

Keshav_Deep Learning with Keras and Tensorflow_project

October 1, 2022

```
[1]: # import libraries
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import MinMaxScaler
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, Dropout
from tensorflow.keras.callbacks import EarlyStopping
from tensorflow.keras.models import load_model
from sklearn.metrics import confusion_matrix, classification_report
from pickle import dump, load

%matplotlib inline
```

```
[2]: df = pd.read_csv('loan_data.csv')
```

```
[3]: df.info()
df.head()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 9578 entries, 0 to 9577
Data columns (total 14 columns):
 #   Column                Non-Null Count  Dtype
---  -
 0   credit.policy          9578 non-null   int64
 1   purpose                9578 non-null   object
 2   int.rate              9578 non-null   float64
 3   installment           9578 non-null   float64
 4   log.annual.inc        9578 non-null   float64
 5   dti                   9578 non-null   float64
 6   fico                  9578 non-null   int64
 7   days.with.cr.line     9578 non-null   float64
 8   revol.bal             9578 non-null   int64
 9   revol.util            9578 non-null   float64
10  inq.last.6mths        9578 non-null   int64
```

```

11 delinq.2yrs      9578 non-null   int64
12 pub.rec          9578 non-null   int64
13 not.fully.paid   9578 non-null   int64
dtypes: float64(6), int64(7), object(1)
memory usage: 1.0+ MB

```

```

[3]:   credit.policy      purpose  int.rate  installment  log.annual.inc  \
0         1  debt_consolidation    0.1189         829.10      11.350407
1         1      credit_card    0.1071         228.22      11.082143
2         1  debt_consolidation    0.1357         366.86      10.373491
3         1  debt_consolidation    0.1008         162.34      11.350407
4         1      credit_card    0.1426         102.92      11.299732

      dti  fico  days.with.cr.line  revol.bal  revol.util  inq.last.6mths  \
0  19.48  737      5639.958333      28854         52.1           0
1  14.29  707      2760.000000      33623         76.7           0
2  11.63  682      4710.000000       3511         25.6           1
3   8.10  712      2699.958333      33667         73.2           1
4  14.97  667      4066.000000       4740         39.5           0

      delinq.2yrs  pub.rec  not.fully.paid
0              0         0              0
1              0         0              0
2              0         0              0
3              0         0              0
4              1         0              0

```

```
[4]: df.describe().transpose()
```

```

[4]:      count      mean      std      min  \
credit.policy  9578.0    0.804970    0.396245    0.000000
int.rate      9578.0    0.122640    0.026847    0.060000
installment   9578.0   319.089413   207.071301   15.670000
log.annual.inc 9578.0   10.932117    0.614813    7.547502
dti           9578.0   12.606679    6.883970    0.000000
fico          9578.0   710.846314   37.970537   612.000000
days.with.cr.line 9578.0  4560.767197  2496.930377  178.958333
revol.bal      9578.0  16913.963876  33756.189557    0.000000
revol.util     9578.0    46.799236    29.014417    0.000000
inq.last.6mths 9578.0    1.577469    2.200245    0.000000
delinq.2yrs    9578.0    0.163708    0.546215    0.000000
pub.rec        9578.0    0.062122    0.262126    0.000000
not.fully.paid 9578.0    0.160054    0.366676    0.000000

      25%      50%      75%      max
credit.policy  1.000000  1.000000  1.000000  1.000000e+00
int.rate      0.103900  0.122100  0.140700  2.164000e-01

```

installment	163.770000	268.950000	432.762500	9.401400e+02
log.annual.inc	10.558414	10.928884	11.291293	1.452835e+01
dti	7.212500	12.665000	17.950000	2.996000e+01
fico	682.000000	707.000000	737.000000	8.270000e+02
days.with.cr.line	2820.000000	4139.958333	5730.000000	1.763996e+04
revol.bal	3187.000000	8596.000000	18249.500000	1.207359e+06
revol.util	22.600000	46.300000	70.900000	1.190000e+02
inq.last.6mths	0.000000	1.000000	2.000000	3.300000e+01
delinq.2yrs	0.000000	0.000000	0.000000	1.300000e+01
pub.rec	0.000000	0.000000	0.000000	5.000000e+00
not.fully.paid	0.000000	0.000000	0.000000	1.000000e+00

```
[5]: df['not.fully.paid'].isnull().mean()
```

```
[5]: 0.0
```

```
[6]: df1=pd.get_dummies(df, columns=['purpose'])
```

```
[7]: df1['log.annual.inc'] = np.exp(df1['log.annual.inc'])
```

```
[8]: df1.head()
```

```
[8]:
```

	credit.policy	int.rate	installment	log.annual.inc	dti	fico	\
0	1	0.1189	829.10	85000.000385	19.48	737	
1	1	0.1071	228.22	65000.000073	14.29	707	
2	1	0.1357	366.86	31999.999943	11.63	682	
3	1	0.1008	162.34	85000.000385	8.10	712	
4	1	0.1426	102.92	80799.999636	14.97	667	

	days.with.cr.line	revol.bal	revol.util	inq.last.6mths	delinq.2yrs	\
0	5639.958333	28854	52.1	0	0	
1	2760.000000	33623	76.7	0	0	
2	4710.000000	3511	25.6	1	0	
3	2699.958333	33667	73.2	1	0	
4	4066.000000	4740	39.5	0	1	

	pub.rec	not.fully.paid	purpose_all_other	purpose_credit_card	\
0	0	0	0	0	
1	0	0	0	1	
2	0	0	0	0	
3	0	0	0	0	
4	0	0	0	1	

	purpose_debt_consolidation	purpose_educational	purpose_home_improvement	\
0	1	0	0	
1	0	0	0	
2	1	0	0	

3	1	0	0
4	0	0	0

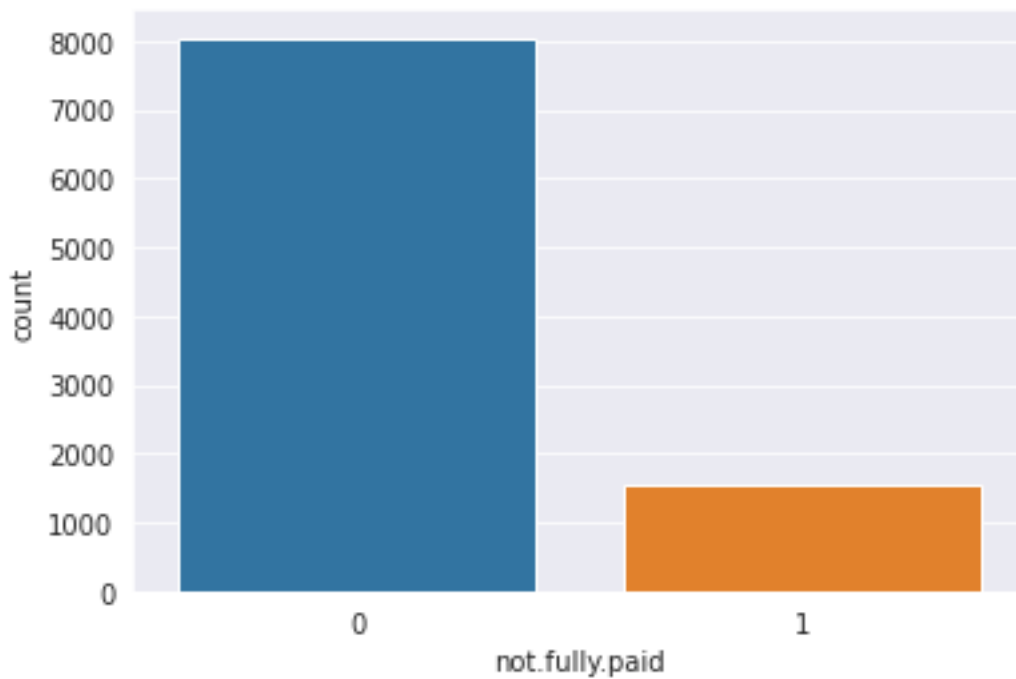
	purpose_major_purchase	purpose_small_business
0	0	0
1	0	0
2	0	0
3	0	0
4	0	0

```
[9]: df.groupby('not.fully.paid')['not.fully.paid'].count()/len(df)
```

```
[9]: not.fully.paid
0    0.839946
1    0.160054
Name: not.fully.paid, dtype: float64
```

```
[10]: sns.set_style('darkgrid')
sns.countplot(x='not.fully.paid', data=df)
```

```
[10]: <AxesSubplot:xlabel='not.fully.paid', ylabel='count'>
```



```
[11]: count_class_0, count_class_1 = df['not.fully.paid'].value_counts()
```

```
[12]: df_0 = df[df['not.fully.paid'] == 0]
      df_1 = df[df['not.fully.paid'] == 1]
```

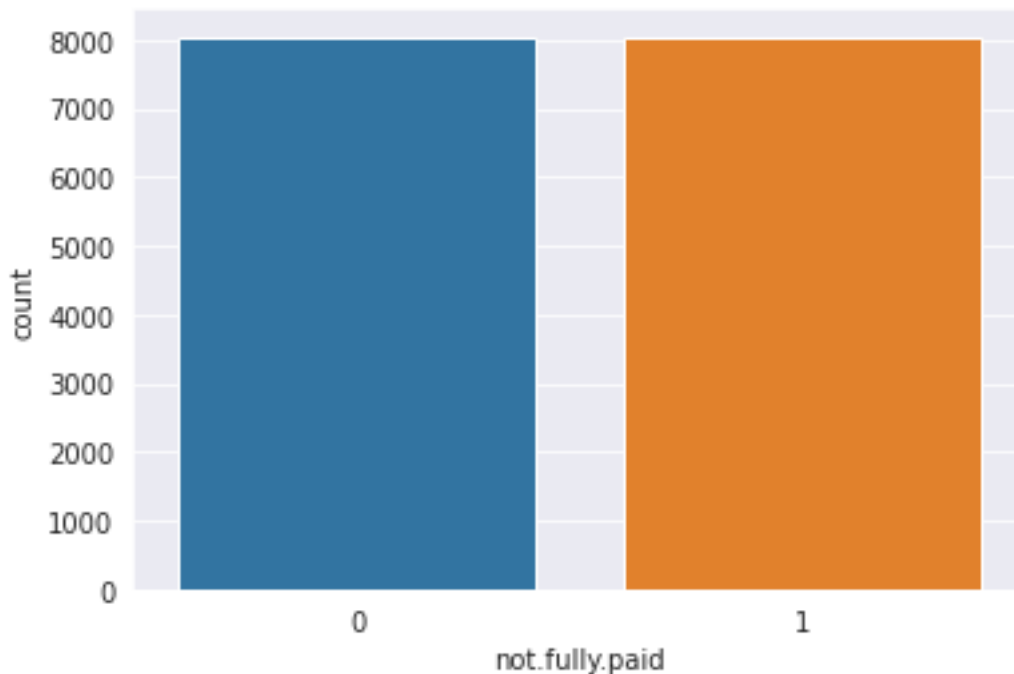
```
[13]: df_1_over = df_1.sample(count_class_0, replace=True)
      df_test_over = pd.concat([df_0, df_1_over], axis=0)
```

```
[14]: print('Random over-sampling:')
      print(df_test_over['not.fully.paid'].value_counts())
```

```
Random over-sampling:
1      8045
0      8045
Name: not.fully.paid, dtype: int64
```

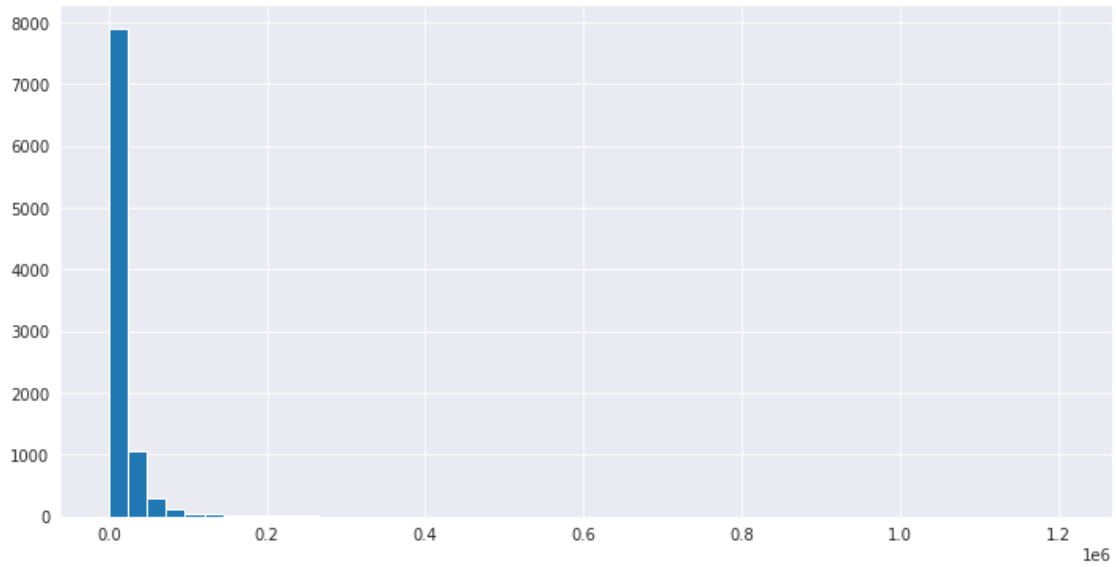
```
[15]: sns.set_style('darkgrid')
      sns.countplot(x='not.fully.paid', data=df_test_over)
```

```
[15]: <AxesSubplot:xlabel='not.fully.paid', ylabel='count'>
```



```
[16]: df['revol.bal'].hist(figsize=[12,6], bins=50)
```

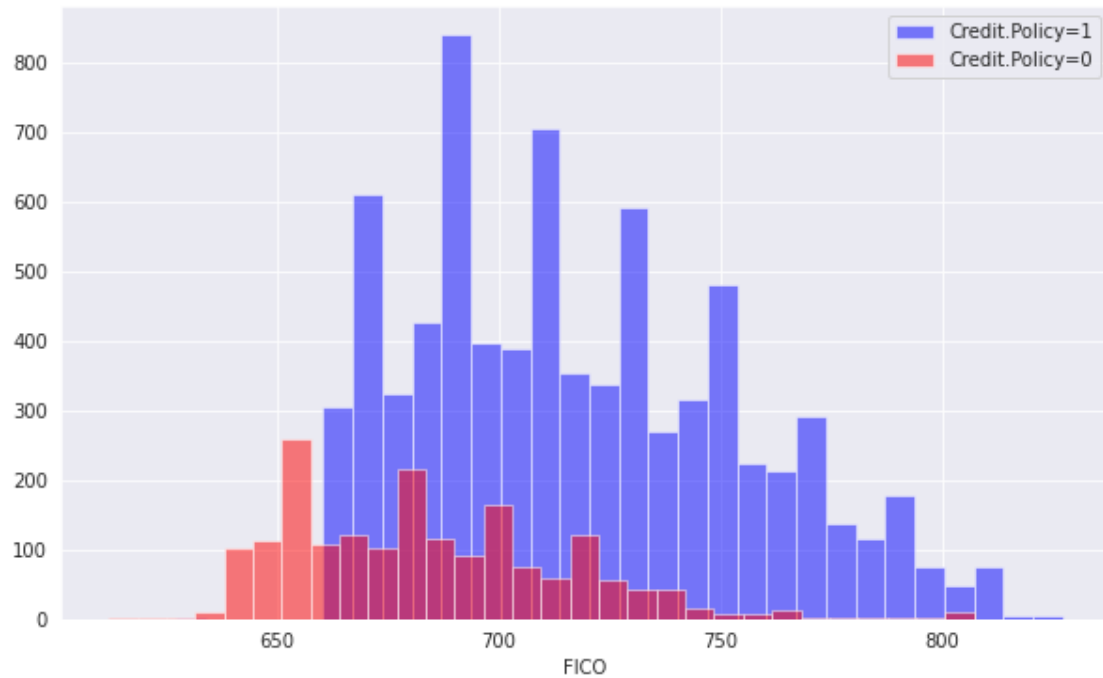
```
[16]: <AxesSubplot:>
```



```
[17]: df1=pd.get_dummies(df, columns=['purpose'])
```

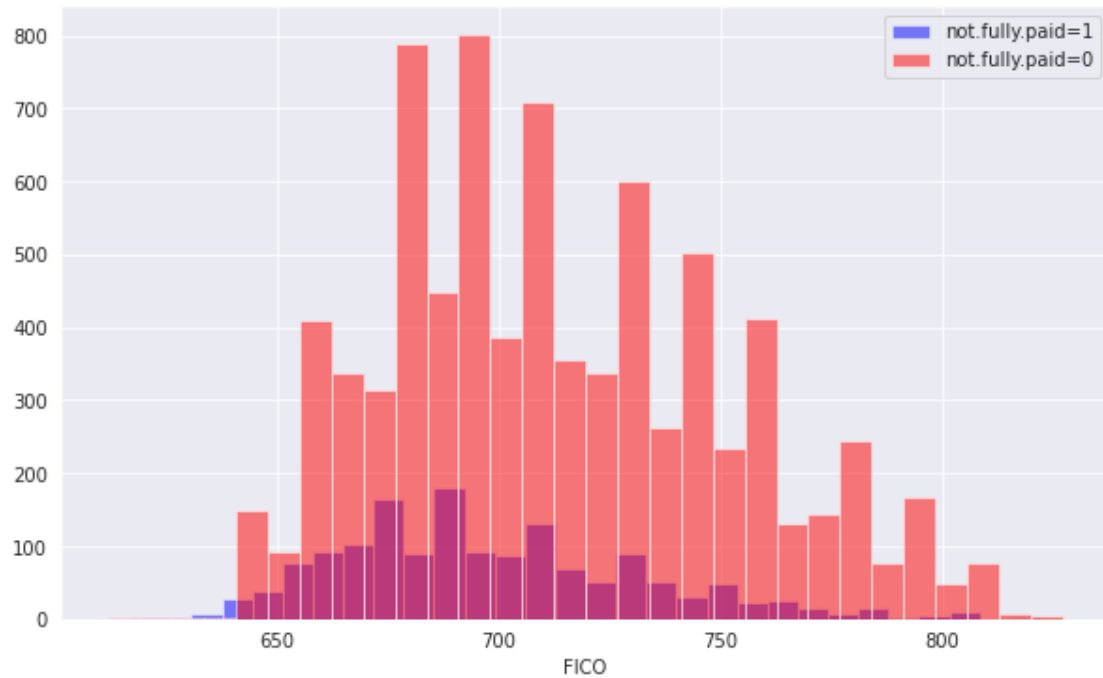
```
[18]: plt.figure(figsize=(10,6))
df[df['credit.policy']==1]['fico'].hist(alpha=0.
    ↳5,color='blue',bins=30,label='Credit.Policy=1')
df[df['credit.policy']==0]['fico'].hist(alpha=0.
    ↳5,color='red',bins=30,label='Credit.Policy=0')
plt.legend()
plt.xlabel('FICO')
```

```
[18]: Text(0.5, 0, 'FICO')
```



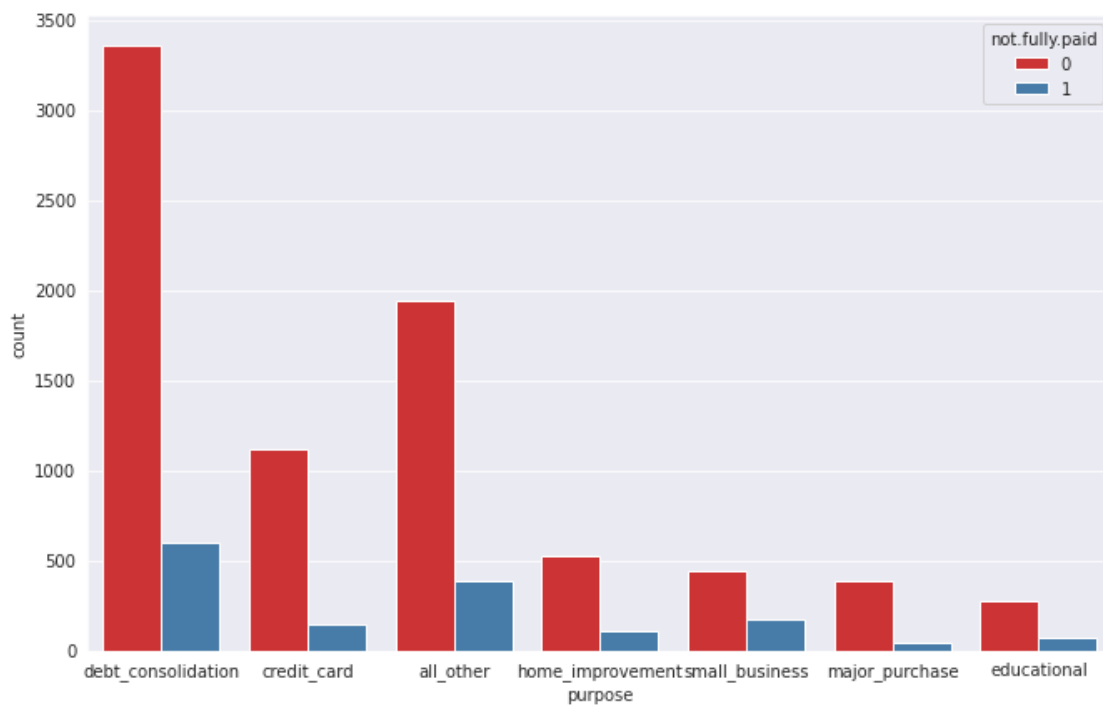
```
[19]: plt.figure(figsize=(10,6))
df[df['not.fully.paid']==1]['fico'].hist(alpha=0.5,color='blue',
                                          bins=30,label='not.fully.paid=1')
df[df['not.fully.paid']==0]['fico'].hist(alpha=0.5,color='red',
                                          bins=30,label='not.fully.paid=0')
plt.legend()
plt.xlabel('FICO')
```

```
[19]: Text(0.5, 0, 'FICO')
```



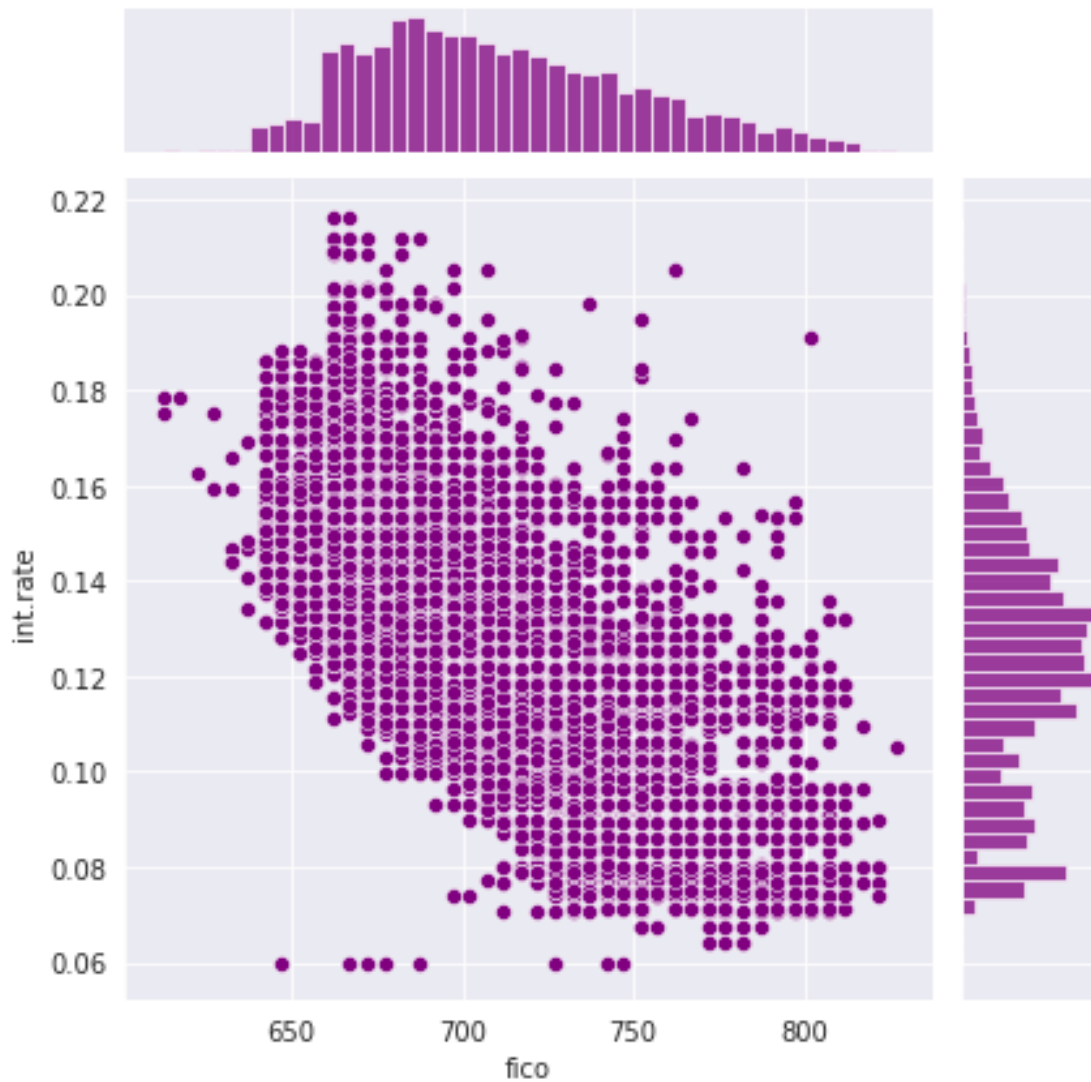
```
[20]: plt.figure(figsize=(11,7))
      sns.countplot(x='purpose',hue='not.fully.paid',data=df,palette='Set1')
```

```
[20]: <AxesSubplot:xlabel='purpose', ylabel='count'>
```




```
[21]: sns.jointplot(x='fico',y='int.rate',data=df,color='purple')
```

```
[21]: <seaborn.axisgrid.JointGrid at 0x7f8ad7141510>
```



```
[22]: plt.figure(figsize=(11,7))
sns.lmplot(y='int.rate',x='fico',data=df,hue='credit.policy',
          col='not.fully.paid',palette='Set1')
```

```
[22]: <seaborn.axisgrid.FacetGrid at 0x7f8ad71a9090>
```

<Figure size 792x504 with 0 Axes>



```
[23]: cat_feats = ['purpose']
```

```
[24]: final_data = pd.get_dummies(df_test_over, columns=cat_feats, drop_first=True)
```

```
[25]: final_data.info()
final_data.head()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 16090 entries, 0 to 4315
Data columns (total 19 columns):
#   Column                                Non-Null Count  Dtype
---  -
0   credit.policy                         16090 non-null  int64
1   int.rate                             16090 non-null  float64
2   installment                           16090 non-null  float64
3   log.annual.inc                       16090 non-null  float64
4   dti                                   16090 non-null  float64
5   fico                                 16090 non-null  int64
6   days.with.cr.line                    16090 non-null  float64
7   revol.bal                            16090 non-null  int64
8   revol.util                           16090 non-null  float64
9   inq.last.6mths                       16090 non-null  int64
10  delinq.2yrs                          16090 non-null  int64
11  pub.rec                              16090 non-null  int64
12  not.fully.paid                       16090 non-null  int64
13  purpose_credit_card                  16090 non-null  uint8
14  purpose_debt_consolidation           16090 non-null  uint8
15  purpose_educational                  16090 non-null  uint8
16  purpose_home_improvement             16090 non-null  uint8
```

```

17  purpose_major_purchase      16090 non-null  uint8
18  purpose_small_business      16090 non-null  uint8
dtypes: float64(6), int64(7), uint8(6)
memory usage: 2.1 MB

```

```

[25]:  credit.policy  int.rate  installment  log.annual.inc  dti  fico  \
0          1      0.1189      829.10      11.350407  19.48  737
1          1      0.1071      228.22      11.082143  14.29  707
2          1      0.1357      366.86      10.373491  11.63  682
3          1      0.1008      162.34      11.350407   8.10  712
4          1      0.1426      102.92      11.299732  14.97  667

      days.with.cr.line  revol.bal  revol.util  inq.last.6mths  delinq.2yrs  \
0      5639.958333      28854      52.1          0          0
1      2760.000000      33623      76.7          0          0
2      4710.000000       3511      25.6          1          0
3      2699.958333      33667      73.2          1          0
4      4066.000000       4740      39.5          0          1

      pub.rec  not.fully.paid  purpose_credit_card  purpose_debt_consolidation  \
0          0          0          0          1
1          0          0          1          0
2          0          0          0          1
3          0          0          0          1
4          0          0          1          0

      purpose_educational  purpose_home_improvement  purpose_major_purchase  \
0          0          0          0
1          0          0          0
2          0          0          0
3          0          0          0
4          0          0          0

      purpose_small_business
0          0
1          0
2          0
3          0
4          0

```

```
[26]: final_data.corr()
```

```

[26]:          credit.policy  int.rate  installment  \
credit.policy          1.000000 -0.295544    0.057990
int.rate             -0.295544  1.000000    0.277545
installment           0.057990  0.277545    1.000000
log.annual.inc        0.018070  0.087808    0.476910

```

dti	-0.098428	0.212383	0.030655
fico	0.369263	-0.680088	0.113450
days.with.cr.line	0.092276	-0.107113	0.185601
revol.bal	-0.197823	0.094883	0.263186
revol.util	-0.104210	0.420691	0.049696
inq.last.6mths	-0.541699	0.184805	-0.008781
delinq.2yrs	-0.062710	0.147858	-0.002103
pub.rec	-0.062137	0.103555	-0.030278
not.fully.paid	-0.193359	0.216616	0.074420
purpose_credit_card	0.017078	-0.038440	-0.000241
purpose_debt_consolidation	0.016658	0.085005	0.112162
purpose_educational	-0.033701	-0.024312	-0.099523
purpose_home_improvement	-0.016037	-0.046381	0.045572
purpose_major_purchase	0.034915	-0.056611	-0.049599
purpose_small_business	-0.005971	0.177825	0.187920

	log.annual.inc	dti	fico \
credit.policy	0.018070	-0.098428	0.369263
int.rate	0.087808	0.212383	-0.680088
installment	0.476910	0.030655	0.113450
log.annual.inc	1.000000	-0.026076	0.106830
dti	-0.026076	1.000000	-0.228387
fico	0.106830	-0.228387	1.000000
days.with.cr.line	0.352173	0.091460	0.266222
revol.bal	0.417839	0.209042	0.004232
revol.util	0.077213	0.328635	-0.506991
inq.last.6mths	0.043729	0.032594	-0.184167
delinq.2yrs	0.019707	-0.024707	-0.209333
pub.rec	0.018162	0.015360	-0.161569
not.fully.paid	-0.045483	0.058822	-0.206154
purpose_credit_card	0.076743	0.071149	-0.013839
purpose_debt_consolidation	-0.029469	0.180770	-0.143780
purpose_educational	-0.116793	-0.029354	-0.016698
purpose_home_improvement	0.111364	-0.099662	0.104293
purpose_major_purchase	-0.025610	-0.078275	0.059528
purpose_small_business	0.119848	-0.050460	0.070910

	days.with.cr.line	revol.bal	revol.util \
credit.policy	0.092276	-0.197823	-0.104210
int.rate	-0.107113	0.094883	0.420691
installment	0.185601	0.263186	0.049696
log.annual.inc	0.352173	0.417839	0.077213
dti	0.091460	0.209042	0.328635
fico	0.266222	0.004232	-0.506991
days.with.cr.line	1.000000	0.280120	0.002073
revol.bal	0.280120	1.000000	0.199707
revol.util	0.002073	0.199707	1.000000

inq.last.6mths	-0.012952	0.030217	-0.020935
delinq.2yrs	0.073314	-0.036001	-0.046918
pub.rec	0.059873	-0.045501	0.077446
not.fully.paid	-0.031152	0.056515	0.106418
purpose_credit_card	0.049745	0.064350	0.083252
purpose_debt_consolidation	-0.004957	0.002944	0.200376
purpose_educational	-0.051422	-0.036032	-0.062894
purpose_home_improvement	0.073477	-0.004193	-0.115662
purpose_major_purchase	-0.027389	-0.062365	-0.107918
purpose_small_business	0.056410	0.105354	-0.059585

	inq.last.6mths	delinq.2yrs	pub.rec	\
credit.policy	-0.541699	-0.062710	-0.062137	
int.rate	0.184805	0.147858	0.103555	
installment	-0.008781	-0.002103	-0.030278	
log.annual.inc	0.043729	0.019707	0.018162	
dti	0.032594	-0.024707	0.015360	
fico	-0.184167	-0.209333	-0.161569	
days.with.cr.line	-0.012952	0.073314	0.059873	
revol.bal	0.030217	-0.036001	-0.045501	
revol.util	-0.020935	-0.046918	0.077446	
inq.last.6mths	1.000000	0.000119	0.098895	
delinq.2yrs	0.000119	1.000000	-0.015529	
pub.rec	0.098895	-0.015529	1.000000	
not.fully.paid	0.174378	0.014165	0.067446	
purpose_credit_card	-0.041840	0.000188	0.033698	
purpose_debt_consolidation	-0.043960	-0.022602	0.043853	
purpose_educational	0.032035	0.001540	-0.017902	
purpose_home_improvement	0.072453	-0.009752	0.006401	
purpose_major_purchase	-0.009353	0.008836	-0.024673	
purpose_small_business	0.031996	0.028123	-0.011371	

	not.fully.paid	purpose_credit_card	\
credit.policy	-0.193359	0.017078	
int.rate	0.216616	-0.038440	
installment	0.074420	-0.000241	
log.annual.inc	-0.045483	0.076743	
dti	0.058822	0.071149	
fico	-0.206154	-0.013839	
days.with.cr.line	-0.031152	0.049745	
revol.bal	0.056515	0.064350	
revol.util	0.106418	0.083252	
inq.last.6mths	0.174378	-0.041840	
delinq.2yrs	0.014165	0.000188	
pub.rec	0.067446	0.033698	
not.fully.paid	1.000000	-0.077409	
purpose_credit_card	-0.077409	1.000000	

purpose_debt_consolidation	-0.015294	-0.298801
purpose_educational	0.031320	-0.073461
purpose_home_improvement	0.013791	-0.097222
purpose_major_purchase	-0.047138	-0.072389
purpose_small_business	0.095318	-0.107025

	purpose_debt_consolidation	purpose_educational \
credit.policy	0.016658	-0.033701
int.rate	0.085005	-0.024312
installment	0.112162	-0.099523
log.annual.inc	-0.029469	-0.116793
dti	0.180770	-0.029354
fico	-0.143780	-0.016698
days.with.cr.line	-0.004957	-0.051422
revol.bal	0.002944	-0.036032
revol.util	0.200376	-0.062894
inq.last.6mths	-0.043960	0.032035
delinq.2yrs	-0.022602	0.001540
pub.rec	0.043853	-0.017902
not.fully.paid	-0.015294	0.031320
purpose_credit_card	-0.298801	-0.073461
purpose_debt_consolidation	1.000000	-0.170412
purpose_educational	-0.170412	1.000000
purpose_home_improvement	-0.225532	-0.055447
purpose_major_purchase	-0.167927	-0.041285
purpose_small_business	-0.248275	-0.061039

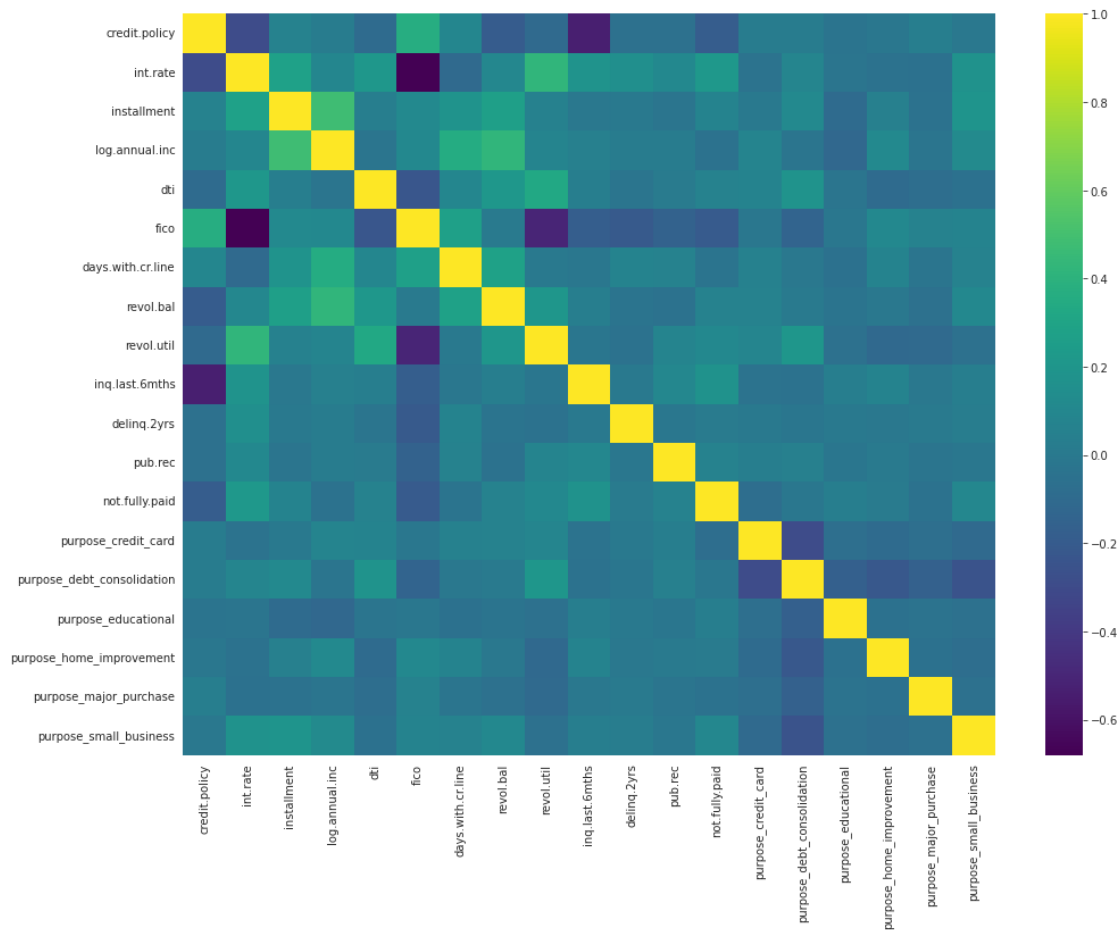
	purpose_home_improvement	purpose_major_purchase \
credit.policy	-0.016037	0.034915
int.rate	-0.046381	-0.056611
installment	0.045572	-0.049599
log.annual.inc	0.111364	-0.025610
dti	-0.099662	-0.078275
fico	0.104293	0.059528
days.with.cr.line	0.073477	-0.027389
revol.bal	-0.004193	-0.062365
revol.util	-0.115662	-0.107918
inq.last.6mths	0.072453	-0.009353
delinq.2yrs	-0.009752	0.008836
pub.rec	0.006401	-0.024673
not.fully.paid	0.013791	-0.047138
purpose_credit_card	-0.097222	-0.072389
purpose_debt_consolidation	-0.225532	-0.167927
purpose_educational	-0.055447	-0.041285
purpose_home_improvement	1.000000	-0.054639
purpose_major_purchase	-0.054639	1.000000
purpose_small_business	-0.080782	-0.060149

	purpose_small_business
credit.policy	-0.005971
int.rate	0.177825
installment	0.187920
log.annual.inc	0.119848
dti	-0.050460
fico	0.070910
days.with.cr.line	0.056410
revol.bal	0.105354
revol.util	-0.059585
inq.last.6mths	0.031996
delinq.2yrs	0.028123
pub.rec	-0.011371
not.fully.paid	0.095318
purpose_credit_card	-0.107025
purpose_debt_consolidation	-0.248275
purpose_educational	-0.061039
purpose_home_improvement	-0.080782
purpose_major_purchase	-0.060149
purpose_small_business	1.000000

```
[27]: plt.figure(
        figsize=[16,12]
    )

    sns.heatmap(
        data=final_data.corr(),
        cmap='viridis',
        annot=False,
        fmt='.2g'
    )
```

[27]: <AxesSubplot:>



```
[28]: to_drop2 = ['revol.bal', 'days.with.cr.line', 'installment', 'revol.bal']

final_data.drop(to_drop2, axis=1, inplace=True)
```

```
[29]: final_data.isnull().mean()
```

```
[29]: credit.policy      0.0
      int.rate          0.0
      log.annual.inc    0.0
      dti              0.0
      fico             0.0
      revol.util       0.0
      inq.last.6mths    0.0
      delinq.2yrs       0.0
      pub.rec          0.0
      not.fully.paid    0.0
      purpose_credit_card 0.0
      purpose_debt_consolidation 0.0
      purpose_educational 0.0
      purpose_home_improvement 0.0
      purpose_major_purchase 0.0
      purpose_small_business 0.0
```



```
purpose_educational      0.0
purpose_home_improvement  0.0
purpose_major_purchase    0.0
purpose_small_business     0.0
dtype: float64
```

```
[30]: to_train = final_data[final_data['not.fully.paid'].isin([0,1])]
      to_pred = final_data[final_data['not.fully.paid'] == 2]
```

```
[31]: X = to_train.drop('not.fully.paid', axis=1).values
      y = to_train['not.fully.paid'].values

      X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3,
      ↪random_state = 101)
```

```
[32]: scaler = MinMaxScaler()
      X_train = scaler.fit_transform(X_train)
      X_test = scaler.transform(X_test)
```

```
[33]: X_train.shape
```

```
[33]: (11263, 15)
```

```
[34]: model = Sequential()

      model.add(
          Dense(94, activation='relu')
      )

      model.add(
          Dense(30, activation='relu')
      )

      model.add(
          Dense(15, activation='relu')
      )

      model.add(
          Dense(1, activation='sigmoid')
      )

      model.compile(
          optimizer='adam',
          loss='binary_crossentropy',
          metrics=['accuracy']
      )
```

```
[35]: early_stop = EarlyStopping(
        monitor='val_loss',
        mode='min',
        verbose=1,
        patience=25
    )

    model.fit(
        X_train,
        y_train,
        epochs=200,
        batch_size=256,
        validation_data=(X_test, y_test),
        callbacks=[early_stop]
    )
```

Epoch 1/200

44/44 [=====] - 1s 6ms/step - loss: 0.6779 - accuracy: 0.5738 - val_loss: 0.6646 - val_accuracy: 0.5995

Epoch 2/200

44/44 [=====] - 0s 2ms/step - loss: 0.6543 - accuracy: 0.6137 - val_loss: 0.6524 - val_accuracy: 0.6126

Epoch 3/200

44/44 [=====] - 0s 2ms/step - loss: 0.6457 - accuracy: 0.6186 - val_loss: 0.6497 - val_accuracy: 0.6172

Epoch 4/200

44/44 [=====] - 0s 2ms/step - loss: 0.6433 - accuracy: 0.6228 - val_loss: 0.6471 - val_accuracy: 0.6248

Epoch 5/200

44/44 [=====] - 0s 2ms/step - loss: 0.6412 - accuracy: 0.6226 - val_loss: 0.6466 - val_accuracy: 0.6190

Epoch 6/200

44/44 [=====] - 0s 2ms/step - loss: 0.6392 - accuracy: 0.6304 - val_loss: 0.6447 - val_accuracy: 0.6273

Epoch 7/200

44/44 [=====] - 0s 2ms/step - loss: 0.6375 - accuracy: 0.6322 - val_loss: 0.6439 - val_accuracy: 0.6279

Epoch 8/200

44/44 [=====] - 0s 2ms/step - loss: 0.6355 - accuracy: 0.6332 - val_loss: 0.6440 - val_accuracy: 0.6279

Epoch 9/200

44/44 [=====] - 0s 2ms/step - loss: 0.6353 - accuracy: 0.6328 - val_loss: 0.6428 - val_accuracy: 0.6288

Epoch 10/200

44/44 [=====] - 0s 2ms/step - loss: 0.6336 - accuracy: 0.6342 - val_loss: 0.6428 - val_accuracy: 0.6283

Epoch 11/200

44/44 [=====] - 0s 2ms/step - loss: 0.6335 - accuracy: 0.6360 - val_loss: 0.6436 - val_accuracy: 0.6161
Epoch 12/200
44/44 [=====] - 0s 2ms/step - loss: 0.6321 - accuracy: 0.6355 - val_loss: 0.6429 - val_accuracy: 0.6259
Epoch 13/200
44/44 [=====] - 0s 2ms/step - loss: 0.6316 - accuracy: 0.6394 - val_loss: 0.6419 - val_accuracy: 0.6194
Epoch 14/200
44/44 [=====] - 0s 2ms/step - loss: 0.6301 - accuracy: 0.6379 - val_loss: 0.6399 - val_accuracy: 0.6292
Epoch 15/200
44/44 [=====] - 0s 2ms/step - loss: 0.6293 - accuracy: 0.6378 - val_loss: 0.6415 - val_accuracy: 0.6254
Epoch 16/200
44/44 [=====] - 0s 2ms/step - loss: 0.6285 - accuracy: 0.6371 - val_loss: 0.6474 - val_accuracy: 0.6161
Epoch 17/200
44/44 [=====] - 0s 2ms/step - loss: 0.6285 - accuracy: 0.6401 - val_loss: 0.6384 - val_accuracy: 0.6300
Epoch 18/200
44/44 [=====] - 0s 2ms/step - loss: 0.6270 - accuracy: 0.6377 - val_loss: 0.6424 - val_accuracy: 0.6238
Epoch 19/200
44/44 [=====] - 0s 2ms/step - loss: 0.6257 - accuracy: 0.6386 - val_loss: 0.6372 - val_accuracy: 0.6292
Epoch 20/200
44/44 [=====] - 0s 3ms/step - loss: 0.6249 - accuracy: 0.6420 - val_loss: 0.6384 - val_accuracy: 0.6240
Epoch 21/200
44/44 [=====] - 0s 3ms/step - loss: 0.6233 - accuracy: 0.6447 - val_loss: 0.6367 - val_accuracy: 0.6331
Epoch 22/200
44/44 [=====] - 0s 2ms/step - loss: 0.6222 - accuracy: 0.6418 - val_loss: 0.6362 - val_accuracy: 0.6321
Epoch 23/200
44/44 [=====] - 0s 2ms/step - loss: 0.6214 - accuracy: 0.6452 - val_loss: 0.6367 - val_accuracy: 0.6259
Epoch 24/200
44/44 [=====] - 0s 2ms/step - loss: 0.6200 - accuracy: 0.6421 - val_loss: 0.6356 - val_accuracy: 0.6341
Epoch 25/200
44/44 [=====] - 0s 2ms/step - loss: 0.6205 - accuracy: 0.6443 - val_loss: 0.6337 - val_accuracy: 0.6383
Epoch 26/200
44/44 [=====] - 0s 2ms/step - loss: 0.6181 - accuracy: 0.6481 - val_loss: 0.6334 - val_accuracy: 0.6368
Epoch 27/200

44/44 [=====] - 0s 2ms/step - loss: 0.6186 - accuracy:
0.6474 - val_loss: 0.6360 - val_accuracy: 0.6333
Epoch 28/200
44/44 [=====] - 0s 2ms/step - loss: 0.6163 - accuracy:
0.6483 - val_loss: 0.6321 - val_accuracy: 0.6352
Epoch 29/200
44/44 [=====] - 0s 2ms/step - loss: 0.6150 - accuracy:
0.6471 - val_loss: 0.6320 - val_accuracy: 0.6412
Epoch 30/200
44/44 [=====] - 0s 2ms/step - loss: 0.6139 - accuracy:
0.6473 - val_loss: 0.6306 - val_accuracy: 0.6379
Epoch 31/200
44/44 [=====] - 0s 2ms/step - loss: 0.6129 - accuracy:
0.6496 - val_loss: 0.6299 - val_accuracy: 0.6389
Epoch 32/200
44/44 [=====] - 0s 2ms/step - loss: 0.6117 - accuracy:
0.6493 - val_loss: 0.6315 - val_accuracy: 0.6354
Epoch 33/200
44/44 [=====] - 0s 2ms/step - loss: 0.6101 - accuracy:
0.6545 - val_loss: 0.6338 - val_accuracy: 0.6325
Epoch 34/200
44/44 [=====] - 0s 2ms/step - loss: 0.6110 - accuracy:
0.6490 - val_loss: 0.6287 - val_accuracy: 0.6350
Epoch 35/200
44/44 [=====] - 0s 2ms/step - loss: 0.6104 - accuracy:
0.6520 - val_loss: 0.6312 - val_accuracy: 0.6358
Epoch 36/200
44/44 [=====] - 0s 2ms/step - loss: 0.6081 - accuracy:
0.6559 - val_loss: 0.6319 - val_accuracy: 0.6339
Epoch 37/200
44/44 [=====] - 0s 2ms/step - loss: 0.6049 - accuracy:
0.6577 - val_loss: 0.6269 - val_accuracy: 0.6377
Epoch 38/200
44/44 [=====] - 0s 2ms/step - loss: 0.6044 - accuracy:
0.6568 - val_loss: 0.6264 - val_accuracy: 0.6428
Epoch 39/200
44/44 [=====] - 0s 2ms/step - loss: 0.6038 - accuracy:
0.6595 - val_loss: 0.6290 - val_accuracy: 0.6391
Epoch 40/200
44/44 [=====] - 0s 2ms/step - loss: 0.6039 - accuracy:
0.6558 - val_loss: 0.6261 - val_accuracy: 0.6356
Epoch 41/200
44/44 [=====] - 0s 2ms/step - loss: 0.6008 - accuracy:
0.6586 - val_loss: 0.6277 - val_accuracy: 0.6383
Epoch 42/200
44/44 [=====] - 0s 2ms/step - loss: 0.5996 - accuracy:
0.6596 - val_loss: 0.6249 - val_accuracy: 0.6408
Epoch 43/200

44/44 [=====] - 0s 2ms/step - loss: 0.5985 - accuracy:
0.6608 - val_loss: 0.6244 - val_accuracy: 0.6443
Epoch 44/200
44/44 [=====] - 0s 2ms/step - loss: 0.5980 - accuracy:
0.6617 - val_loss: 0.6244 - val_accuracy: 0.6426
Epoch 45/200
44/44 [=====] - 0s 2ms/step - loss: 0.5969 - accuracy:
0.6629 - val_loss: 0.6232 - val_accuracy: 0.6443
Epoch 46/200
44/44 [=====] - 0s 2ms/step - loss: 0.5938 - accuracy:
0.6653 - val_loss: 0.6264 - val_accuracy: 0.6408
Epoch 47/200
44/44 [=====] - 0s 2ms/step - loss: 0.5945 - accuracy:
0.6637 - val_loss: 0.6218 - val_accuracy: 0.6509
Epoch 48/200
44/44 [=====] - 0s 2ms/step - loss: 0.5938 - accuracy:
0.6672 - val_loss: 0.6252 - val_accuracy: 0.6433
Epoch 49/200
44/44 [=====] - 0s 2ms/step - loss: 0.5903 - accuracy:
0.6702 - val_loss: 0.6205 - val_accuracy: 0.6505
Epoch 50/200
44/44 [=====] - 0s 2ms/step - loss: 0.5905 - accuracy:
0.6679 - val_loss: 0.6214 - val_accuracy: 0.6493
Epoch 51/200
44/44 [=====] - 0s 2ms/step - loss: 0.5898 - accuracy:
0.6683 - val_loss: 0.6280 - val_accuracy: 0.6433
Epoch 52/200
44/44 [=====] - 0s 2ms/step - loss: 0.5914 - accuracy:
0.6647 - val_loss: 0.6256 - val_accuracy: 0.6379
Epoch 53/200
44/44 [=====] - 0s 2ms/step - loss: 0.5872 - accuracy:
0.6648 - val_loss: 0.6229 - val_accuracy: 0.6428
Epoch 54/200
44/44 [=====] - 0s 2ms/step - loss: 0.5852 - accuracy:
0.6722 - val_loss: 0.6204 - val_accuracy: 0.6544
Epoch 55/200
44/44 [=====] - 0s 2ms/step - loss: 0.5843 - accuracy:
0.6719 - val_loss: 0.6221 - val_accuracy: 0.6466
Epoch 56/200
44/44 [=====] - 0s 2ms/step - loss: 0.5833 - accuracy:
0.6766 - val_loss: 0.6191 - val_accuracy: 0.6515
Epoch 57/200
44/44 [=====] - 0s 2ms/step - loss: 0.5821 - accuracy:
0.6763 - val_loss: 0.6176 - val_accuracy: 0.6576
Epoch 58/200
44/44 [=====] - 0s 2ms/step - loss: 0.5812 - accuracy:
0.6771 - val_loss: 0.6187 - val_accuracy: 0.6515
Epoch 59/200

44/44 [=====] - 0s 2ms/step - loss: 0.5799 - accuracy:
0.6767 - val_loss: 0.6154 - val_accuracy: 0.6598
Epoch 60/200
44/44 [=====] - 0s 2ms/step - loss: 0.5782 - accuracy:
0.6790 - val_loss: 0.6174 - val_accuracy: 0.6592
Epoch 61/200
44/44 [=====] - 0s 2ms/step - loss: 0.5757 - accuracy:
0.6818 - val_loss: 0.6225 - val_accuracy: 0.6571
Epoch 62/200
44/44 [=====] - 0s 2ms/step - loss: 0.5761 - accuracy:
0.6816 - val_loss: 0.6199 - val_accuracy: 0.6472
Epoch 63/200
44/44 [=====] - 0s 2ms/step - loss: 0.5762 - accuracy:
0.6789 - val_loss: 0.6152 - val_accuracy: 0.6625
Epoch 64/200
44/44 [=====] - 0s 2ms/step - loss: 0.5717 - accuracy:
0.6861 - val_loss: 0.6164 - val_accuracy: 0.6530
Epoch 65/200
44/44 [=====] - 0s 2ms/step - loss: 0.5726 - accuracy:
0.6829 - val_loss: 0.6213 - val_accuracy: 0.6499
Epoch 66/200
44/44 [=====] - 0s 2ms/step - loss: 0.5731 - accuracy:
0.6817 - val_loss: 0.6207 - val_accuracy: 0.6540
Epoch 67/200
44/44 [=====] - 0s 2ms/step - loss: 0.5713 - accuracy:
0.6823 - val_loss: 0.6164 - val_accuracy: 0.6615
Epoch 68/200
44/44 [=====] - 0s 2ms/step - loss: 0.5698 - accuracy:
0.6885 - val_loss: 0.6162 - val_accuracy: 0.6553
Epoch 69/200
44/44 [=====] - 0s 2ms/step - loss: 0.5693 - accuracy:
0.6871 - val_loss: 0.6174 - val_accuracy: 0.6640
Epoch 70/200
44/44 [=====] - 0s 2ms/step - loss: 0.5673 - accuracy:
0.6894 - val_loss: 0.6153 - val_accuracy: 0.6656
Epoch 71/200
44/44 [=====] - 0s 2ms/step - loss: 0.5668 - accuracy:
0.6872 - val_loss: 0.6238 - val_accuracy: 0.6462
Epoch 72/200
44/44 [=====] - 0s 2ms/step - loss: 0.5666 - accuracy:
0.6846 - val_loss: 0.6135 - val_accuracy: 0.6526
Epoch 73/200
44/44 [=====] - 0s 2ms/step - loss: 0.5643 - accuracy:
0.6896 - val_loss: 0.6125 - val_accuracy: 0.6576
Epoch 74/200
44/44 [=====] - 0s 2ms/step - loss: 0.5621 - accuracy:
0.6908 - val_loss: 0.6144 - val_accuracy: 0.6725
Epoch 75/200

44/44 [=====] - 0s 2ms/step - loss: 0.5592 - accuracy:
0.6957 - val_loss: 0.6113 - val_accuracy: 0.6706
Epoch 76/200
44/44 [=====] - 0s 2ms/step - loss: 0.5596 - accuracy:
0.6935 - val_loss: 0.6082 - val_accuracy: 0.6696
Epoch 77/200
44/44 [=====] - 0s 2ms/step - loss: 0.5572 - accuracy:
0.6984 - val_loss: 0.6134 - val_accuracy: 0.6586
Epoch 78/200
44/44 [=====] - 0s 2ms/step - loss: 0.5567 - accuracy:
0.6988 - val_loss: 0.6183 - val_accuracy: 0.6484
Epoch 79/200
44/44 [=====] - 0s 2ms/step - loss: 0.5581 - accuracy:
0.6937 - val_loss: 0.6185 - val_accuracy: 0.6549
Epoch 80/200
44/44 [=====] - 0s 2ms/step - loss: 0.5545 - accuracy:
0.6940 - val_loss: 0.6097 - val_accuracy: 0.6689
Epoch 81/200
44/44 [=====] - 0s 2ms/step - loss: 0.5553 - accuracy:
0.6977 - val_loss: 0.6099 - val_accuracy: 0.6700
Epoch 82/200
44/44 [=====] - 0s 2ms/step - loss: 0.5565 - accuracy:
0.6938 - val_loss: 0.6279 - val_accuracy: 0.6594
Epoch 83/200
44/44 [=====] - 0s 2ms/step - loss: 0.5549 - accuracy:
0.6960 - val_loss: 0.6166 - val_accuracy: 0.6625
Epoch 84/200
44/44 [=====] - 0s 2ms/step - loss: 0.5525 - accuracy:
0.6978 - val_loss: 0.6168 - val_accuracy: 0.6605
Epoch 85/200
44/44 [=====] - 0s 2ms/step - loss: 0.5481 - accuracy:
0.7028 - val_loss: 0.6081 - val_accuracy: 0.6698
Epoch 86/200
44/44 [=====] - 0s 2ms/step - loss: 0.5496 - accuracy:
0.7020 - val_loss: 0.6127 - val_accuracy: 0.6675
Epoch 87/200
44/44 [=====] - 0s 2ms/step - loss: 0.5479 - accuracy:
0.7035 - val_loss: 0.6094 - val_accuracy: 0.6669
Epoch 88/200
44/44 [=====] - 0s 2ms/step - loss: 0.5480 - accuracy:
0.7017 - val_loss: 0.6038 - val_accuracy: 0.6689
Epoch 89/200
44/44 [=====] - 0s 2ms/step - loss: 0.5458 - accuracy:
0.7006 - val_loss: 0.6060 - val_accuracy: 0.6716
Epoch 90/200
44/44 [=====] - 0s 2ms/step - loss: 0.5450 - accuracy:
0.7032 - val_loss: 0.6078 - val_accuracy: 0.6671
Epoch 91/200

44/44 [=====] - 0s 2ms/step - loss: 0.5446 - accuracy:
0.7021 - val_loss: 0.6062 - val_accuracy: 0.6735
Epoch 92/200
44/44 [=====] - 0s 2ms/step - loss: 0.5435 - accuracy:
0.7076 - val_loss: 0.6130 - val_accuracy: 0.6685
Epoch 93/200
44/44 [=====] - 0s 2ms/step - loss: 0.5419 - accuracy:
0.7082 - val_loss: 0.6087 - val_accuracy: 0.6611
Epoch 94/200
44/44 [=====] - 0s 2ms/step - loss: 0.5421 - accuracy:
0.7076 - val_loss: 0.6062 - val_accuracy: 0.6667
Epoch 95/200
44/44 [=====] - 0s 2ms/step - loss: 0.5396 - accuracy:
0.7102 - val_loss: 0.6020 - val_accuracy: 0.6743
Epoch 96/200
44/44 [=====] - 0s 2ms/step - loss: 0.5398 - accuracy:
0.7083 - val_loss: 0.6016 - val_accuracy: 0.6764
Epoch 97/200
44/44 [=====] - 0s 2ms/step - loss: 0.5396 - accuracy:
0.7110 - val_loss: 0.6046 - val_accuracy: 0.6787
Epoch 98/200
44/44 [=====] - 0s 2ms/step - loss: 0.5367 - accuracy:
0.7086 - val_loss: 0.6001 - val_accuracy: 0.6837
Epoch 99/200
44/44 [=====] - 0s 2ms/step - loss: 0.5351 - accuracy:
0.7132 - val_loss: 0.6090 - val_accuracy: 0.6607
Epoch 100/200
44/44 [=====] - 0s 2ms/step - loss: 0.5345 - accuracy:
0.7170 - val_loss: 0.6074 - val_accuracy: 0.6679
Epoch 101/200
44/44 [=====] - 0s 2ms/step - loss: 0.5356 - accuracy:
0.7160 - val_loss: 0.6034 - val_accuracy: 0.6716
Epoch 102/200
44/44 [=====] - 0s 2ms/step - loss: 0.5372 - accuracy:
0.7122 - val_loss: 0.5986 - val_accuracy: 0.6801
Epoch 103/200
44/44 [=====] - 0s 2ms/step - loss: 0.5371 - accuracy:
0.7106 - val_loss: 0.5986 - val_accuracy: 0.6737
Epoch 104/200
44/44 [=====] - 0s 2ms/step - loss: 0.5327 - accuracy:
0.7154 - val_loss: 0.6006 - val_accuracy: 0.6803
Epoch 105/200
44/44 [=====] - 0s 2ms/step - loss: 0.5316 - accuracy:
0.7154 - val_loss: 0.5963 - val_accuracy: 0.6845
Epoch 106/200
44/44 [=====] - 0s 2ms/step - loss: 0.5270 - accuracy:
0.7223 - val_loss: 0.6086 - val_accuracy: 0.6789
Epoch 107/200

44/44 [=====] - 0s 2ms/step - loss: 0.5281 - accuracy:
0.7195 - val_loss: 0.5976 - val_accuracy: 0.6702
Epoch 108/200
44/44 [=====] - 0s 2ms/step - loss: 0.5262 - accuracy:
0.7166 - val_loss: 0.6037 - val_accuracy: 0.6816
Epoch 109/200
44/44 [=====] - 0s 2ms/step - loss: 0.5234 - accuracy:
0.7267 - val_loss: 0.5988 - val_accuracy: 0.6841
Epoch 110/200
44/44 [=====] - 0s 2ms/step - loss: 0.5247 - accuracy:
0.7228 - val_loss: 0.6072 - val_accuracy: 0.6754
Epoch 111/200
44/44 [=====] - 0s 2ms/step - loss: 0.5253 - accuracy:
0.7225 - val_loss: 0.6165 - val_accuracy: 0.6613
Epoch 112/200
44/44 [=====] - 0s 2ms/step - loss: 0.5277 - accuracy:
0.7210 - val_loss: 0.6250 - val_accuracy: 0.6673
Epoch 113/200
44/44 [=====] - 0s 2ms/step - loss: 0.5241 - accuracy:
0.7185 - val_loss: 0.5971 - val_accuracy: 0.6818
Epoch 114/200
44/44 [=====] - 0s 2ms/step - loss: 0.5217 - accuracy:
0.7227 - val_loss: 0.5998 - val_accuracy: 0.6841
Epoch 115/200
44/44 [=====] - 0s 2ms/step - loss: 0.5195 - accuracy:
0.7235 - val_loss: 0.5958 - val_accuracy: 0.6816
Epoch 116/200
44/44 [=====] - 0s 2ms/step - loss: 0.5195 - accuracy:
0.7262 - val_loss: 0.5967 - val_accuracy: 0.6793
Epoch 117/200
44/44 [=====] - 0s 2ms/step - loss: 0.5203 - accuracy:
0.7233 - val_loss: 0.6067 - val_accuracy: 0.6739
Epoch 118/200
44/44 [=====] - 0s 2ms/step - loss: 0.5202 - accuracy:
0.7271 - val_loss: 0.6017 - val_accuracy: 0.6741
Epoch 119/200
44/44 [=====] - 0s 2ms/step - loss: 0.5184 - accuracy:
0.7285 - val_loss: 0.5954 - val_accuracy: 0.6756
Epoch 120/200
44/44 [=====] - 0s 2ms/step - loss: 0.5193 - accuracy:
0.7230 - val_loss: 0.5996 - val_accuracy: 0.6745
Epoch 121/200
44/44 [=====] - 0s 2ms/step - loss: 0.5149 - accuracy:
0.7309 - val_loss: 0.5996 - val_accuracy: 0.6743
Epoch 122/200
44/44 [=====] - 0s 2ms/step - loss: 0.5182 - accuracy:
0.7299 - val_loss: 0.5907 - val_accuracy: 0.6884
Epoch 123/200

44/44 [=====] - 0s 2ms/step - loss: 0.5160 - accuracy:
0.7284 - val_loss: 0.5935 - val_accuracy: 0.6855
Epoch 124/200
44/44 [=====] - 0s 2ms/step - loss: 0.5145 - accuracy:
0.7249 - val_loss: 0.5967 - val_accuracy: 0.6870
Epoch 125/200
44/44 [=====] - 0s 2ms/step - loss: 0.5104 - accuracy:
0.7277 - val_loss: 0.5921 - val_accuracy: 0.6899
Epoch 126/200
44/44 [=====] - 0s 2ms/step - loss: 0.5087 - accuracy:
0.7352 - val_loss: 0.5932 - val_accuracy: 0.6834
Epoch 127/200
44/44 [=====] - 0s 2ms/step - loss: 0.5091 - accuracy:
0.7356 - val_loss: 0.5987 - val_accuracy: 0.6909
Epoch 128/200
44/44 [=====] - 0s 2ms/step - loss: 0.5088 - accuracy:
0.7357 - val_loss: 0.5925 - val_accuracy: 0.6824
Epoch 129/200
44/44 [=====] - 0s 2ms/step - loss: 0.5054 - accuracy:
0.7351 - val_loss: 0.5967 - val_accuracy: 0.6847
Epoch 130/200
44/44 [=====] - 0s 2ms/step - loss: 0.5098 - accuracy:
0.7330 - val_loss: 0.5984 - val_accuracy: 0.6830
Epoch 131/200
44/44 [=====] - 0s 2ms/step - loss: 0.5081 - accuracy:
0.7325 - val_loss: 0.5924 - val_accuracy: 0.6849
Epoch 132/200
44/44 [=====] - 0s 2ms/step - loss: 0.5044 - accuracy:
0.7351 - val_loss: 0.5944 - val_accuracy: 0.6828
Epoch 133/200
44/44 [=====] - 0s 2ms/step - loss: 0.5059 - accuracy:
0.7339 - val_loss: 0.6100 - val_accuracy: 0.6764
Epoch 134/200
44/44 [=====] - 0s 2ms/step - loss: 0.5055 - accuracy:
0.7373 - val_loss: 0.5895 - val_accuracy: 0.6882
Epoch 135/200
44/44 [=====] - 0s 2ms/step - loss: 0.5065 - accuracy:
0.7352 - val_loss: 0.5910 - val_accuracy: 0.6913
Epoch 136/200
44/44 [=====] - 0s 2ms/step - loss: 0.4980 - accuracy:
0.7433 - val_loss: 0.5903 - val_accuracy: 0.6872
Epoch 137/200
44/44 [=====] - 0s 2ms/step - loss: 0.5016 - accuracy:
0.7391 - val_loss: 0.5959 - val_accuracy: 0.6903
Epoch 138/200
44/44 [=====] - 0s 2ms/step - loss: 0.4977 - accuracy:
0.7427 - val_loss: 0.5955 - val_accuracy: 0.6874
Epoch 139/200

44/44 [=====] - 0s 2ms/step - loss: 0.4999 - accuracy:
0.7374 - val_loss: 0.5933 - val_accuracy: 0.6830
Epoch 140/200
44/44 [=====] - 0s 2ms/step - loss: 0.4997 - accuracy:
0.7364 - val_loss: 0.5970 - val_accuracy: 0.6938
Epoch 141/200
44/44 [=====] - 0s 2ms/step - loss: 0.4965 - accuracy:
0.7407 - val_loss: 0.5897 - val_accuracy: 0.6882
Epoch 142/200
44/44 [=====] - 0s 2ms/step - loss: 0.5002 - accuracy:
0.7402 - val_loss: 0.5928 - val_accuracy: 0.6901
Epoch 143/200
44/44 [=====] - 0s 2ms/step - loss: 0.4963 - accuracy:
0.7429 - val_loss: 0.5949 - val_accuracy: 0.6884
Epoch 144/200
44/44 [=====] - 0s 2ms/step - loss: 0.4995 - accuracy:
0.7386 - val_loss: 0.5883 - val_accuracy: 0.6874
Epoch 145/200
44/44 [=====] - 0s 2ms/step - loss: 0.4993 - accuracy:
0.7431 - val_loss: 0.5883 - val_accuracy: 0.6907
Epoch 146/200
44/44 [=====] - 0s 2ms/step - loss: 0.4961 - accuracy:
0.7409 - val_loss: 0.6011 - val_accuracy: 0.6801
Epoch 147/200
44/44 [=====] - 0s 2ms/step - loss: 0.4935 - accuracy:
0.7434 - val_loss: 0.5900 - val_accuracy: 0.6762
Epoch 148/200
44/44 [=====] - 0s 2ms/step - loss: 0.4922 - accuracy:
0.7455 - val_loss: 0.5885 - val_accuracy: 0.6955
Epoch 149/200
44/44 [=====] - 0s 2ms/step - loss: 0.4916 - accuracy:
0.7454 - val_loss: 0.5923 - val_accuracy: 0.6905
Epoch 150/200
44/44 [=====] - 0s 2ms/step - loss: 0.4947 - accuracy:
0.7464 - val_loss: 0.5871 - val_accuracy: 0.6874
Epoch 151/200
44/44 [=====] - 0s 2ms/step - loss: 0.4959 - accuracy:
0.7420 - val_loss: 0.5877 - val_accuracy: 0.6998
Epoch 152/200
44/44 [=====] - 0s 2ms/step - loss: 0.4877 - accuracy:
0.7510 - val_loss: 0.5898 - val_accuracy: 0.6950
Epoch 153/200
44/44 [=====] - 0s 2ms/step - loss: 0.4892 - accuracy:
0.7492 - val_loss: 0.5924 - val_accuracy: 0.6990
Epoch 154/200
44/44 [=====] - 0s 2ms/step - loss: 0.4873 - accuracy:
0.7497 - val_loss: 0.5875 - val_accuracy: 0.6973
Epoch 155/200

44/44 [=====] - 0s 2ms/step - loss: 0.4874 - accuracy:
 0.7495 - val_loss: 0.5864 - val_accuracy: 0.6878
 Epoch 156/200
 44/44 [=====] - 0s 2ms/step - loss: 0.4884 - accuracy:
 0.7486 - val_loss: 0.5927 - val_accuracy: 0.6948
 Epoch 157/200
 44/44 [=====] - 0s 2ms/step - loss: 0.4884 - accuracy:
 0.7514 - val_loss: 0.5870 - val_accuracy: 0.6905
 Epoch 158/200
 44/44 [=====] - 0s 2ms/step - loss: 0.4840 - accuracy:
 0.7498 - val_loss: 0.5883 - val_accuracy: 0.6839
 Epoch 159/200
 44/44 [=====] - 0s 2ms/step - loss: 0.4839 - accuracy:
 0.7516 - val_loss: 0.5905 - val_accuracy: 0.6928
 Epoch 160/200
 44/44 [=====] - 0s 2ms/step - loss: 0.4815 - accuracy:
 0.7544 - val_loss: 0.5911 - val_accuracy: 0.6895
 Epoch 161/200
 44/44 [=====] - 0s 2ms/step - loss: 0.4868 - accuracy:
 0.7484 - val_loss: 0.5871 - val_accuracy: 0.6880
 Epoch 162/200
 44/44 [=====] - 0s 2ms/step - loss: 0.4843 - accuracy:
 0.7508 - val_loss: 0.5979 - val_accuracy: 0.6890
 Epoch 163/200
 44/44 [=====] - 0s 2ms/step - loss: 0.4830 - accuracy:
 0.7497 - val_loss: 0.6072 - val_accuracy: 0.6768
 Epoch 164/200
 44/44 [=====] - 0s 2ms/step - loss: 0.4826 - accuracy:
 0.7554 - val_loss: 0.5853 - val_accuracy: 0.6967
 Epoch 165/200
 44/44 [=====] - 0s 2ms/step - loss: 0.4823 - accuracy:
 0.7505 - val_loss: 0.5856 - val_accuracy: 0.7008
 Epoch 166/200
 44/44 [=====] - 0s 2ms/step - loss: 0.4873 - accuracy:
 0.7481 - val_loss: 0.5911 - val_accuracy: 0.6946
 Epoch 167/200
 44/44 [=====] - 0s 2ms/step - loss: 0.4780 - accuracy:
 0.7587 - val_loss: 0.5908 - val_accuracy: 0.6957
 Epoch 168/200
 44/44 [=====] - 0s 2ms/step - loss: 0.4789 - accuracy:
 0.7533 - val_loss: 0.5876 - val_accuracy: 0.7048
 Epoch 169/200
 44/44 [=====] - 0s 2ms/step - loss: 0.4805 - accuracy:
 0.7534 - val_loss: 0.5981 - val_accuracy: 0.6892
 Epoch 170/200
 44/44 [=====] - 0s 2ms/step - loss: 0.4791 - accuracy:
 0.7582 - val_loss: 0.5915 - val_accuracy: 0.6899
 Epoch 171/200

44/44 [=====] - 0s 2ms/step - loss: 0.4807 - accuracy:
0.7563 - val_loss: 0.5926 - val_accuracy: 0.6930
Epoch 172/200
44/44 [=====] - 0s 2ms/step - loss: 0.4786 - accuracy:
0.7553 - val_loss: 0.5861 - val_accuracy: 0.7054
Epoch 173/200
44/44 [=====] - 0s 2ms/step - loss: 0.4760 - accuracy:
0.7611 - val_loss: 0.5951 - val_accuracy: 0.6921
Epoch 174/200
44/44 [=====] - 0s 2ms/step - loss: 0.4862 - accuracy:
0.7487 - val_loss: 0.6039 - val_accuracy: 0.6822
Epoch 175/200
44/44 [=====] - 0s 2ms/step - loss: 0.4779 - accuracy:
0.7573 - val_loss: 0.5876 - val_accuracy: 0.6979
Epoch 176/200
44/44 [=====] - 0s 2ms/step - loss: 0.4764 - accuracy:
0.7546 - val_loss: 0.5927 - val_accuracy: 0.6870
Epoch 177/200
44/44 [=====] - 0s 2ms/step - loss: 0.4744 - accuracy:
0.7572 - val_loss: 0.5850 - val_accuracy: 0.6982
Epoch 178/200
44/44 [=====] - 0s 2ms/step - loss: 0.4703 - accuracy:
0.7642 - val_loss: 0.5878 - val_accuracy: 0.6973
Epoch 179/200
44/44 [=====] - 0s 3ms/step - loss: 0.4713 - accuracy:
0.7635 - val_loss: 0.5893 - val_accuracy: 0.6979
Epoch 180/200
44/44 [=====] - 0s 3ms/step - loss: 0.4726 - accuracy:
0.7578 - val_loss: 0.5824 - val_accuracy: 0.7058
Epoch 181/200
44/44 [=====] - 0s 2ms/step - loss: 0.4700 - accuracy:
0.7631 - val_loss: 0.5867 - val_accuracy: 0.6936
Epoch 182/200
44/44 [=====] - 0s 3ms/step - loss: 0.4704 - accuracy:
0.7621 - val_loss: 0.5854 - val_accuracy: 0.6897
Epoch 183/200
44/44 [=====] - 0s 2ms/step - loss: 0.4743 - accuracy:
0.7605 - val_loss: 0.5941 - val_accuracy: 0.6884
Epoch 184/200
44/44 [=====] - 0s 3ms/step - loss: 0.4734 - accuracy:
0.7614 - val_loss: 0.5836 - val_accuracy: 0.7044
Epoch 185/200
44/44 [=====] - 0s 2ms/step - loss: 0.4666 - accuracy:
0.7633 - val_loss: 0.5792 - val_accuracy: 0.7037
Epoch 186/200
44/44 [=====] - 0s 2ms/step - loss: 0.4680 - accuracy:
0.7637 - val_loss: 0.5935 - val_accuracy: 0.6963
Epoch 187/200

```

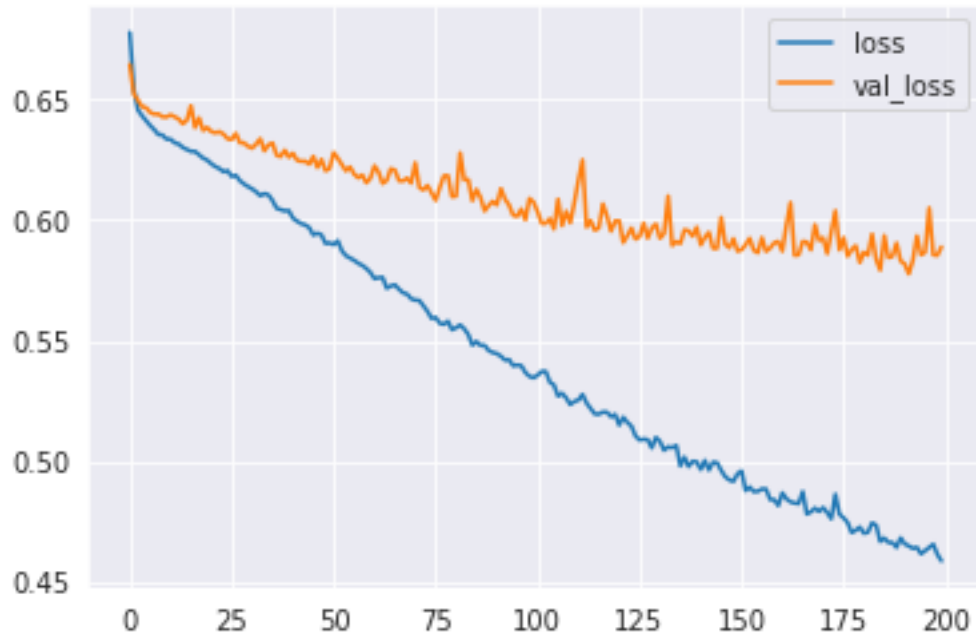
44/44 [=====] - 0s 2ms/step - loss: 0.4662 - accuracy:
0.7691 - val_loss: 0.5844 - val_accuracy: 0.7073
Epoch 188/200
44/44 [=====] - 0s 2ms/step - loss: 0.4661 - accuracy:
0.7660 - val_loss: 0.5849 - val_accuracy: 0.7013
Epoch 189/200
44/44 [=====] - 0s 2ms/step - loss: 0.4641 - accuracy:
0.7653 - val_loss: 0.5904 - val_accuracy: 0.6924
Epoch 190/200
44/44 [=====] - 0s 2ms/step - loss: 0.4681 - accuracy:
0.7654 - val_loss: 0.5830 - val_accuracy: 0.6909
Epoch 191/200
44/44 [=====] - 0s 2ms/step - loss: 0.4656 - accuracy:
0.7639 - val_loss: 0.5818 - val_accuracy: 0.7044
Epoch 192/200
44/44 [=====] - 0s 2ms/step - loss: 0.4648 - accuracy:
0.7616 - val_loss: 0.5777 - val_accuracy: 0.7052
Epoch 193/200
44/44 [=====] - 0s 2ms/step - loss: 0.4637 - accuracy:
0.7685 - val_loss: 0.5832 - val_accuracy: 0.7042
Epoch 194/200
44/44 [=====] - 0s 2ms/step - loss: 0.4642 - accuracy:
0.7683 - val_loss: 0.5935 - val_accuracy: 0.7027
Epoch 195/200
44/44 [=====] - 0s 2ms/step - loss: 0.4615 - accuracy:
0.7679 - val_loss: 0.5856 - val_accuracy: 0.6984
Epoch 196/200
44/44 [=====] - 0s 2ms/step - loss: 0.4627 - accuracy:
0.7687 - val_loss: 0.5866 - val_accuracy: 0.7071
Epoch 197/200
44/44 [=====] - 0s 2ms/step - loss: 0.4641 - accuracy:
0.7650 - val_loss: 0.6050 - val_accuracy: 0.6905
Epoch 198/200
44/44 [=====] - 0s 2ms/step - loss: 0.4655 - accuracy:
0.7645 - val_loss: 0.5856 - val_accuracy: 0.7040
Epoch 199/200
44/44 [=====] - 0s 2ms/step - loss: 0.4613 - accuracy:
0.7677 - val_loss: 0.5854 - val_accuracy: 0.7062
Epoch 200/200
44/44 [=====] - 0s 2ms/step - loss: 0.4586 - accuracy:
0.7704 - val_loss: 0.5889 - val_accuracy: 0.7029

```

```
[35]: <keras.callbacks.History at 0x7f8ad54fdc50>
```

```
[36]: pd.DataFrame(model.history.history)[['loss', 'val_loss']].plot()
```

```
[36]: <AxesSubplot:>
```



```
[48]: model_new = Sequential()

model_new.add(
    Dense(94, activation='relu')
)

model_new.add(Dropout(0.2))

model_new.add(
    Dense(30, activation='relu')
)

model_new.add(Dropout(0.2))

model_new.add(
    Dense(15, activation='relu')
)

model_new.add(Dropout(0.2))

model_new.add(
    Dense(1, activation='sigmoid')
)

model_new.compile(
    optimizer='adam',
```

```

        loss='binary_crossentropy',
        metrics=['binary_accuracy']
    )

model_new.fit(
    X_train,
    y_train,
    epochs=200,
    batch_size=256,
    validation_data=(X_test, y_test),
    callbacks=[early_stop]
)

```

Epoch 1/200

44/44 [=====] - 1s 5ms/step - loss: 0.6813 -
binary_accuracy: 0.5689 - val_loss: 0.6646 - val_binary_accuracy: 0.6022

Epoch 2/200

44/44 [=====] - 0s 3ms/step - loss: 0.6654 -
binary_accuracy: 0.5989 - val_loss: 0.6574 - val_binary_accuracy: 0.6099

Epoch 3/200

44/44 [=====] - 0s 3ms/step - loss: 0.6578 -
binary_accuracy: 0.6077 - val_loss: 0.6537 - val_binary_accuracy: 0.6058

Epoch 4/200

44/44 [=====] - 0s 3ms/step - loss: 0.6562 -
binary_accuracy: 0.6087 - val_loss: 0.6519 - val_binary_accuracy: 0.6089

Epoch 5/200

44/44 [=====] - 0s 3ms/step - loss: 0.6540 -
binary_accuracy: 0.6108 - val_loss: 0.6501 - val_binary_accuracy: 0.6116

Epoch 6/200

44/44 [=====] - 0s 3ms/step - loss: 0.6493 -
binary_accuracy: 0.6169 - val_loss: 0.6499 - val_binary_accuracy: 0.6099

Epoch 7/200

44/44 [=====] - 0s 3ms/step - loss: 0.6484 -
binary_accuracy: 0.6156 - val_loss: 0.6484 - val_binary_accuracy: 0.6184

Epoch 8/200

44/44 [=====] - 0s 3ms/step - loss: 0.6482 -
binary_accuracy: 0.6171 - val_loss: 0.6478 - val_binary_accuracy: 0.6149

Epoch 9/200

44/44 [=====] - 0s 3ms/step - loss: 0.6473 -
binary_accuracy: 0.6166 - val_loss: 0.6467 - val_binary_accuracy: 0.6232

Epoch 10/200

44/44 [=====] - 0s 3ms/step - loss: 0.6471 -
binary_accuracy: 0.6183 - val_loss: 0.6460 - val_binary_accuracy: 0.6230

Epoch 11/200

44/44 [=====] - 0s 3ms/step - loss: 0.6456 -
binary_accuracy: 0.6219 - val_loss: 0.6456 - val_binary_accuracy: 0.6223

Epoch 12/200
44/44 [=====] - 0s 3ms/step - loss: 0.6442 -
binary_accuracy: 0.6238 - val_loss: 0.6454 - val_binary_accuracy: 0.6265
Epoch 13/200
44/44 [=====] - 0s 3ms/step - loss: 0.6434 -
binary_accuracy: 0.6160 - val_loss: 0.6456 - val_binary_accuracy: 0.6252
Epoch 14/200
44/44 [=====] - 0s 3ms/step - loss: 0.6430 -
binary_accuracy: 0.6232 - val_loss: 0.6448 - val_binary_accuracy: 0.6246
Epoch 15/200
44/44 [=====] - 0s 3ms/step - loss: 0.6420 -
binary_accuracy: 0.6223 - val_loss: 0.6441 - val_binary_accuracy: 0.6261
Epoch 16/200
44/44 [=====] - 0s 3ms/step - loss: 0.6387 -
binary_accuracy: 0.6287 - val_loss: 0.6436 - val_binary_accuracy: 0.6242
Epoch 17/200
44/44 [=====] - 0s 3ms/step - loss: 0.6408 -
binary_accuracy: 0.6242 - val_loss: 0.6434 - val_binary_accuracy: 0.6205
Epoch 18/200
44/44 [=====] - 0s 3ms/step - loss: 0.6412 -
binary_accuracy: 0.6266 - val_loss: 0.6421 - val_binary_accuracy: 0.6246
Epoch 19/200
44/44 [=====] - 0s 3ms/step - loss: 0.6386 -
binary_accuracy: 0.6303 - val_loss: 0.6447 - val_binary_accuracy: 0.6178
Epoch 20/200
44/44 [=====] - 0s 3ms/step - loss: 0.6387 -
binary_accuracy: 0.6249 - val_loss: 0.6426 - val_binary_accuracy: 0.6252
Epoch 21/200
44/44 [=====] - 0s 3ms/step - loss: 0.6384 -
binary_accuracy: 0.6289 - val_loss: 0.6423 - val_binary_accuracy: 0.6277
Epoch 22/200
44/44 [=====] - 0s 3ms/step - loss: 0.6373 -
binary_accuracy: 0.6304 - val_loss: 0.6431 - val_binary_accuracy: 0.6178
Epoch 23/200
44/44 [=====] - 0s 3ms/step - loss: 0.6381 -
binary_accuracy: 0.6258 - val_loss: 0.6410 - val_binary_accuracy: 0.6213
Epoch 24/200
44/44 [=====] - 0s 3ms/step - loss: 0.6395 -
binary_accuracy: 0.6330 - val_loss: 0.6420 - val_binary_accuracy: 0.6302
Epoch 25/200
44/44 [=====] - 0s 3ms/step - loss: 0.6357 -
binary_accuracy: 0.6329 - val_loss: 0.6417 - val_binary_accuracy: 0.6259
Epoch 26/200
44/44 [=====] - 0s 3ms/step - loss: 0.6362 -
binary_accuracy: 0.6294 - val_loss: 0.6400 - val_binary_accuracy: 0.6300
Epoch 27/200
44/44 [=====] - 0s 3ms/step - loss: 0.6351 -
binary_accuracy: 0.6360 - val_loss: 0.6395 - val_binary_accuracy: 0.6277

Epoch 28/200
44/44 [=====] - 0s 3ms/step - loss: 0.6328 -
binary_accuracy: 0.6333 - val_loss: 0.6398 - val_binary_accuracy: 0.6317
Epoch 29/200
44/44 [=====] - 0s 3ms/step - loss: 0.6329 -
binary_accuracy: 0.6328 - val_loss: 0.6405 - val_binary_accuracy: 0.6240
Epoch 30/200
44/44 [=====] - 0s 3ms/step - loss: 0.6344 -
binary_accuracy: 0.6331 - val_loss: 0.6390 - val_binary_accuracy: 0.6288
Epoch 31/200
44/44 [=====] - 0s 3ms/step - loss: 0.6340 -
binary_accuracy: 0.6308 - val_loss: 0.6395 - val_binary_accuracy: 0.6296
Epoch 32/200
44/44 [=====] - 0s 3ms/step - loss: 0.6343 -
binary_accuracy: 0.6363 - val_loss: 0.6382 - val_binary_accuracy: 0.6244
Epoch 33/200
44/44 [=====] - 0s 3ms/step - loss: 0.6323 -
binary_accuracy: 0.6358 - val_loss: 0.6387 - val_binary_accuracy: 0.6285
Epoch 34/200
44/44 [=====] - 0s 3ms/step - loss: 0.6329 -
binary_accuracy: 0.6377 - val_loss: 0.6378 - val_binary_accuracy: 0.6310
Epoch 35/200
44/44 [=====] - 0s 3ms/step - loss: 0.6309 -
binary_accuracy: 0.6346 - val_loss: 0.6374 - val_binary_accuracy: 0.6323
Epoch 36/200
44/44 [=====] - 0s 3ms/step - loss: 0.6308 -
binary_accuracy: 0.6387 - val_loss: 0.6366 - val_binary_accuracy: 0.6298
Epoch 37/200
44/44 [=====] - 0s 3ms/step - loss: 0.6324 -
binary_accuracy: 0.6361 - val_loss: 0.6369 - val_binary_accuracy: 0.6261
Epoch 38/200
44/44 [=====] - 0s 3ms/step - loss: 0.6304 -
binary_accuracy: 0.6338 - val_loss: 0.6362 - val_binary_accuracy: 0.6308
Epoch 39/200
44/44 [=====] - 0s 3ms/step - loss: 0.6280 -
binary_accuracy: 0.6394 - val_loss: 0.6378 - val_binary_accuracy: 0.6319
Epoch 40/200
44/44 [=====] - 0s 3ms/step - loss: 0.6304 -
binary_accuracy: 0.6391 - val_loss: 0.6350 - val_binary_accuracy: 0.6294
Epoch 41/200
44/44 [=====] - 0s 3ms/step - loss: 0.6286 -
binary_accuracy: 0.6360 - val_loss: 0.6353 - val_binary_accuracy: 0.6333
Epoch 42/200
44/44 [=====] - 0s 3ms/step - loss: 0.6273 -
binary_accuracy: 0.6434 - val_loss: 0.6337 - val_binary_accuracy: 0.6288
Epoch 43/200
44/44 [=====] - 0s 3ms/step - loss: 0.6285 -
binary_accuracy: 0.6394 - val_loss: 0.6345 - val_binary_accuracy: 0.6329

Epoch 44/200
44/44 [=====] - 0s 3ms/step - loss: 0.6256 -
binary_accuracy: 0.6394 - val_loss: 0.6338 - val_binary_accuracy: 0.6317
Epoch 45/200
44/44 [=====] - 0s 3ms/step - loss: 0.6251 -
binary_accuracy: 0.6412 - val_loss: 0.6333 - val_binary_accuracy: 0.6300
Epoch 46/200
44/44 [=====] - 0s 3ms/step - loss: 0.6270 -
binary_accuracy: 0.6376 - val_loss: 0.6354 - val_binary_accuracy: 0.6265
Epoch 47/200
44/44 [=====] - 0s 3ms/step - loss: 0.6257 -
binary_accuracy: 0.6435 - val_loss: 0.6324 - val_binary_accuracy: 0.6273
Epoch 48/200
44/44 [=====] - 0s 3ms/step - loss: 0.6267 -
binary_accuracy: 0.6410 - val_loss: 0.6345 - val_binary_accuracy: 0.6314
Epoch 49/200
44/44 [=====] - 0s 3ms/step - loss: 0.6278 -
binary_accuracy: 0.6349 - val_loss: 0.6319 - val_binary_accuracy: 0.6327
Epoch 50/200
44/44 [=====] - 0s 3ms/step - loss: 0.6244 -
binary_accuracy: 0.6416 - val_loss: 0.6319 - val_binary_accuracy: 0.6250
Epoch 51/200
44/44 [=====] - 0s 3ms/step - loss: 0.6223 -
binary_accuracy: 0.6421 - val_loss: 0.6309 - val_binary_accuracy: 0.6310
Epoch 52/200
44/44 [=====] - 0s 3ms/step - loss: 0.6236 -
binary_accuracy: 0.6372 - val_loss: 0.6308 - val_binary_accuracy: 0.6310
Epoch 53/200
44/44 [=====] - 0s 3ms/step - loss: 0.6214 -
binary_accuracy: 0.6442 - val_loss: 0.6293 - val_binary_accuracy: 0.6358
Epoch 54/200
44/44 [=====] - 0s 3ms/step - loss: 0.6227 -
binary_accuracy: 0.6440 - val_loss: 0.6322 - val_binary_accuracy: 0.6350
Epoch 55/200
44/44 [=====] - 0s 3ms/step - loss: 0.6237 -
binary_accuracy: 0.6398 - val_loss: 0.6334 - val_binary_accuracy: 0.6277
Epoch 56/200
44/44 [=====] - 0s 3ms/step - loss: 0.6199 -
binary_accuracy: 0.6429 - val_loss: 0.6298 - val_binary_accuracy: 0.6331
Epoch 57/200
44/44 [=====] - 0s 3ms/step - loss: 0.6198 -
binary_accuracy: 0.6441 - val_loss: 0.6316 - val_binary_accuracy: 0.6312
Epoch 58/200
44/44 [=====] - 0s 3ms/step - loss: 0.6209 -
binary_accuracy: 0.6444 - val_loss: 0.6280 - val_binary_accuracy: 0.6350
Epoch 59/200
44/44 [=====] - 0s 3ms/step - loss: 0.6190 -
binary_accuracy: 0.6471 - val_loss: 0.6291 - val_binary_accuracy: 0.6323

Epoch 60/200
44/44 [=====] - 0s 3ms/step - loss: 0.6178 -
binary_accuracy: 0.6454 - val_loss: 0.6281 - val_binary_accuracy: 0.6352
Epoch 61/200
44/44 [=====] - 0s 3ms/step - loss: 0.6193 -
binary_accuracy: 0.6455 - val_loss: 0.6268 - val_binary_accuracy: 0.6296
Epoch 62/200
44/44 [=====] - 0s 3ms/step - loss: 0.6188 -
binary_accuracy: 0.6425 - val_loss: 0.6271 - val_binary_accuracy: 0.6290
Epoch 63/200
44/44 [=====] - 0s 3ms/step - loss: 0.6161 -
binary_accuracy: 0.6465 - val_loss: 0.6277 - val_binary_accuracy: 0.6310
Epoch 64/200
44/44 [=====] - 0s 3ms/step - loss: 0.6204 -
binary_accuracy: 0.6465 - val_loss: 0.6271 - val_binary_accuracy: 0.6370
Epoch 65/200
44/44 [=====] - 0s 3ms/step - loss: 0.6172 -
binary_accuracy: 0.6482 - val_loss: 0.6263 - val_binary_accuracy: 0.6321
Epoch 66/200
44/44 [=====] - 0s 3ms/step - loss: 0.6160 -
binary_accuracy: 0.6477 - val_loss: 0.6252 - val_binary_accuracy: 0.6366
Epoch 67/200
44/44 [=====] - 0s 3ms/step - loss: 0.6157 -
binary_accuracy: 0.6479 - val_loss: 0.6254 - val_binary_accuracy: 0.6352
Epoch 68/200
44/44 [=====] - 0s 3ms/step - loss: 0.6158 -
binary_accuracy: 0.6490 - val_loss: 0.6245 - val_binary_accuracy: 0.6350
Epoch 69/200
44/44 [=====] - 0s 3ms/step - loss: 0.6149 -
binary_accuracy: 0.6473 - val_loss: 0.6260 - val_binary_accuracy: 0.6352
Epoch 70/200
44/44 [=====] - 0s 3ms/step - loss: 0.6173 -
binary_accuracy: 0.6462 - val_loss: 0.6249 - val_binary_accuracy: 0.6364
Epoch 71/200
44/44 [=====] - 0s 3ms/step - loss: 0.6118 -
binary_accuracy: 0.6506 - val_loss: 0.6236 - val_binary_accuracy: 0.6356
Epoch 72/200
44/44 [=====] - 0s 3ms/step - loss: 0.6162 -
binary_accuracy: 0.6493 - val_loss: 0.6248 - val_binary_accuracy: 0.6372
Epoch 73/200
44/44 [=====] - 0s 3ms/step - loss: 0.6131 -
binary_accuracy: 0.6483 - val_loss: 0.6228 - val_binary_accuracy: 0.6366
Epoch 74/200
44/44 [=====] - 0s 3ms/step - loss: 0.6125 -
binary_accuracy: 0.6544 - val_loss: 0.6225 - val_binary_accuracy: 0.6381
Epoch 75/200
44/44 [=====] - 0s 3ms/step - loss: 0.6135 -
binary_accuracy: 0.6489 - val_loss: 0.6234 - val_binary_accuracy: 0.6343

Epoch 76/200
44/44 [=====] - 0s 3ms/step - loss: 0.6086 -
binary_accuracy: 0.6528 - val_loss: 0.6214 - val_binary_accuracy: 0.6433
Epoch 77/200
44/44 [=====] - 0s 3ms/step - loss: 0.6104 -
binary_accuracy: 0.6498 - val_loss: 0.6195 - val_binary_accuracy: 0.6346
Epoch 78/200
44/44 [=====] - 0s 3ms/step - loss: 0.6105 -
binary_accuracy: 0.6532 - val_loss: 0.6212 - val_binary_accuracy: 0.6364
Epoch 79/200
44/44 [=====] - 0s 3ms/step - loss: 0.6076 -
binary_accuracy: 0.6540 - val_loss: 0.6197 - val_binary_accuracy: 0.6387
Epoch 80/200
44/44 [=====] - 0s 3ms/step - loss: 0.6091 -
binary_accuracy: 0.6535 - val_loss: 0.6208 - val_binary_accuracy: 0.6495
Epoch 81/200
44/44 [=====] - 0s 3ms/step - loss: 0.6102 -
binary_accuracy: 0.6563 - val_loss: 0.6190 - val_binary_accuracy: 0.6435
Epoch 82/200
44/44 [=====] - 0s 3ms/step - loss: 0.6074 -
binary_accuracy: 0.6505 - val_loss: 0.6202 - val_binary_accuracy: 0.6522
Epoch 83/200
44/44 [=====] - 0s 3ms/step - loss: 0.6097 -
binary_accuracy: 0.6554 - val_loss: 0.6197 - val_binary_accuracy: 0.6464
Epoch 84/200
44/44 [=====] - 0s 3ms/step - loss: 0.6067 -
binary_accuracy: 0.6558 - val_loss: 0.6168 - val_binary_accuracy: 0.6447
Epoch 85/200
44/44 [=====] - 0s 3ms/step - loss: 0.6048 -
binary_accuracy: 0.6591 - val_loss: 0.6184 - val_binary_accuracy: 0.6466
Epoch 86/200
44/44 [=====] - 0s 3ms/step - loss: 0.6058 -
binary_accuracy: 0.6571 - val_loss: 0.6170 - val_binary_accuracy: 0.6449
Epoch 87/200
44/44 [=====] - 0s 3ms/step - loss: 0.6054 -
binary_accuracy: 0.6527 - val_loss: 0.6185 - val_binary_accuracy: 0.6503
Epoch 88/200
44/44 [=====] - 0s 3ms/step - loss: 0.6048 -
binary_accuracy: 0.6552 - val_loss: 0.6162 - val_binary_accuracy: 0.6522
Epoch 89/200
44/44 [=====] - 0s 3ms/step - loss: 0.6053 -
binary_accuracy: 0.6601 - val_loss: 0.6194 - val_binary_accuracy: 0.6489
Epoch 90/200
44/44 [=====] - 0s 3ms/step - loss: 0.6016 -
binary_accuracy: 0.6572 - val_loss: 0.6174 - val_binary_accuracy: 0.6474
Epoch 91/200
44/44 [=====] - 0s 3ms/step - loss: 0.6033 -
binary_accuracy: 0.6561 - val_loss: 0.6151 - val_binary_accuracy: 0.6505

Epoch 92/200
44/44 [=====] - 0s 3ms/step - loss: 0.6061 -
binary_accuracy: 0.6591 - val_loss: 0.6154 - val_binary_accuracy: 0.6420
Epoch 93/200
44/44 [=====] - 0s 3ms/step - loss: 0.6017 -
binary_accuracy: 0.6639 - val_loss: 0.6155 - val_binary_accuracy: 0.6553
Epoch 94/200
44/44 [=====] - 0s 3ms/step - loss: 0.6015 -
binary_accuracy: 0.6633 - val_loss: 0.6145 - val_binary_accuracy: 0.6476
Epoch 95/200
44/44 [=====] - 0s 3ms/step - loss: 0.6046 -
binary_accuracy: 0.6579 - val_loss: 0.6166 - val_binary_accuracy: 0.6507
Epoch 96/200
44/44 [=====] - 0s 3ms/step - loss: 0.6021 -
binary_accuracy: 0.6625 - val_loss: 0.6142 - val_binary_accuracy: 0.6451
Epoch 97/200
44/44 [=====] - 0s 3ms/step - loss: 0.6015 -
binary_accuracy: 0.6590 - val_loss: 0.6148 - val_binary_accuracy: 0.6509
Epoch 98/200
44/44 [=====] - 0s 3ms/step - loss: 0.6022 -
binary_accuracy: 0.6583 - val_loss: 0.6152 - val_binary_accuracy: 0.6472
Epoch 99/200
44/44 [=====] - 0s 3ms/step - loss: 0.5979 -
binary_accuracy: 0.6607 - val_loss: 0.6153 - val_binary_accuracy: 0.6484
Epoch 100/200
44/44 [=====] - 0s 3ms/step - loss: 0.5997 -
binary_accuracy: 0.6588 - val_loss: 0.6107 - val_binary_accuracy: 0.6534
Epoch 101/200
44/44 [=====] - 0s 3ms/step - loss: 0.6016 -
binary_accuracy: 0.6606 - val_loss: 0.6119 - val_binary_accuracy: 0.6563
Epoch 102/200
44/44 [=====] - 0s 3ms/step - loss: 0.5989 -
binary_accuracy: 0.6635 - val_loss: 0.6132 - val_binary_accuracy: 0.6464
Epoch 103/200
44/44 [=====] - 0s 3ms/step - loss: 0.5978 -
binary_accuracy: 0.6613 - val_loss: 0.6090 - val_binary_accuracy: 0.6561
Epoch 104/200
44/44 [=====] - 0s 3ms/step - loss: 0.5998 -
binary_accuracy: 0.6598 - val_loss: 0.6118 - val_binary_accuracy: 0.6555
Epoch 105/200
44/44 [=====] - 0s 3ms/step - loss: 0.5978 -
binary_accuracy: 0.6641 - val_loss: 0.6095 - val_binary_accuracy: 0.6561
Epoch 106/200
44/44 [=====] - 0s 3ms/step - loss: 0.5975 -
binary_accuracy: 0.6656 - val_loss: 0.6106 - val_binary_accuracy: 0.6542
Epoch 107/200
44/44 [=====] - 0s 3ms/step - loss: 0.5963 -
binary_accuracy: 0.6631 - val_loss: 0.6101 - val_binary_accuracy: 0.6561

Epoch 108/200
44/44 [=====] - 0s 3ms/step - loss: 0.5946 -
binary_accuracy: 0.6644 - val_loss: 0.6094 - val_binary_accuracy: 0.6588
Epoch 109/200
44/44 [=====] - 0s 3ms/step - loss: 0.5941 -
binary_accuracy: 0.6669 - val_loss: 0.6072 - val_binary_accuracy: 0.6621
Epoch 110/200
44/44 [=====] - 0s 3ms/step - loss: 0.5971 -
binary_accuracy: 0.6649 - val_loss: 0.6071 - val_binary_accuracy: 0.6609
Epoch 111/200
44/44 [=====] - 0s 3ms/step - loss: 0.5941 -
binary_accuracy: 0.6667 - val_loss: 0.6073 - val_binary_accuracy: 0.6580
Epoch 112/200
44/44 [=====] - 0s 3ms/step - loss: 0.5934 -
binary_accuracy: 0.6678 - val_loss: 0.6075 - val_binary_accuracy: 0.6576
Epoch 113/200
44/44 [=====] - 0s 3ms/step - loss: 0.5920 -
binary_accuracy: 0.6701 - val_loss: 0.6062 - val_binary_accuracy: 0.6631
Epoch 114/200
44/44 [=====] - 0s 3ms/step - loss: 0.5929 -
binary_accuracy: 0.6707 - val_loss: 0.6062 - val_binary_accuracy: 0.6613
Epoch 115/200
44/44 [=====] - 0s 3ms/step - loss: 0.5917 -
binary_accuracy: 0.6660 - val_loss: 0.6048 - val_binary_accuracy: 0.6615
Epoch 116/200
44/44 [=====] - 0s 3ms/step - loss: 0.5895 -
binary_accuracy: 0.6727 - val_loss: 0.6072 - val_binary_accuracy: 0.6551
Epoch 117/200
44/44 [=====] - 0s 3ms/step - loss: 0.5925 -
binary_accuracy: 0.6653 - val_loss: 0.6090 - val_binary_accuracy: 0.6542
Epoch 118/200
44/44 [=====] - 0s 3ms/step - loss: 0.5904 -
binary_accuracy: 0.6691 - val_loss: 0.6052 - val_binary_accuracy: 0.6611
Epoch 119/200
44/44 [=====] - 0s 3ms/step - loss: 0.5893 -
binary_accuracy: 0.6702 - val_loss: 0.6038 - val_binary_accuracy: 0.6594
Epoch 120/200
44/44 [=====] - 0s 3ms/step - loss: 0.5903 -
binary_accuracy: 0.6717 - val_loss: 0.6042 - val_binary_accuracy: 0.6671
Epoch 121/200
44/44 [=====] - 0s 3ms/step - loss: 0.5898 -
binary_accuracy: 0.6655 - val_loss: 0.6040 - val_binary_accuracy: 0.6650
Epoch 122/200
44/44 [=====] - 0s 3ms/step - loss: 0.5899 -
binary_accuracy: 0.6680 - val_loss: 0.6051 - val_binary_accuracy: 0.6648
Epoch 123/200
44/44 [=====] - 0s 3ms/step - loss: 0.5892 -
binary_accuracy: 0.6702 - val_loss: 0.6055 - val_binary_accuracy: 0.6569

Epoch 124/200
44/44 [=====] - 0s 3ms/step - loss: 0.5891 -
binary_accuracy: 0.6671 - val_loss: 0.6024 - val_binary_accuracy: 0.6623
Epoch 125/200
44/44 [=====] - 0s 3ms/step - loss: 0.5888 -
binary_accuracy: 0.6736 - val_loss: 0.6015 - val_binary_accuracy: 0.6671
Epoch 126/200
44/44 [=====] - 0s 3ms/step - loss: 0.5881 -
binary_accuracy: 0.6740 - val_loss: 0.6027 - val_binary_accuracy: 0.6652
Epoch 127/200
44/44 [=====] - 0s 3ms/step - loss: 0.5882 -
binary_accuracy: 0.6694 - val_loss: 0.6019 - val_binary_accuracy: 0.6605
Epoch 128/200
44/44 [=====] - 0s 3ms/step - loss: 0.5873 -
binary_accuracy: 0.6715 - val_loss: 0.6008 - val_binary_accuracy: 0.6675
Epoch 129/200
44/44 [=====] - 0s 3ms/step - loss: 0.5856 -
binary_accuracy: 0.6671 - val_loss: 0.6034 - val_binary_accuracy: 0.6650
Epoch 130/200
44/44 [=====] - 0s 3ms/step - loss: 0.5856 -
binary_accuracy: 0.6734 - val_loss: 0.6014 - val_binary_accuracy: 0.6648
Epoch 131/200
44/44 [=====] - 0s 3ms/step - loss: 0.5857 -
binary_accuracy: 0.6769 - val_loss: 0.6046 - val_binary_accuracy: 0.6600
Epoch 132/200
44/44 [=====] - 0s 3ms/step - loss: 0.5863 -
binary_accuracy: 0.6737 - val_loss: 0.6014 - val_binary_accuracy: 0.6644
Epoch 133/200
44/44 [=====] - 0s 3ms/step - loss: 0.5816 -
binary_accuracy: 0.6794 - val_loss: 0.6001 - val_binary_accuracy: 0.6658
Epoch 134/200
44/44 [=====] - 0s 3ms/step - loss: 0.5854 -
binary_accuracy: 0.6736 - val_loss: 0.6014 - val_binary_accuracy: 0.6640
Epoch 135/200
44/44 [=====] - 0s 3ms/step - loss: 0.5831 -
binary_accuracy: 0.6788 - val_loss: 0.5995 - val_binary_accuracy: 0.6615
Epoch 136/200
44/44 [=====] - 0s 3ms/step - loss: 0.5832 -
binary_accuracy: 0.6749 - val_loss: 0.6017 - val_binary_accuracy: 0.6596
Epoch 137/200
44/44 [=====] - 0s 3ms/step - loss: 0.5808 -
binary_accuracy: 0.6768 - val_loss: 0.6004 - val_binary_accuracy: 0.6631
Epoch 138/200
44/44 [=====] - 0s 3ms/step - loss: 0.5845 -
binary_accuracy: 0.6724 - val_loss: 0.5974 - val_binary_accuracy: 0.6656
Epoch 139/200
44/44 [=====] - 0s 3ms/step - loss: 0.5826 -
binary_accuracy: 0.6705 - val_loss: 0.6024 - val_binary_accuracy: 0.6739

Epoch 140/200
44/44 [=====] - 0s 3ms/step - loss: 0.5809 -
binary_accuracy: 0.6792 - val_loss: 0.5959 - val_binary_accuracy: 0.6698
Epoch 141/200
44/44 [=====] - 0s 3ms/step - loss: 0.5842 -
binary_accuracy: 0.6794 - val_loss: 0.5964 - val_binary_accuracy: 0.6665
Epoch 142/200
44/44 [=====] - 0s 3ms/step - loss: 0.5813 -
binary_accuracy: 0.6783 - val_loss: 0.5949 - val_binary_accuracy: 0.6687
Epoch 143/200
44/44 [=====] - 0s 3ms/step - loss: 0.5814 -
binary_accuracy: 0.6787 - val_loss: 0.5974 - val_binary_accuracy: 0.6708
Epoch 144/200
44/44 [=====] - 0s 3ms/step - loss: 0.5840 -
binary_accuracy: 0.6769 - val_loss: 0.5956 - val_binary_accuracy: 0.6694
Epoch 145/200
44/44 [=====] - 0s 3ms/step - loss: 0.5793 -
binary_accuracy: 0.6806 - val_loss: 0.5955 - val_binary_accuracy: 0.6671
Epoch 146/200
44/44 [=====] - 0s 3ms/step - loss: 0.5797 -
binary_accuracy: 0.6827 - val_loss: 0.5955 - val_binary_accuracy: 0.6658
Epoch 147/200
44/44 [=====] - 0s 3ms/step - loss: 0.5799 -
binary_accuracy: 0.6768 - val_loss: 0.5954 - val_binary_accuracy: 0.6704
Epoch 148/200
44/44 [=====] - 0s 3ms/step - loss: 0.5772 -
binary_accuracy: 0.6780 - val_loss: 0.5947 - val_binary_accuracy: 0.6723
Epoch 149/200
44/44 [=====] - 0s 3ms/step - loss: 0.5803 -
binary_accuracy: 0.6778 - val_loss: 0.5935 - val_binary_accuracy: 0.6706
Epoch 150/200
44/44 [=====] - 0s 3ms/step - loss: 0.5791 -
binary_accuracy: 0.6785 - val_loss: 0.5931 - val_binary_accuracy: 0.6723
Epoch 151/200
44/44 [=====] - 0s 3ms/step - loss: 0.5767 -
binary_accuracy: 0.6812 - val_loss: 0.5929 - val_binary_accuracy: 0.6731
Epoch 152/200
44/44 [=====] - 0s 3ms/step - loss: 0.5752 -
binary_accuracy: 0.6785 - val_loss: 0.5922 - val_binary_accuracy: 0.6745
Epoch 153/200
44/44 [=====] - 0s 3ms/step - loss: 0.5740 -
binary_accuracy: 0.6853 - val_loss: 0.5940 - val_binary_accuracy: 0.6731
Epoch 154/200
44/44 [=====] - 0s 3ms/step - loss: 0.5728 -
binary_accuracy: 0.6831 - val_loss: 0.5926 - val_binary_accuracy: 0.6762
Epoch 155/200
44/44 [=====] - 0s 3ms/step - loss: 0.5776 -
binary_accuracy: 0.6805 - val_loss: 0.5921 - val_binary_accuracy: 0.6731

Epoch 156/200
44/44 [=====] - 0s 3ms/step - loss: 0.5736 -
binary_accuracy: 0.6837 - val_loss: 0.5955 - val_binary_accuracy: 0.6687
Epoch 157/200
44/44 [=====] - 0s 3ms/step - loss: 0.5759 -
binary_accuracy: 0.6789 - val_loss: 0.5925 - val_binary_accuracy: 0.6723
Epoch 158/200
44/44 [=====] - 0s 3ms/step - loss: 0.5729 -
binary_accuracy: 0.6804 - val_loss: 0.5913 - val_binary_accuracy: 0.6729
Epoch 159/200
44/44 [=====] - 0s 3ms/step - loss: 0.5722 -
binary_accuracy: 0.6855 - val_loss: 0.5913 - val_binary_accuracy: 0.6772
Epoch 160/200
44/44 [=====] - 0s 3ms/step - loss: 0.5712 -
binary_accuracy: 0.6884 - val_loss: 0.5905 - val_binary_accuracy: 0.6698
Epoch 161/200
44/44 [=====] - 0s 3ms/step - loss: 0.5737 -
binary_accuracy: 0.6851 - val_loss: 0.5897 - val_binary_accuracy: 0.6741
Epoch 162/200
44/44 [=====] - 0s 3ms/step - loss: 0.5689 -
binary_accuracy: 0.6890 - val_loss: 0.5887 - val_binary_accuracy: 0.6756
Epoch 163/200
44/44 [=====] - 0s 3ms/step - loss: 0.5723 -
binary_accuracy: 0.6817 - val_loss: 0.5915 - val_binary_accuracy: 0.6747
Epoch 164/200
44/44 [=====] - 0s 3ms/step - loss: 0.5645 -
binary_accuracy: 0.6929 - val_loss: 0.5885 - val_binary_accuracy: 0.6795
Epoch 165/200
44/44 [=====] - 0s 3ms/step - loss: 0.5733 -
binary_accuracy: 0.6845 - val_loss: 0.5882 - val_binary_accuracy: 0.6718
Epoch 166/200
44/44 [=====] - 0s 3ms/step - loss: 0.5708 -
binary_accuracy: 0.6850 - val_loss: 0.5901 - val_binary_accuracy: 0.6791
Epoch 167/200
44/44 [=====] - 0s 3ms/step - loss: 0.5677 -
binary_accuracy: 0.6910 - val_loss: 0.5869 - val_binary_accuracy: 0.6803
Epoch 168/200
44/44 [=====] - 0s 3ms/step - loss: 0.5651 -
binary_accuracy: 0.6879 - val_loss: 0.5868 - val_binary_accuracy: 0.6799
Epoch 169/200
44/44 [=====] - 0s 3ms/step - loss: 0.5679 -
binary_accuracy: 0.6878 - val_loss: 0.5876 - val_binary_accuracy: 0.6779
Epoch 170/200
44/44 [=====] - 0s 3ms/step - loss: 0.5677 -
binary_accuracy: 0.6873 - val_loss: 0.5879 - val_binary_accuracy: 0.6698
Epoch 171/200
44/44 [=====] - 0s 3ms/step - loss: 0.5660 -
binary_accuracy: 0.6883 - val_loss: 0.5853 - val_binary_accuracy: 0.6781

Epoch 172/200
44/44 [=====] - 0s 3ms/step - loss: 0.5660 -
binary_accuracy: 0.6886 - val_loss: 0.5859 - val_binary_accuracy: 0.6810
Epoch 173/200
44/44 [=====] - 0s 3ms/step - loss: 0.5687 -
binary_accuracy: 0.6872 - val_loss: 0.5871 - val_binary_accuracy: 0.6795
Epoch 174/200
44/44 [=====] - 0s 3ms/step - loss: 0.5682 -
binary_accuracy: 0.6891 - val_loss: 0.5845 - val_binary_accuracy: 0.6820
Epoch 175/200
44/44 [=====] - 0s 3ms/step - loss: 0.5691 -
binary_accuracy: 0.6884 - val_loss: 0.5859 - val_binary_accuracy: 0.6733
Epoch 176/200
44/44 [=====] - 0s 3ms/step - loss: 0.5653 -
binary_accuracy: 0.6912 - val_loss: 0.5844 - val_binary_accuracy: 0.6830
Epoch 177/200
44/44 [=====] - 0s 3ms/step - loss: 0.5675 -
binary_accuracy: 0.6851 - val_loss: 0.5884 - val_binary_accuracy: 0.6708
Epoch 178/200
44/44 [=====] - 0s 3ms/step - loss: 0.5646 -
binary_accuracy: 0.6900 - val_loss: 0.5847 - val_binary_accuracy: 0.6791
Epoch 179/200
44/44 [=====] - 0s 3ms/step - loss: 0.5662 -
binary_accuracy: 0.6911 - val_loss: 0.5873 - val_binary_accuracy: 0.6812
Epoch 180/200
44/44 [=====] - 0s 3ms/step - loss: 0.5638 -
binary_accuracy: 0.6869 - val_loss: 0.5828 - val_binary_accuracy: 0.6770
Epoch 181/200
44/44 [=====] - 0s 3ms/step - loss: 0.5694 -
binary_accuracy: 0.6859 - val_loss: 0.5830 - val_binary_accuracy: 0.6816
Epoch 182/200
44/44 [=====] - 0s 3ms/step - loss: 0.5636 -
binary_accuracy: 0.6952 - val_loss: 0.5796 - val_binary_accuracy: 0.6859
Epoch 183/200
44/44 [=====] - 0s 3ms/step - loss: 0.5652 -
binary_accuracy: 0.6906 - val_loss: 0.5837 - val_binary_accuracy: 0.6781
Epoch 184/200
44/44 [=====] - 0s 3ms/step - loss: 0.5632 -
binary_accuracy: 0.6889 - val_loss: 0.5830 - val_binary_accuracy: 0.6832
Epoch 185/200
44/44 [=====] - 0s 3ms/step - loss: 0.5624 -
binary_accuracy: 0.6947 - val_loss: 0.5821 - val_binary_accuracy: 0.6770
Epoch 186/200
44/44 [=====] - 0s 3ms/step - loss: 0.5634 -
binary_accuracy: 0.6936 - val_loss: 0.5815 - val_binary_accuracy: 0.6830
Epoch 187/200
44/44 [=====] - 0s 3ms/step - loss: 0.5647 -
binary_accuracy: 0.6916 - val_loss: 0.5808 - val_binary_accuracy: 0.6843

```

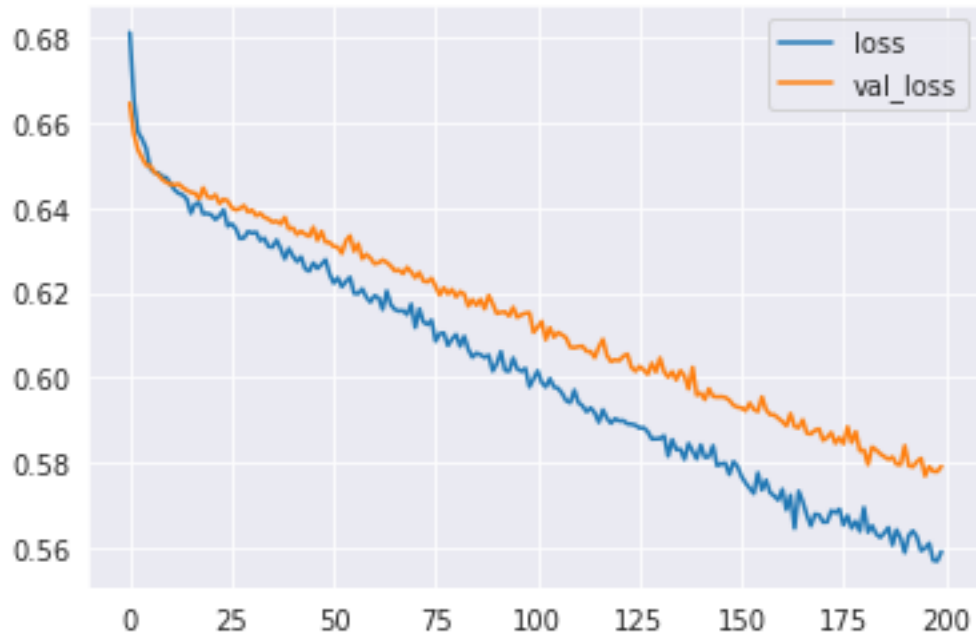
Epoch 188/200
44/44 [=====] - 0s 3ms/step - loss: 0.5606 -
binary_accuracy: 0.6894 - val_loss: 0.5813 - val_binary_accuracy: 0.6818
Epoch 189/200
44/44 [=====] - 0s 3ms/step - loss: 0.5642 -
binary_accuracy: 0.6900 - val_loss: 0.5796 - val_binary_accuracy: 0.6861
Epoch 190/200
44/44 [=====] - 0s 3ms/step - loss: 0.5622 -
binary_accuracy: 0.6914 - val_loss: 0.5796 - val_binary_accuracy: 0.6843
Epoch 191/200
44/44 [=====] - 0s 3ms/step - loss: 0.5588 -
binary_accuracy: 0.6935 - val_loss: 0.5840 - val_binary_accuracy: 0.6872
Epoch 192/200
44/44 [=====] - 0s 3ms/step - loss: 0.5629 -
binary_accuracy: 0.6912 - val_loss: 0.5793 - val_binary_accuracy: 0.6822
Epoch 193/200
44/44 [=====] - 0s 3ms/step - loss: 0.5639 -
binary_accuracy: 0.6912 - val_loss: 0.5790 - val_binary_accuracy: 0.6828
Epoch 194/200
44/44 [=====] - 0s 3ms/step - loss: 0.5625 -
binary_accuracy: 0.6924 - val_loss: 0.5802 - val_binary_accuracy: 0.6845
Epoch 195/200
44/44 [=====] - 0s 3ms/step - loss: 0.5593 -
binary_accuracy: 0.6971 - val_loss: 0.5810 - val_binary_accuracy: 0.6872
Epoch 196/200
44/44 [=====] - 0s 3ms/step - loss: 0.5598 -
binary_accuracy: 0.6956 - val_loss: 0.5769 - val_binary_accuracy: 0.6888
Epoch 197/200
44/44 [=====] - 0s 3ms/step - loss: 0.5610 -
binary_accuracy: 0.6956 - val_loss: 0.5791 - val_binary_accuracy: 0.6866
Epoch 198/200
44/44 [=====] - 0s 3ms/step - loss: 0.5570 -
binary_accuracy: 0.6964 - val_loss: 0.5780 - val_binary_accuracy: 0.6880
Epoch 199/200
44/44 [=====] - 0s 3ms/step - loss: 0.5569 -
binary_accuracy: 0.6997 - val_loss: 0.5779 - val_binary_accuracy: 0.6849
Epoch 200/200
44/44 [=====] - 0s 3ms/step - loss: 0.5591 -
binary_accuracy: 0.6951 - val_loss: 0.5792 - val_binary_accuracy: 0.6832

```

```
[48]: <keras.callbacks.History at 0x7f8ad5427810>
```

```
[49]: pd.DataFrame(model_new.history.history)[['loss', 'val_loss']].plot()
```

```
[49]: <AxesSubplot:>
```



```
[52]: dump(scaler, open('scaler.pkl', 'wb'))  
      model_new.save('my_model_lending_club.h5')
```

```
[53]: later_scaler = load(open('scaler.pkl', 'rb'))  
      later_model = load_model('my_model_lending_club.h5')
```

```
[54]: X_00T = to_pred.drop('not.fully.paid', axis=1).values  
      to_pred.drop('not.fully.paid', axis=1).values  
  
      print(X_00T.shape)
```

```
(0, 15)
```