Contents

Architecture

conv_1	CONV2D (32, 3*3)	
max_1	MaxPooling2D (2, 2)	
conv_2	CONV2D (64, 3*3)	
max_2	MaxPooling2D (2, 2)	
conv_3	CONV2D (128, 3*3)	
max_3	MaxPooling2D (2, 2)	
drop_1	Dropout(0.20)	
	Flatten	
dense_1	Dense(128, relu)	
drop_2	Dropout(0.50)	
dense_2	Dense(5, softmax)	

Callbacks:

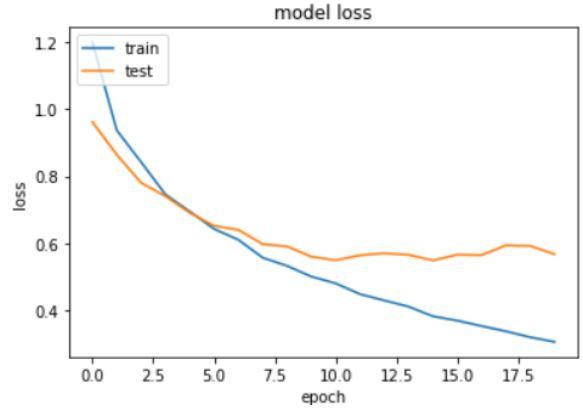
EarlyStopping	val_acc, patience=5

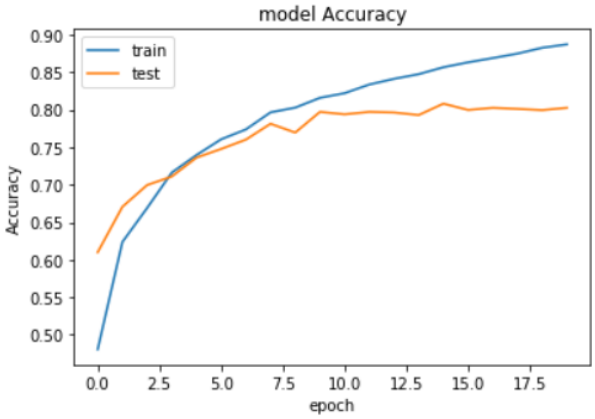
Batch Size = 64
Epochs = 40
Optimizer = Adam

TEST#0 Test above architecture

Observations:

	TRAIN	TEST
Accuracy	88.73	80.26
Val_loss	0.3054	0.5673



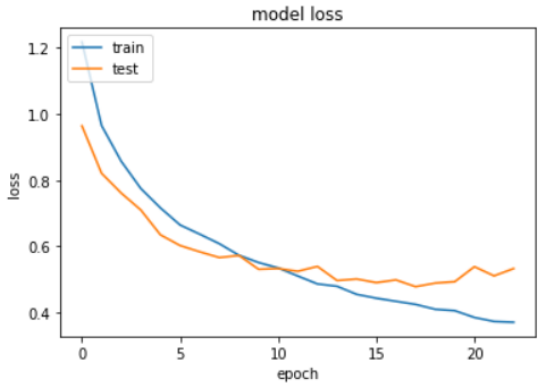


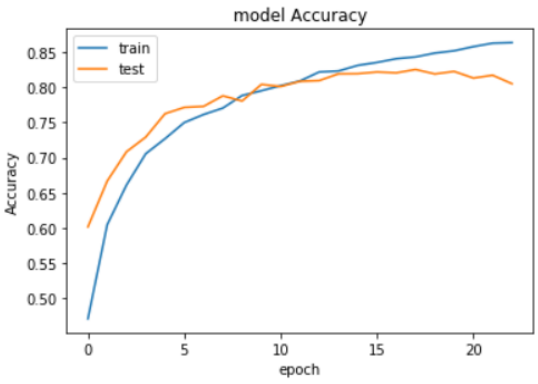

```
Train on 25000 samples, validate on 5000 samples
Epoch 1/40
25000/25000 [==============================] - 10s 412us/step - loss: 1.2001 - acc: 0.4805 - val loss: 0.9620 - val acc: 0.6100
Epoch 2/40
25000/25000 [==============================] - 8s 339us/step - loss: 0.9371 - acc: 0.6236 - val_loss: 0.8645 - val_acc: 0.6706
Epoch 3/40
25000/25000 [==============================] - 9s 340us/step - loss: 0.8425 - acc: 0.6690 - val loss: 0.7807 - val acc: 0.6996
Epoch 4/40
25000/25000 [==============================] - 8s 339us/step - loss: 0.7457 - acc: 0.7162 - val loss: 0.7407 - val acc: 0.7110
Epoch 5/40
25000/25000 [==============================] - 8s 337us/step - loss: 0.6949 - acc: 0.7396 - val loss: 0.6910 - val acc: 0.7362
Epoch 6/40
25000/25000 [==============================] - 8s 339us/step - loss: 0.6428 - acc: 0.7607 - val_loss: 0.6520 - val_acc: 0.7478
Epoch 7/40
25000/25000 [==============================] - 8s 340us/step - loss: 0.6103 - acc: 0.7738 - val_loss: 0.6400 - val_acc: 0.7602
Epoch 8/40
25000/25000 [==============================] - 9s 345us/step - loss: 0.5568 - acc: 0.7966 - val loss: 0.5973 - val acc: 0.7814
Epoch 9/40
25000/25000 [==============================] - 8s 329us/step - loss: 0.5325 - acc: 0.8029 - val loss: 0.5905 - val acc: 0.7696
Epoch 10/40
25000/25000 [==============================] - 8s 329us/step - loss: 0.5005 - acc: 0.8160 - val_loss: 0.5598 - val_acc: 0.7972
Epoch 11/40
25000/25000 [==============================] - 9s 346us/step - loss: 0.4802 - acc: 0.8222 - val_loss: 0.5492 - val_acc: 0.7940
Epoch 12/40
25000/25000 [==============================] - 8s 334us/step - loss: 0.4480 - acc: 0.8337 - val_loss: 0.5638 - val_acc: 0.7972
Epoch 13/40
25000/25000 [==============================] - 8s 329us/step - loss: 0.4292 - acc: 0.8413 - val loss: 0.5700 - val acc: 0.7964
Epoch 14/40
25000/25000 [==============================] - 8s 327us/step - loss: 0.4107 - acc: 0.8475 - val loss: 0.5655 - val acc: 0.7930
Epoch 15/40
25000/25000 [==============================] - 8s 328us/step - loss: 0.3818 - acc: 0.8568 - val_loss: 0.5487 - val_acc: 0.8082
Epoch 16/40
25000/25000 [==============================] - 8s 328us/step - loss: 0.3689 - acc: 0.8633 - val_loss: 0.5657 - val_acc: 0.7998
Epoch 17/40
25000/25000 [==============================] - 8s 330us/step - loss: 0.3527 - acc: 0.8690 - val loss: 0.5645 - val acc: 0.8026
Epoch 18/40
25000/25000 [==============================] - 8s 330us/step - loss: 0.3370 - acc: 0.8750 - val loss: 0.5935 - val acc: 0.8012
Epoch 19/40
25000/25000 [==============================] - 8s 338us/step - loss: 0.3193 - acc: 0.8827 - val loss: 0.5921 - val acc: 0.7996
Epoch 20/40
25000/25000 [==============================] - 8s 333us/step - loss: 0.3054 - acc: 0.8873 - val_loss: 0.5673 - val_acc: 0.8026
Epoch 00020: early stopping
```

TEST#1 Increased drop_1 dropout percentage from 0.20 to 0.50

Observations:

	TRAIN	TEST
Accuracy	86.31	80.48
Val_loss	0.3714	0.5333



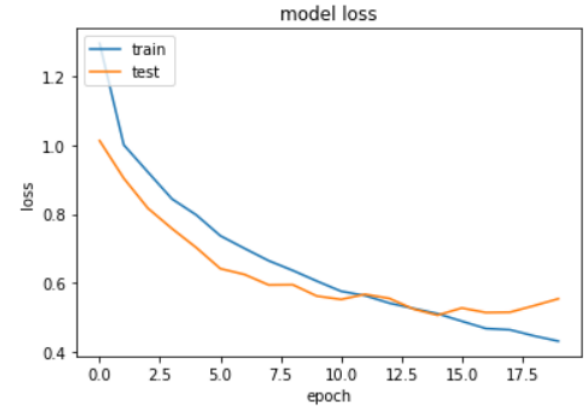


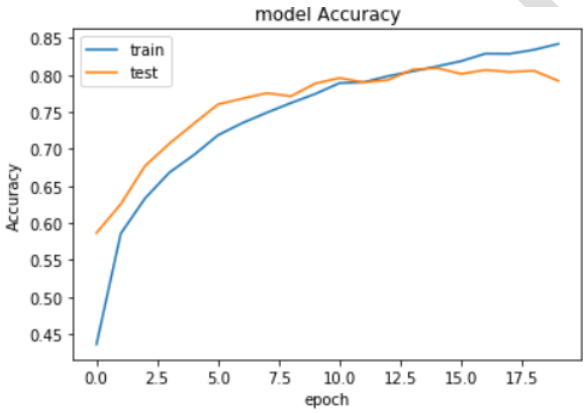

```
Train on 25000 samples, validate on 5000 samples
Epoch 1/40
25000/25000 [==============================] - 10s 403us/step - loss: 1.2167 - acc: 0.4712 - val_loss: 0.9637 - val_acc: 0.6016
Epoch 2/40
25000/25000 [==============================] - 8s 327us/step - loss: 0.9647 - acc: 0.6046 - val loss: 0.8207 - val acc: 0.6666
Epoch 3/40
25000/25000 [==============================] - 8s 335us/step - loss: 0.8570 - acc: 0.6609 - val loss: 0.7611 - val acc: 0.7082
Epoch 4/40
25000/25000 [==============================] - 8s 328us/step - loss: 0.7747 - acc: 0.7054 - val loss: 0.7100 - val acc: 0.7290
Epoch 5/40
25000/25000 [==============================] - 8s 329us/step - loss: 0.7163 - acc: 0.7267 - val_loss: 0.6350 - val_acc: 0.7622
Epoch 6/40
25000/25000 [==============================] - 8s 327us/step - loss: 0.6648 - acc: 0.7497 - val_loss: 0.6028 - val_acc: 0.7712
Epoch 7/40
25000/25000 [==============================] - 8s 326us/step - loss: 0.6371 - acc: 0.7610 - val loss: 0.5839 - val acc: 0.7726
Epoch 8/40
25000/25000 [==============================] - 8s 333us/step - loss: 0.6083 - acc: 0.7702 - val loss: 0.5665 - val acc: 0.7876
Epoch 9/40
25000/25000 [==============================] - 8s 339us/step - loss: 0.5734 - acc: 0.7881 - val_loss: 0.5728 - val_acc: 0.7802
Epoch 10/40
25000/25000 [==============================] - 8s 339us/step - loss: 0.5515 - acc: 0.7948 - val_loss: 0.5313 - val_acc: 0.8038
Epoch 11/40
25000/25000 [==============================] - 8s 324us/step - loss: 0.5352 - acc: 0.8020 - val_loss: 0.5334 - val_acc: 0.8008
Epoch 12/40
25000/25000 [==============================] - 8s 334us/step - loss: 0.5108 - acc: 0.8087 - val loss: 0.5251 - val acc: 0.8082
Epoch 13/40
25000/25000 [==============================] - 8s 318us/step - loss: 0.4870 - acc: 0.8214 - val loss: 0.5398 - val acc: 0.8092
Epoch 14/40
25000/25000 [==============================] - 8s 323us/step - loss: 0.4799 - acc: 0.8228 - val_loss: 0.4972 - val_acc: 0.8188
Epoch 15/40
25000/25000 [==============================] - 8s 325us/step - loss: 0.4555 - acc: 0.8308 - val_loss: 0.5018 - val_acc: 0.8190
Epoch 16/40
25000/25000 [==============================] - 8s 325us/step - loss: 0.4439 - acc: 0.8350 - val loss: 0.4909 - val acc: 0.8214
Epoch 17/40
25000/25000 [==============================] - 8s 326us/step - loss: 0.4345 - acc: 0.8403 - val loss: 0.4991 - val acc: 0.8202
Epoch 18/40
25000/25000 [==============================] - 8s 323us/step - loss: 0.4253 - acc: 0.8428 - val loss: 0.4787 - val acc: 0.8250
Epoch 19/40
25000/25000 [==============================] - 8s 322us/step - loss: 0.4105 - acc: 0.8483 - val_loss: 0.4895 - val_acc: 0.8186
Epoch 20/40
25000/25000 [==============================] - 8s 322us/step - loss: 0.4062 - acc: 0.8515 - val loss: 0.4938 - val acc: 0.8222
Epoch 21/40
25000/25000 [==============================] - 8s 322us/step - loss: 0.3858 - acc: 0.8574 - val loss: 0.5390 - val acc: 0.8128
Epoch 22/40
25000/25000 [==============================] - 8s 336us/step - loss: 0.3738 - acc: 0.8623 - val loss: 0.5113 - val acc: 0.8168
Epoch 23/40
25000/25000 [==============================] - 8s 321us/step - loss: 0.3714 - acc: 0.8631 - val_loss: 0.5333 - val_acc: 0.8048
Epoch 00023: early stopping
```

TEST#2 Increased batch size from 64 to 128

Observations:

	TRAIN	TEST
Accuracy	84.22	79.22
Val_loss	0.4311	0.5542






```
Train on 25000 samples, validate on 5000 samples
Epoch 1/40
25000/25000 [==============================] - 8s 321us/step - loss: 1.2962 - acc: 0.4361 - val_loss: 1.0133 - val_acc: 0.5866
Epoch 2/40
25000/25000 [==============================] - 6s 245us/step - loss: 1.0013 - acc: 0.5858 - val loss: 0.9043 - val acc: 0.6256
Epoch 3/40
25000/25000 [==============================] - 6s 243us/step - loss: 0.9223 - acc: 0.6335 - val loss: 0.8172 - val acc: 0.6772
Epoch 4/40
25000/25000 [==============================] - 6s 245us/step - loss: 0.8440 - acc: 0.6683 - val loss: 0.7579 - val acc: 0.7074
Epoch 5/40
25000/25000 [==============================] - 6s 246us/step - loss: 0.7979 - acc: 0.6918 - val_loss: 0.7030 - val_acc: 0.7342
Epoch 6/40
25000/25000 [==============================] - 6s 244us/step - loss: 0.7372 - acc: 0.7188 - val loss: 0.6417 - val acc: 0.7604
Epoch 7/40
25000/25000 [==============================] - 6s 247us/step - loss: 0.7005 - acc: 0.7352 - val loss: 0.6248 - val acc: 0.7682
Epoch 8/40
25000/25000 [==============================] - 6s 243us/step - loss: 0.6648 - acc: 0.7492 - val loss: 0.5944 - val acc: 0.7756
Epoch 9/40
25000/25000 [==============================] - 6s 246us/step - loss: 0.6364 - acc: 0.7622 - val_loss: 0.5950 - val_acc: 0.7714
Epoch 10/40
25000/25000 [==============================] - 6s 247us/step - loss: 0.6055 - acc: 0.7746 - val_loss: 0.5620 - val_acc: 0.7886
Epoch 11/40
25000/25000 [==============================] - 6s 245us/step - loss: 0.5761 - acc: 0.7892 - val loss: 0.5523 - val acc: 0.7960
Epoch 12/40
25000/25000 [==============================] - 6s 248us/step - loss: 0.5632 - acc: 0.7904 - val loss: 0.5671 - val acc: 0.7902
Epoch 13/40
25000/25000 [==============================] - 6s 247us/step - loss: 0.5416 - acc: 0.7986 - val_loss: 0.5553 - val_acc: 0.7934
Epoch 14/40
25000/25000 [==============================] - 6s 248us/step - loss: 0.5260 - acc: 0.8050 - val_loss: 0.5244 - val_acc: 0.8074
Epoch 15/40
25000/25000 [==============================] - 6s 248us/step - loss: 0.5109 - acc: 0.8117 - val_loss: 0.5065 - val_acc: 0.8096
Epoch 16/40
25000/25000 [==============================] - 6s 246us/step - loss: 0.4891 - acc: 0.8188 - val loss: 0.5273 - val acc: 0.8016
Epoch 17/40
25000/25000 [==============================] - 6s 245us/step - loss: 0.4678 - acc: 0.8290 - val loss: 0.5142 - val acc: 0.8068
Epoch 18/40
25000/25000 [==============================] - 6s 247us/step - loss: 0.4641 - acc: 0.8288 - val_loss: 0.5152 - val_acc: 0.8042
Epoch 19/40
25000/25000 [==============================] - 6s 247us/step - loss: 0.4463 - acc: 0.8342 - val_loss: 0.5342 - val_acc: 0.8058
Epoch 20/40
25000/25000 [==============================] - 6s 248us/step - loss: 0.4311 - acc: 0.8422 - val loss: 0.5542 - val acc: 0.7922
Epoch 00020: early stopping
```

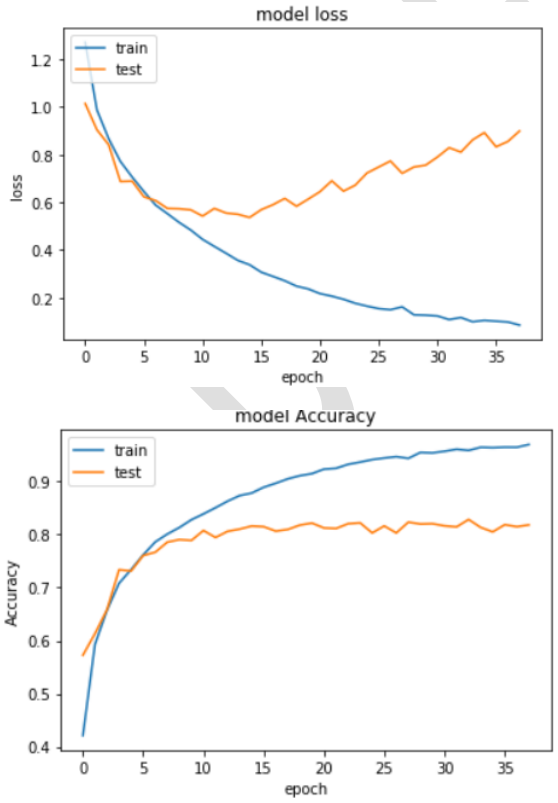
TEST#3 Added one more conv layer

Architecture

Conv_1	CONV2D (32, 3*3)	
max_1	MaxPooling2D (2, 2)	
conv_2	CONV2D (64, 3*3)	
max_2	MaxPooling2D (2, 2)	
conv_3	CONV2D (128, 3*3)	
max_3	MaxPooling2D (2, 2)	Removed this layer
conv_4	CONV2D (256, 3*3)	Added this layer
max_4	MaxPooling2D (2, 2)	Added this layer
drop_1	Dropout(0.50)	
	Flatten	
dense_1	Dense(128, relu)	
drop_2	Dropout(0.50)	
dense_2	Dense(5, softmax)	

Observations:

	TRAIN	TEST
Accuracy	97.00	81.84
Val_loss	0.0848	0.8994



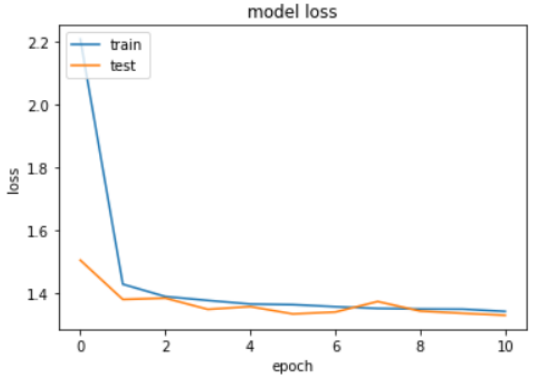
```
Train on 25000 samples, validate on 5000 samples
Epoch 1/40
25000/25000 [==============================] - 12s 484us/step - loss: 1.2713 - acc: 0.4212 - val_loss: 1.0144 - val_acc: 0.5726
Epoch 2/40
25000/25000 [==============================] - 7s 282us/step - loss: 0.9876 - acc: 0.5928 - val loss: 0.9044 - val acc: 0.6132
Epoch 3/40
25000/25000 [==============================] - 7s 282us/step - loss: 0.8670 - acc: 0.6574 - val loss: 0.8413 - val acc: 0.6586
Epoch 4/40
25000/25000 [==============================] - 7s 286us/step - loss: 0.7714 - acc: 0.7083 - val_loss: 0.6875 - val_acc: 0.7338
Epoch 5/40
25000/25000 [==============================] - 7s 284us/step - loss: 0.7061 - acc: 0.7341 - val_loss: 0.6890 - val_acc: 0.7314
Epoch 6/40
25000/25000 [==============================] - 7s 281us/step - loss: 0.6454 - acc: 0.7618 - val loss: 0.6232 - val acc: 0.7606
Epoch 7/40
25000/25000 [==============================] - 7s 283us/step - loss: 0.5883 - acc: 0.7862 - val loss: 0.6074 - val acc: 0.7668
Epoch 8/40
25000/25000 [==============================] - 7s 283us/step - loss: 0.5525 - acc: 0.8010 - val_loss: 0.5745 - val_acc: 0.7858
Epoch 9/40
25000/25000 [==============================] - 7s 281us/step - loss: 0.5157 - acc: 0.8134 - val_loss: 0.5731 - val_acc: 0.7906
Epoch 10/40
25000/25000 [==============================] - 7s 283us/step - loss: 0.4833 - acc: 0.8281 - val loss: 0.5683 - val acc: 0.7890
Epoch 11/40
25000/25000 [==============================] - 7s 282us/step - loss: 0.4445 - acc: 0.8390 - val loss: 0.5423 - val acc: 0.8078
Epoch 12/40
25000/25000 [==============================] - 7s 285us/step - loss: 0.4150 - acc: 0.8507 - val loss: 0.5745 - val acc: 0.7946
Epoch 13/40
25000/25000 [==============================] - 7s 283us/step - loss: 0.3862 - acc: 0.8630 - val_loss: 0.5551 - val_acc: 0.8062
Epoch 14/40
25000/25000 [==============================] - 7s 284us/step - loss: 0.3564 - acc: 0.8736 - val loss: 0.5500 - val acc: 0.8104
Epoch 15/40
25000/25000 [==============================] - 7s 284us/step - loss: 0.3380 - acc: 0.8784 - val loss: 0.5364 - val acc: 0.8162
Epoch 16/40
25000/25000 [==============================] - 7s 283us/step - loss: 0.3067 - acc: 0.8894 - val loss: 0.5693 - val acc: 0.8150
Epoch 17/40
25000/25000 [==============================] - 7s 285us/step - loss: 0.2889 - acc: 0.8969 - val loss: 0.5901 - val acc: 0.8066
Epoch 18/40
25000/25000 [==============================] - 7s 284us/step - loss: 0.2708 - acc: 0.9052 - val_loss: 0.6164 - val_acc: 0.8098
Epoch 19/40
25000/25000 [==============================] - 7s 282us/step - loss: 0.2482 - acc: 0.9112 - val loss: 0.5835 - val acc: 0.8180
Epoch 20/40
25000/25000 [==============================] - 7s 285us/step - loss: 0.2364 - acc: 0.9150 - val loss: 0.6136 - val acc: 0.8218
Epoch 21/40
25000/25000 [==============================] - 7s 287us/step - loss: 0.2169 - acc: 0.9236 - val_loss: 0.6448 - val_acc: 0.8126
Epoch 22/40
25000/25000 [==============================] - 7s 284us/step - loss: 0.2063 - acc: 0.9251 - val_loss: 0.6903 - val_acc: 0.8116
Epoch 23/40
25000/25000 [==============================] - 7s 283us/step - loss: 0.1931 - acc: 0.9326 - val_loss: 0.6470 - val_acc: 0.8206
Epoch 24/40
25000/25000 [==============================] - 7s 284us/step - loss: 0.1764 - acc: 0.9368 - val loss: 0.6719 - val acc: 0.8222
Epoch 25/40
25000/25000 [==============================] - 7s 284us/step - loss: 0.1643 - acc: 0.9415 - val loss: 0.7229 - val acc: 0.8032
Epoch 26/40
25000/25000 [==============================] - 7s 283us/step - loss: 0.1539 - acc: 0.9445 - val_loss: 0.7483 - val_acc: 0.8164
Epoch 27/40
25000/25000 [==============================] - 7s 284us/step - loss: 0.1493 - acc: 0.9470 - val_loss: 0.7735 - val_acc: 0.8032
Epoch 28/40
25000/25000 [==============================] - 7s 284us/step - loss: 0.1613 - acc: 0.9438 - val loss: 0.7218 - val acc: 0.8236
Epoch 29/40
25000/25000 [==============================] - 7s 284us/step - loss: 0.1280 - acc: 0.9550 - val loss: 0.7483 - val acc: 0.8200
Epoch 30/40
25000/25000 [==============================] - 7s 285us/step - loss: 0.1265 - acc: 0.9542 - val loss: 0.7560 - val acc: 0.8206
Epoch 31/40
25000/25000 [==============================] - 7s 285us/step - loss: 0.1232 - acc: 0.9572 - val_loss: 0.7900 - val_acc: 0.8166
Epoch 32/40
25000/25000 [==============================] - 7s 284us/step - loss: 0.1081 - acc: 0.9610 - val loss: 0.8293 - val acc: 0.8146
Epoch 33/40
25000/25000 [==============================] - 7s 284us/step - loss: 0.1166 - acc: 0.9589 - val loss: 0.8108 - val acc: 0.8286
Epoch 34/40
25000/25000 [==============================] - 7s 285us/step - loss: 0.0988 - acc: 0.9648 - val loss: 0.8620 - val acc: 0.8136
Epoch 35/40
25000/25000 [==============================] - 7s 287us/step - loss: 0.1047 - acc: 0.9640 - val_loss: 0.8927 - val_acc: 0.8052
Epoch 36/40
25000/25000 [==============================] - 7s 284us/step - loss: 0.1011 - acc: 0.9650 - val_loss: 0.8331 - val_acc: 0.8188
Epoch 37/40
25000/25000 [==============================] - 7s 285us/step - loss: 0.0978 - acc: 0.9648 - val loss: 0.8554 - val acc: 0.8150
Epoch 38/40
25000/25000 [==============================] - 7s 285us/step - loss: 0.0848 - acc: 0.9700 - val loss: 0.8994 - val acc: 0.8184
Epoch 00038: early stopping
```

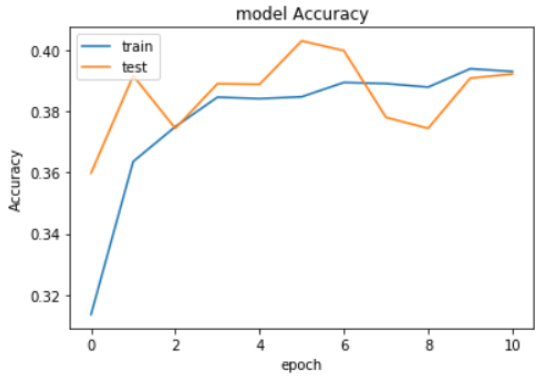
TEST#4 Added kernel_regularizer to each of the 4 Conv & 2 Dense Layers

```
kernel_regularizer=regularizers.l2(0.01)
```

Observations:

	TRAIN	TEST
Accuracy	39.30	39.22
Val_loss	1.3413	1.3289



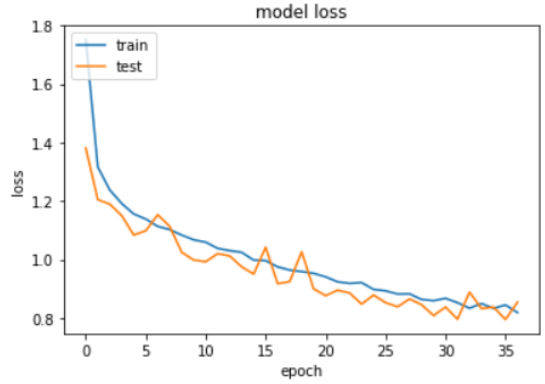


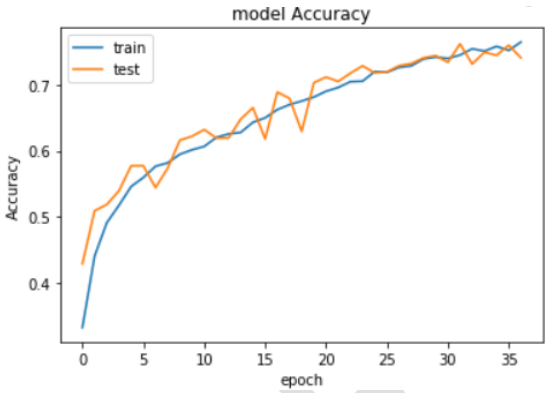

```
Train on 25000 samples, validate on 5000 samples
Epoch 1/40
25000/25000 [==============================] - 10s 395us/step - loss: 2.2098 - acc: 0.3136 - val_loss: 1.5046 - val_acc: 0.3598
Epoch 2/40
25000/25000 [==============================] - 7s 285us/step - loss: 1.4281 - acc: 0.3636 - val loss: 1.3796 - val acc: 0.3916
Epoch 3/40
25000/25000 [==============================] - 7s 297us/step - loss: 1.3887 - acc: 0.3750 - val loss: 1.3837 - val acc: 0.3744
Epoch 4/40
25000/25000 [==============================] - 7s 291us/step - loss: 1.3763 - acc: 0.3846 - val loss: 1.3479 - val acc: 0.3890
Epoch 5/40
25000/25000 [==============================] - 7s 282us/step - loss: 1.3649 - acc: 0.3841 - val_loss: 1.3566 - val_acc: 0.3888
Epoch 6/40
25000/25000 [==============================] - 7s 285us/step - loss: 1.3629 - acc: 0.3847 - val_loss: 1.3333 - val_acc: 0.4030
Epoch 7/40
25000/25000 [==============================] - 7s 282us/step - loss: 1.3564 - acc: 0.3894 - val loss: 1.3393 - val acc: 0.3998
Epoch 8/40
25000/25000 [==============================] - 7s 284us/step - loss: 1.3508 - acc: 0.3890 - val loss: 1.3729 - val acc: 0.3780
Epoch 9/40
25000/25000 [==============================] - 7s 284us/step - loss: 1.3490 - acc: 0.3879 - val_loss: 1.3423 - val_acc: 0.3744
Epoch 10/40
25000/25000 [==============================] - 7s 282us/step - loss: 1.3485 - acc: 0.3939 - val_loss: 1.3352 - val_acc: 0.3908
Epoch 11/40
25000/25000 [==============================] - 7s 285us/step - loss: 1.3413 - acc: 0.3930 - val_loss: 1.3289 - val_acc: 0.3922
Epoch 00011: early stopping
```

TEST#5 Added kernel_regularizer to just 4 Conv

Observations:

	TRAIN	TEST
Accuracy	76.47	74.08
Val_loss	0.8188	0.8542






```
Train on 25000 samples, validate on 5000 samples
Epoch 1/100
25000/25000 [==============================] - 7s 273us/step - loss: 1.7516 - acc: 0.3325 - val_loss: 1.3809 - val_acc: 0.4290
Epoch 2/100
25000/25000 [==============================] - 4s 149us/step - loss: 1.3162 - acc: 0.4404 - val_loss: 1.2047 - val_acc: 0.5092
Epoch 3/100
25000/25000 [==============================] - 4s 145us/step - loss: 1.2377 - acc: 0.4910 - val loss: 1.1894 - val acc: 0.5186
Epoch 4/100
25000/25000 [==============================] - 4s 149us/step - loss: 1.1913 - acc: 0.5174 - val loss: 1.1500 - val acc: 0.5394
Epoch 5/100
25000/25000 [==============================] - 4s 148us/step - loss: 1.1558 - acc: 0.5459 - val_loss: 1.0838 - val_acc: 0.5772
Epoch 6/100
25000/25000 [==============================] - 4s 145us/step - loss: 1.1385 - acc: 0.5594 - val_loss: 1.0985 - val_acc: 0.5774
Epoch 7/100
25000/25000 [==============================] - 4s 146us/step - loss: 1.1133 - acc: 0.5766 - val_loss: 1.1532 - val_acc: 0.5442
Epoch 8/100
25000/25000 [==============================] - 4s 145us/step - loss: 1.1023 - acc: 0.5817 - val loss: 1.1129 - val acc: 0.5736
Epoch 9/100
25000/25000 [==============================] - 4s 145us/step - loss: 1.0835 - acc: 0.5947 - val loss: 1.0247 - val acc: 0.6160
Epoch 10/100
25000/25000 [==============================] - 4s 146us/step - loss: 1.0674 - acc: 0.6015 - val_loss: 0.9982 - val_acc: 0.6220
Epoch 11/100
25000/25000 [==============================] - 4s 145us/step - loss: 1.0593 - acc: 0.6066 - val_loss: 0.9926 - val_acc: 0.6320
Epoch 12/100
25000/25000 [==============================] - 4s 146us/step - loss: 1.0382 - acc: 0.6203 - val loss: 1.0202 - val acc: 0.6192
Epoch 13/100
25000/25000 [==============================] - 4s 146us/step - loss: 1.0304 - acc: 0.6255 - val loss: 1.0123 - val acc: 0.6194
Epoch 14/100
25000/25000 [==============================] - 4s 146us/step - loss: 1.0246 - acc: 0.6278 - val loss: 0.9751 - val acc: 0.6480
Epoch 15/100
25000/25000 [==============================] - 4s 147us/step - loss: 0.9981 - acc: 0.6432 - val_loss: 0.9505 - val_acc: 0.6652
Epoch 16/100
25000/25000 [==============================] - 4s 146us/step - loss: 0.9963 - acc: 0.6499 - val loss: 1.0422 - val acc: 0.6180
Epoch 17/100
25000/25000 [==============================] - 4s 148us/step - loss: 0.9749 - acc: 0.6623 - val loss: 0.9174 - val acc: 0.6888
Epoch 18/100
25000/25000 [==============================] - 4s 146us/step - loss: 0.9642 - acc: 0.6699 - val_loss: 0.9244 - val_acc: 0.6794
Epoch 19/100
25000/25000 [==============================] - 4s 147us/step - loss: 0.9588 - acc: 0.6753 - val_loss: 1.0265 - val_acc: 0.6294
Epoch 20/100
25000/25000 [==============================] - 4s 154us/step - loss: 0.9529 - acc: 0.6813 - val_loss: 0.9000 - val_acc: 0.7030
Epoch 21/100
25000/25000 [==============================] - 4s 149us/step - loss: 0.9408 - acc: 0.6901 - val loss: 0.8766 - val acc: 0.7116
Epoch 22/100
25000/25000 [==============================] - 4s 148us/step - loss: 0.9238 - acc: 0.6958 - val_loss: 0.8952 - val_acc: 0.7050
```

```
Epoch 23/100
25000/25000 [==============================] - 4s 147us/step - loss: 0.9184 - acc: 0.7046 - val_loss: 0.8858 - val_acc: 0.7174
Epoch 24/100
25000/25000 [==============================] - 4s 147us/step - loss: 0.9212 - acc: 0.7054 - val loss: 0.8477 - val acc: 0.7286
Epoch 25/100
25000/25000 [==============================] - 4s 157us/step - loss: 0.8979 - acc: 0.7200 - val loss: 0.8786 - val acc: 0.7180
Epoch 26/100
25000/25000 [==============================] - 4s 149us/step - loss: 0.8931 - acc: 0.7188 - val_loss: 0.8528 - val_acc: 0.7194
Epoch 27/100
25000/25000 [==============================] - 4s 148us/step - loss: 0.8822 - acc: 0.7263 - val_loss: 0.8386 - val_acc: 0.7288
Epoch 28/100
25000/25000 [==============================] - 4s 150us/step - loss: 0.8827 - acc: 0.7286 - val_loss: 0.8654 - val_acc: 0.7320
Epoch 29/100
25000/25000 [==============================] - 4s 149us/step - loss: 0.8637 - acc: 0.7390 - val loss: 0.8456 - val acc: 0.7406
Epoch 30/100
25000/25000 [==============================] - 4s 146us/step - loss: 0.8594 - acc: 0.7419 - val loss: 0.8086 - val acc: 0.7440
Epoch 31/100
25000/25000 [==============================] - 4s 147us/step - loss: 0.8674 - acc: 0.7398 - val_loss: 0.8377 - val_acc: 0.7340
Epoch 32/100
25000/25000 [==============================] - 4s 147us/step - loss: 0.8524 - acc: 0.7449 - val_loss: 0.7962 - val_acc: 0.7618
Epoch 33/100
25000/25000 [==============================] - 4s 147us/step - loss: 0.8338 - acc: 0.7544 - val loss: 0.8887 - val acc: 0.7314
Epoch 34/100
25000/25000 [==============================] - 5s 196us/step - loss: 0.8497 - acc: 0.7510 - val loss: 0.8323 - val acc: 0.7492
Epoch 35/100
25000/25000 [==============================] - 4s 147us/step - loss: 0.8331 - acc: 0.7581 - val loss: 0.8375 - val acc: 0.7446
Epoch 36/100
25000/25000 [==============================] - 4s 148us/step - loss: 0.8448 - acc: 0.7519 - val_loss: 0.7952 - val_acc: 0.7598
Epoch 37/100
25000/25000 [==============================] - 4s 148us/step - loss: 0.8188 - acc: 0.7647 - val loss: 0.8542 - val acc: 0.7408
Epoch 00037: early stopping
```

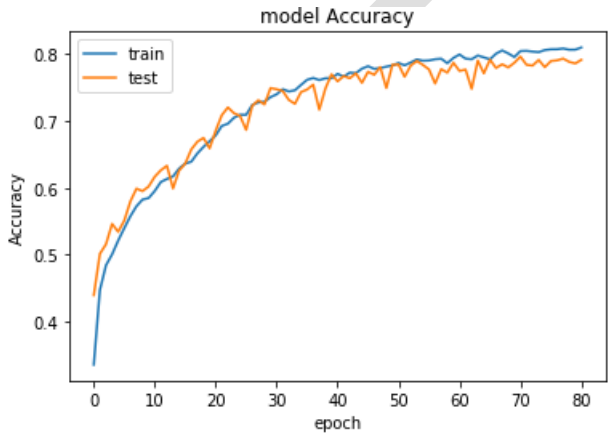
TEST#6 Changed EarlyStopping patience from 5 to 10

Callbacks:

EarlyStopping	val_acc, patience=~~5~~ 10

Observations:

	TRAIN	TEST
Accuracy	80.98	79.14
Val_loss	0.7285	0.7471




```
Train on 25000 samples, validate on 5000 samples

Epoch 1/100

25000/25000 [==============================] - 5s 195us/step - loss: 1.7371 - acc: 0.3354 - val_loss: 1.3176 - val_acc: 0.4394

Epoch 2/100

25000/25000 [==============================] - 4s 145us/step - loss: 1.3055 - acc: 0.4470 - val_loss: 1.1982 - val_acc: 0.5012

Epoch 3/100

25000/25000 [==============================] - 7s 277us/step - loss: 1.2393 - acc: 0.4840 - val_loss: 1.1995 - val_acc: 0.5156

Epoch 4/100

25000/25000 [==============================] - 7s 292us/step - loss: 1.1971 - acc: 0.5004 - val_loss: 1.1280 - val_acc: 0.5460

Epoch 5/100

25000/25000 [==============================] - 7s 291us/step - loss: 1.1803 - acc: 0.5210 - val_loss: 1.1466 - val_acc: 0.5342

Epoch 6/100

25000/25000 [==============================] - 7s 293us/step - loss: 1.1565 - acc: 0.5396 - val_loss: 1.1326 - val_acc: 0.5510

Epoch 7/100
```

```
25000/25000 [==============================] - 7s 287us/step - loss: 1.1393 - acc: 0.5574 - val_loss: 1.0907 - val_acc: 0.5796
Epoch 8/100
25000/25000 [==============================] - 7s 293us/step - loss: 1.1104 - acc: 0.5724 - val_loss: 1.0462 - val_acc: 0.5988
Epoch 9/100
25000/25000 [==============================] - 7s 288us/step - loss: 1.0966 - acc: 0.5824 - val_loss: 1.0601 - val_acc: 0.5950
Epoch 10/100
25000/25000 [==============================] - 7s 287us/step - loss: 1.0911 - acc: 0.5846 - val_loss: 1.0480 - val_acc: 0.6020
Epoch 11/100
25000/25000 [==============================] - 7s 290us/step - loss: 1.0728 - acc: 0.5952 - val_loss: 1.0015 - val_acc: 0.6166
Epoch 12/100
25000/25000 [==============================] - 7s 287us/step - loss: 1.0523 - acc: 0.6087 - val_loss: 0.9957 - val_acc: 0.6262
Epoch 13/100
25000/25000 [==============================] - 7s 288us/step - loss: 1.0441 - acc: 0.6132 - val_loss: 0.9949 - val_acc: 0.6330
Epoch 14/100
25000/25000 [==============================] - 7s 287us/step - loss: 1.0343 - acc: 0.6171 - val_loss: 1.0462 - val_acc: 0.5990
Epoch 15/100
25000/25000 [==============================] - 7s 286us/step - loss: 1.0152 - acc: 0.6288 - val_loss: 0.9936 - val_acc: 0.6258
Epoch 16/100
25000/25000 [==============================] - 7s 286us/step - loss: 1.0042 - acc: 0.6362 - val_loss: 1.0246 - val_acc: 0.6362
Epoch 17/100
25000/25000 [==============================] - 7s 285us/step - loss: 1.0052 - acc: 0.6390 - val_loss: 0.9736 - val_acc: 0.6574
Epoch 18/100
25000/25000 [==============================] - 7s 286us/step - loss: 0.9844 - acc: 0.6515 - val_loss: 0.9380 - val_acc: 0.6690
Epoch 19/100
25000/25000 [==============================] - 7s 287us/step - loss: 0.9773 - acc: 0.6612 - val_loss: 0.9499 - val_acc: 0.6746
Epoch 20/100
25000/25000 [==============================] - 7s 284us/step - loss: 0.9657 - acc: 0.6696 - val_loss: 0.9614 - val_acc: 0.6590
Epoch 21/100
25000/25000 [==============================] - 7s 287us/step - loss: 0.9525 - acc: 0.6784 - val_loss: 0.9441 - val_acc: 0.6854
Epoch 22/100
25000/25000 [==============================] - 7s 286us/step - loss: 0.9403 - acc: 0.6925 - val_loss: 0.8875 - val_acc: 0.7086
Epoch 23/100
25000/25000 [==============================] - 7s 286us/step - loss: 0.9321 - acc: 0.6958 - val_loss: 0.8606 - val_acc: 0.7202
Epoch 24/100
25000/25000 [==============================] - 7s 287us/step - loss: 0.9152 - acc: 0.7048 - val_loss: 0.8870 - val_acc: 0.7116
Epoch 25/100
25000/25000 [==============================] - 7s 286us/step - loss: 0.9115 - acc: 0.7092 - val_loss: 0.8980 - val_acc: 0.7074
Epoch 26/100
25000/25000 [==============================] - 7s 287us/step - loss: 0.9210 - acc: 0.7091 - val_loss: 0.9225 - val_acc: 0.6866
Epoch 27/100
25000/25000 [==============================] - 7s 286us/step - loss: 0.9022 - acc: 0.7240 - val_loss: 0.8647 - val_acc: 0.7226
Epoch 28/100
25000/25000 [==============================] - 7s 286us/step - loss: 0.8879 - acc: 0.7277 - val_loss: 0.8629 - val_acc: 0.7310
Epoch 29/100
25000/25000 [==============================] - 7s 286us/step - loss: 0.8825 - acc: 0.7286 - val_loss: 0.8772 - val_acc: 0.7246
Epoch 30/100
25000/25000 [==============================] - 7s 283us/step - loss: 0.8695 - acc: 0.7356 - val_loss: 0.8423 - val_acc: 0.7492
```

```
Epoch 31/100
25000/25000 [==============================] - 7s 286us/step - loss: 0.8636 - acc: 0.7398 - val_loss: 0.8316 - val_acc: 0.7474
Epoch 32/100
25000/25000 [==============================] - 7s 286us/step - loss: 0.8557 - acc: 0.7475 - val_loss: 0.8317 - val_acc: 0.7448
Epoch 33/100
25000/25000 [==============================] - 7s 284us/step - loss: 0.8589 - acc: 0.7441 - val_loss: 0.8729 - val_acc: 0.7314
Epoch 34/100
25000/25000 [==============================] - 7s 288us/step - loss: 0.8594 - acc: 0.7458 - val_loss: 0.8764 - val_acc: 0.7256
Epoch 35/100
25000/25000 [==============================] - 7s 285us/step - loss: 0.8427 - acc: 0.7539 - val_loss: 0.8507 - val_acc: 0.7432
Epoch 36/100
25000/25000 [==============================] - 7s 285us/step - loss: 0.8365 - acc: 0.7615 - val_loss: 0.8375 - val_acc: 0.7470
Epoch 37/100
25000/25000 [==============================] - 7s 284us/step - loss: 0.8281 - acc: 0.7642 - val_loss: 0.8337 - val_acc: 0.7544
Epoch 38/100
25000/25000 [==============================] - 7s 287us/step - loss: 0.8288 - acc: 0.7611 - val_loss: 0.9052 - val_acc: 0.7168
Epoch 39/100
25000/25000 [==============================] - 7s 285us/step - loss: 0.8239 - acc: 0.7638 - val_loss: 0.8340 - val_acc: 0.7484
Epoch 40/100
25000/25000 [==============================] - 7s 283us/step - loss: 0.8241 - acc: 0.7638 - val_loss: 0.7909 - val_acc: 0.7698
Epoch 41/100
25000/25000 [==============================] - 7s 284us/step - loss: 0.8020 - acc: 0.7705 - val_loss: 0.8420 - val_acc: 0.7592
Epoch 42/100
25000/25000 [==============================] - 7s 287us/step - loss: 0.8172 - acc: 0.7662 - val_loss: 0.7947 - val_acc: 0.7672
Epoch 43/100
25000/25000 [==============================] - 7s 287us/step - loss: 0.8090 - acc: 0.7723 - val_loss: 0.8063 - val_acc: 0.7638
Epoch 44/100
25000/25000 [==============================] - 7s 285us/step - loss: 0.8066 - acc: 0.7715 - val_loss: 0.7890 - val_acc: 0.7712
Epoch 45/100
25000/25000 [==============================] - 7s 285us/step - loss: 0.7899 - acc: 0.7782 - val_loss: 0.8162 - val_acc: 0.7570
Epoch 46/100
25000/25000 [==============================] - 7s 285us/step - loss: 0.7846 - acc: 0.7819 - val_loss: 0.7804 - val_acc: 0.7736
Epoch 47/100
25000/25000 [==============================] - 7s 283us/step - loss: 0.7917 - acc: 0.7779 - val_loss: 0.8036 - val_acc: 0.7690
Epoch 48/100
25000/25000 [==============================] - 7s 285us/step - loss: 0.7981 - acc: 0.7791 - val_loss: 0.7715 - val_acc: 0.7806
Epoch 49/100
25000/25000 [==============================] - 7s 284us/step - loss: 0.7893 - acc: 0.7812 - val_loss: 0.8597 - val_acc: 0.7492
Epoch 50/100
25000/25000 [==============================] - 7s 283us/step - loss: 0.7818 - acc: 0.7831 - val_loss: 0.7746 - val_acc: 0.7840
Epoch 51/100
25000/25000 [==============================] - 7s 286us/step - loss: 0.7775 - acc: 0.7866 - val_loss: 0.7713 - val_acc: 0.7844
Epoch 52/100
25000/25000 [==============================] - 7s 284us/step - loss: 0.7830 - acc: 0.7833 - val_loss: 0.8225 - val_acc: 0.7660
Epoch 53/100
25000/25000 [==============================] - 7s 284us/step - loss: 0.7688 - acc: 0.7874 - val_loss: 0.7722 - val_acc: 0.7828
Epoch 54/100
```

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25000/25000 [==============================] - 7s 282us/step - loss: 0.7640 - acc: 0.7920 - val_loss: 0.7574 - val_acc: 0.7896
Epoch 55/100
25000/25000 [==============================] - 7s 289us/step - loss: 0.7654 - acc: 0.7900 - val_loss: 0.7760 - val_acc: 0.7838
Epoch 56/100
25000/25000 [==============================] - 7s 285us/step - loss: 0.7646 - acc: 0.7904 - val_loss: 0.7917 - val_acc: 0.7770
Epoch 57/100
25000/25000 [==============================] - 7s 283us/step - loss: 0.7619 - acc: 0.7923 - val_loss: 0.8229 - val_acc: 0.7560
Epoch 58/100
25000/25000 [==============================] - 7s 285us/step - loss: 0.7550 - acc: 0.7931 - val_loss: 0.7774 - val_acc: 0.7774
Epoch 59/100
25000/25000 [==============================] - 7s 284us/step - loss: 0.7756 - acc: 0.7864 - val_loss: 0.8004 - val_acc: 0.7722
Epoch 60/100
25000/25000 [==============================] - 7s 282us/step - loss: 0.7587 - acc: 0.7942 - val_loss: 0.7573 - val_acc: 0.7870
Epoch 61/100
25000/25000 [==============================] - 7s 285us/step - loss: 0.7526 - acc: 0.7994 - val_loss: 0.8029 - val_acc: 0.7748
Epoch 62/100
25000/25000 [==============================] - 7s 284us/step - loss: 0.7632 - acc: 0.7932 - val_loss: 0.7906 - val_acc: 0.7768
Epoch 63/100
25000/25000 [==============================] - 7s 285us/step - loss: 0.7664 - acc: 0.7923 - val_loss: 0.8557 - val_acc: 0.7480
Epoch 64/100
25000/25000 [==============================] - 7s 283us/step - loss: 0.7487 - acc: 0.7979 - val_loss: 0.7572 - val_acc: 0.7902
Epoch 65/100
25000/25000 [==============================] - 7s 284us/step - loss: 0.7585 - acc: 0.7950 - val_loss: 0.7996 - val_acc: 0.7712
Epoch 66/100
25000/25000 [==============================] - 7s 286us/step - loss: 0.7627 - acc: 0.7922 - val_loss: 0.7500 - val_acc: 0.7916
Epoch 67/100
25000/25000 [==============================] - 7s 286us/step - loss: 0.7466 - acc: 0.8006 - val_loss: 0.7822 - val_acc: 0.7792
Epoch 68/100
25000/25000 [==============================] - 7s 286us/step - loss: 0.7408 - acc: 0.8054 - val_loss: 0.7702 - val_acc: 0.7848
Epoch 69/100
25000/25000 [==============================] - 7s 285us/step - loss: 0.7435 - acc: 0.8010 - val_loss: 0.7965 - val_acc: 0.7800
Epoch 70/100
25000/25000 [==============================] - 7s 285us/step - loss: 0.7536 - acc: 0.7956 - val_loss: 0.7656 - val_acc: 0.7870
Epoch 71/100
25000/25000 [==============================] - 7s 285us/step - loss: 0.7344 - acc: 0.8045 - val_loss: 0.7533 - val_acc: 0.7962
Epoch 72/100
25000/25000 [==============================] - 7s 285us/step - loss: 0.7354 - acc: 0.8048 - val_loss: 0.7675 - val_acc: 0.7840
Epoch 73/100
25000/25000 [==============================] - 7s 285us/step - loss: 0.7368 - acc: 0.8037 - val_loss: 0.7803 - val_acc: 0.7828
Epoch 74/100
25000/25000 [==============================] - 7s 284us/step - loss: 0.7391 - acc: 0.8030 - val_loss: 0.7511 - val_acc: 0.7912
Epoch 75/100
25000/25000 [==============================] - 7s 285us/step - loss: 0.7350 - acc: 0.8060 - val_loss: 0.7925 - val_acc: 0.7804
Epoch 76/100
25000/25000 [==============================] - 7s 286us/step - loss: 0.7390 - acc: 0.8071 - val_loss: 0.7651 - val_acc: 0.7896
Epoch 77/100
25000/25000 [==============================] - 7s 283us/step - loss: 0.7267 - acc: 0.8072 - val_loss: 0.7502 - val_acc: 0.7906
```

```
Epoch 78/100
25000/25000 [==============================] - 7s 286us/step - loss: 0.7314 - acc: 0.8084 - val_loss: 0.7540 - val_acc: 0.7932
Epoch 79/100
25000/25000 [==============================] - 7s 284us/step - loss: 0.7323 - acc: 0.8066 - val_loss: 0.7710 - val_acc: 0.7884
Epoch 80/100
25000/25000 [==============================] - 7s 285us/step - loss: 0.7349 - acc: 0.8066 - val_loss: 0.7769 - val_acc: 0.7860
Epoch 81/100
25000/25000 [==============================] - 7s 285us/step - loss: 0.7285 - acc: 0.8098 - val_loss: 0.7471 - val_acc: 0.7914
Epoch 00081: early stopping
```

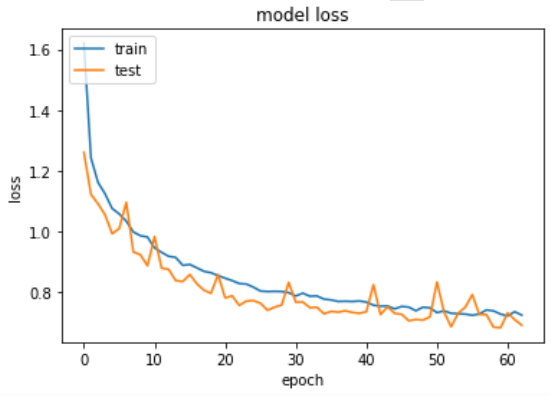
TEST#7 Removed the conv_4 layer

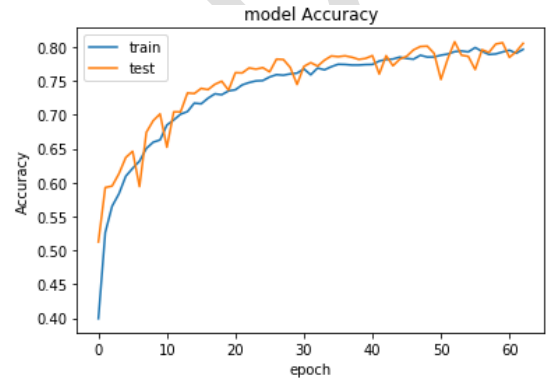
Architecture

Conv_1	CONV2D (32, 3*3)	
max_1	MaxPooling2D (2, 2)	
conv_2	CONV2D (64, 3*3)	
max_2	MaxPooling2D (2, 2)	
conv_3	CONV2D (128, 3*3)	
max_3	MaxPooling2D (2, 2)	Added this layer back
conv_4	CONV2D (256, 3*3)	Removed this layer
max_4	MaxPooling2D (2, 2)	Removed this layer
drop_1	Dropout(0.50)	
	Flatten	
dense_1	Dense(128, relu)	
drop_2	Dropout(0.50)	
dense_2	Dense(5, softmax)	

Observations:

	TRAIN	TEST
Accuracy	79.66	80.54
Val_loss	0.7255	0.6922






```
Train on 25000 samples, validate on 5000 samples

Epoch 1/100

25000/25000 [==============================] - 9s 351us/step - loss: 1.6203 - acc: 0.3994 - val_loss: 1.2604 - val_acc: 0.5126
```

```
Epoch 2/100
25000/25000 [==============================] - 6s 250us/step - loss: 1.2428 - acc: 0.5264 - val_loss: 1.1225 - val_acc: 0.5928
Epoch 3/100
25000/25000 [==============================] - 6s 247us/step - loss: 1.1620 - acc: 0.5652 - val_loss: 1.0916 - val_acc: 0.5950
Epoch 4/100
25000/25000 [==============================] - 6s 249us/step - loss: 1.1243 - acc: 0.5836 - val_loss: 1.0551 - val_acc: 0.6132
Epoch 5/100
25000/25000 [==============================] - 6s 249us/step - loss: 1.0761 - acc: 0.6096 - val_loss: 0.9932 - val_acc: 0.6372
Epoch 6/100
25000/25000 [==============================] - 6s 247us/step - loss: 1.0583 - acc: 0.6211 - val_loss: 1.0102 - val_acc: 0.6462
Epoch 7/100
25000/25000 [==============================] - 6s 250us/step - loss: 1.0345 - acc: 0.6317 - val_loss: 1.0965 - val_acc: 0.5942
Epoch 8/100
25000/25000 [==============================] - 6s 247us/step - loss: 0.9991 - acc: 0.6504 - val_loss: 0.9332 - val_acc: 0.6742
Epoch 9/100
25000/25000 [==============================] - 6s 252us/step - loss: 0.9866 - acc: 0.6596 - val_loss: 0.9238 - val_acc: 0.6914
Epoch 10/100
25000/25000 [==============================] - 6s 258us/step - loss: 0.9823 - acc: 0.6630 - val_loss: 0.8876 - val_acc: 0.7014
Epoch 11/100
25000/25000 [==============================] - 6s 249us/step - loss: 0.9466 - acc: 0.6850 - val_loss: 0.9833 - val_acc: 0.6522
Epoch 12/100
25000/25000 [==============================] - 6s 251us/step - loss: 0.9318 - acc: 0.6924 - val_loss: 0.8801 - val_acc: 0.7044
Epoch 13/100
25000/25000 [==============================] - 6s 250us/step - loss: 0.9189 - acc: 0.7010 - val_loss: 0.8759 - val_acc: 0.7044
Epoch 14/100
25000/25000 [==============================] - 6s 252us/step - loss: 0.9151 - acc: 0.7048 - val_loss: 0.8389 - val_acc: 0.7322
Epoch 15/100
25000/25000 [==============================] - 6s 250us/step - loss: 0.8893 - acc: 0.7173 - val_loss: 0.8358 - val_acc: 0.7314
Epoch 16/100
25000/25000 [==============================] - 6s 249us/step - loss: 0.8920 - acc: 0.7162 - val_loss: 0.8589 - val_acc: 0.7390
Epoch 17/100
25000/25000 [==============================] - 6s 249us/step - loss: 0.8808 - acc: 0.7245 - val_loss: 0.8283 - val_acc: 0.7372
Epoch 18/100
25000/25000 [==============================] - 6s 250us/step - loss: 0.8695 - acc: 0.7310 - val_loss: 0.8073 - val_acc: 0.7450
Epoch 19/100
25000/25000 [==============================] - 6s 249us/step - loss: 0.8647 - acc: 0.7297 - val_loss: 0.7970 - val_acc: 0.7496
Epoch 20/100
25000/25000 [==============================] - 6s 249us/step - loss: 0.8552 - acc: 0.7353 - val_loss: 0.8587 - val_acc: 0.7364
Epoch 21/100
25000/25000 [==============================] - 6s 253us/step - loss: 0.8467 - acc: 0.7370 - val_loss: 0.7821 - val_acc: 0.7622
Epoch 22/100
25000/25000 [==============================] - 6s 251us/step - loss: 0.8389 - acc: 0.7442 - val_loss: 0.7887 - val_acc: 0.7618
Epoch 23/100
25000/25000 [==============================] - 6s 249us/step - loss: 0.8290 - acc: 0.7476 - val_loss: 0.7574 - val_acc: 0.7692
Epoch 24/100
25000/25000 [==============================] - 6s 251us/step - loss: 0.8276 - acc: 0.7500 - val_loss: 0.7715 - val_acc: 0.7674
Epoch 25/100
```

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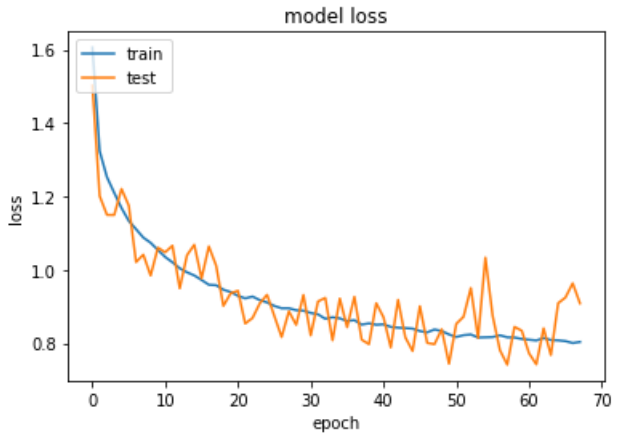
25000/25000 [==============================] - 6s 252us/step - loss: 0.8174 - acc: 0.7506 - val_loss: 0.7733 - val_acc: 0.7696
Epoch 26/100
25000/25000 [==============================] - 6s 251us/step - loss: 0.8045 - acc: 0.7558 - val_loss: 0.7644 - val_acc: 0.7634
Epoch 27/100
25000/25000 [==============================] - 6s 256us/step - loss: 0.8030 - acc: 0.7593 - val_loss: 0.7412 - val_acc: 0.7822
Epoch 28/100
25000/25000 [==============================] - 6s 253us/step - loss: 0.8035 - acc: 0.7584 - val_loss: 0.7516 - val_acc: 0.7816
Epoch 29/100
25000/25000 [==============================] - 6s 257us/step - loss: 0.8030 - acc: 0.7604 - val_loss: 0.7583 - val_acc: 0.7700
Epoch 30/100
25000/25000 [==============================] - 6s 257us/step - loss: 0.7992 - acc: 0.7615 - val_loss: 0.8328 - val_acc: 0.7448
Epoch 31/100
25000/25000 [==============================] - 7s 261us/step - loss: 0.7882 - acc: 0.7677 - val_loss: 0.7681 - val_acc: 0.7714
Epoch 32/100
25000/25000 [==============================] - 6s 251us/step - loss: 0.7975 - acc: 0.7591 - val_loss: 0.7684 - val_acc: 0.7770
Epoch 33/100
25000/25000 [==============================] - 7s 263us/step - loss: 0.7874 - acc: 0.7690 - val_loss: 0.7496 - val_acc: 0.7718
Epoch 34/100
25000/25000 [==============================] - 6s 247us/step - loss: 0.7883 - acc: 0.7664 - val_loss: 0.7513 - val_acc: 0.7806
Epoch 35/100
25000/25000 [==============================] - 6s 249us/step - loss: 0.7779 - acc: 0.7710 - val_loss: 0.7296 - val_acc: 0.7868
Epoch 36/100
25000/25000 [==============================] - 6s 249us/step - loss: 0.7753 - acc: 0.7746 - val_loss: 0.7376 - val_acc: 0.7858
Epoch 37/100
25000/25000 [==============================] - 6s 248us/step - loss: 0.7704 - acc: 0.7743 - val_loss: 0.7350 - val_acc: 0.7870
Epoch 38/100
25000/25000 [==============================] - 6s 252us/step - loss: 0.7711 - acc: 0.7734 - val_loss: 0.7396 - val_acc: 0.7850
Epoch 39/100
25000/25000 [==============================] - 6s 252us/step - loss: 0.7703 - acc: 0.7734 - val_loss: 0.7340 - val_acc: 0.7818
Epoch 40/100
25000/25000 [==============================] - 6s 247us/step - loss: 0.7718 - acc: 0.7741 - val_loss: 0.7312 - val_acc: 0.7832
Epoch 41/100
25000/25000 [==============================] - 6s 250us/step - loss: 0.7683 - acc: 0.7744 - val_loss: 0.7364 - val_acc: 0.7874
Epoch 42/100
25000/25000 [==============================] - 6s 249us/step - loss: 0.7580 - acc: 0.7794 - val_loss: 0.8255 - val_acc: 0.7602
Epoch 43/100
25000/25000 [==============================] - 6s 248us/step - loss: 0.7545 - acc: 0.7816 - val_loss: 0.7272 - val_acc: 0.7872
Epoch 44/100
25000/25000 [==============================] - 6s 252us/step - loss: 0.7553 - acc: 0.7823 - val_loss: 0.7528 - val_acc: 0.7724
Epoch 45/100
25000/25000 [==============================] - 6s 250us/step - loss: 0.7459 - acc: 0.7852 - val_loss: 0.7312 - val_acc: 0.7822
Epoch 46/100
25000/25000 [==============================] - 6s 251us/step - loss: 0.7538 - acc: 0.7832 - val_loss: 0.7280 - val_acc: 0.7864
Epoch 47/100
25000/25000 [==============================] - 6s 249us/step - loss: 0.7517 - acc: 0.7821 - val_loss: 0.7067 - val_acc: 0.7958
Epoch 48/100
25000/25000 [==============================] - 6s 251us/step - loss: 0.7396 - acc: 0.7879 - val_loss: 0.7109 - val_acc: 0.8008
```

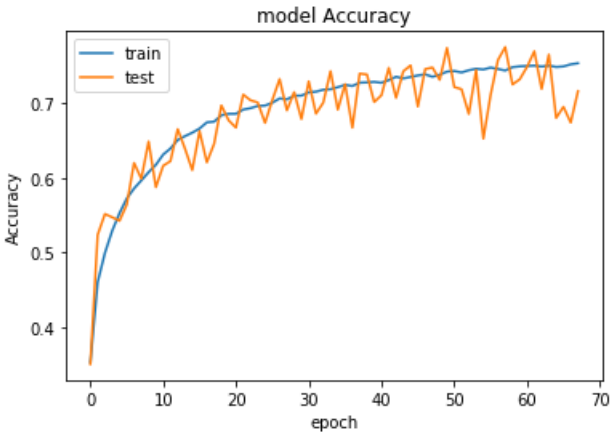
```
Epoch 49/100
25000/25000 [==============================] - 6s 249us/step - loss: 0.7514 - acc: 0.7853 - val_loss: 0.7089 - val_acc: 0.8014
Epoch 50/100
25000/25000 [==============================] - 6s 250us/step - loss: 0.7494 - acc: 0.7854 - val_loss: 0.7192 - val_acc: 0.7908
Epoch 51/100
25000/25000 [==============================] - 6s 251us/step - loss: 0.7334 - acc: 0.7880 - val_loss: 0.8339 - val_acc: 0.7522
Epoch 52/100
25000/25000 [==============================] - 6s 250us/step - loss: 0.7393 - acc: 0.7897 - val_loss: 0.7353 - val_acc: 0.7828
Epoch 53/100
25000/25000 [==============================] - 6s 259us/step - loss: 0.7315 - acc: 0.7932 - val_loss: 0.6870 - val_acc: 0.8078
Epoch 54/100
25000/25000 [==============================] - 6s 253us/step - loss: 0.7299 - acc: 0.7941 - val_loss: 0.7313 - val_acc: 0.7880
Epoch 55/100
25000/25000 [==============================] - 6s 248us/step - loss: 0.7287 - acc: 0.7929 - val_loss: 0.7511 - val_acc: 0.7862
Epoch 56/100
25000/25000 [==============================] - 6s 252us/step - loss: 0.7249 - acc: 0.7992 - val_loss: 0.7927 - val_acc: 0.7668
Epoch 57/100
25000/25000 [==============================] - 6s 249us/step - loss: 0.7289 - acc: 0.7937 - val_loss: 0.7273 - val_acc: 0.7960
Epoch 58/100
25000/25000 [==============================] - 6s 249us/step - loss: 0.7423 - acc: 0.7891 - val_loss: 0.7271 - val_acc: 0.7920
Epoch 59/100
25000/25000 [==============================] - 6s 246us/step - loss: 0.7392 - acc: 0.7898 - val_loss: 0.6857 - val_acc: 0.8044
Epoch 60/100
25000/25000 [==============================] - 6s 245us/step - loss: 0.7287 - acc: 0.7928 - val_loss: 0.6837 - val_acc: 0.8064
Epoch 61/100
25000/25000 [==============================] - 6s 248us/step - loss: 0.7225 - acc: 0.7953 - val_loss: 0.7325 - val_acc: 0.7848
Epoch 62/100
25000/25000 [==============================] - 6s 255us/step - loss: 0.7364 - acc: 0.7909 - val_loss: 0.7105 - val_acc: 0.7934
Epoch 63/100
25000/25000 [==============================] - 6s 250us/step - loss: 0.7255 - acc: 0.7966 - val_loss: 0.6922 - val_acc: 0.8054
Epoch 00063: early stopping
```

TEST#8 Changed optimizer from Adam to RMSprop

Observations:

	TRAIN	TEST
Accuracy	75.41	71.66
Val_loss	0.8033	0.9084






```
Train on 25000 samples, validate on 5000 samples

Epoch 1/100

25000/25000 [==============================] - 16s 637us/step - loss: 1.6056 - acc: 0.3525 - val_loss: 1.5017 - val_acc: 0.3500

Epoch 2/100

25000/25000 [==============================] - 6s 253us/step - loss: 1.3231 - acc: 0.4600 - val_loss: 1.2008 - val_acc: 0.5236

Epoch 3/100

25000/25000 [==============================] - 6s 244us/step - loss: 1.2523 - acc: 0.4993 - val_loss: 1.1496 - val_acc: 0.5516

Epoch 4/100

25000/25000 [==============================] - 6s 240us/step - loss: 1.2097 - acc: 0.5291 - val_loss: 1.1492 - val_acc: 0.5472

Epoch 5/100

25000/25000 [==============================] - 6s 245us/step - loss: 1.1683 - acc: 0.5528 - val_loss: 1.2203 - val_acc: 0.5424

Epoch 6/100

25000/25000 [==============================] - 6s 247us/step - loss: 1.1332 - acc: 0.5725 - val_loss: 1.1747 - val_acc: 0.5642

Epoch 7/100

25000/25000 [==============================] - 6s 245us/step - loss: 1.1105 - acc: 0.5858 - val_loss: 1.0209 - val_acc: 0.6202

Epoch 8/100
```

```
25000/25000 [==============================] - 6s 246us/step - loss: 1.0876 - acc: 0.5967 - val_loss: 1.0412 - val_acc: 0.5990
Epoch 9/100
25000/25000 [==============================] - 6s 244us/step - loss: 1.0735 - acc: 0.6077 - val_loss: 0.9842 - val_acc: 0.6490
Epoch 10/100
25000/25000 [==============================] - 6s 241us/step - loss: 1.0539 - acc: 0.6177 - val_loss: 1.0603 - val_acc: 0.5876
Epoch 11/100
25000/25000 [==============================] - 6s 242us/step - loss: 1.0349 - acc: 0.6315 - val_loss: 1.0476 - val_acc: 0.6164
Epoch 12/100
25000/25000 [==============================] - 6s 236us/step - loss: 1.0202 - acc: 0.6396 - val_loss: 1.0657 - val_acc: 0.6226
Epoch 13/100
25000/25000 [==============================] - 6s 238us/step - loss: 1.0040 - acc: 0.6511 - val_loss: 0.9494 - val_acc: 0.6656
Epoch 14/100
25000/25000 [==============================] - 6s 237us/step - loss: 0.9931 - acc: 0.6562 - val_loss: 1.0397 - val_acc: 0.6394
Epoch 15/100
25000/25000 [==============================] - 6s 235us/step - loss: 0.9845 - acc: 0.6608 - val_loss: 1.0681 - val_acc: 0.6106
Epoch 16/100
25000/25000 [==============================] - 6s 235us/step - loss: 0.9722 - acc: 0.6664 - val_loss: 0.9765 - val_acc: 0.6630
Epoch 17/100
25000/25000 [==============================] - 6s 239us/step - loss: 0.9591 - acc: 0.6747 - val_loss: 1.0637 - val_acc: 0.6210
Epoch 18/100
25000/25000 [==============================] - 6s 247us/step - loss: 0.9579 - acc: 0.6757 - val_loss: 1.0116 - val_acc: 0.6458
Epoch 19/100
25000/25000 [==============================] - 6s 245us/step - loss: 0.9456 - acc: 0.6843 - val_loss: 0.9015 - val_acc: 0.6974
Epoch 20/100
25000/25000 [==============================] - 6s 249us/step - loss: 0.9393 - acc: 0.6862 - val_loss: 0.9360 - val_acc: 0.6774
Epoch 21/100
25000/25000 [==============================] - 6s 256us/step - loss: 0.9290 - acc: 0.6862 - val_loss: 0.9427 - val_acc: 0.6676
Epoch 22/100
25000/25000 [==============================] - 6s 247us/step - loss: 0.9220 - acc: 0.6919 - val_loss: 0.8534 - val_acc: 0.7120
Epoch 23/100
25000/25000 [==============================] - 6s 248us/step - loss: 0.9270 - acc: 0.6938 - val_loss: 0.8685 - val_acc: 0.7044
Epoch 24/100
25000/25000 [==============================] - 6s 246us/step - loss: 0.9173 - acc: 0.6967 - val_loss: 0.9084 - val_acc: 0.7014
Epoch 25/100
25000/25000 [==============================] - 6s 251us/step - loss: 0.9109 - acc: 0.6973 - val_loss: 0.9319 - val_acc: 0.6740
Epoch 26/100
25000/25000 [==============================] - 6s 250us/step - loss: 0.9014 - acc: 0.7010 - val_loss: 0.8742 - val_acc: 0.7046
Epoch 27/100
25000/25000 [==============================] - 6s 247us/step - loss: 0.8951 - acc: 0.7068 - val_loss: 0.8167 - val_acc: 0.7328
Epoch 28/100
25000/25000 [==============================] - 6s 252us/step - loss: 0.8952 - acc: 0.7056 - val_loss: 0.8867 - val_acc: 0.6908
Epoch 29/100
25000/25000 [==============================] - 6s 250us/step - loss: 0.8898 - acc: 0.7105 - val_loss: 0.8498 - val_acc: 0.7152
Epoch 30/100
25000/25000 [==============================] - 6s 250us/step - loss: 0.8884 - acc: 0.7106 - val_loss: 0.9315 - val_acc: 0.6792
Epoch 31/100
25000/25000 [==============================] - 6s 251us/step - loss: 0.8824 - acc: 0.7150 - val_loss: 0.8211 - val_acc: 0.7298
```

```
Epoch 32/100
25000/25000 [==============================] - 6s 248us/step - loss: 0.8786 - acc: 0.7160 - val_loss: 0.9137 - val_acc: 0.6864
Epoch 33/100
25000/25000 [==============================] - 6s 259us/step - loss: 0.8663 - acc: 0.7185 - val_loss: 0.9234 - val_acc: 0.7012
Epoch 34/100
25000/25000 [==============================] - 6s 251us/step - loss: 0.8706 - acc: 0.7192 - val_loss: 0.8077 - val_acc: 0.7434
Epoch 35/100
25000/25000 [==============================] - 6s 247us/step - loss: 0.8675 - acc: 0.7220 - val_loss: 0.9216 - val_acc: 0.6918
Epoch 36/100
25000/25000 [==============================] - 6s 249us/step - loss: 0.8603 - acc: 0.7251 - val_loss: 0.8433 - val_acc: 0.7260
Epoch 37/100
25000/25000 [==============================] - 6s 248us/step - loss: 0.8626 - acc: 0.7236 - val_loss: 0.9264 - val_acc: 0.6676
Epoch 38/100
25000/25000 [==============================] - 6s 249us/step - loss: 0.8506 - acc: 0.7280 - val_loss: 0.8095 - val_acc: 0.7402
Epoch 39/100
25000/25000 [==============================] - 6s 249us/step - loss: 0.8539 - acc: 0.7284 - val_loss: 0.7971 - val_acc: 0.7390
Epoch 40/100
25000/25000 [==============================] - 6s 246us/step - loss: 0.8503 - acc: 0.7291 - val_loss: 0.9090 - val_acc: 0.7020
Epoch 41/100
25000/25000 [==============================] - 6s 249us/step - loss: 0.8514 - acc: 0.7279 - val_loss: 0.8706 - val_acc: 0.7112
Epoch 42/100
25000/25000 [==============================] - 6s 246us/step - loss: 0.8442 - acc: 0.7314 - val_loss: 0.7883 - val_acc: 0.7478
Epoch 43/100
25000/25000 [==============================] - 6s 238us/step - loss: 0.8422 - acc: 0.7359 - val_loss: 0.9181 - val_acc: 0.7076
Epoch 44/100
25000/25000 [==============================] - 6s 235us/step - loss: 0.8410 - acc: 0.7338 - val_loss: 0.8158 - val_acc: 0.7434
Epoch 45/100
25000/25000 [==============================] - 6s 233us/step - loss: 0.8396 - acc: 0.7357 - val_loss: 0.7785 - val_acc: 0.7512
Epoch 46/100
25000/25000 [==============================] - 6s 234us/step - loss: 0.8329 - acc: 0.7378 - val_loss: 0.9009 - val_acc: 0.6960
Epoch 47/100
25000/25000 [==============================] - 6s 232us/step - loss: 0.8293 - acc: 0.7392 - val_loss: 0.8007 - val_acc: 0.7462
Epoch 48/100
25000/25000 [==============================] - 6s 233us/step - loss: 0.8372 - acc: 0.7360 - val_loss: 0.7971 - val_acc: 0.7484
Epoch 49/100
25000/25000 [==============================] - 6s 230us/step - loss: 0.8331 - acc: 0.7387 - val_loss: 0.8378 - val_acc: 0.7318
Epoch 50/100
25000/25000 [==============================] - 6s 234us/step - loss: 0.8238 - acc: 0.7428 - val_loss: 0.7438 - val_acc: 0.7746
Epoch 51/100
25000/25000 [==============================] - 6s 232us/step - loss: 0.8168 - acc: 0.7437 - val_loss: 0.8526 - val_acc: 0.7222
Epoch 52/100
25000/25000 [==============================] - 6s 228us/step - loss: 0.8218 - acc: 0.7417 - val_loss: 0.8720 - val_acc: 0.7192
Epoch 53/100
25000/25000 [==============================] - 6s 231us/step - loss: 0.8236 - acc: 0.7448 - val_loss: 0.9501 - val_acc: 0.6860
Epoch 54/100
25000/25000 [==============================] - 6s 231us/step - loss: 0.8154 - acc: 0.7466 - val_loss: 0.8138 - val_acc: 0.7450
Epoch 55/100
```

```
25000/25000 [==============================] - 6s 233us/step - loss: 0.8160 - acc: 0.7458 - val_loss: 1.0333 - val_acc: 0.6528
Epoch 56/100
25000/25000 [==============================] - 6s 231us/step - loss: 0.8167 - acc: 0.7483 - val_loss: 0.8743 - val_acc: 0.7120
Epoch 57/100
25000/25000 [==============================] - 6s 234us/step - loss: 0.8215 - acc: 0.7464 - val_loss: 0.7808 - val_acc: 0.7584
Epoch 58/100
25000/25000 [==============================] - 6s 234us/step - loss: 0.8160 - acc: 0.7444 - val_loss: 0.7414 - val_acc: 0.7758
Epoch 59/100
25000/25000 [==============================] - 6s 231us/step - loss: 0.8154 - acc: 0.7488 - val_loss: 0.8445 - val_acc: 0.7256
Epoch 60/100
25000/25000 [==============================] - 6s 234us/step - loss: 0.8115 - acc: 0.7500 - val_loss: 0.8339 - val_acc: 0.7326
Epoch 61/100
25000/25000 [==============================] - 6s 232us/step - loss: 0.8094 - acc: 0.7505 - val_loss: 0.7723 - val_acc: 0.7492
Epoch 62/100
25000/25000 [==============================] - 6s 235us/step - loss: 0.8073 - acc: 0.7509 - val_loss: 0.7422 - val_acc: 0.7702
Epoch 63/100
25000/25000 [==============================] - 6s 232us/step - loss: 0.8139 - acc: 0.7497 - val_loss: 0.8405 - val_acc: 0.7196
Epoch 64/100
25000/25000 [==============================] - 6s 235us/step - loss: 0.8085 - acc: 0.7509 - val_loss: 0.7675 - val_acc: 0.7658
Epoch 65/100
25000/25000 [==============================] - 6s 232us/step - loss: 0.8077 - acc: 0.7491 - val_loss: 0.9089 - val_acc: 0.6806
Epoch 66/100
25000/25000 [==============================] - 6s 231us/step - loss: 0.8056 - acc: 0.7498 - val_loss: 0.9244 - val_acc: 0.6956
Epoch 67/100
25000/25000 [==============================] - 6s 233us/step - loss: 0.8003 - acc: 0.7526 - val_loss: 0.9631 - val_acc: 0.6744
Epoch 68/100
25000/25000 [==============================] - 6s 232us/step - loss: 0.8033 - acc: 0.7541 - val_loss: 0.9084 - val_acc: 0.7166
Epoch 00068: early stopping
```

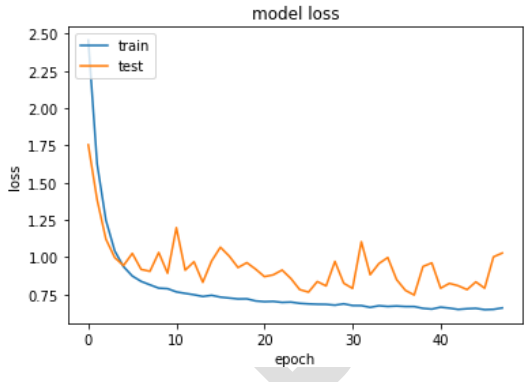
TEST#9 Changed optimizer back to Adam, Added BatchNormalization

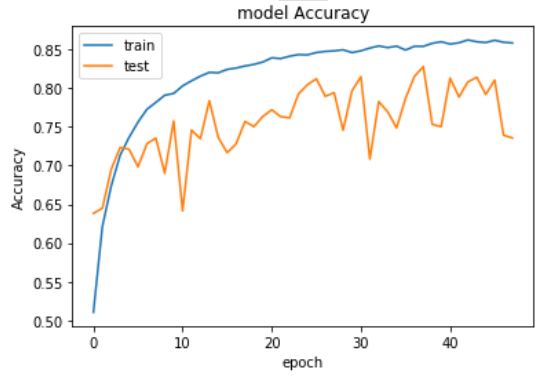
Architecture

Conv_1	CONV2D (32, 3*3)	
max_1	MaxPooling2D (2, 2)	
batch_norm_1	BatchNormalization	Added this layer back
conv_2	CONV2D (64, 3*3)	
max_2	MaxPooling2D (2, 2)	
batch_norm_2	BatchNormalization	Added this layer back
conv_3	CONV2D (128, 3*3)	
max_3	MaxPooling2D (2, 2)	
batch_norm_3	BatchNormalization	Added this layer back
drop_1	Dropout(0.50)	
	Flatten	
dense_1	Dense(128, relu)	
batch_norm_4	BatchNormalization	Added this layer back
drop_2	Dropout(0.50)	
dense_2	Dense(5, softmax)	

Observations:

	TRAIN	TEST
Accuracy	85.84	73.56
Val_loss	0.6597	1.0280





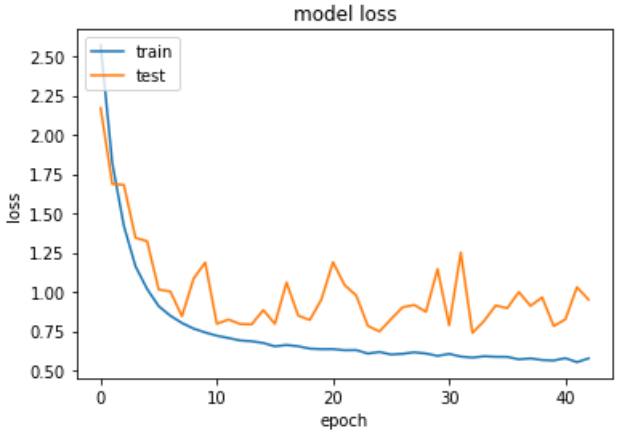

```
Train on 25000 samples, validate on 5000 samples
Epoch 1/100
25000/25000 [==============================] - 11s 441us/step - loss: 2.4556 - acc: 0.5104 - val_loss: 1.7543 - val_acc: 0.6382
Epoch 2/100
```

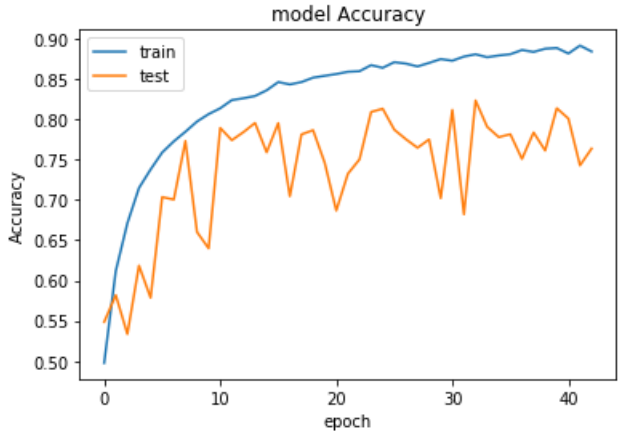
```
25000/25000 [==============================] - 8s 328us/step - loss: 1.6276 - acc: 0.6210 - val_loss: 1.3863 - val_acc: 0.6448
Epoch 3/100
25000/25000 [==============================] - 9s 347us/step - loss: 1.2487 - acc: 0.6738 - val_loss: 1.1215 - val_acc: 0.6954
Epoch 4/100
25000/25000 [==============================] - 8s 333us/step - loss: 1.0427 - acc: 0.7134 - val loss: 0.9976 - val acc: 0.7234
Epoch 5/100
25000/25000 [==============================] - 8s 324us/step - loss: 0.9366 - acc: 0.7364 - val loss: 0.9445 - val acc: 0.7210
Epoch 6/100
25000/25000 [==============================] - 8s 331us/step - loss: 0.8739 - acc: 0.7561 - val_loss: 1.0257 - val_acc: 0.6984
Epoch 7/100
25000/25000 [==============================] - 9s 363us/step - loss: 0.8378 - acc: 0.7727 - val_loss: 0.9183 - val_acc: 0.7282
Epoch 8/100
25000/25000 [==============================] - 9s 356us/step - loss: 0.8148 - acc: 0.7816 - val loss: 0.9055 - val acc: 0.7354
Epoch 9/100
25000/25000 [==============================] - 8s 330us/step - loss: 0.7925 - acc: 0.7908 - val loss: 1.0315 - val acc: 0.6900
Epoch 10/100
25000/25000 [==============================] - 8s 326us/step - loss: 0.7890 - acc: 0.7932 - val_loss: 0.8925 - val_acc: 0.7576
Epoch 11/100
25000/25000 [==============================] - 8s 324us/step - loss: 0.7674 - acc: 0.8029 - val_loss: 1.1982 - val_acc: 0.6414
Epoch 12/100
25000/25000 [==============================] - 8s 326us/step - loss: 0.7574 - acc: 0.8095 - val loss: 0.9131 - val acc: 0.7458
Epoch 13/100
25000/25000 [==============================] - 8s 324us/step - loss: 0.7482 - acc: 0.8155 - val loss: 0.9697 - val acc: 0.7346
Epoch 14/100
25000/25000 [==============================] - 8s 327us/step - loss: 0.7366 - acc: 0.8204 - val loss: 0.8318 - val acc: 0.7838
Epoch 15/100
25000/25000 [==============================] - 8s 328us/step - loss: 0.7445 - acc: 0.8198 - val_loss: 0.9744 - val_acc: 0.7364
Epoch 16/100
25000/25000 [==============================] - 8s 326us/step - loss: 0.7323 - acc: 0.8242 - val loss: 1.0670 - val acc: 0.7166
Epoch 17/100
25000/25000 [==============================] - 8s 328us/step - loss: 0.7261 - acc: 0.8259 - val loss: 1.0075 - val acc: 0.7280
Epoch 18/100
25000/25000 [==============================] - 8s 325us/step - loss: 0.7201 - acc: 0.8286 - val loss: 0.9305 - val acc: 0.7570
Epoch 19/100
25000/25000 [==============================] - 8s 323us/step - loss: 0.7208 - acc: 0.8306 - val loss: 0.9633 - val acc: 0.7502
Epoch 20/100
25000/25000 [==============================] - 8s 325us/step - loss: 0.7066 - acc: 0.8338 - val_loss: 0.9198 - val_acc: 0.7634
Epoch 21/100
25000/25000 [==============================] - 8s 326us/step - loss: 0.7018 - acc: 0.8392 - val loss: 0.8696 - val acc: 0.7720
Epoch 22/100
25000/25000 [==============================] - 8s 327us/step - loss: 0.7036 - acc: 0.8382 - val loss: 0.8817 - val acc: 0.7632
Epoch 23/100
25000/25000 [==============================] - 8s 326us/step - loss: 0.6968 - acc: 0.8412 - val_loss: 0.9138 - val_acc: 0.7616
Epoch 24/100
25000/25000 [==============================] - 8s 323us/step - loss: 0.6990 - acc: 0.8434 - val_loss: 0.8571 - val_acc: 0.7926
Epoch 25/100
25000/25000 [==============================] - 8s 327us/step - loss: 0.6906 - acc: 0.8430 - val_loss: 0.7828 - val_acc: 0.8044
Epoch 26/100
25000/25000 [==============================] - 8s 327us/step - loss: 0.6868 - acc: 0.8460 - val loss: 0.7657 - val acc: 0.8122
Epoch 27/100
25000/25000 [==============================] - 8s 326us/step - loss: 0.6845 - acc: 0.8474 - val loss: 0.8366 - val acc: 0.7894
Epoch 28/100
25000/25000 [==============================] - 8s 326us/step - loss: 0.6836 - acc: 0.8482 - val_loss: 0.8074 - val_acc: 0.7942
Epoch 29/100
25000/25000 [==============================] - 8s 327us/step - loss: 0.6784 - acc: 0.8495 - val_loss: 0.9715 - val_acc: 0.7456
Epoch 30/100
25000/25000 [==============================] - 8s 325us/step - loss: 0.6871 - acc: 0.8460 - val loss: 0.8255 - val acc: 0.7966
Epoch 31/100
25000/25000 [==============================] - 8s 328us/step - loss: 0.6758 - acc: 0.8482 - val loss: 0.7907 - val acc: 0.8148
Epoch 32/100
25000/25000 [==============================] - 8s 326us/step - loss: 0.6753 - acc: 0.8518 - val loss: 1.1041 - val acc: 0.7082
Epoch 33/100
25000/25000 [==============================] - 8s 324us/step - loss: 0.6635 - acc: 0.8545 - val_loss: 0.8827 - val_acc: 0.7826
Epoch 34/100
25000/25000 [==============================] - 8s 323us/step - loss: 0.6745 - acc: 0.8524 - val loss: 0.9577 - val acc: 0.7694
Epoch 35/100
25000/25000 [==============================] - 8s 326us/step - loss: 0.6696 - acc: 0.8543 - val loss: 0.9979 - val acc: 0.7486
Epoch 36/100
25000/25000 [==============================] - 8s 328us/step - loss: 0.6725 - acc: 0.8492 - val loss: 0.8498 - val acc: 0.7866
Epoch 37/100
25000/25000 [==============================] - 8s 329us/step - loss: 0.6691 - acc: 0.8541 - val_loss: 0.7778 - val_acc: 0.8152
Epoch 38/100
25000/25000 [==============================] - 8s 327us/step - loss: 0.6689 - acc: 0.8540 - val_loss: 0.7463 - val_acc: 0.8278
Epoch 39/100
25000/25000 [==============================] - 8s 327us/step - loss: 0.6569 - acc: 0.8579 - val loss: 0.9378 - val acc: 0.7532
Epoch 40/100
25000/25000 [==============================] - 8s 325us/step - loss: 0.6519 - acc: 0.8599 - val loss: 0.9617 - val acc: 0.7502
Epoch 41/100
25000/25000 [==============================] - 8s 325us/step - loss: 0.6649 - acc: 0.8570 - val_loss: 0.7921 - val_acc: 0.8130
Epoch 42/100
25000/25000 [==============================] - 8s 326us/step - loss: 0.6583 - acc: 0.8586 - val_loss: 0.8245 - val_acc: 0.7886
Epoch 43/100
25000/25000 [==============================] - 8s 333us/step - loss: 0.6496 - acc: 0.8623 - val_loss: 0.8085 - val_acc: 0.8082
Epoch 44/100
25000/25000 [==============================] - 8s 325us/step - loss: 0.6544 - acc: 0.8599 - val loss: 0.7826 - val acc: 0.8140
Epoch 45/100
25000/25000 [==============================] - 8s 324us/step - loss: 0.6569 - acc: 0.8589 - val loss: 0.8345 - val acc: 0.7918
Epoch 46/100
25000/25000 [==============================] - 8s 325us/step - loss: 0.6481 - acc: 0.8619 - val_loss: 0.7922 - val_acc: 0.8104
Epoch 47/100
25000/25000 [==============================] - 8s 325us/step - loss: 0.6501 - acc: 0.8593 - val_loss: 1.0023 - val_acc: 0.7392
Epoch 48/100
25000/25000 [==============================] - 8s 325us/step - loss: 0.6597 - acc: 0.8584 - val_loss: 1.0280 - val_acc: 0.7356
Epoch 00048: early stopping
```

TEST#10 Changed BATCH_SIZE from 128 to 256

Observations:

	TRAIN	TEST
Accuracy	88.37	76.34
Val_loss	0.5768	0.9504





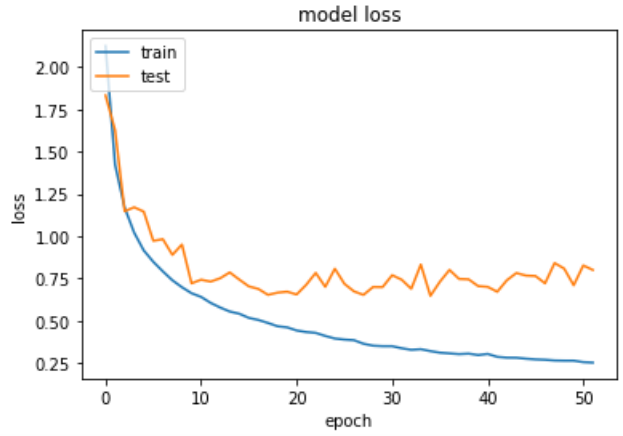

```
Train on 25000 samples, validate on 5000 samples
Epoch 1/100
25000/25000 [==============================] - 4s 179us/step - loss: 2.5698 - acc: 0.4977 - val_loss: 2.1705 - val_acc: 0.5486
Epoch 2/100
25000/25000 [==============================] - 3s 118us/step - loss: 1.8201 - acc: 0.6118 - val loss: 1.6866 - val acc: 0.5818
Epoch 3/100
25000/25000 [==============================] - 3s 117us/step - loss: 1.4198 - acc: 0.6710 - val loss: 1.6813 - val acc: 0.5336
Epoch 4/100
25000/25000 [==============================] - 3s 117us/step - loss: 1.1630 - acc: 0.7146 - val loss: 1.3442 - val acc: 0.6184
Epoch 5/100
25000/25000 [==============================] - 3s 117us/step - loss: 1.0183 - acc: 0.7376 - val_loss: 1.3226 - val_acc: 0.5786
Epoch 6/100
25000/25000 [==============================] - 3s 118us/step - loss: 0.9088 - acc: 0.7586 - val loss: 1.0145 - val acc: 0.7034
Epoch 7/100
25000/25000 [==============================] - 3s 117us/step - loss: 0.8483 - acc: 0.7724 - val loss: 1.0029 - val acc: 0.7002
Epoch 8/100
25000/25000 [==============================] - 3s 118us/step - loss: 0.8019 - acc: 0.7843 - val loss: 0.8449 - val acc: 0.7728
Epoch 9/100
25000/25000 [==============================] - 3s 119us/step - loss: 0.7663 - acc: 0.7970 - val_loss: 1.0847 - val_acc: 0.6600
Epoch 10/100
25000/25000 [==============================] - 3s 117us/step - loss: 0.7417 - acc: 0.8062 - val_loss: 1.1872 - val_acc: 0.6398
Epoch 11/100
25000/25000 [==============================] - 3s 117us/step - loss: 0.7212 - acc: 0.8134 - val loss: 0.7969 - val acc: 0.7890
Epoch 12/100
25000/25000 [==============================] - 3s 117us/step - loss: 0.7064 - acc: 0.8235 - val loss: 0.8241 - val acc: 0.7738
Epoch 13/100
25000/25000 [==============================] - 3s 119us/step - loss: 0.6911 - acc: 0.8258 - val_loss: 0.7959 - val_acc: 0.7838
Epoch 14/100
25000/25000 [==============================] - 3s 117us/step - loss: 0.6857 - acc: 0.8286 - val_loss: 0.7935 - val_acc: 0.7952
Epoch 15/100
25000/25000 [==============================] - 3s 119us/step - loss: 0.6749 - acc: 0.8356 - val_loss: 0.8846 - val_acc: 0.7588
Epoch 16/100
25000/25000 [==============================] - 3s 118us/step - loss: 0.6533 - acc: 0.8458 - val loss: 0.7967 - val acc: 0.7950
Epoch 17/100
25000/25000 [==============================] - 3s 117us/step - loss: 0.6621 - acc: 0.8429 - val loss: 1.0606 - val acc: 0.7044
Epoch 18/100
25000/25000 [==============================] - 3s 117us/step - loss: 0.6539 - acc: 0.8458 - val_loss: 0.8497 - val_acc: 0.7810
Epoch 19/100
25000/25000 [==============================] - 3s 118us/step - loss: 0.6392 - acc: 0.8513 - val_loss: 0.8210 - val_acc: 0.7862
Epoch 20/100
25000/25000 [==============================] - 3s 117us/step - loss: 0.6356 - acc: 0.8536 - val loss: 0.9515 - val acc: 0.7460
Epoch 21/100
```

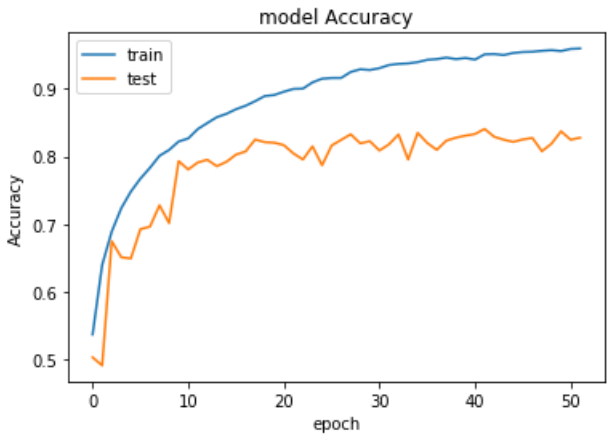
```
25000/25000 [==============================] - 3s 118us/step - loss: 0.6360 - acc: 0.8558 - val_loss: 1.1897 - val_acc: 0.6866
Epoch 22/100
25000/25000 [==============================] - 3s 117us/step - loss: 0.6287 - acc: 0.8586 - val_loss: 1.0432 - val_acc: 0.7322
Epoch 23/100
25000/25000 [==============================] - 3s 118us/step - loss: 0.6298 - acc: 0.8593 - val loss: 0.9773 - val acc: 0.7500
Epoch 24/100
25000/25000 [==============================] - 3s 118us/step - loss: 0.6075 - acc: 0.8668 - val loss: 0.7837 - val acc: 0.8088
Epoch 25/100
25000/25000 [==============================] - 3s 118us/step - loss: 0.6179 - acc: 0.8635 - val_loss: 0.7480 - val_acc: 0.8128
Epoch 26/100
25000/25000 [==============================] - 3s 119us/step - loss: 0.6013 - acc: 0.8705 - val_loss: 0.8273 - val_acc: 0.7868
Epoch 27/100
25000/25000 [==============================] - 3s 118us/step - loss: 0.6063 - acc: 0.8687 - val loss: 0.9026 - val acc: 0.7750
Epoch 28/100
25000/25000 [==============================] - 3s 118us/step - loss: 0.6158 - acc: 0.8652 - val loss: 0.9168 - val acc: 0.7644
Epoch 29/100
25000/25000 [==============================] - 3s 118us/step - loss: 0.6079 - acc: 0.8696 - val_loss: 0.8730 - val_acc: 0.7748
Epoch 30/100
25000/25000 [==============================] - 3s 119us/step - loss: 0.5928 - acc: 0.8744 - val_loss: 1.1454 - val_acc: 0.7020
Epoch 31/100
25000/25000 [==============================] - 3s 118us/step - loss: 0.6054 - acc: 0.8723 - val loss: 0.7875 - val acc: 0.8114
Epoch 32/100
25000/25000 [==============================] - 3s 119us/step - loss: 0.5886 - acc: 0.8774 - val loss: 1.2509 - val acc: 0.6820
Epoch 33/100
25000/25000 [==============================] - 3s 120us/step - loss: 0.5818 - acc: 0.8803 - val loss: 0.7389 - val acc: 0.8230
Epoch 34/100
25000/25000 [==============================] - 3s 118us/step - loss: 0.5904 - acc: 0.8766 - val_loss: 0.8151 - val_acc: 0.7904
Epoch 35/100
25000/25000 [==============================] - 3s 118us/step - loss: 0.5871 - acc: 0.8788 - val loss: 0.9131 - val acc: 0.7776
Epoch 36/100
25000/25000 [==============================] - 3s 119us/step - loss: 0.5865 - acc: 0.8804 - val loss: 0.8970 - val acc: 0.7812
Epoch 37/100
25000/25000 [==============================] - 3s 120us/step - loss: 0.5707 - acc: 0.8856 - val loss: 0.9994 - val acc: 0.7506
Epoch 38/100
25000/25000 [==============================] - 3s 119us/step - loss: 0.5769 - acc: 0.8832 - val loss: 0.9108 - val acc: 0.7834
Epoch 39/100
25000/25000 [==============================] - 3s 119us/step - loss: 0.5663 - acc: 0.8872 - val_loss: 0.9653 - val_acc: 0.7610
Epoch 40/100
25000/25000 [==============================] - 3s 122us/step - loss: 0.5635 - acc: 0.8881 - val loss: 0.7825 - val acc: 0.8134
Epoch 41/100
25000/25000 [==============================] - 3s 119us/step - loss: 0.5782 - acc: 0.8812 - val loss: 0.8253 - val acc: 0.8006
Epoch 42/100
25000/25000 [==============================] - 3s 118us/step - loss: 0.5530 - acc: 0.8911 - val_loss: 1.0300 - val_acc: 0.7426
Epoch 43/100
25000/25000 [==============================] - 3s 121us/step - loss: 0.5768 - acc: 0.8837 - val_loss: 0.9504 - val_acc: 0.7634
Epoch 00043: early stopping
```

TEST#11 Changed optimizer from Adam to Adagrad

Observations:

	TRAIN	TEST
Accuracy	95.93	82.76
Val_loss	0.2514	0.7995






```
Train on 25000 samples, validate on 5000 samples
Epoch 1/100
25000/25000 [==============================] - 16s 636us/step - loss: 2.1241 - acc: 0.5370 - val_loss: 1.8323 - val_acc: 0.5032
Epoch 2/100
25000/25000 [==============================] - 9s 378us/step - loss: 1.4216 - acc: 0.6396 - val_loss: 1.6261 - val_acc: 0.4912
Epoch 3/100
25000/25000 [==============================] - 9s 371us/step - loss: 1.1680 - acc: 0.6889 - val_loss: 1.1470 - val_acc: 0.6748
Epoch 4/100
25000/25000 [==============================] - 9s 371us/step - loss: 1.0197 - acc: 0.7236 - val loss: 1.1701 - val acc: 0.6510
Epoch 5/100
25000/25000 [==============================] - 9s 374us/step - loss: 0.9149 - acc: 0.7480 - val loss: 1.1447 - val acc: 0.6492
Epoch 6/100
25000/25000 [==============================] - 9s 374us/step - loss: 0.8477 - acc: 0.7672 - val_loss: 0.9719 - val_acc: 0.6926
Epoch 7/100
25000/25000 [==============================] - 9s 369us/step - loss: 0.7911 - acc: 0.7832 - val_loss: 0.9815 - val_acc: 0.6962
Epoch 8/100
25000/25000 [==============================] - 9s 342us/step - loss: 0.7382 - acc: 0.8009 - val loss: 0.8888 - val acc: 0.7278
Epoch 9/100
25000/25000 [==============================] - 9s 367us/step - loss: 0.6972 - acc: 0.8095 - val loss: 0.9501 - val acc: 0.7014
Epoch 10/100
25000/25000 [==============================] - 9s 349us/step - loss: 0.6618 - acc: 0.8220 - val loss: 0.7203 - val acc: 0.7930
Epoch 11/100
25000/25000 [==============================] - 9s 361us/step - loss: 0.6401 - acc: 0.8265 - val_loss: 0.7417 - val_acc: 0.7806
Epoch 12/100
25000/25000 [==============================] - 8s 306us/step - loss: 0.6047 - acc: 0.8403 - val loss: 0.7305 - val acc: 0.7910
Epoch 13/100
25000/25000 [==============================] - 9s 374us/step - loss: 0.5771 - acc: 0.8493 - val loss: 0.7504 - val acc: 0.7950
Epoch 14/100
25000/25000 [==============================] - 9s 371us/step - loss: 0.5535 - acc: 0.8579 - val loss: 0.7849 - val acc: 0.7854
Epoch 15/100
25000/25000 [==============================] - 9s 376us/step - loss: 0.5404 - acc: 0.8628 - val_loss: 0.7425 - val_acc: 0.7920
Epoch 16/100
25000/25000 [==============================] - 9s 375us/step - loss: 0.5159 - acc: 0.8696 - val_loss: 0.7023 - val_acc: 0.8026
Epoch 17/100
25000/25000 [==============================] - 10s 393us/step - loss: 0.5036 - acc: 0.8748 - val loss: 0.6871 - val acc: 0.8072
Epoch 18/100
25000/25000 [==============================] - 10s 384us/step - loss: 0.4859 - acc: 0.8815 - val loss: 0.6522 - val acc: 0.8248
Epoch 19/100
25000/25000 [==============================] - 9s 378us/step - loss: 0.4664 - acc: 0.8891 - val_loss: 0.6652 - val_acc: 0.8210
Epoch 20/100
25000/25000 [==============================] - 9s 366us/step - loss: 0.4600 - acc: 0.8906 - val_loss: 0.6711 - val_acc: 0.8202
Epoch 21/100
```

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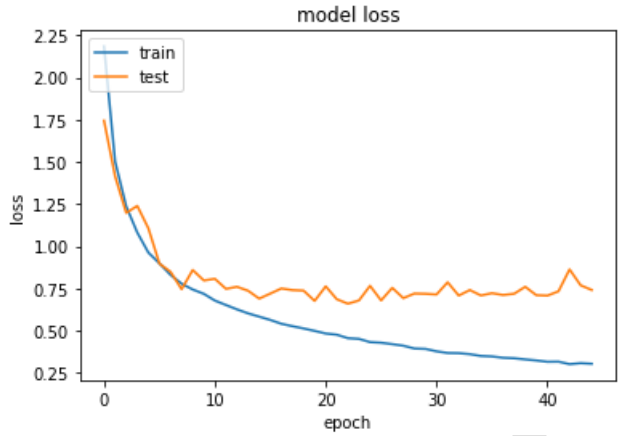
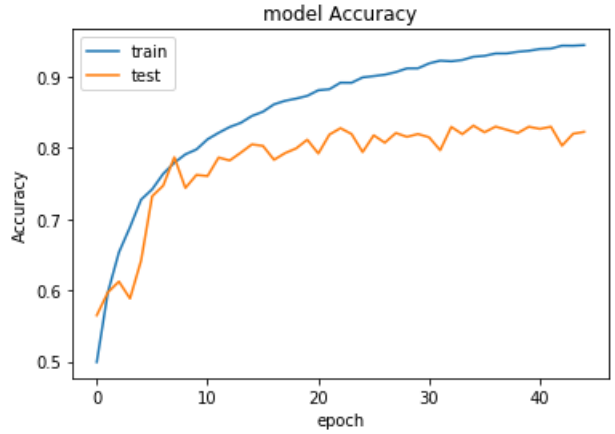
25000/25000 [==============================] - 9s 379us/step - loss: 0.4415 - acc: 0.8955 - val_loss: 0.6543 - val_acc: 0.8166
Epoch 22/100
25000/25000 [==============================] - 9s 376us/step - loss: 0.4323 - acc: 0.8996 - val_loss: 0.7116 - val_acc: 0.8044
Epoch 23/100
25000/25000 [==============================] - 9s 369us/step - loss: 0.4272 - acc: 0.9000 - val loss: 0.7822 - val acc: 0.7954
Epoch 24/100
25000/25000 [==============================] - 9s 373us/step - loss: 0.4090 - acc: 0.9093 - val loss: 0.6993 - val acc: 0.8148
Epoch 25/100
25000/25000 [==============================] - 9s 375us/step - loss: 0.3938 - acc: 0.9147 - val_loss: 0.8071 - val_acc: 0.7868
Epoch 26/100
25000/25000 [==============================] - 9s 365us/step - loss: 0.3876 - acc: 0.9158 - val_loss: 0.7175 - val_acc: 0.8160
Epoch 27/100
25000/25000 [==============================] - 9s 368us/step - loss: 0.3840 - acc: 0.9158 - val loss: 0.6728 - val acc: 0.8244
Epoch 28/100
25000/25000 [==============================] - 9s 368us/step - loss: 0.3629 - acc: 0.9247 - val loss: 0.6519 - val acc: 0.8326
Epoch 29/100
25000/25000 [==============================] - 9s 371us/step - loss: 0.3516 - acc: 0.9286 - val_loss: 0.6988 - val_acc: 0.8192
Epoch 30/100
25000/25000 [==============================] - 9s 374us/step - loss: 0.3486 - acc: 0.9276 - val_loss: 0.6983 - val_acc: 0.8224
Epoch 31/100
25000/25000 [==============================] - 9s 370us/step - loss: 0.3484 - acc: 0.9302 - val loss: 0.7687 - val acc: 0.8086
Epoch 32/100
25000/25000 [==============================] - 9s 369us/step - loss: 0.3361 - acc: 0.9350 - val loss: 0.7417 - val acc: 0.8178
Epoch 33/100
25000/25000 [==============================] - 9s 373us/step - loss: 0.3271 - acc: 0.9366 - val loss: 0.6881 - val acc: 0.8324
Epoch 34/100
25000/25000 [==============================] - 9s 372us/step - loss: 0.3308 - acc: 0.9373 - val_loss: 0.8315 - val_acc: 0.7954
Epoch 35/100
25000/25000 [==============================] - 9s 353us/step - loss: 0.3194 - acc: 0.9392 - val loss: 0.6462 - val acc: 0.8348
Epoch 36/100
25000/25000 [==============================] - 9s 368us/step - loss: 0.3101 - acc: 0.9426 - val loss: 0.7302 - val acc: 0.8198
Epoch 37/100
25000/25000 [==============================] - 9s 374us/step - loss: 0.3059 - acc: 0.9436 - val loss: 0.7998 - val acc: 0.8096
Epoch 38/100
25000/25000 [==============================] - 9s 368us/step - loss: 0.3016 - acc: 0.9459 - val loss: 0.7465 - val acc: 0.8232
Epoch 39/100
25000/25000 [==============================] - 9s 372us/step - loss: 0.3044 - acc: 0.9436 - val_loss: 0.7441 - val_acc: 0.8276
Epoch 40/100
25000/25000 [==============================] - 9s 372us/step - loss: 0.2962 - acc: 0.9453 - val loss: 0.7038 - val acc: 0.8306
Epoch 41/100
25000/25000 [==============================] - 9s 371us/step - loss: 0.3026 - acc: 0.9429 - val loss: 0.6994 - val acc: 0.8330
Epoch 42/100
25000/25000 [==============================] - 9s 369us/step - loss: 0.2854 - acc: 0.9507 - val_loss: 0.6704 - val_acc: 0.8406
Epoch 43/100
25000/25000 [==============================] - 9s 377us/step - loss: 0.2806 - acc: 0.9512 - val_loss: 0.7385 - val_acc: 0.8290
Epoch 44/100
25000/25000 [==============================] - 9s 367us/step - loss: 0.2801 - acc: 0.9496 - val_loss: 0.7814 - val_acc: 0.8246
Epoch 45/100
25000/25000 [==============================] - 9s 372us/step - loss: 0.2746 - acc: 0.9527 - val loss: 0.7663 - val acc: 0.8214
Epoch 46/100
25000/25000 [==============================] - 9s 373us/step - loss: 0.2703 - acc: 0.9541 - val loss: 0.7636 - val acc: 0.8250
Epoch 47/100
25000/25000 [==============================] - 9s 372us/step - loss: 0.2682 - acc: 0.9545 - val_loss: 0.7203 - val_acc: 0.8272
Epoch 48/100
25000/25000 [==============================] - 9s 372us/step - loss: 0.2639 - acc: 0.9559 - val_loss: 0.8403 - val_acc: 0.8076
Epoch 49/100
25000/25000 [==============================] - 9s 370us/step - loss: 0.2628 - acc: 0.9568 - val loss: 0.8077 - val acc: 0.8188
Epoch 50/100
25000/25000 [==============================] - 9s 375us/step - loss: 0.2627 - acc: 0.9556 - val loss: 0.7087 - val acc: 0.8370
Epoch 51/100
25000/25000 [==============================] - 9s 361us/step - loss: 0.2542 - acc: 0.9587 - val loss: 0.8262 - val acc: 0.8246
Epoch 52/100
25000/25000 [==============================] - 9s 371us/step - loss: 0.2514 - acc: 0.9593 - val_loss: 0.7995 - val_acc: 0.8276
Epoch 00052: early stopping
```

TEST#12 Added an additional Dense layer

Observations:

	TRAIN	TEST
Accuracy	94.44	82.26
Val_loss	0.3034	0.7405






```
Train on 25000 samples, validate on 5000 samples
Epoch 1/100
25000/25000 [==============================] - 10s 381us/step - loss: 2.1836 - acc: 0.4993 - val_loss: 1.7436 - val_acc: 0.5650
Epoch 2/100
25000/25000 [==============================] - 6s 260us/step - loss: 1.5018 - acc: 0.5971 - val_loss: 1.4136 - val_acc: 0.5972
Epoch 3/100
25000/25000 [==============================] - 8s 323us/step - loss: 1.2363 - acc: 0.6534 - val loss: 1.1972 - val acc: 0.6124
Epoch 4/100
25000/25000 [==============================] - 10s 399us/step - loss: 1.0807 - acc: 0.6888 - val loss: 1.2387 - val acc: 0.5886
Epoch 5/100
25000/25000 [==============================] - 7s 278us/step - loss: 0.9622 - acc: 0.7274 - val_loss: 1.1059 - val_acc: 0.6418
Epoch 6/100
25000/25000 [==============================] - 8s 319us/step - loss: 0.8981 - acc: 0.7419 - val_loss: 0.8966 - val_acc: 0.7322
Epoch 7/100
25000/25000 [==============================] - 9s 374us/step - loss: 0.8300 - acc: 0.7638 - val_loss: 0.8483 - val_acc: 0.7472
Epoch 8/100
25000/25000 [==============================] - 9s 352us/step - loss: 0.7775 - acc: 0.7792 - val loss: 0.7449 - val acc: 0.7870
Epoch 9/100
25000/25000 [==============================] - 8s 319us/step - loss: 0.7434 - acc: 0.7911 - val loss: 0.8590 - val acc: 0.7438
Epoch 10/100
25000/25000 [==============================] - 9s 358us/step - loss: 0.7178 - acc: 0.7980 - val_loss: 0.7969 - val_acc: 0.7622
Epoch 11/100
25000/25000 [==============================] - 10s 393us/step - loss: 0.6778 - acc: 0.8122 - val loss: 0.8066 - val acc: 0.7606
Epoch 12/100
25000/25000 [==============================] - 10s 393us/step - loss: 0.6514 - acc: 0.8213 - val loss: 0.7473 - val acc: 0.7866
Epoch 13/100
25000/25000 [==============================] - 9s 365us/step - loss: 0.6254 - acc: 0.8294 - val loss: 0.7592 - val acc: 0.7824
Epoch 14/100
25000/25000 [==============================] - 8s 330us/step - loss: 0.6018 - acc: 0.8353 - val_loss: 0.7360 - val_acc: 0.7934
Epoch 15/100
25000/25000 [==============================] - 9s 349us/step - loss: 0.5825 - acc: 0.8449 - val_loss: 0.6892 - val_acc: 0.8050
Epoch 16/100
25000/25000 [==============================] - 10s 387us/step - loss: 0.5630 - acc: 0.8509 - val loss: 0.7192 - val acc: 0.8030
Epoch 17/100
25000/25000 [==============================] - 9s 380us/step - loss: 0.5402 - acc: 0.8613 - val loss: 0.7495 - val acc: 0.7834
Epoch 18/100
25000/25000 [==============================] - 8s 328us/step - loss: 0.5259 - acc: 0.8662 - val_loss: 0.7398 - val_acc: 0.7928
Epoch 19/100
25000/25000 [==============================] - 10s 390us/step - loss: 0.5125 - acc: 0.8693 - val_loss: 0.7367 - val_acc: 0.7994
Epoch 20/100
25000/25000 [==============================] - 9s 355us/step - loss: 0.4981 - acc: 0.8732 - val_loss: 0.6758 - val_acc: 0.8116
Epoch 21/100
25000/25000 [==============================] - 9s 373us/step - loss: 0.4826 - acc: 0.8810 - val_loss: 0.7621 - val_acc: 0.7922
```

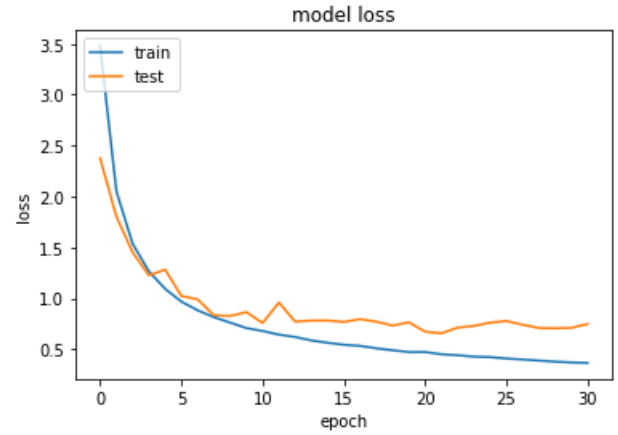
```
Epoch 22/100
25000/25000 [==============================] - 10s 386us/step - loss: 0.4755 - acc: 0.8825 - val_loss: 0.6858 - val_acc: 0.8188
Epoch 23/100
25000/25000 [==============================] - 10s 390us/step - loss: 0.4550 - acc: 0.8917 - val loss: 0.6591 - val acc: 0.8278
Epoch 24/100
25000/25000 [==============================] - 9s 375us/step - loss: 0.4508 - acc: 0.8916 - val loss: 0.6785 - val acc: 0.8196
Epoch 25/100
25000/25000 [==============================] - 9s 341us/step - loss: 0.4316 - acc: 0.8991 - val_loss: 0.7653 - val_acc: 0.7942
Epoch 26/100
25000/25000 [==============================] - 9s 371us/step - loss: 0.4280 - acc: 0.9009 - val_loss: 0.6786 - val_acc: 0.8178
Epoch 27/100
25000/25000 [==============================] - 7s 286us/step - loss: 0.4195 - acc: 0.9029 - val_loss: 0.7531 - val_acc: 0.8074
Epoch 28/100
25000/25000 [==============================] - 7s 260us/step - loss: 0.4104 - acc: 0.9066 - val loss: 0.6922 - val acc: 0.8210
Epoch 29/100
25000/25000 [==============================] - 9s 361us/step - loss: 0.3937 - acc: 0.9118 - val loss: 0.7193 - val acc: 0.8156
Epoch 30/100
25000/25000 [==============================] - 6s 260us/step - loss: 0.3915 - acc: 0.9118 - val_loss: 0.7178 - val_acc: 0.8196
Epoch 31/100
25000/25000 [==============================] - 7s 262us/step - loss: 0.3770 - acc: 0.9188 - val_loss: 0.7138 - val_acc: 0.8150
Epoch 32/100
25000/25000 [==============================] - 6s 260us/step - loss: 0.3672 - acc: 0.9226 - val loss: 0.7862 - val acc: 0.7968
Epoch 33/100
25000/25000 [==============================] - 7s 271us/step - loss: 0.3662 - acc: 0.9217 - val loss: 0.7074 - val acc: 0.8296
Epoch 34/100
25000/25000 [==============================] - 7s 265us/step - loss: 0.3603 - acc: 0.9235 - val loss: 0.7402 - val acc: 0.8194
Epoch 35/100
25000/25000 [==============================] - 7s 267us/step - loss: 0.3496 - acc: 0.9280 - val_loss: 0.7081 - val_acc: 0.8314
Epoch 36/100
25000/25000 [==============================] - 7s 266us/step - loss: 0.3467 - acc: 0.9294 - val loss: 0.7216 - val acc: 0.8220
Epoch 37/100
25000/25000 [==============================] - 7s 262us/step - loss: 0.3389 - acc: 0.9327 - val loss: 0.7109 - val acc: 0.8300
Epoch 38/100
25000/25000 [==============================] - 7s 261us/step - loss: 0.3360 - acc: 0.9327 - val loss: 0.7182 - val acc: 0.8256
Epoch 39/100
25000/25000 [==============================] - 7s 261us/step - loss: 0.3291 - acc: 0.9350 - val_loss: 0.7594 - val_acc: 0.8210
Epoch 40/100
25000/25000 [==============================] - 7s 271us/step - loss: 0.3229 - acc: 0.9364 - val_loss: 0.7097 - val_acc: 0.8298
Epoch 41/100
25000/25000 [==============================] - 7s 264us/step - loss: 0.3152 - acc: 0.9390 - val loss: 0.7071 - val acc: 0.8268
Epoch 42/100
25000/25000 [==============================] - 7s 262us/step - loss: 0.3158 - acc: 0.9396 - val loss: 0.7326 - val acc: 0.8298
Epoch 43/100
25000/25000 [==============================] - 7s 261us/step - loss: 0.3012 - acc: 0.9437 - val_loss: 0.8626 - val_acc: 0.8032
Epoch 44/100
25000/25000 [==============================] - 6s 260us/step - loss: 0.3069 - acc: 0.9436 - val_loss: 0.7681 - val_acc: 0.8200
Epoch 45/100
25000/25000 [==============================] - 7s 262us/step - loss: 0.3034 - acc: 0.9444 - val_loss: 0.7405 - val_acc: 0.8226
Epoch 00045: early stopping
```

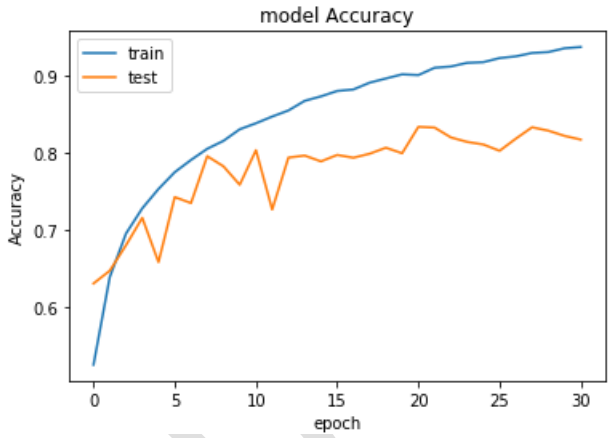
TEST#13 Removed additional Dense Layer, added kernel_regularizer to dense_1

```
kernel_regularizer=regularizers.l2(0.01)
```

Observations:

	TRAIN	TEST
Accuracy	93.78	81.74
Val_loss	0.3648	0.7476






```
Train on 25000 samples, validate on 5000 samples
Epoch 1/100
25000/25000 [==============================] - 15s 590us/step - loss: 3.4760 - acc: 0.5245 - val loss: 2.3748 - val acc: 0.6302
Epoch 2/100
25000/25000 [==============================] - 9s 368us/step - loss: 2.0514 - acc: 0.6385 - val_loss: 1.8022 - val_acc: 0.6468
Epoch 3/100
25000/25000 [==============================] - 9s 364us/step - loss: 1.5360 - acc: 0.6952 - val_loss: 1.4519 - val_acc: 0.6800
Epoch 4/100
25000/25000 [==============================] - 9s 375us/step - loss: 1.2647 - acc: 0.7279 - val loss: 1.2257 - val acc: 0.7156
Epoch 5/100
25000/25000 [==============================] - 9s 345us/step - loss: 1.0925 - acc: 0.7532 - val loss: 1.2815 - val acc: 0.6580
Epoch 6/100
25000/25000 [==============================] - 9s 364us/step - loss: 0.9670 - acc: 0.7750 - val_loss: 1.0222 - val_acc: 0.7426
Epoch 7/100
25000/25000 [==============================] - 9s 364us/step - loss: 0.8822 - acc: 0.7909 - val_loss: 0.9900 - val_acc: 0.7348
Epoch 8/100
25000/25000 [==============================] - 9s 359us/step - loss: 0.8142 - acc: 0.8054 - val loss: 0.8323 - val acc: 0.7958
Epoch 9/100
25000/25000 [==============================] - 9s 354us/step - loss: 0.7613 - acc: 0.8158 - val loss: 0.8264 - val acc: 0.7826
Epoch 10/100
25000/25000 [==============================] - 9s 357us/step - loss: 0.7073 - acc: 0.8308 - val loss: 0.8643 - val acc: 0.7586
Epoch 11/100
25000/25000 [==============================] - 9s 363us/step - loss: 0.6787 - acc: 0.8386 - val_loss: 0.7571 - val_acc: 0.8036
Epoch 12/100
25000/25000 [==============================] - 9s 363us/step - loss: 0.6433 - acc: 0.8474 - val loss: 0.9589 - val acc: 0.7264
Epoch 13/100
25000/25000 [==============================] - 9s 360us/step - loss: 0.6201 - acc: 0.8553 - val loss: 0.7708 - val acc: 0.7940
Epoch 14/100
25000/25000 [==============================] - 9s 363us/step - loss: 0.5859 - acc: 0.8678 - val loss: 0.7812 - val acc: 0.7966
Epoch 15/100
25000/25000 [==============================] - 9s 361us/step - loss: 0.5630 - acc: 0.8736 - val_loss: 0.7817 - val_acc: 0.7890
Epoch 16/100
25000/25000 [==============================] - 9s 362us/step - loss: 0.5437 - acc: 0.8806 - val_loss: 0.7676 - val_acc: 0.7974
Epoch 17/100
25000/25000 [==============================] - 9s 359us/step - loss: 0.5323 - acc: 0.8826 - val loss: 0.7956 - val acc: 0.7938
Epoch 18/100
```

```
25000/25000 [==============================] - 9s 368us/step - loss: 0.5087 - acc: 0.8914 - val_loss: 0.7701 - val_acc: 0.7990
Epoch 19/100
25000/25000 [==============================] - 9s 359us/step - loss: 0.4893 - acc: 0.8969 - val_loss: 0.7325 - val_acc: 0.8068
Epoch 20/100
25000/25000 [==============================] - 9s 364us/step - loss: 0.4720 - acc: 0.9023 - val loss: 0.7645 - val acc: 0.7996
Epoch 21/100
25000/25000 [==============================] - 9s 359us/step - loss: 0.4726 - acc: 0.9013 - val loss: 0.6720 - val acc: 0.8340
Epoch 22/100
25000/25000 [==============================] - 9s 357us/step - loss: 0.4500 - acc: 0.9108 - val_loss: 0.6563 - val_acc: 0.8330
Epoch 23/100
25000/25000 [==============================] - 9s 363us/step - loss: 0.4406 - acc: 0.9125 - val_loss: 0.7118 - val_acc: 0.8202
Epoch 24/100
25000/25000 [==============================] - 9s 363us/step - loss: 0.4269 - acc: 0.9172 - val loss: 0.7284 - val acc: 0.8144
Epoch 25/100
25000/25000 [==============================] - 9s 353us/step - loss: 0.4223 - acc: 0.9181 - val loss: 0.7610 - val acc: 0.8110
Epoch 26/100
25000/25000 [==============================] - 11s 437us/step - loss: 0.4084 - acc: 0.9234 - val_loss: 0.7768 - val_acc: 0.8028
Epoch 27/100
25000/25000 [==============================] - 9s 360us/step - loss: 0.3986 - acc: 0.9257 - val_loss: 0.7406 - val_acc: 0.8186
Epoch 28/100
25000/25000 [==============================] - 9s 363us/step - loss: 0.3882 - acc: 0.9301 - val loss: 0.7084 - val acc: 0.8334
Epoch 29/100
25000/25000 [==============================] - 9s 362us/step - loss: 0.3775 - acc: 0.9313 - val loss: 0.7056 - val acc: 0.8290
Epoch 30/100
25000/25000 [==============================] - 9s 362us/step - loss: 0.3698 - acc: 0.9362 - val loss: 0.7102 - val acc: 0.8222
Epoch 31/100
25000/25000 [==============================] - 9s 351us/step - loss: 0.3648 - acc: 0.9378 - val_loss: 0.7476 - val_acc: 0.8174
Epoch 00031: early stopping
```

TEST#14 Added dropout layers after each conv layer

BATCH_SIZE = 256

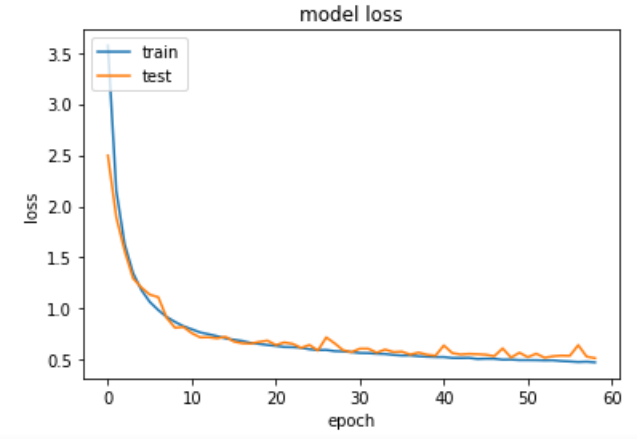
EPOCHS = 100

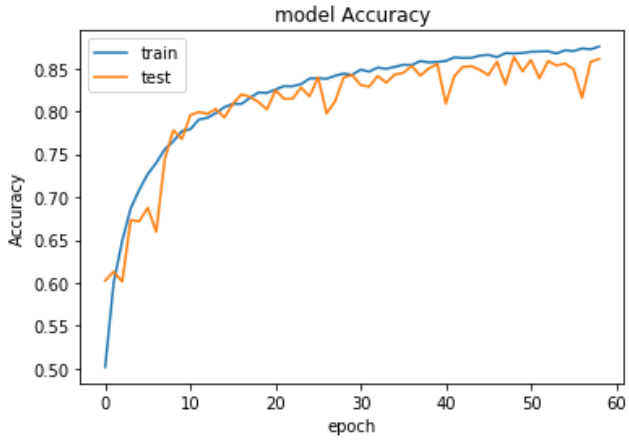
Architecture

conv_1	CONV2D (32, 3*3)	
max_1	MaxPooling2D (2, 2)	
batch_norm_1	BatchNormalization	
drop_11	Dropout(0.25)	Added this layer
conv_2	CONV2D (64, 3*3)	
max_2	MaxPooling2D (2, 2)	
batch_norm_2	BatchNormalization	
drop_22	Dropout(0.25)	Added this layer
conv_3	CONV2D (128, 3*3)	
max_3	MaxPooling2D (2, 2)	
batch_norm_3	BatchNormalization	
drop_1	Dropout(0.50)	
	Flatten	
dense_1	Dense(128, relu)	
batch_norm_4	BatchNormalization	
drop_2	Dropout(0.50)	
dense_2	Dense(5, softmax)	

Observations:

	TRAIN	TEST
Accuracy	87.55	86.10
Val_loss	0.4757	0.5167






```
Train on 25000 samples, validate on 5000 samples

Epoch 1/100

25000/25000 [==============================] - 12s 485us/step - loss: 3.5693 - acc: 0.5020 - val_loss: 2.4962 - val_acc: 0.6028

Epoch 2/100

25000/25000 [==============================] - 10s 389us/step - loss: 2.1522 - acc: 0.6007 - val_loss: 1.8931 - val_acc: 0.6132

Epoch 3/100

25000/25000 [==============================] - 10s 394us/step - loss: 1.6288 - acc: 0.6490 - val_loss: 1.5628 - val_acc: 0.6016

Epoch 4/100

25000/25000 [==============================] - 10s 392us/step - loss: 1.3473 - acc: 0.6870 - val_loss: 1.2960 - val_acc: 0.6732

Epoch 5/100

25000/25000 [==============================] - 10s 394us/step - loss: 1.1807 - acc: 0.7085 - val_loss: 1.2059 - val_acc: 0.6718

Epoch 6/100

25000/25000 [==============================] - 10s 391us/step - loss: 1.0648 - acc: 0.7269 - val_loss: 1.1367 - val_acc: 0.6876

Epoch 7/100

25000/25000 [==============================] - 10s 393us/step - loss: 0.9865 - acc: 0.7400 - val_loss: 1.1130 - val_acc: 0.6596

Epoch 8/100

25000/25000 [==============================] - 10s 392us/step - loss: 0.9192 - acc: 0.7558 - val_loss: 0.9098 - val_acc: 0.7444

Epoch 9/100

25000/25000 [==============================] - 10s 398us/step - loss: 0.8704 - acc: 0.7651 - val_loss: 0.8132 - val_acc: 0.7780

Epoch 10/100

25000/25000 [==============================] - 10s 397us/step - loss: 0.8288 - acc: 0.7769 - val_loss: 0.8210 - val_acc: 0.7678

Epoch 11/100

25000/25000 [==============================] - 10s 396us/step - loss: 0.7986 - acc: 0.7792 - val_loss: 0.7603 - val_acc: 0.7956

Epoch 12/100

25000/25000 [==============================] - 10s 393us/step - loss: 0.7679 - acc: 0.7904 - val_loss: 0.7197 - val_acc: 0.7992

Epoch 13/100

25000/25000 [==============================] - 10s 397us/step - loss: 0.7504 - acc: 0.7925 - val_loss: 0.7206 - val_acc: 0.7972

Epoch 14/100

25000/25000 [==============================] - 10s 396us/step - loss: 0.7316 - acc: 0.7980 - val_loss: 0.7104 - val_acc: 0.8026

Epoch 15/100

25000/25000 [==============================] - 10s 391us/step - loss: 0.7097 - acc: 0.8049 - val_loss: 0.7254 - val_acc: 0.7928

Epoch 16/100

25000/25000 [==============================] - 10s 395us/step - loss: 0.6969 - acc: 0.8087 - val_loss: 0.6790 - val_acc: 0.8088

Epoch 17/100

25000/25000 [==============================] - 10s 393us/step - loss: 0.6849 - acc: 0.8086 - val_loss: 0.6616 - val_acc: 0.8198

Epoch 18/100
```

```
25000/25000 [==============================] - 10s 395us/step - loss: 0.6661 - acc: 0.8157 - val_loss: 0.6590 - val_acc: 0.8168
Epoch 19/100
25000/25000 [==============================] - 10s 392us/step - loss: 0.6559 - acc: 0.8220 - val_loss: 0.6757 - val_acc: 0.8108
Epoch 20/100
25000/25000 [==============================] - 10s 390us/step - loss: 0.6451 - acc: 0.8215 - val_loss: 0.6878 - val_acc: 0.8022
Epoch 21/100
25000/25000 [==============================] - 10s 391us/step - loss: 0.6366 - acc: 0.8254 - val_loss: 0.6453 - val_acc: 0.8246
Epoch 22/100
25000/25000 [==============================] - 10s 395us/step - loss: 0.6258 - acc: 0.8294 - val_loss: 0.6700 - val_acc: 0.8146
Epoch 23/100
25000/25000 [==============================] - 10s 396us/step - loss: 0.6241 - acc: 0.8292 - val_loss: 0.6567 - val_acc: 0.8146
Epoch 24/100
25000/25000 [==============================] - 10s 396us/step - loss: 0.6185 - acc: 0.8316 - val_loss: 0.6172 - val_acc: 0.8278
Epoch 25/100
25000/25000 [==============================] - 10s 391us/step - loss: 0.6035 - acc: 0.8382 - val_loss: 0.6460 - val_acc: 0.8174
Epoch 26/100
25000/25000 [==============================] - 10s 394us/step - loss: 0.5959 - acc: 0.8386 - val_loss: 0.5909 - val_acc: 0.8396
Epoch 27/100
25000/25000 [==============================] - 10s 395us/step - loss: 0.5972 - acc: 0.8379 - val_loss: 0.7198 - val_acc: 0.7976
Epoch 28/100
25000/25000 [==============================] - 10s 395us/step - loss: 0.5850 - acc: 0.8415 - val_loss: 0.6613 - val_acc: 0.8116
Epoch 29/100
25000/25000 [==============================] - 10s 397us/step - loss: 0.5824 - acc: 0.8440 - val_loss: 0.5950 - val_acc: 0.8394
Epoch 30/100
25000/25000 [==============================] - 10s 399us/step - loss: 0.5760 - acc: 0.8425 - val_loss: 0.5755 - val_acc: 0.8424
Epoch 31/100
25000/25000 [==============================] - 10s 390us/step - loss: 0.5671 - acc: 0.8486 - val_loss: 0.6093 - val_acc: 0.8306
Epoch 32/100
25000/25000 [==============================] - 10s 384us/step - loss: 0.5656 - acc: 0.8463 - val_loss: 0.6093 - val_acc: 0.8288
Epoch 33/100
25000/25000 [==============================] - 10s 389us/step - loss: 0.5601 - acc: 0.8510 - val_loss: 0.5703 - val_acc: 0.8412
Epoch 34/100
25000/25000 [==============================] - 10s 388us/step - loss: 0.5576 - acc: 0.8496 - val_loss: 0.6009 - val_acc: 0.8334
Epoch 35/100
25000/25000 [==============================] - 10s 395us/step - loss: 0.5485 - acc: 0.8517 - val_loss: 0.5766 - val_acc: 0.8428
Epoch 36/100
25000/25000 [==============================] - 10s 393us/step - loss: 0.5427 - acc: 0.8543 - val_loss: 0.5803 - val_acc: 0.8448
Epoch 37/100
25000/25000 [==============================] - 10s 394us/step - loss: 0.5430 - acc: 0.8540 - val_loss: 0.5520 - val_acc: 0.8528
Epoch 38/100
25000/25000 [==============================] - 10s 394us/step - loss: 0.5354 - acc: 0.8586 - val_loss: 0.5712 - val_acc: 0.8416
Epoch 39/100
25000/25000 [==============================] - 10s 391us/step - loss: 0.5307 - acc: 0.8570 - val_loss: 0.5505 - val_acc: 0.8500
Epoch 40/100
25000/25000 [==============================] - 10s 394us/step - loss: 0.5279 - acc: 0.8575 - val_loss: 0.5410 - val_acc: 0.8552
Epoch 41/100
25000/25000 [==============================] - 10s 391us/step - loss: 0.5275 - acc: 0.8587 - val_loss: 0.6409 - val_acc: 0.8090
```

```
Epoch 42/100
25000/25000 [==============================] - 10s 393us/step - loss: 0.5189 - acc: 0.8628 - val_loss: 0.5667 - val_acc: 0.8410
Epoch 43/100
25000/25000 [==============================] - 10s 394us/step - loss: 0.5181 - acc: 0.8622 - val_loss: 0.5530 - val_acc: 0.8518
Epoch 44/100
25000/25000 [==============================] - 10s 394us/step - loss: 0.5196 - acc: 0.8622 - val_loss: 0.5585 - val_acc: 0.8526
Epoch 45/100
25000/25000 [==============================] - 10s 392us/step - loss: 0.5087 - acc: 0.8650 - val_loss: 0.5553 - val_acc: 0.8484
Epoch 46/100
25000/25000 [==============================] - 10s 406us/step - loss: 0.5118 - acc: 0.8658 - val_loss: 0.5509 - val_acc: 0.8422
Epoch 47/100
25000/25000 [==============================] - 9s 342us/step - loss: 0.5111 - acc: 0.8632 - val_loss: 0.5357 - val_acc: 0.8578
Epoch 48/100
25000/25000 [==============================] - 9s 352us/step - loss: 0.5020 - acc: 0.8678 - val_loss: 0.6125 - val_acc: 0.8314
Epoch 49/100
25000/25000 [==============================] - 9s 363us/step - loss: 0.5033 - acc: 0.8674 - val_loss: 0.5227 - val_acc: 0.8636
Epoch 50/100
25000/25000 [==============================] - 9s 353us/step - loss: 0.4978 - acc: 0.8680 - val_loss: 0.5700 - val_acc: 0.8466
Epoch 51/100
25000/25000 [==============================] - 9s 374us/step - loss: 0.4977 - acc: 0.8694 - val_loss: 0.5266 - val_acc: 0.8598
Epoch 52/100
25000/25000 [==============================] - 9s 357us/step - loss: 0.4971 - acc: 0.8697 - val_loss: 0.5606 - val_acc: 0.8384
Epoch 53/100
25000/25000 [==============================] - 9s 374us/step - loss: 0.4950 - acc: 0.8700 - val_loss: 0.5213 - val_acc: 0.8588
Epoch 54/100
25000/25000 [==============================] - 9s 374us/step - loss: 0.4956 - acc: 0.8674 - val_loss: 0.5355 - val_acc: 0.8534
Epoch 55/100
25000/25000 [==============================] - 10s 395us/step - loss: 0.4884 - acc: 0.8712 - val_loss: 0.5415 - val_acc: 0.8558
Epoch 56/100
25000/25000 [==============================] - 10s 386us/step - loss: 0.4845 - acc: 0.8702 - val_loss: 0.5395 - val_acc: 0.8490
Epoch 57/100
25000/25000 [==============================] - 10s 396us/step - loss: 0.4792 - acc: 0.8733 - val_loss: 0.6440 - val_acc: 0.8156
Epoch 58/100
25000/25000 [==============================] - 10s 394us/step - loss: 0.4821 - acc: 0.8723 - val_loss: 0.5319 - val_acc: 0.8578
Epoch 59/100
25000/25000 [==============================] - 10s 393us/step - loss: 0.4757 - acc: 0.8755 - val_loss: 0.5167 - val_acc: 0.8610
Epoch 00059: early stopping
```