Proposed model

Training without regularization over fer2013

```
Epoch 00042: val_loss did not improve from 1.14807
57/57 [==============================] - 1062s 19s/step - loss: 0.3890 - accuracy: 0.8584 - val_loss: 1.1967 - val_accuracy: 0.5752 - lr:
Epoch 43/100
57/57 [==============================] - ETA: 0s - loss: 0.3867 - accuracy: 0.8586
Epoch 00043: val_loss did not improve from 1.14807
57/57 [==============================] - 1065s 19s/step - loss: 0.3867 - accuracy: 0.8586 - val_loss: 1.2024 - val_accuracy: 0.5731 - lr:
Epoch 44/100
57/57 [==============================] - ETA: 0s - loss: 0.3616 - accuracy: 0.8664
Epoch 00044: ReduceLROnPlateau reducing learning rate to 0.0006561000715009868.

Epoch 00044: val_loss did not improve from 1.14807
57/57 [==============================] - 1064s 19s/step - loss: 0.3616 - accuracy: 0.8664 - val_loss: 1.1853 - val_accuracy: 0.5703 - lr:
Epoch 45/100
57/57 [==============================] - ETA: 0s - loss: 0.3253 - accuracy: 0.8808
Epoch 00045: val_loss did not improve from 1.14807
57/57 [==============================] - 1063s 19s/step - loss: 0.3253 - accuracy: 0.8808 - val_loss: 1.1581 - val_accuracy: 0.5864 - lr:
Epoch 46/100
57/57 [==============================] - ETA: 0s - loss: 0.3052 - accuracy: 0.8888
Epoch 00046: val_loss did not improve from 1.14807
57/57 [==============================] - 1067s 19s/step - loss: 0.3052 - accuracy: 0.8888 - val_loss: 1.1978 - val_accuracy: 0.5697 - lr:
Epoch 47/100
57/57 [==============================] - ETA: 0s - loss: 0.2963 - accuracy: 0.8919
Epoch 00047: ReduceLROnPlateau reducing learning rate to 0.0005904900433961303.

Epoch 00047: val_loss did not improve from 1.14807
57/57 [==============================] - 1078s 19s/step - loss: 0.2963 - accuracy: 0.8919 - val_loss: 1.1837 - val_accuracy: 0.5802 - lr:
Epoch 48/100
57/57 [==============================] - ETA: 0s - loss: 0.2863 - accuracy: 0.8962
Epoch 00048: val_loss did not improve from 1.14807
57/57 [==============================] - 1078s 19s/step - loss: 0.2863 - accuracy: 0.8962 - val_loss: 1.1679 - val_accuracy: 0.5743 - lr:
Epoch 49/100
57/57 [==============================] - ETA: 0s - loss: 0.2740 - accuracy: 0.9016
Epoch 00049: val_loss did not improve from 1.14807
57/57 [==============================] - 1067s 19s/step - loss: 0.2740 - accuracy: 0.9016 - val_loss: 1.2014 - val_accuracy: 0.5734 - lr:
Epoch 00049: early stopping
```

Accuracy of dexpression

Loss of dexpression
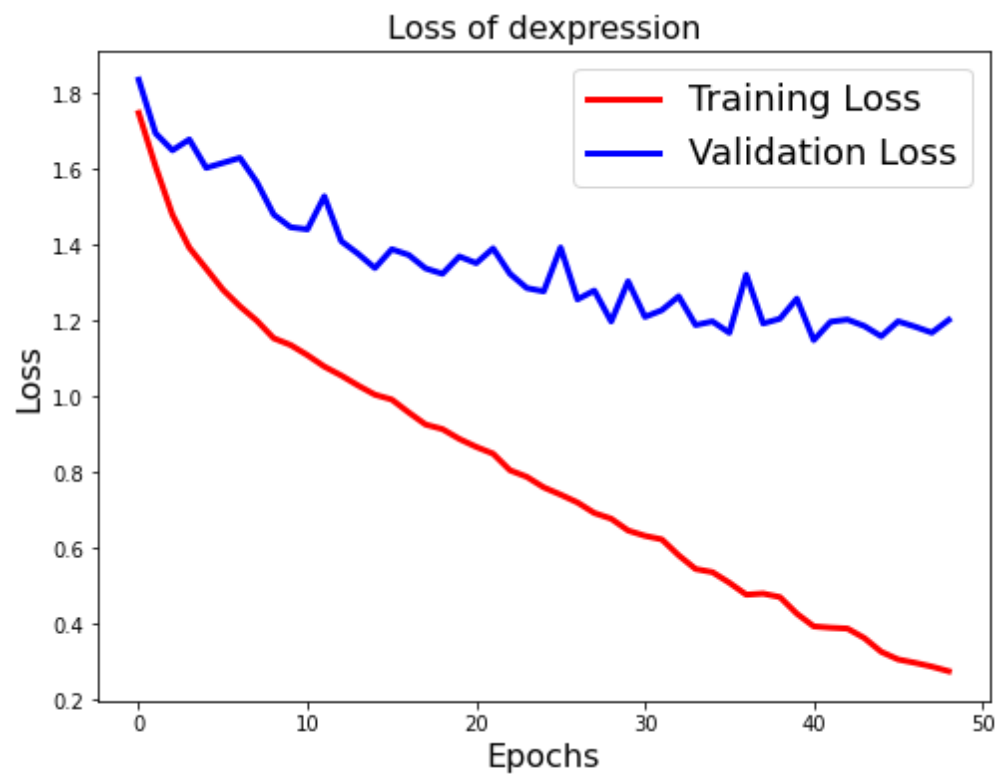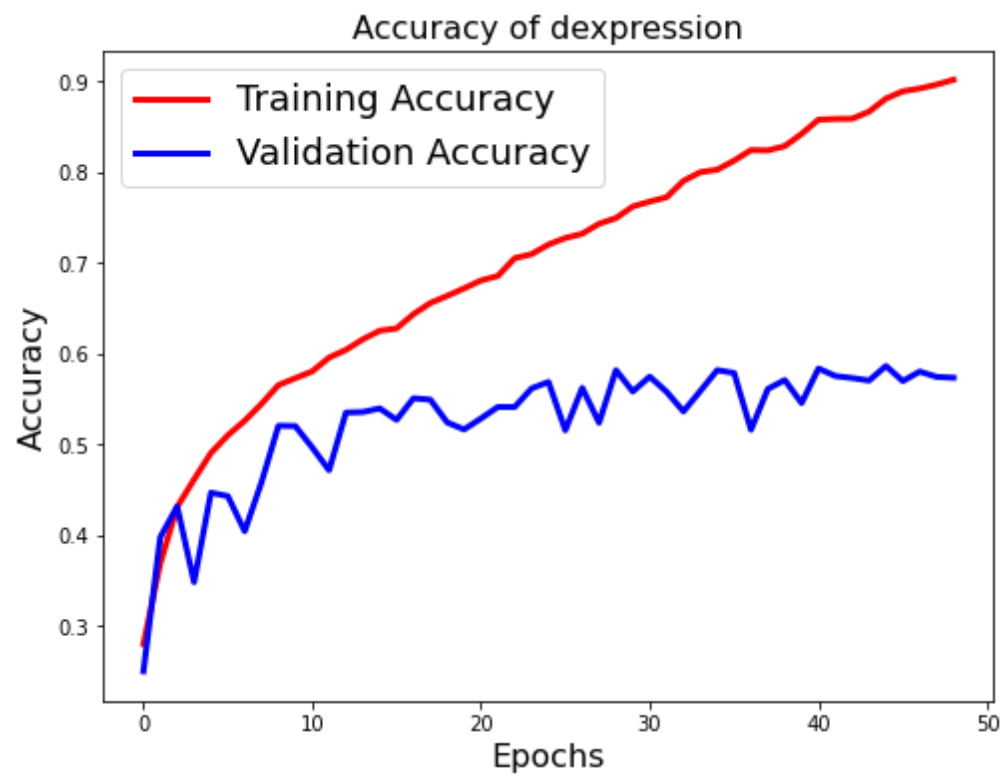
```
8/8 [==============================] - 26s 3s/step - loss: 1.1370
Testing Loss = 1.1369704008102417
Testing Accuracy = 0.5600445866584778
```
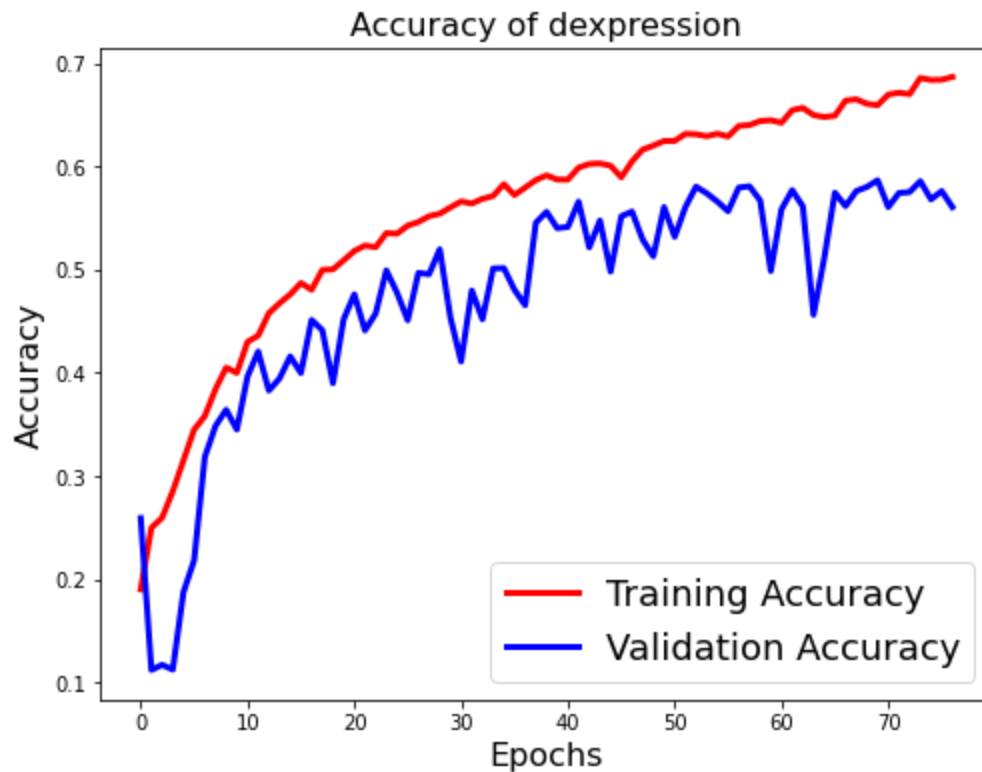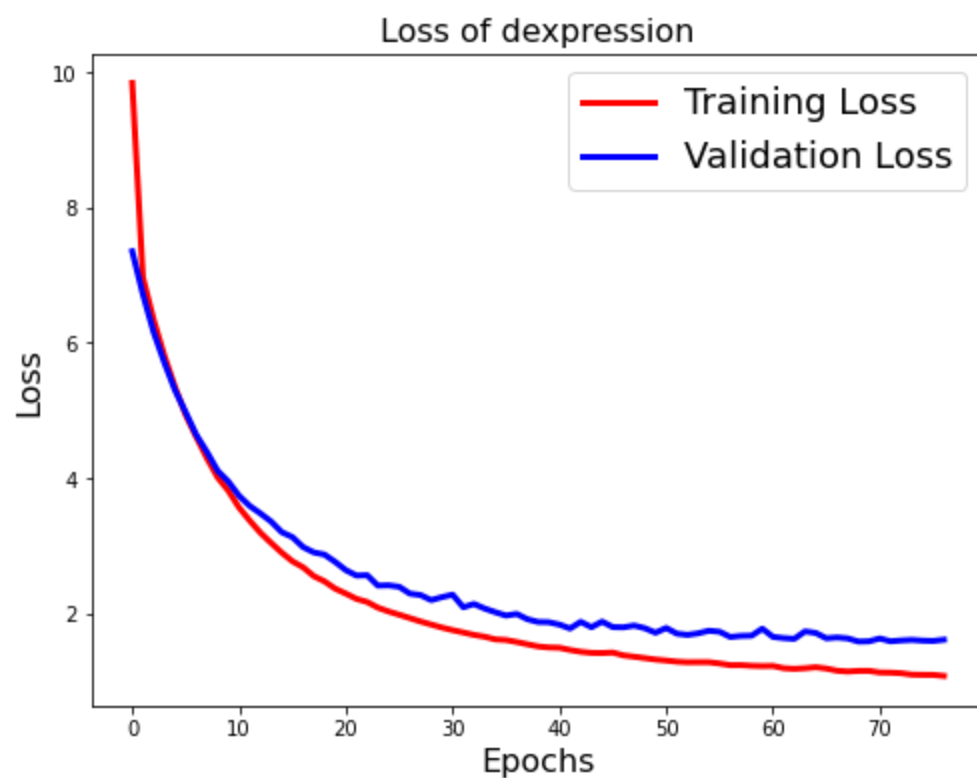
Training with regularization l2 over fer2013

```
Epoch 71/100
15/15 [==============================] - ETA: 0s - loss: 1.1326 - accuracy: 0.6697
Epoch 00071: saving model to /content/training_withReg/cp.ckpt
15/15 [==============================] - 472s 31s/step - loss: 1.1326 - accuracy: 0.6697 - val_loss: 1.6352 - val_accuracy: 0.5607 -
Epoch 72/100
15/15 [==============================] - ETA: 0s - loss: 1.1304 - accuracy: 0.6714
Epoch 00072: ReduceLROnPlateau reducing learning rate to 0.0005314410547725857.

Epoch 00072: saving model to /content/training_withReg/cp.ckpt
15/15 [==============================] - 472s 31s/step - loss: 1.1304 - accuracy: 0.6714 - val_loss: 1.5933 - val_accuracy: 0.5743 -
Epoch 73/100
15/15 [==============================] - ETA: 0s - loss: 1.1220 - accuracy: 0.6701
Epoch 00073: saving model to /content/training_withReg/cp.ckpt
15/15 [==============================] - 474s 32s/step - loss: 1.1220 - accuracy: 0.6701 - val_loss: 1.6053 - val_accuracy: 0.5752 -
Epoch 74/100
15/15 [==============================] - ETA: 0s - loss: 1.1011 - accuracy: 0.6858
Epoch 00074: saving model to /content/training_withReg/cp.ckpt
15/15 [==============================] - 474s 32s/step - loss: 1.1011 - accuracy: 0.6858 - val_loss: 1.6138 - val_accuracy: 0.5858 -
Epoch 75/100
15/15 [==============================] - ETA: 0s - loss: 1.0979 - accuracy: 0.6837
Epoch 00075: ReduceLROnPlateau reducing learning rate to 0.00047829695977270604.

Epoch 00075: saving model to /content/training_withReg/cp.ckpt
15/15 [==============================] - 474s 32s/step - loss: 1.0979 - accuracy: 0.6837 - val_loss: 1.6029 - val_accuracy: 0.5681 -
Epoch 76/100
15/15 [==============================] - ETA: 0s - loss: 1.0973 - accuracy: 0.6840
Epoch 00076: saving model to /content/training_withReg/cp.ckpt
15/15 [==============================] - 473s 32s/step - loss: 1.0973 - accuracy: 0.6840 - val_loss: 1.5984 - val_accuracy: 0.5762 -
Epoch 77/100
15/15 [==============================] - ETA: 0s - loss: 1.0817 - accuracy: 0.6867
Epoch 00077: saving model to /content/training_withReg/cp.ckpt
15/15 [==============================] - 473s 32s/step - loss: 1.0817 - accuracy: 0.6867 - val_loss: 1.6164 - val_accuracy: 0.5607 -
Epoch 00077: early stopping
```


Accuracy of dexpression

```
2/2 [==============================] - 4s 2s/step -
Testing Loss = 1.633882999420166
Testing Accuracy = 0.5553078651428223
```
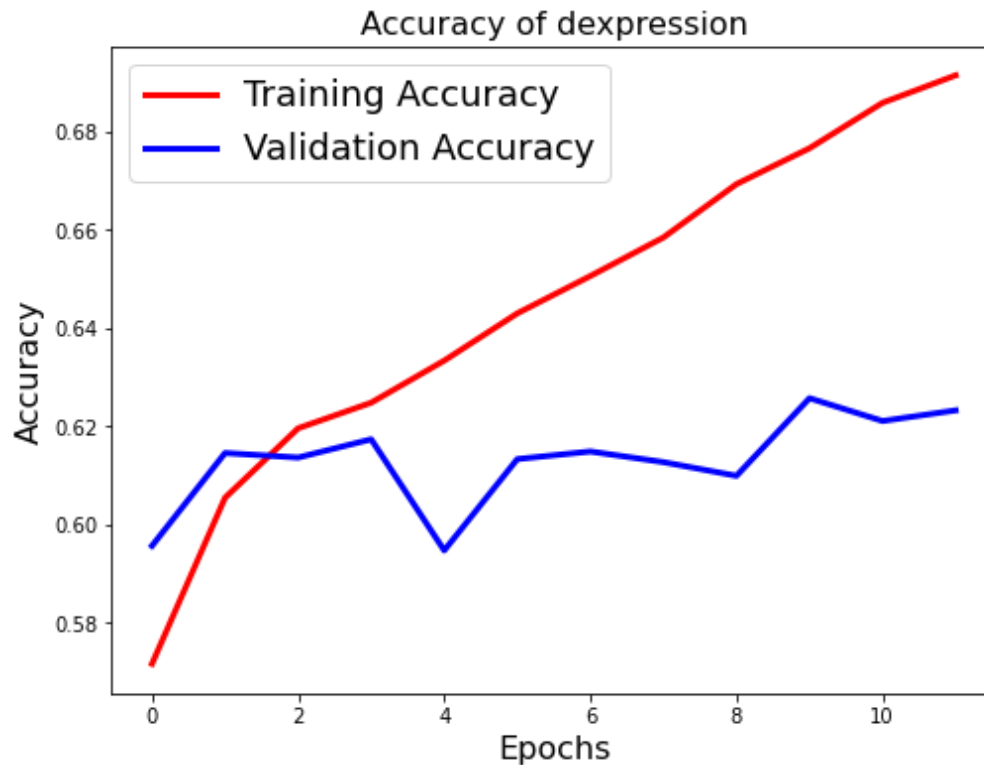

Loss of dexpression

Training with data augmentation mirror w gaussian noise and regularization not in two blocks of feature extractions over fer2013
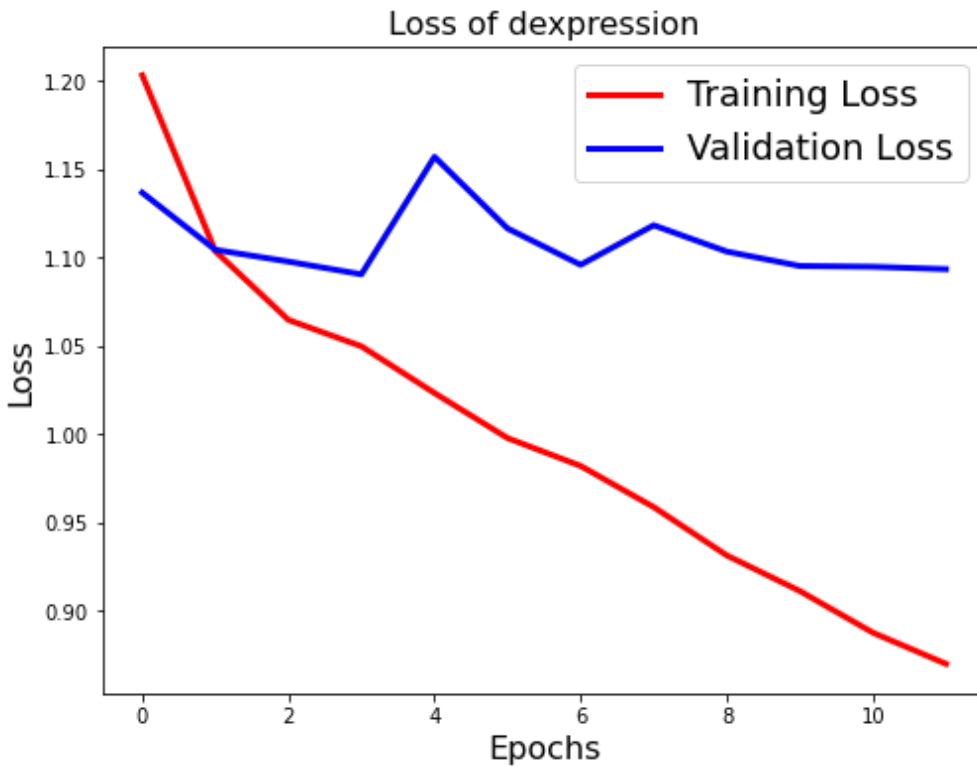
Using initial weights from previous step

```
Epoch 6/100
43/43 [==============================] - ETA: 0s - loss: 0.9978 - accuracy: 0.6429
Epoch 00006: val_loss did not improve from 1.09044
43/43 [==============================] - 1469s 34s/step - loss: 0.9978 - accuracy: 0.6429 - val_loss: 1.1164 - val_accuracy: 0.6133
Epoch 7/100
43/43 [==============================] - ETA: 0s - loss: 0.9820 - accuracy: 0.6505
Epoch 00007: ReduceLROnPlateau reducing learning rate to 0.0004304672533180565.

Epoch 00007: val_loss did not improve from 1.09044
43/43 [==============================] - 1463s 34s/step - loss: 0.9820 - accuracy: 0.6505 - val_loss: 1.0958 - val_accuracy: 0.6149
Epoch 8/100
43/43 [==============================] - ETA: 0s - loss: 0.9587 - accuracy: 0.6584
Epoch 00008: val_loss did not improve from 1.09044
43/43 [==============================] - 1470s 34s/step - loss: 0.9587 - accuracy: 0.6584 - val_loss: 1.1182 - val_accuracy: 0.6127
Epoch 9/100
43/43 [==============================] - ETA: 0s - loss: 0.9314 - accuracy: 0.6692
Epoch 00009: val_loss did not improve from 1.09044
43/43 [==============================] - 1482s 34s/step - loss: 0.9314 - accuracy: 0.6692 - val_loss: 1.1033 - val_accuracy: 0.6099
Epoch 10/100
43/43 [==============================] - ETA: 0s - loss: 0.9112 - accuracy: 0.6765
Epoch 00010: ReduceLROnPlateau reducing learning rate to 0.00038742052274756136.

Epoch 00010: val_loss did not improve from 1.09044
43/43 [==============================] - 1407s 33s/step - loss: 0.9112 - accuracy: 0.6765 - val_loss: 1.0952 - val_accuracy: 0.6257
Epoch 11/100
43/43 [==============================] - ETA: 0s - loss: 0.8877 - accuracy: 0.6858
Epoch 00011: val_loss did not improve from 1.09044
43/43 [==============================] - 1411s 33s/step - loss: 0.8877 - accuracy: 0.6858 - val_loss: 1.0947 - val_accuracy: 0.6211
Epoch 12/100
43/43 [==============================] - ETA: 0s - loss: 0.8700 - accuracy: 0.6913
Epoch 00012: val_loss did not improve from 1.09044
43/43 [==============================] - 1443s 34s/step - loss: 0.8700 - accuracy: 0.6913 - val_loss: 1.0934 - val_accuracy: 0.6232
Epoch 00012: early stopping
```


Accuracy of dexpression

Loss of dexpression

```
2/2 [==============================] - 5s 2s/step - lo
Testing Loss = 1.1222162246704102
Testing Accuracy = 0.6219002604484558
```

Training with data augmentation mirror w gaussian noise and add more regularization not in two blocks of feature extractions over fer2013

Using initial weights from previous step

```
Epoch 32/100
43/43 [==============================] - ETA: 0s - loss: 1.0269 - accuracy: 0.6279
Epoch 00032: val_loss did not improve from 1.48746
43/43 [==============================] - 1285s 30s/step - loss: 1.0269 - accuracy: 0.6279 - val_loss: 1.5177 - val_accuracy: 0.5864 ·
Epoch 33/100
43/43 [==============================] - ETA: 0s - loss: 1.0249 - accuracy: 0.6296
Epoch 00033: ReduceLROnPlateau reducing learning rate to 0.00038742052274756136.

Epoch 00033: val_loss did not improve from 1.48746
43/43 [==============================] - 1268s 29s/step - loss: 1.0249 - accuracy: 0.6296 - val_loss: 1.5379 - val_accuracy: 0.5706 ·
Epoch 34/100
43/43 [==============================] - ETA: 0s - loss: 1.0083 - accuracy: 0.6372
Epoch 00034: val_loss did not improve from 1.48746
43/43 [==============================] - 1270s 30s/step - loss: 1.0083 - accuracy: 0.6372 - val_loss: 1.5031 - val_accuracy: 0.5975 ·
Epoch 35/100
43/43 [==============================] - ETA: 0s - loss: 0.9935 - accuracy: 0.6422
Epoch 00035: val_loss did not improve from 1.48746
43/43 [==============================] - 1286s 30s/step - loss: 0.9935 - accuracy: 0.6422 - val_loss: 1.5152 - val_accuracy: 0.5824 ·
Epoch 36/100
43/43 [==============================] - ETA: 0s - loss: 0.9876 - accuracy: 0.6440
Epoch 00036: ReduceLROnPlateau reducing learning rate to 0.0003486784757114947.

Epoch 00036: val_loss did not improve from 1.48746
43/43 [==============================] - 1283s 30s/step - loss: 0.9876 - accuracy: 0.6440 - val_loss: 1.5218 - val_accuracy: 0.5913 ·
Epoch 37/100
43/43 [==============================] - ETA: 0s - loss: 0.9830 - accuracy: 0.6449
Epoch 00037: val_loss did not improve from 1.48746
43/43 [==============================] - 1282s 30s/step - loss: 0.9830 - accuracy: 0.6449 - val_loss: 1.5040 - val_accuracy: 0.5926 ·
Epoch 38/100
43/43 [==============================] - ETA: 0s - loss: 0.9733 - accuracy: 0.6483
Epoch 00038: val_loss did not improve from 1.48746
43/43 [==============================] - 1355s 32s/step - loss: 0.9733 - accuracy: 0.6483 - val_loss: 1.5079 - val_accuracy: 0.6062 ·
Epoch 00038: early stopping
```

Accuracy of dexpression

Loss of dexpression
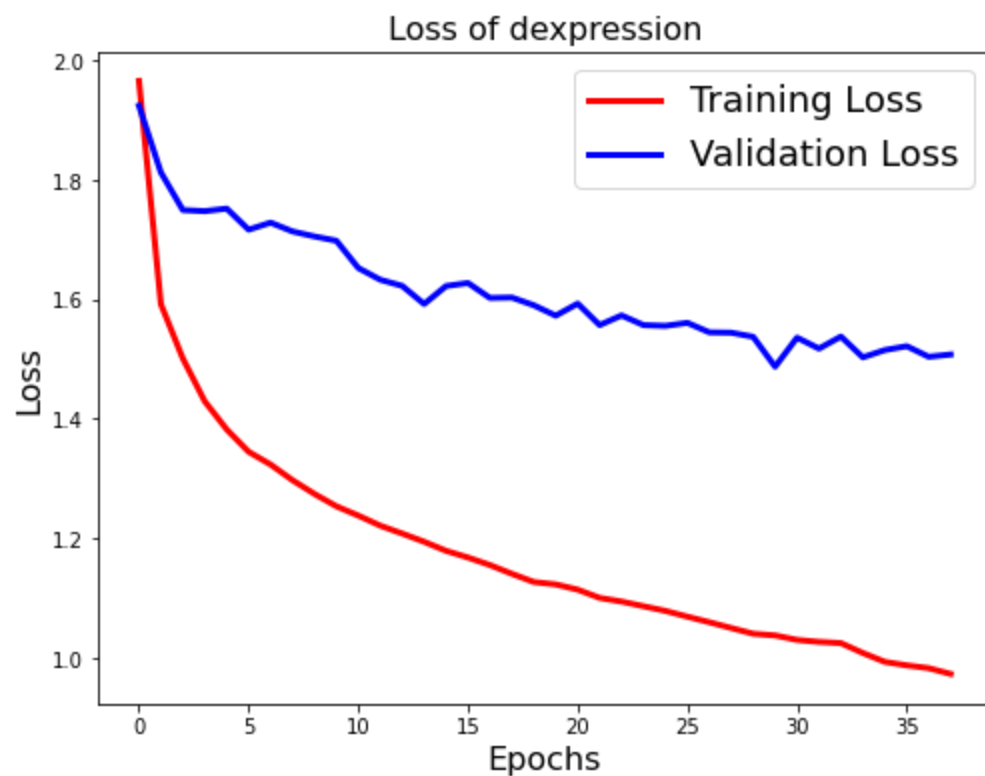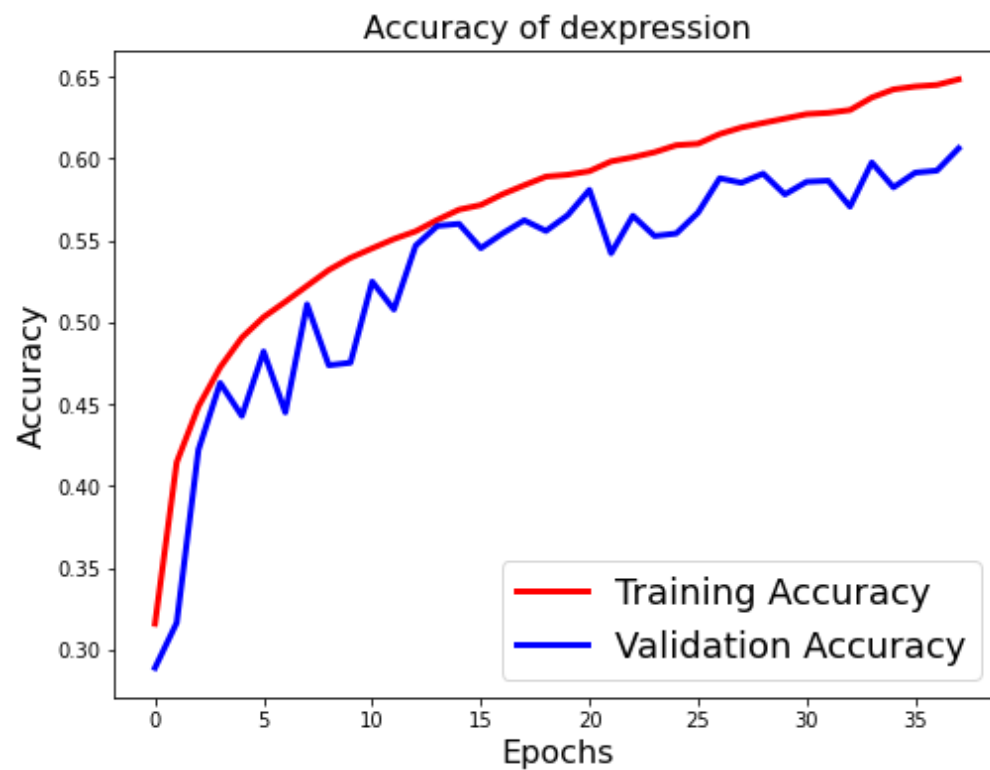
```
2/2 [==============================] - 5s 2s/step -
Testing Loss = 1.5185163021087646
Testing Accuracy = 0.5893006324768066
```

Resnet model :

	Training Accuracy	Validation Accuracy	Testing Acc
Resnet50 (no freezing)	98.35	56.26	56.26
Freezing 7 Layers	0.9861	0.5946	0.59459
Freezing 3 layers	0.8573	0.5116	0.5116
Freezing 3 layers(lr = 0.001)	0.7997	0.5634	0.5634

Notes :
Resnet model still have huge overfitting (training acc reaches ~99%, val/testing still in 50s)

Ensemble models accuracies :

63.77% testing with ensemble voting
66.6% average voting
67.12% weighted average on validation accuracy
67.26% weighted average on individual test set accuracies
for each model

Models :
- Original Dexpression Model
- Original Dexpression Model with one FEX block.
- CNN_1
- CNN_2
- ResNet Model