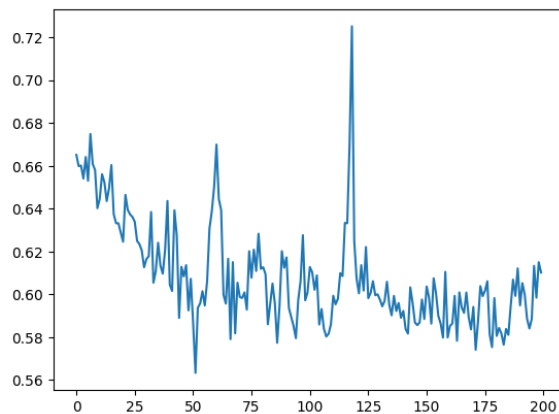
Train Losses



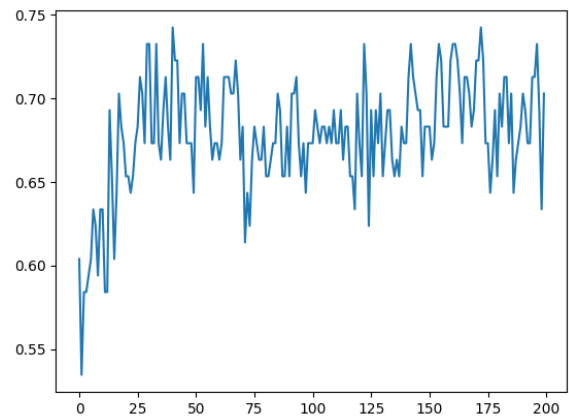
Train Accuracies



Validation Losses



Validation Accuracies

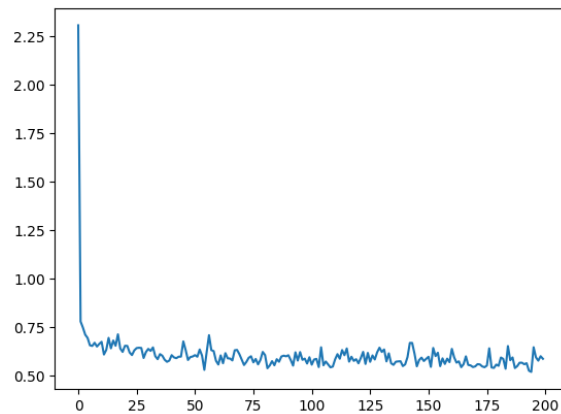


Try GeneralConv

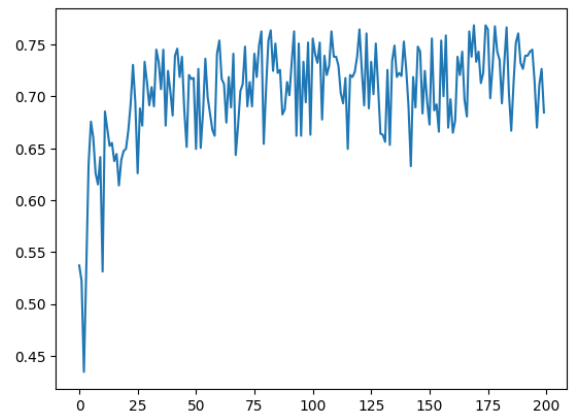
GeneralConv(dataset.num_features, 16, directed_msg = False, attention_type= 'dot_product')

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

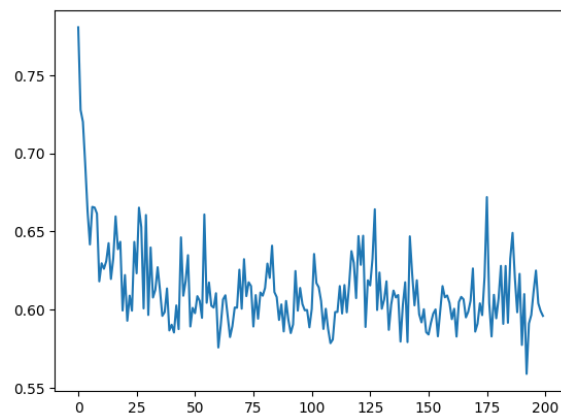
Train Losses



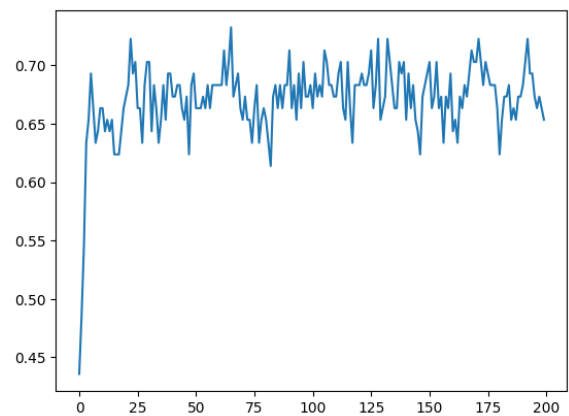
Train Accuracies



Validation Losses



Validation Accuracies

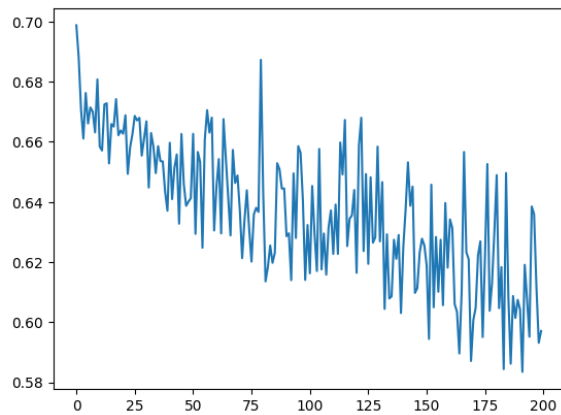


GeneralConv(dataset.num_features, 16, directed_msg = False, l2_normalize=True, attention_type= 'dot_product')

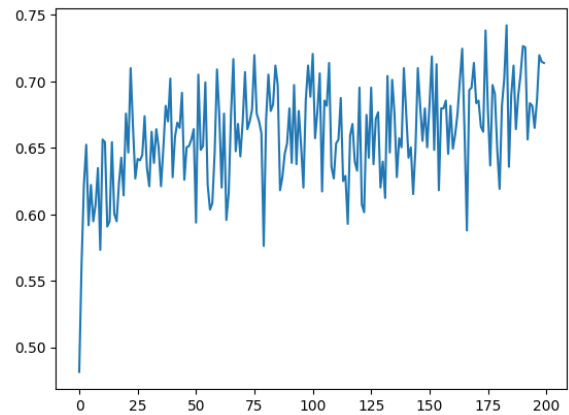
Test loss epoch 199: 0.6247297525405884
Test accuracy epoch 199: 0.6875

Train Losses

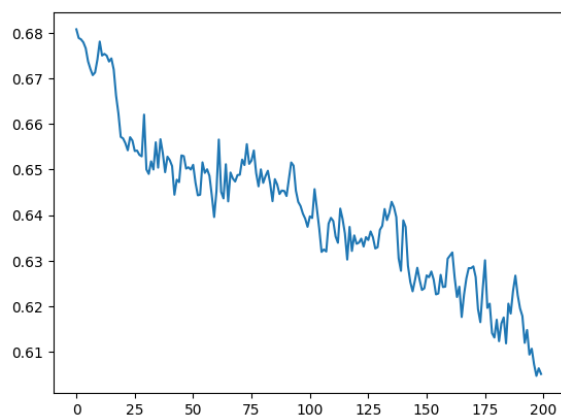
Train Accuracies



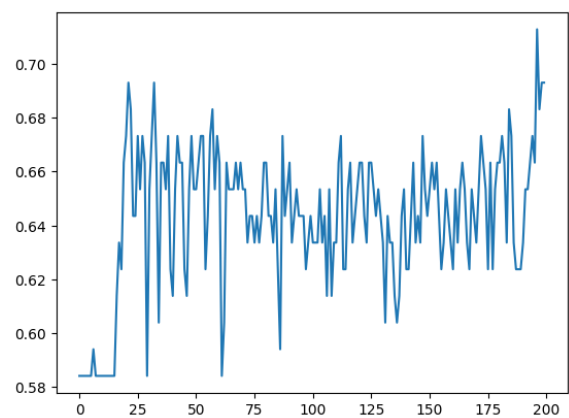
Validation Losses



Validation Accuracies



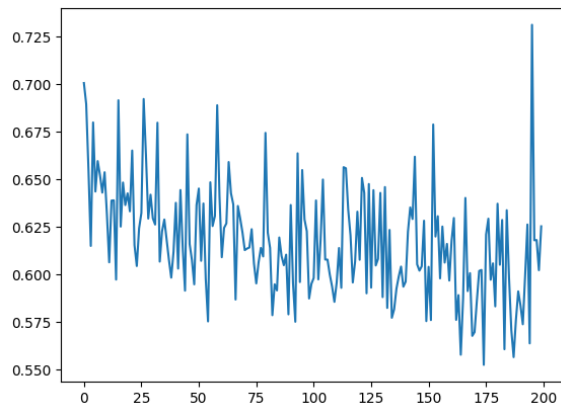
Train Losses



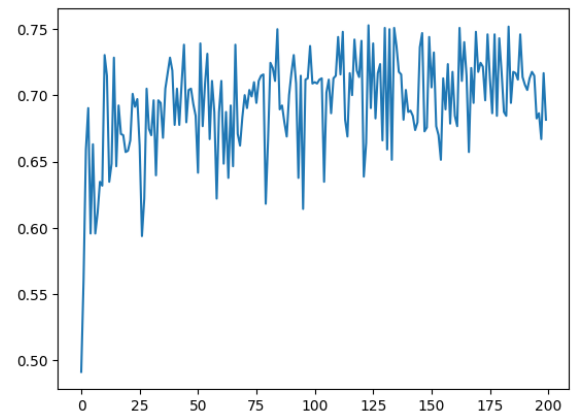
Train Accuracies

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

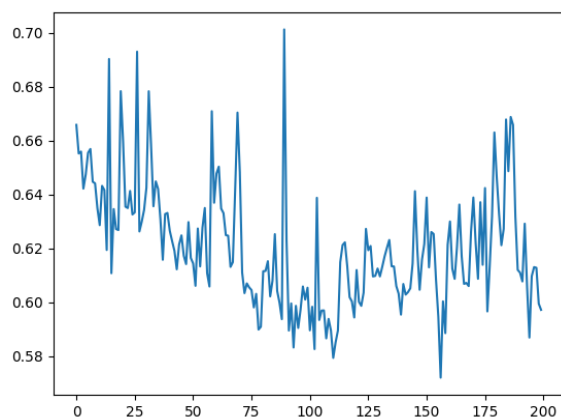
```
Test loss epoch 199: 0.6134846806526184
Test accuracy epoch 199: 0.7232142857142857
```



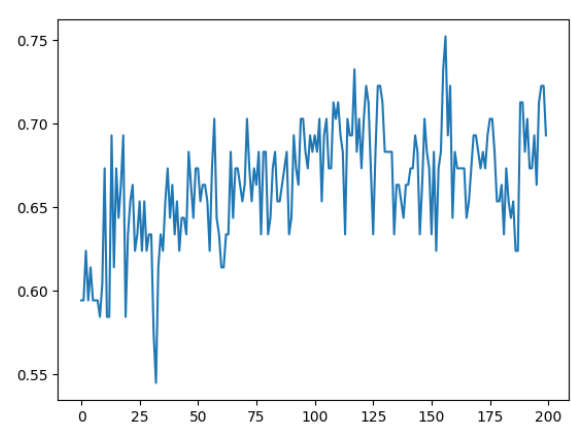
Validation Losses



Validation Accuracies



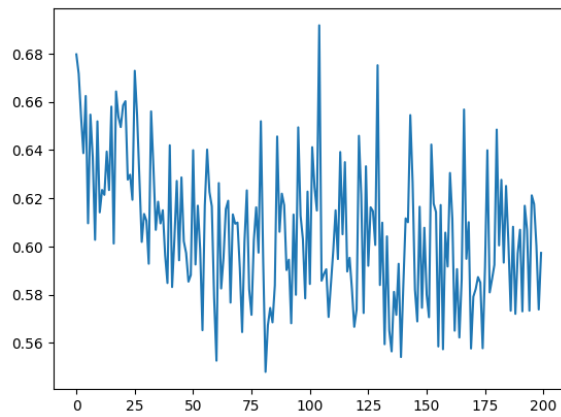
Train Losses



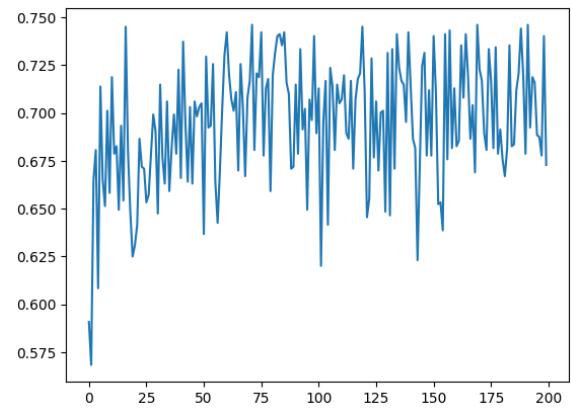
Train Accuracies

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

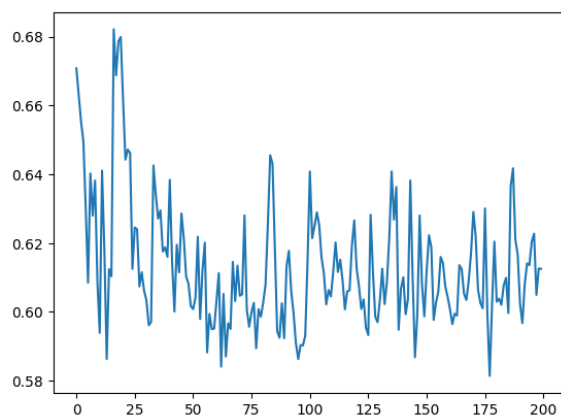
Test loss epoch 199: 0.6249549984931946
Test accuracy epoch 199: 0.6875



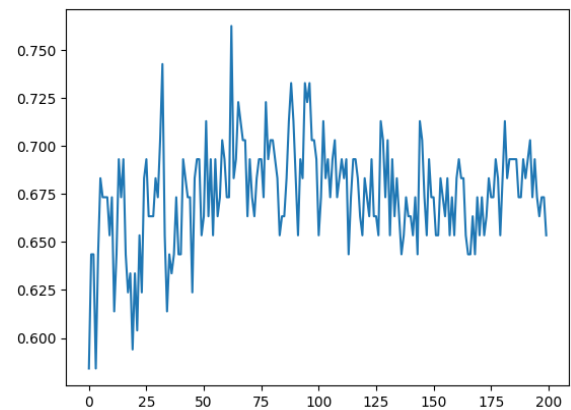
Validation Losses



Validation Accuracies



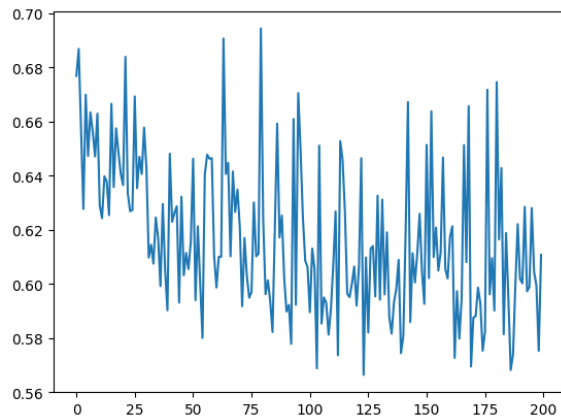
Train Losses



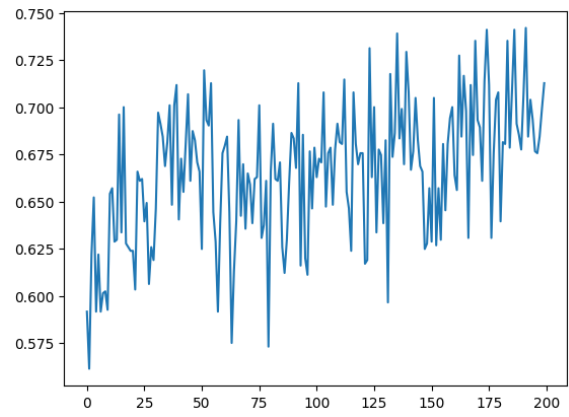
Train Accuracies

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

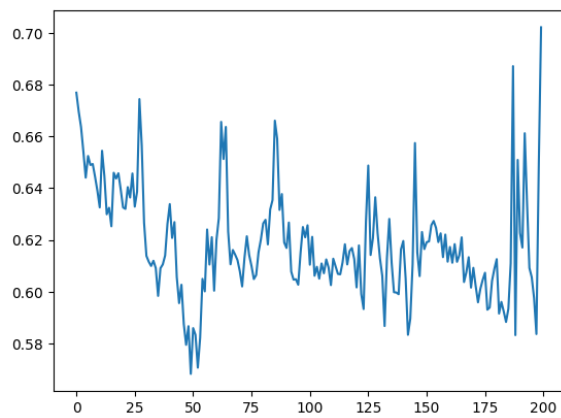
Test loss epoch 199: 0.7227734327316284
Test accuracy epoch 199: 0.6339285714285714



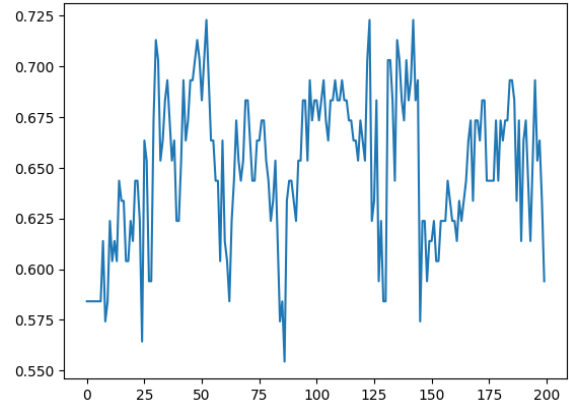
Validation Losses



Validation Accuracies



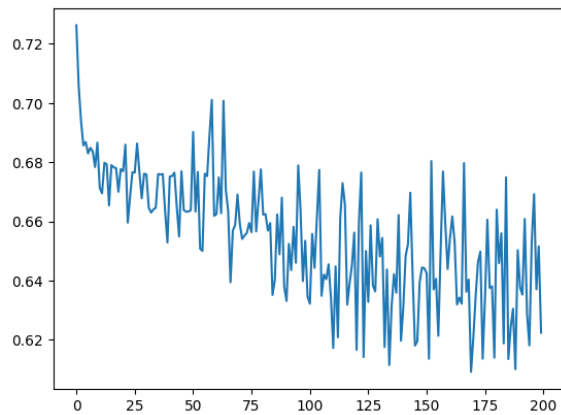
Train Losses



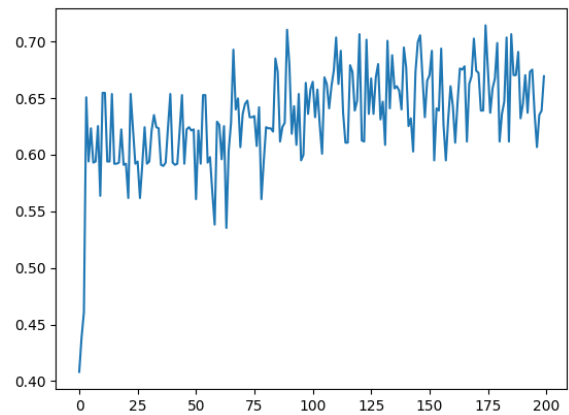
Train Accuracies

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

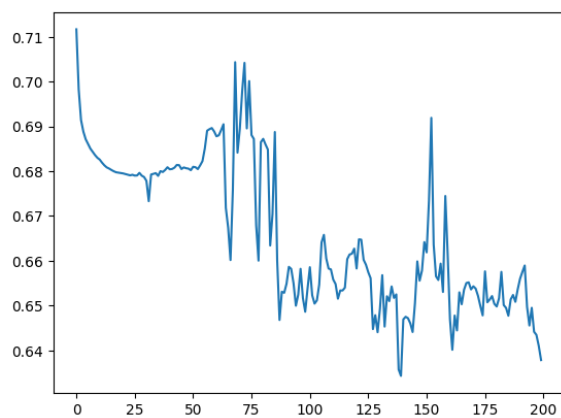
Test loss epoch 199: 0.7227734327316284
Test accuracy epoch 199: 0.6339285714285714



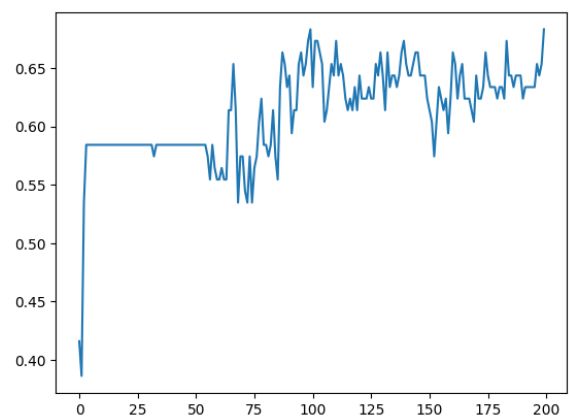
Validation Losses



Validation Accuracies



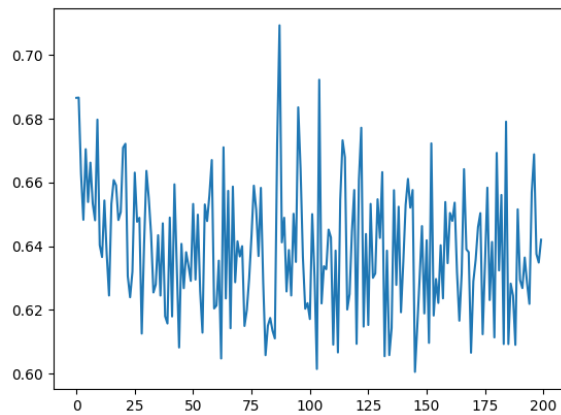
Train Losses



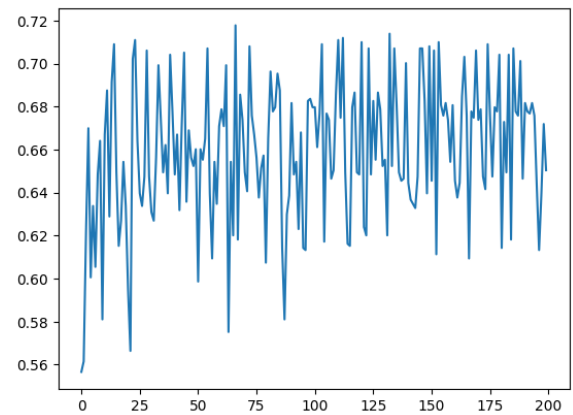
Train Accuracies

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

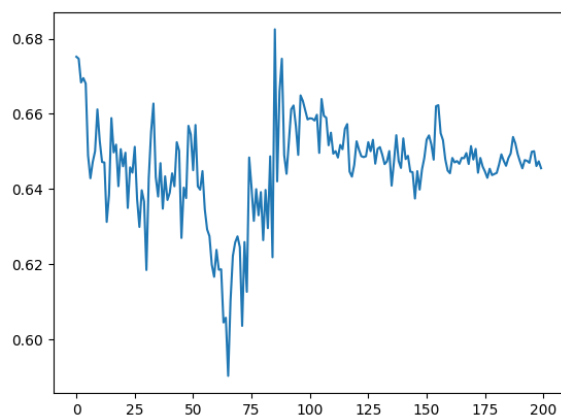
Test loss epoch 199: 0.6792422533035278
Test accuracy epoch 199: 0.6071428571428571



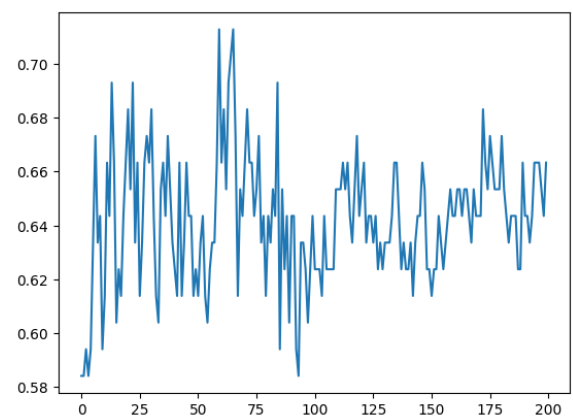
Validation Losses



Validation Accuracies



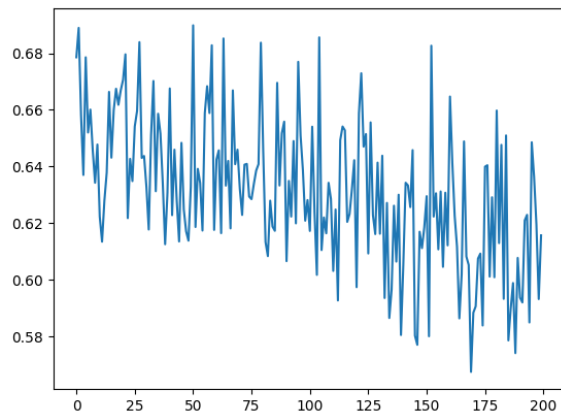
Train Losses



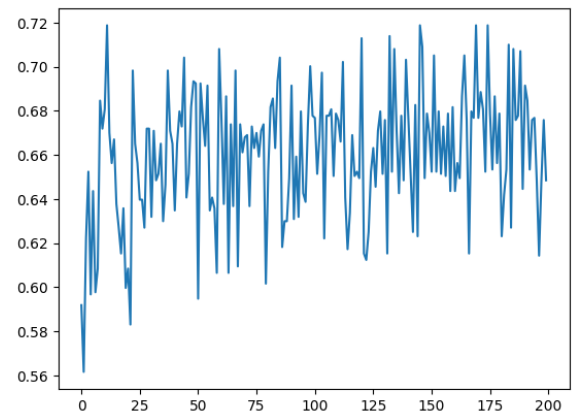
Train Accuracies

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

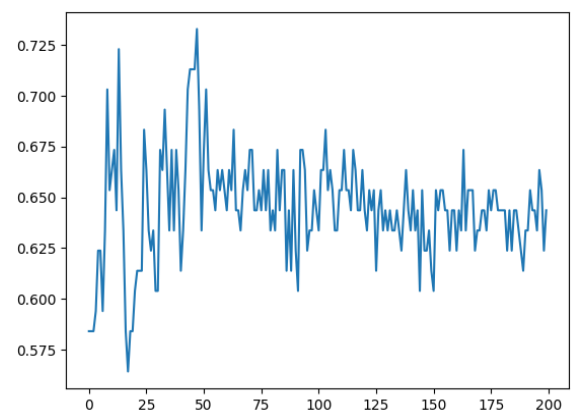
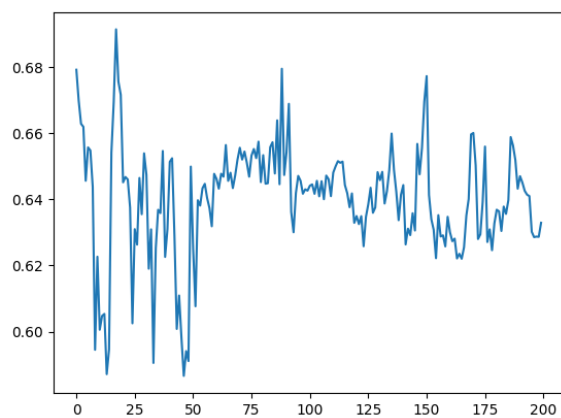
```
Test loss epoch 199: 0.6555837392807007
Test accuracy epoch 199: 0.5714285714285714
```



Validation Losses



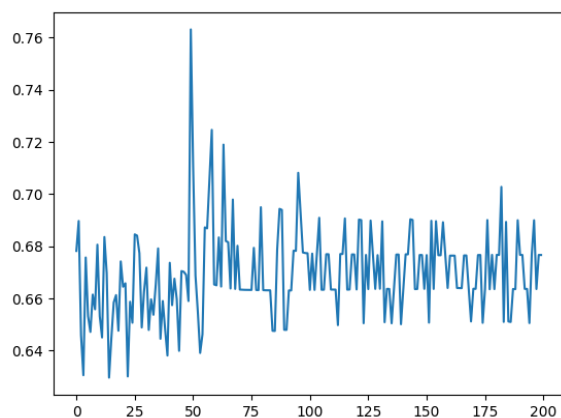
Validation Accuracies



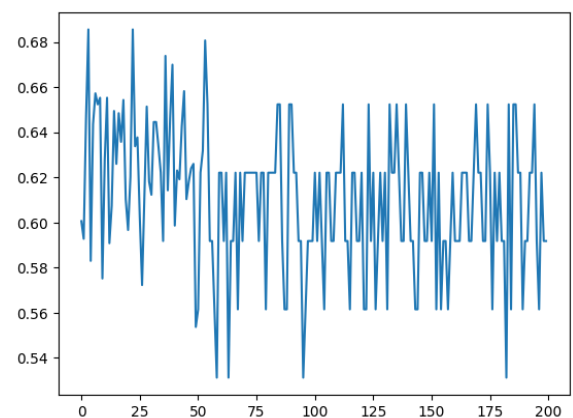
Add residual connections

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

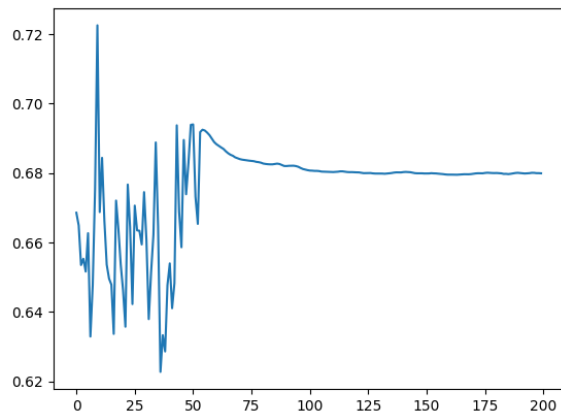
Train Losses



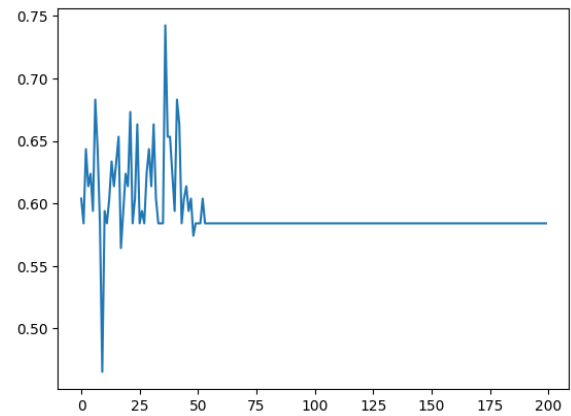
Train Accuracies



Validation Losses



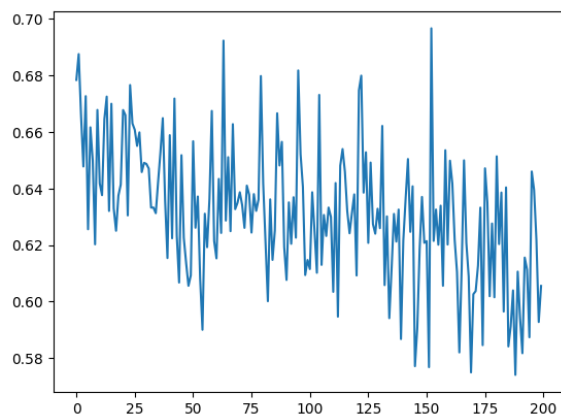
Validation Accuracies



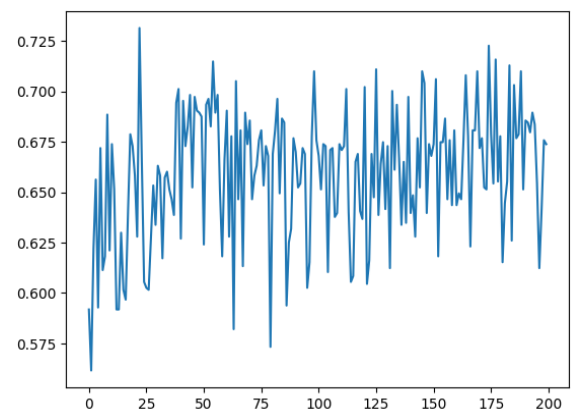
Use ReLU

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

Train Losses

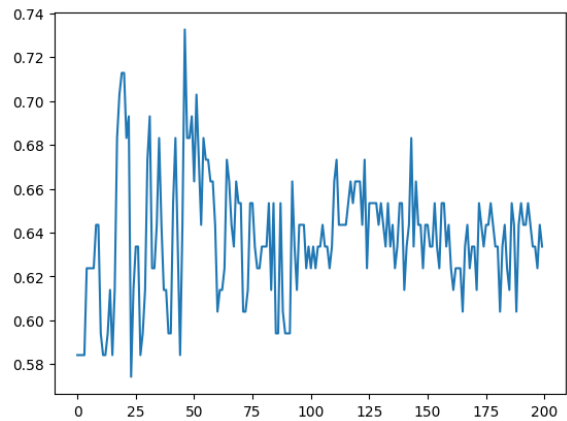
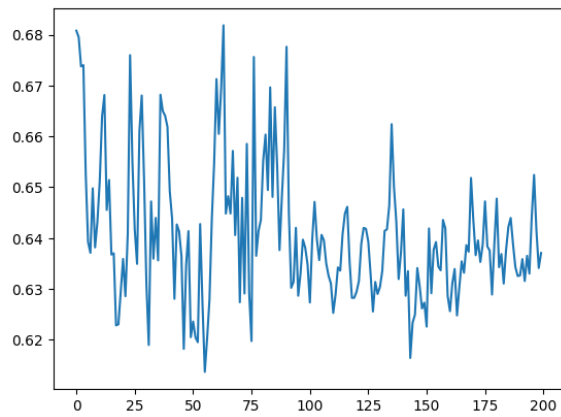


Train Accuracies



Validation Losses

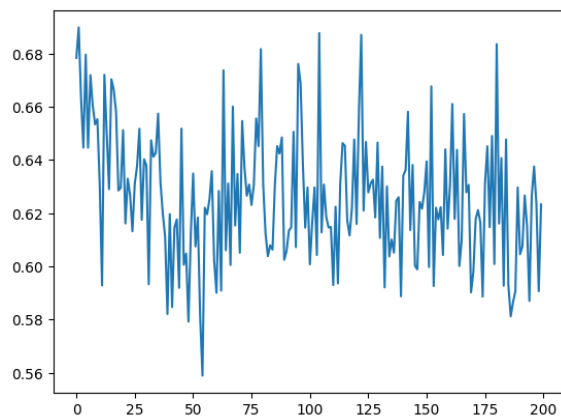
Validation Accuracies



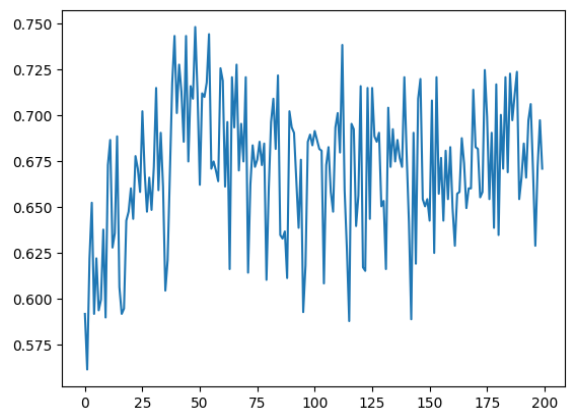
Use LeakyReLU

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

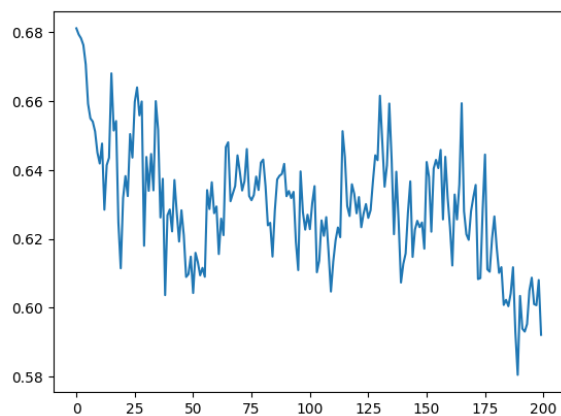
Train Losses



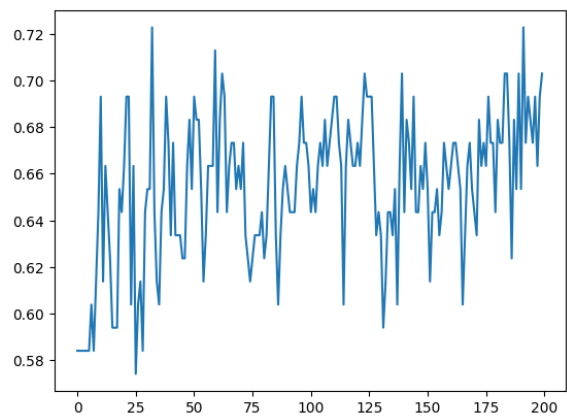
Train Accuracies



Validation Losses



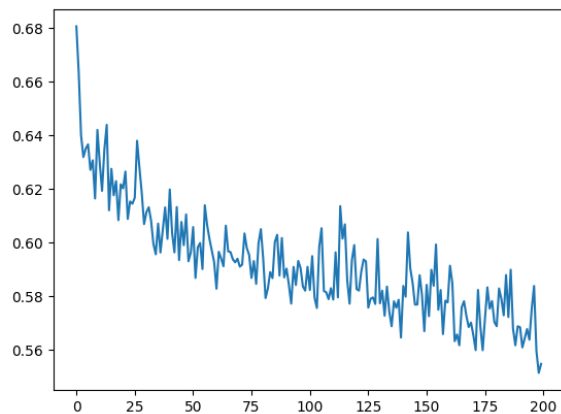
Validation Accuracies



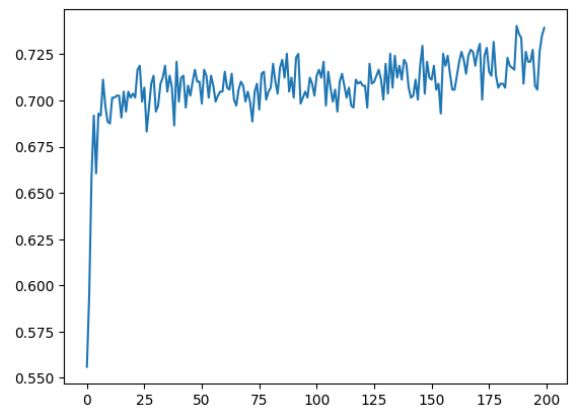
Change the batch size = 32

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

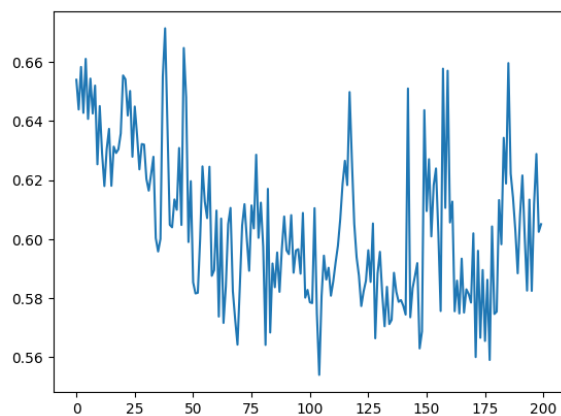
Train Losses



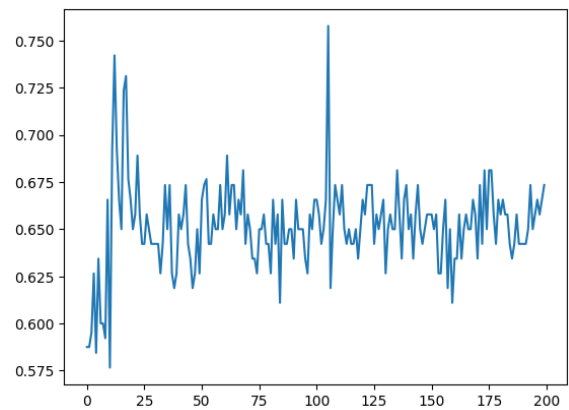
Train Accuracies



Validation Losses



Validation Accuracies

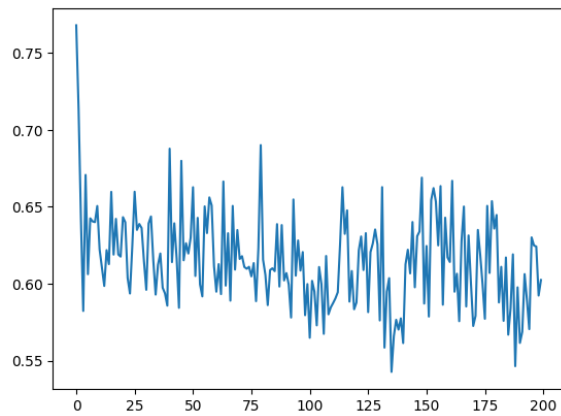


Remove the decoder

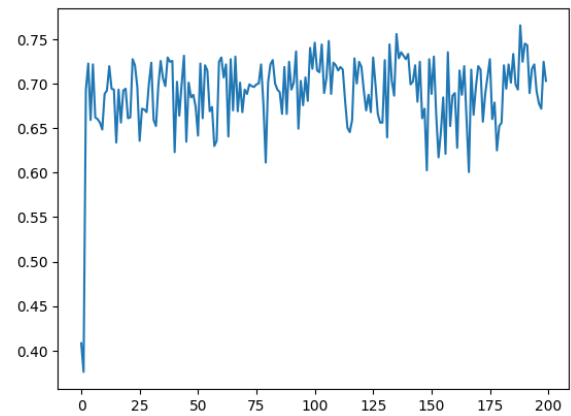
On paper implementation

```
Test loss epoch 199: 0.6045722961425781
Test accuracy epoch 199: 0.7142857142857143
```

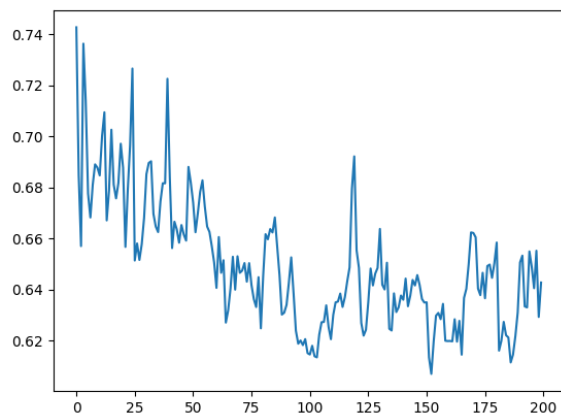
Train Losses



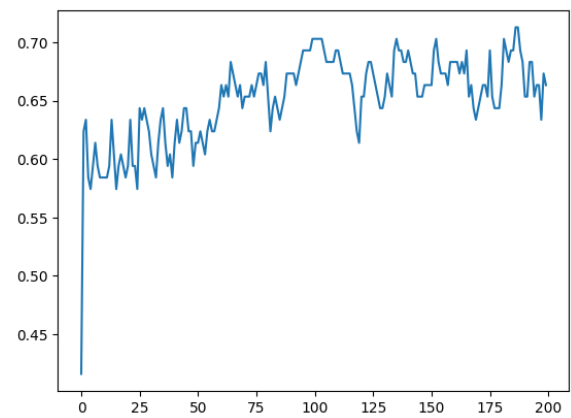
Train Accuracies



Validation Losses



Validation Accuracies

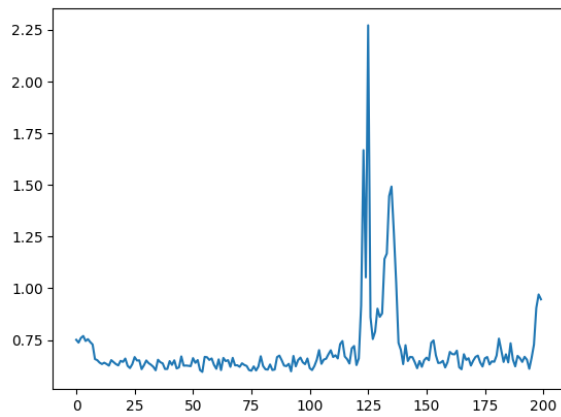


On best case

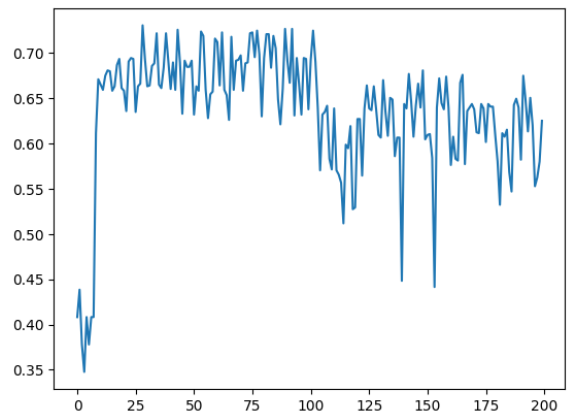
Test loss epoch 199: 0.948885440826416
Test accuracy epoch 199: 0.5982142857142857

Train Losses

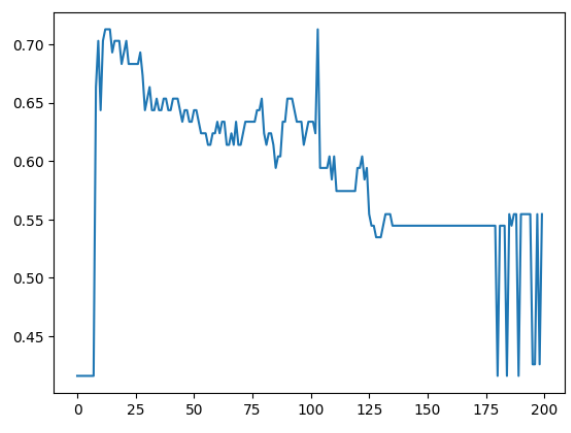
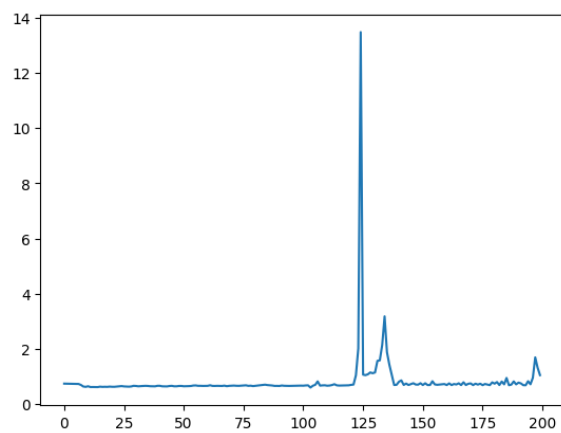
Train Accuracies



Validation Losses



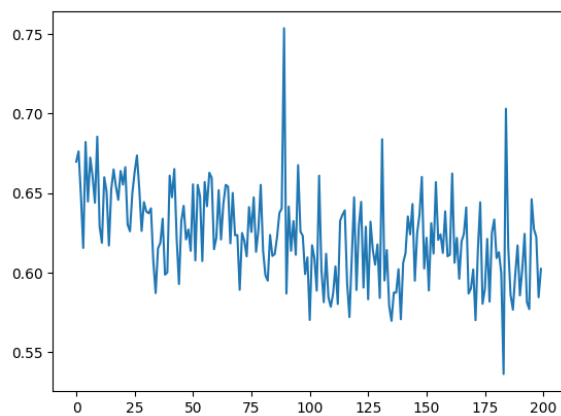
Validation Accuracies



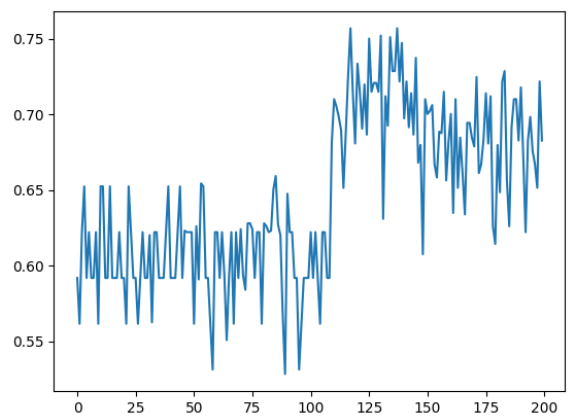
With residual

Test loss epoch 199: 0.597978949546814
Test accuracy epoch 199: 0.7410714285714286

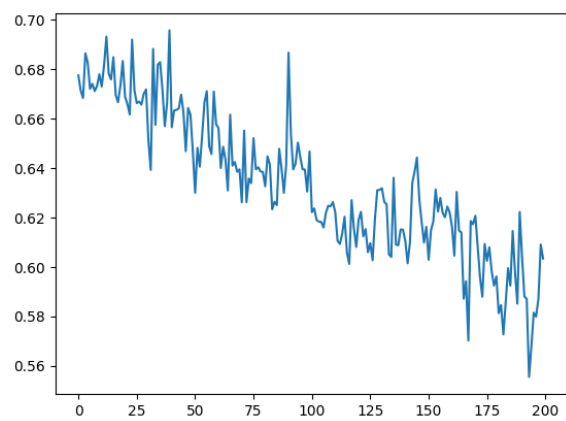
Train Losses



Train Accuracies



Validation Losses



Validation Accuracies

