```
# import libraries
import os
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

loan = pd.read_csv('loan_data.csv',encoding = "ISO-8859-1",
low_memory=False)

loan.shape

(9578, 14)

loan.describe()

       credit.policy     int.rate  installment  log.annual.inc
dti  \
count    9578.000000  9578.000000  9578.000000     9578.000000
9578.000000
mean        0.804970     0.122640   319.089413       10.932117
12.606679
std         0.396245     0.026847   207.071301        0.614813
6.883970
min         0.000000     0.060000    15.670000        7.547502
0.000000
25%         1.000000     0.103900   163.770000       10.558414
7.212500
50%         1.000000     0.122100   268.950000       10.928884
12.665000
75%         1.000000     0.140700   432.762500       11.291293
17.950000
max         1.000000     0.216400   940.140000       14.528354
29.960000

              fico  days.with.cr.line     revol.bal   revol.util  \
count  9578.000000        9578.000000  9.578000e+03  9578.000000
mean    710.846314        4560.767197  1.691396e+04    46.799236
std      37.970537        2496.930377  3.375619e+04    29.014417
min     612.000000         178.958333  0.000000e+00     0.000000
25%     682.000000        2820.000000  3.187000e+03    22.600000
```

```
50%     707.000000        4139.958333  8.596000e+03    46.300000
75%     737.000000        5730.000000  1.824950e+04    70.900000
max     827.000000       17639.958330  1.207359e+06   119.000000

       inq.last.6mths  delinq.2yrs      pub.rec  not.fully.paid
count     9578.000000  9578.000000  9578.000000     9578.000000
mean         1.577469     0.163708     0.062122        0.160054
std          2.200245     0.546215     0.262126        0.366676
min          0.000000     0.000000     0.000000        0.000000
25%          0.000000     0.000000     0.000000        0.000000
50%          1.000000     0.000000     0.000000        0.000000
75%          2.000000     0.000000     0.000000        0.000000
max         33.000000    13.000000     5.000000        1.000000
```

```
loan.head(10)
```

```
   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
5              1         credit_card    0.0788       125.13
11.904968
6              1  debt_consolidation    0.1496       194.02
10.714418
7              1           all_other    0.1114       131.22
11.002100
8              1    home_improvement    0.1134        87.19
11.407565
9              1  debt_consolidation    0.1221        84.12
10.203592

     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
5  16.98   727        6120.041667      50807        51.0
0
6   4.00   667        3180.041667       3839        76.8
0
7  11.08   722        5116.000000      24220        68.6
0
8  17.25   682        3989.000000      69909        51.1
1
9  10.00   707        2730.041667       5630        23.0
1
```

```
   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
5            0        0               0
6            0        1               1
7            0        0               1
8            0        0               0
9            0        0               0
```

```
loan.dtypes
```

```
credit.policy          int64
purpose               object
int.rate             float64
installment          float64
log.annual.inc       float64
dti                  float64
fico                   int64
days.with.cr.line    float64
revol.bal              int64
revol.util           float64
inq.last.6mths         int64
delinq.2yrs            int64
pub.rec                int64
not.fully.paid         int64
dtype: object
```

```
#Transform categorical values into numerical values
obj_loan = loan.select_dtypes(include=['object']).copy()
obj_loan.head()
```

```
              purpose
0  debt_consolidation
1         credit_card
2  debt_consolidation
```

```
3  debt_consolidation
4         credit_card
```

```
#obj_loan[obj_loan.isnull().any(axis=1)]
```

```
obj_loan["purpose"].value_counts()
```

```
debt_consolidation    3957
all_other             2331
credit_card           1262
home_improvement       629
small_business         619
major_purchase         437
educational            343
Name: purpose, dtype: int64
```

```
obj_loan = obj_loan.fillna({"purpose" : "credit_card"})
```

```
cleanup_nums = {"purpose": {"credit_card": 1,"debt_consolidation":
2 }}
```

```
obj_loan=obj_loan.replace(cleanup_nums)
obj_loan.head()
```

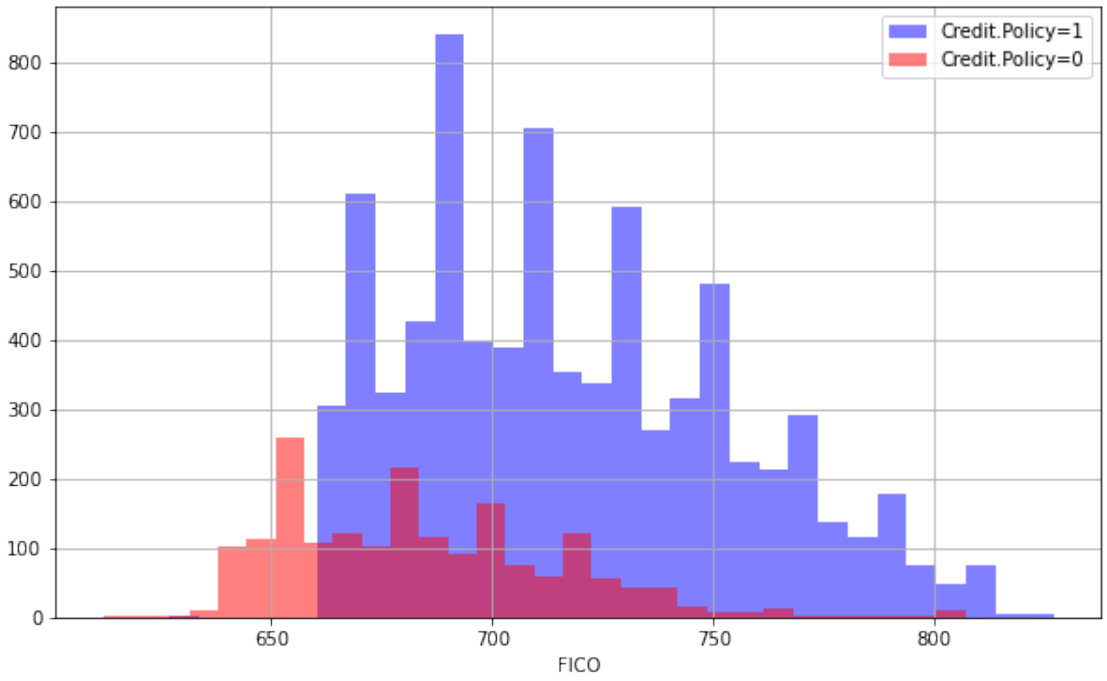
```
  purpose
0       2
1       1
2       2
3       2
4       1
```

```
#clean_loan = loan[:]#pd.read_csv('clean_loan.csv',encoding='utf-8')
```

```
#clean_loan.nunique().sort_values()
```

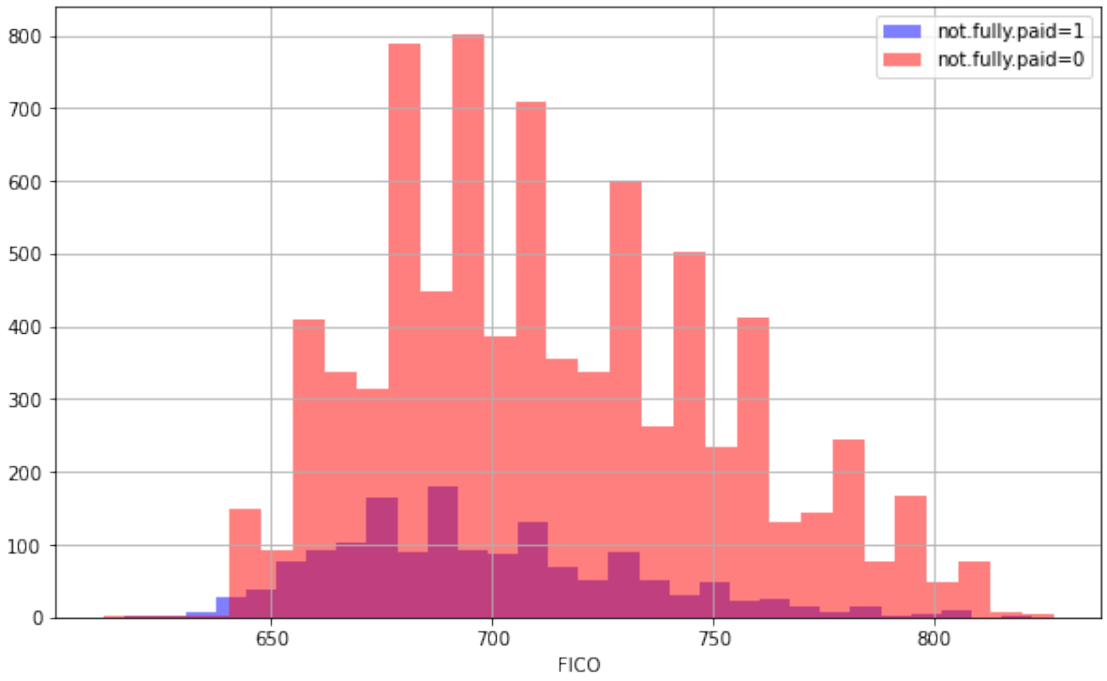
```
#EDA
plt.figure(figsize=(10,6))
loan[loan['credit.policy']==1]
['fico'].hist(alpha=0.5,color='blue',bins=30,label='Credit.Policy=1')
loan[loan['credit.policy']==0]
['fico'].hist(alpha=0.5,color='red',bins=30,label='Credit.Policy=0')
plt.legend()
plt.xlabel('FICO')
```

```
Text(0.5, 0, 'FICO')
```



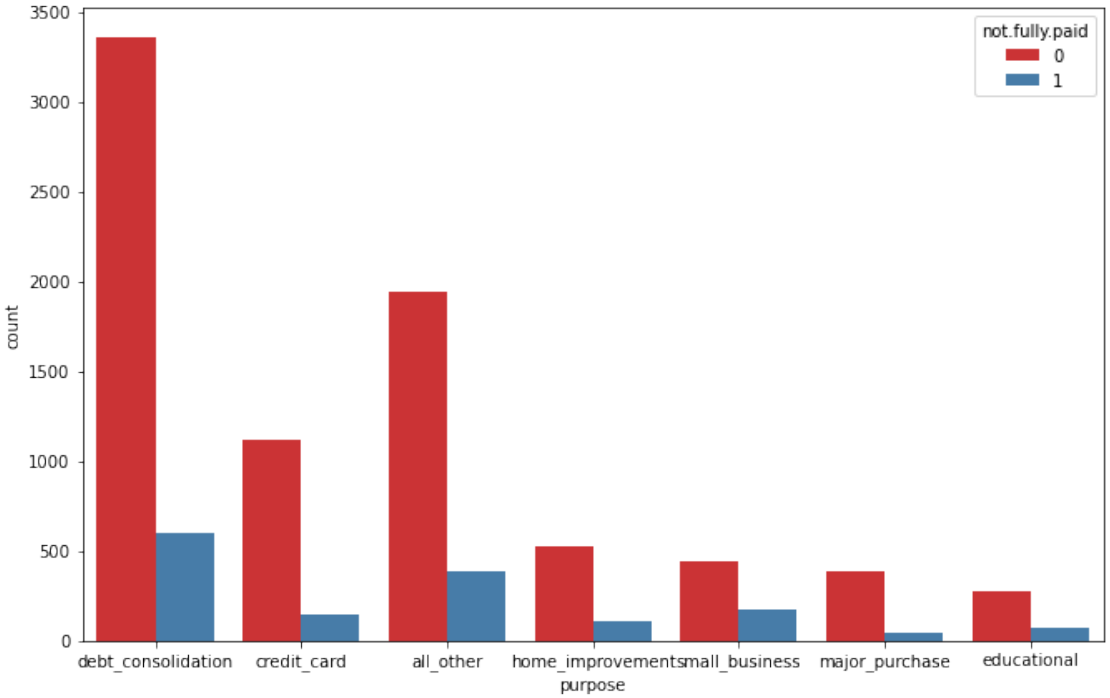

```
plt.figure(figsize=(10,6))
loan[loan['not.fully.paid']==1]
['fico'].hist(alpha=0.5,color='blue',bins=30,label='not.fully.paid=1')
loan[loan['not.fully.paid']==0]
['fico'].hist(alpha=0.5,color='red',bins=30,label='not.fully.paid=0')
plt.legend()
plt.xlabel('FICO')
```

```
Text(0.5, 0, 'FICO')
```



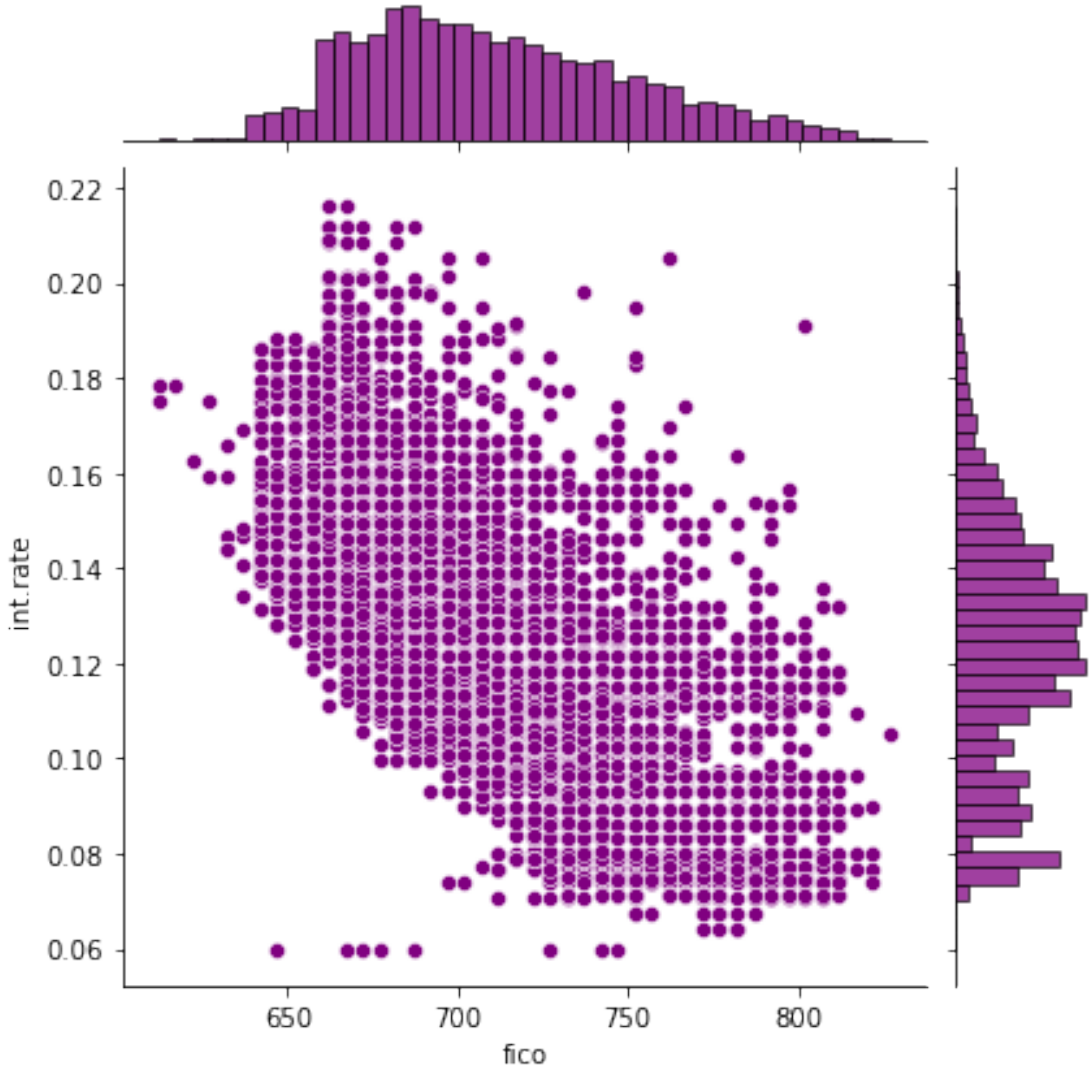

```
plt.figure(figsize=(11,7))
sns.countplot(x='purpose',hue='not.fully.paid',data=loan,palette='Set1
')
```

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




```
sns.jointplot(x='fico',y='int.rate',data=loan,color='purple')
```

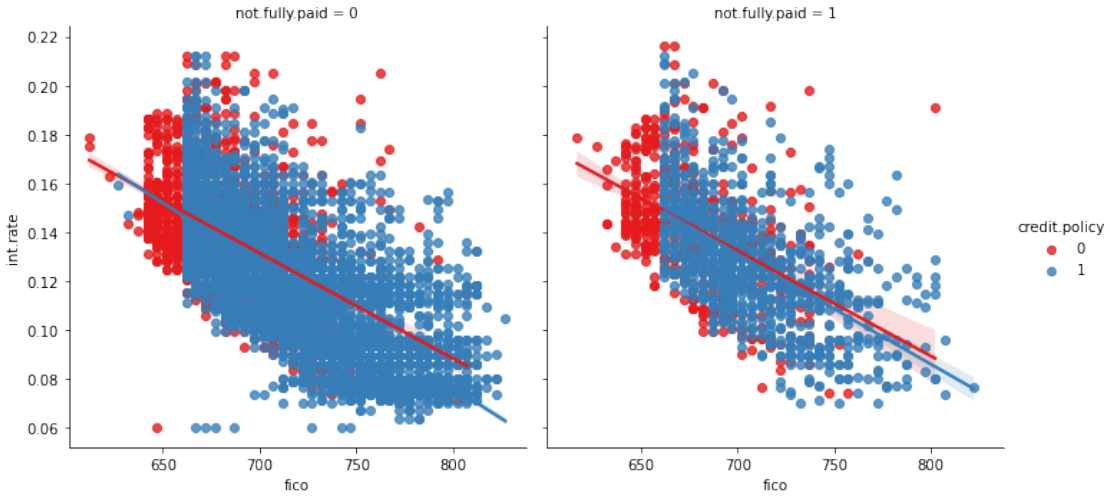
```
<seaborn.axisgrid.JointGrid at 0x1bb341705b0>
```




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

```
<seaborn.axisgrid.FacetGrid at 0x1bb34622d60>
```

```
<Figure size 792x504 with 0 Axes>
```




```
loan_num = loan.select_dtypes(include = ['float64','int64'])
loan_num.head()
```

```
   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
deling.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
0        0               0
1        0               0
2        0               0
```

```
3        0                0
4        0                0

#loan_num.hist(figsize=(16,20), bins=50, xlabelsize=8, ylabelsize=8);

#for i in range(0, len(loan_num.columns),5):
    #sns.pairplot(data=loan_num,
x_vars=loan_num.columns[i:i+5],y_vars=['log.annual.inc'])

#loan_num_corr = loan_num.corr()['int.rate'][:-1] # -1 because the
latest row is SalePrice
#golden_features_list = loan_num_corr[abs(loan_num_corr) >
0.5].sort_values(ascending=False)
#print("There is {} strongly correlated values with rate:\
n{}".format(len(golden_features_list), golden_features_list))

#correlation
cor_matrix = loan.corr().abs()
print(cor_matrix)

                  credit.policy  int.rate  installment
log.annual.inc  \
credit.policy           1.000000  0.294089     0.058770
0.034906
int.rate                0.294089  1.000000     0.276140
0.056383
installment             0.058770  0.276140     1.000000
0.448102
log.annual.inc          0.034906  0.056383     0.448102
1.000000
dti                     0.090901  0.220006     0.050202
0.054065
fico                    0.348319  0.714821     0.086039
0.114576
days.with.cr.line       0.099026  0.124022     0.183297
0.336896
revol.bal               0.187518  0.092527     0.233625
0.372140
revol.util              0.104095  0.464837     0.081356
0.054881
inq.last.6mths          0.535511  0.202780     0.010419
0.029171
delinq.2yrs             0.076318  0.156079     0.004368
0.029203
pub.rec                 0.054243  0.098162     0.032760
0.016506
not.fully.paid          0.158119  0.159552     0.049955
0.033439

                        dti      fico  days.with.cr.line  revol.bal  \
credit.policy      0.090901  0.348319           0.099026   0.187518
```

```
int.rate           0.220006  0.714821           0.124022   0.092527
installment        0.050202  0.086039           0.183297   0.233625
log.annual.inc     0.054065  0.114576           0.336896   0.372140
dti                1.000000  0.241191           0.060101   0.188748
fico               0.241191  1.000000           0.263880   0.015553
days.with.cr.line  0.060101  0.263880           1.000000   0.229344
revol.bal          0.188748  0.015553           0.229344   1.000000
revol.util         0.337109  0.541289           0.024239   0.203779
inq.last.6mths     0.029189  0.185293           0.041736   0.022394
delinq.2yrs        0.021792  0.216340           0.081374   0.033243
pub.rec            0.006209  0.147592           0.071826   0.031010
not.fully.paid     0.037362  0.149666           0.029237   0.053699

                   revol.util  inq.last.6mths  delinq.2yrs
pub.rec  \
credit.policy        0.104095        0.535511     0.076318  0.054243

int.rate             0.464837        0.202780     0.156079  0.098162

installment          0.081356        0.010419     0.004368  0.032760

log.annual.inc       0.054881        0.029171     0.029203  0.016506

dti                  0.337109        0.029189     0.021792  0.006209

fico                 0.541289        0.185293     0.216340  0.147592

days.with.cr.line    0.024239        0.041736     0.081374  0.071826

revol.bal            0.203779        0.022394     0.033243  0.031010

revol.util           1.000000        0.013880     0.042740  0.066717

inq.last.6mths       0.013880        1.000000     0.021245  0.072673

delinq.2yrs          0.042740        0.021245     1.000000  0.009184

pub.rec              0.066717        0.072673     0.009184  1.000000

not.fully.paid       0.082088        0.149452     0.008881  0.048634


                   not.fully.paid
credit.policy            0.158119
int.rate                 0.159552
installment              0.049955
log.annual.inc           0.033439
dti                      0.037362
fico                     0.149666
```

```
days.with.cr.line        0.029237
revol.bal                0.053699
revol.util               0.082088
inq.last.6mths           0.149452
delinq.2yrs              0.008881
pub.rec                  0.048634
not.fully.paid           1.000000

upper_tri =
cor_matrix.where(np.triu(np.ones(cor_matrix.shape),k=1).astype(np.bool
))
print(upper_tri)

                  credit.policy  int.rate  installment
log.annual.inc  \
credit.policy               NaN  0.294089      0.05877
0.034906
int.rate                    NaN       NaN      0.27614
0.056383
installment                 NaN       NaN          NaN
0.448102
log.annual.inc              NaN       NaN          NaN
NaN
dti                         NaN       NaN          NaN
NaN
fico                        NaN       NaN          NaN
NaN
days.with.cr.line           NaN       NaN          NaN
NaN
revol.bal                   NaN       NaN          NaN
NaN
revol.util                  NaN       NaN          NaN
NaN
inq.last.6mths              NaN       NaN          NaN
NaN
delinq.2yrs                 NaN       NaN          NaN
NaN
pub.rec                     NaN       NaN          NaN
NaN
not.fully.paid              NaN       NaN          NaN
NaN

                        dti      fico  days.with.cr.line  revol.bal  \
credit.policy      0.090901  0.348319           0.099026   0.187518
int.rate           0.220006  0.714821           0.124022   0.092527
installment        0.050202  0.086039           0.183297   0.233625
log.annual.inc     0.054065  0.114576           0.336896   0.372140
dti                     NaN  0.241191           0.060101   0.188748
fico                    NaN       NaN           0.263880   0.015553
days.with.cr.line       NaN       NaN                NaN   0.229344
```

```
revol.bal               NaN       NaN                NaN        NaN
revol.util              NaN       NaN                NaN        NaN
inq.last.6mths          NaN       NaN                NaN        NaN
delinq.2yrs             NaN       NaN                NaN        NaN
pub.rec                 NaN       NaN                NaN        NaN
not.fully.paid          NaN       NaN                NaN        NaN

                   revol.util  inq.last.6mths  delinq.2yrs
pub.rec  \
credit.policy        0.104095        0.535511     0.076318  0.054243

int.rate             0.464837        0.202780     0.156079  0.098162

installment          0.081356        0.010419     0.004368  0.032760

log.annual.inc       0.054881        0.029171     0.029203  0.016506

dti                  0.337109        0.029189     0.021792  0.006209

fico                 0.541289        0.185293     0.216340  0.147592

days.with.cr.line    0.024239        0.041736     0.081374  0.071826

revol.bal            0.203779        0.022394     0.033243  0.031010

revol.util                NaN        0.013880     0.042740  0.066717

inq.last.6mths            NaN             NaN     0.021245  0.072673

delinq.2yrs               NaN             NaN          NaN  0.009184

pub.rec                   NaN             NaN          NaN       NaN

not.fully.paid            NaN             NaN          NaN       NaN


                   not.fully.paid
credit.policy            0.158119
int.rate                 0.159552
installment              0.049955
log.annual.inc           0.033439
dti                      0.037362
fico                     0.149666
days.with.cr.line        0.029237
revol.bal                0.053699
revol.util               0.082088
inq.last.6mths           0.149452
delinq.2yrs              0.008881
```

```
pub.rec                  0.048634
not.fully.paid                NaN

C:\Users\MANISH~1\AppData\Local\Temp/ipykernel_20832/3477284062.py:1:
DeprecationWarning: `np.bool` is a deprecated alias for the builtin
`bool`. To silence this warning, use `bool` by itself. Doing this will
not modify any behavior and is safe. If you specifically wanted the
numpy scalar type, use `np.bool_` here.
Deprecated in NumPy 1.20; for more details and guidance:
https://numpy.org/devdocs/release/1.20.0-notes.html#deprecations
  upper_tri =
cor_matrix.where(np.triu(np.ones(cor_matrix.shape),k=1).astype(np.bool
))
```

```
final_data.corr()
plt.figure(
        figsize=[16,12]
)
sns.heatmap(
        data=final_data.corr(),
        cmap='viridis',
        annot=False,
        fmt='.2g'
)
```

```
---------------------------------------------------------------------
-----
NameError                                 Traceback (most recent call
last)
C:\Users\MANISH~1\AppData\Local\Temp/ipykernel_20832/3027186847.py in
<module>
----> 1 final_data.corr()
      2 plt.figure(
      3         figsize=[16,12]
      4 )
      5 sns.heatmap(

NameError: name 'final_data' is not defined
```

```
loan.describe().transpose()
```

```
                     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
```

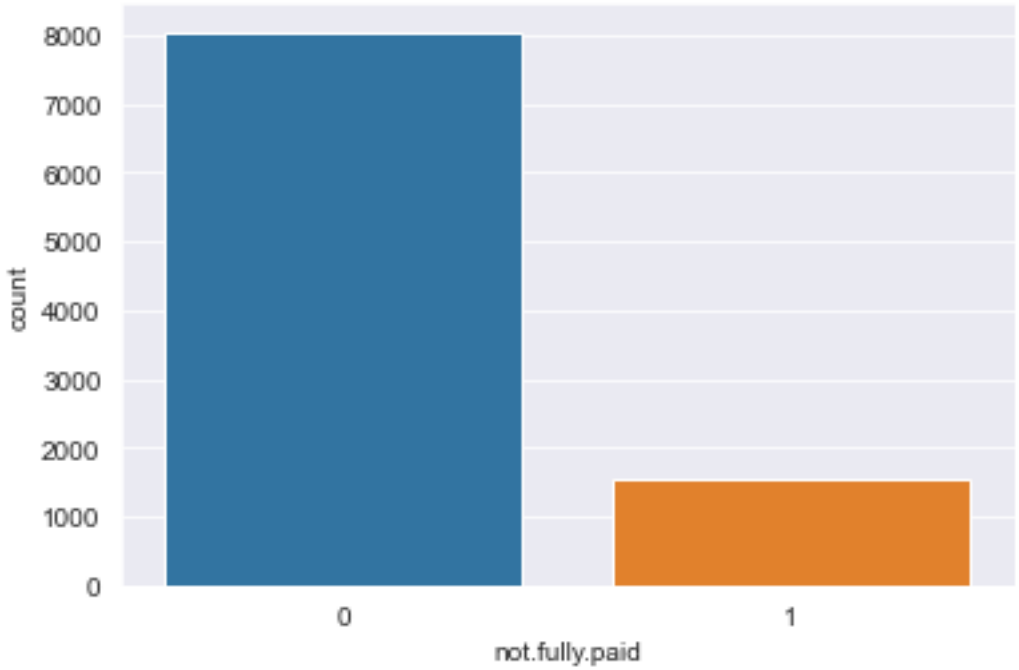
```
inq.last.6mths     9578.0      1.577469      2.200245    0.000000
delinq.2yrs        9578.0      0.163708      0.546215    0.000000
pub.rec            9578.0      0.062122      0.262126    0.000000
not.fully.paid     9578.0      0.160054      0.366676    0.000000

                           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
```

```
loan['not.fully.paid'].isnull().mean()
loan.groupby('not.fully.paid')['not.fully.paid'].count()/len(loan)
```

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

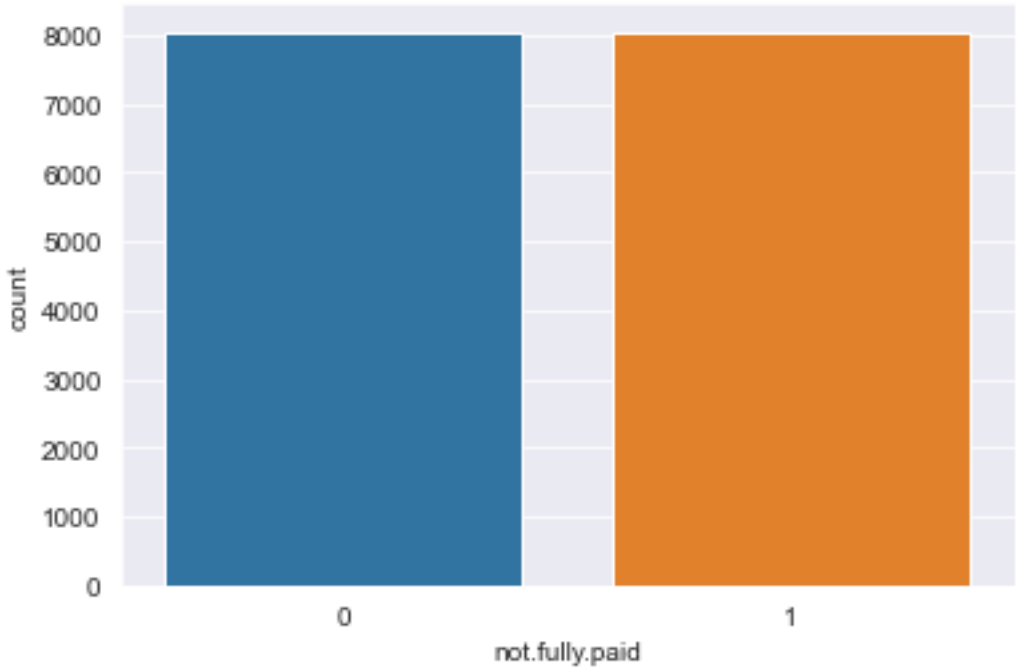
```
sns.set_style('darkgrid')
sns.countplot(x='not.fully.paid', data=loan)
```

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




```
count_class_0, count_class_1 = loan['not.fully.paid'].value_counts()
loan_0 = loan[loan['not.fully.paid'] == 0]
loan_1 = loan[loan['not.fully.paid'] == 1]
loan_1_over = loan_1.sample(count_class_0, replace=True)
loan_test_over = pd.concat([loan_0, loan_1_over], axis=0)
print('Random over-sampling:')
print(loan_test_over['not.fully.paid'].value_counts())

sns.set_style('darkgrid')
sns.countplot(x='not.fully.paid', data=loan_test_over)
```

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

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




```
col_fea = ['purpose']
final_data =
pd.get_dummies(loan_test_over,columns=col_fea,drop_first=True)
final_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 16090 entries, 0 to 8878
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: 2.3 MB
```

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

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)

scaler = MinMaxScaler()
X_train = scaler.fit_transform(X_train)
X_test = scaler.transform(X_test)

model = Sequential()

model.add(
        Dense(19, activation='relu')
)

model.add(
        Dense(10, activation='relu')
)

model.add(
        Dense(5, activation='relu')
)


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

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

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 [==============================] - 4s 6ms/step - loss: 0.6951 -
accuracy: 0.4922 - val_loss: 0.6920 - val_accuracy: 0.5250
Epoch 2/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6898 -
accuracy: 0.5556 - val_loss: 0.6878 - val_accuracy: 0.5770
Epoch 3/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6841 -
accuracy: 0.5867 - val_loss: 0.6817 - val_accuracy: 0.5981
Epoch 4/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6765 -
accuracy: 0.6083 - val_loss: 0.6748 - val_accuracy: 0.6089
Epoch 5/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6677 -
accuracy: 0.6144 - val_loss: 0.6663 - val_accuracy: 0.6093
Epoch 6/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6572 -
accuracy: 0.6156 - val_loss: 0.6567 - val_accuracy: 0.6085
Epoch 7/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6468 -
accuracy: 0.6225 - val_loss: 0.6521 - val_accuracy: 0.6134
Epoch 8/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6423 -
accuracy: 0.6205 - val_loss: 0.6471 - val_accuracy: 0.6143
Epoch 9/200
44/44 [==============================] - 0s 3ms/step - loss: 0.6385 -
accuracy: 0.6233 - val_loss: 0.6464 - val_accuracy: 0.6159
Epoch 10/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6368 -
accuracy: 0.6239 - val_loss: 0.6438 - val_accuracy: 0.6184
Epoch 11/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6355 -
accuracy: 0.6253 - val_loss: 0.6441 - val_accuracy: 0.6211
Epoch 12/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6340 -
accuracy: 0.6302 - val_loss: 0.6422 - val_accuracy: 0.6182
Epoch 13/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6325 -
accuracy: 0.6314 - val_loss: 0.6409 - val_accuracy: 0.6215
Epoch 14/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6311 -
accuracy: 0.6332 - val_loss: 0.6414 - val_accuracy: 0.6196
```

```
Epoch 15/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6298 -
accuracy: 0.6338 - val_loss: 0.6398 - val_accuracy: 0.6219
Epoch 16/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6296 -
accuracy: 0.6322 - val_loss: 0.6417 - val_accuracy: 0.6194
Epoch 17/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6287 -
accuracy: 0.6353 - val_loss: 0.6392 - val_accuracy: 0.6250
Epoch 18/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6277 -
accuracy: 0.6322 - val_loss: 0.6400 - val_accuracy: 0.6221
Epoch 19/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6273 -
accuracy: 0.6338 - val_loss: 0.6385 - val_accuracy: 0.6244
Epoch 20/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6262 -
accuracy: 0.6329 - val_loss: 0.6389 - val_accuracy: 0.6219
Epoch 21/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6254 -
accuracy: 0.6343 - val_loss: 0.6377 - val_accuracy: 0.6267
Epoch 22/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6256 -
accuracy: 0.6362 - val_loss: 0.6376 - val_accuracy: 0.6244
Epoch 23/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6241 -
accuracy: 0.6359 - val_loss: 0.6374 - val_accuracy: 0.6261
Epoch 24/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6240 -
accuracy: 0.6349 - val_loss: 0.6369 - val_accuracy: 0.6261
Epoch 25/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6235 -
accuracy: 0.6362 - val_loss: 0.6395 - val_accuracy: 0.6217
Epoch 26/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6234 -
accuracy: 0.6370 - val_loss: 0.6355 - val_accuracy: 0.6285
Epoch 27/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6220 -
accuracy: 0.6396 - val_loss: 0.6368 - val_accuracy: 0.6250
Epoch 28/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6215 -
accuracy: 0.6383 - val_loss: 0.6349 - val_accuracy: 0.6259
Epoch 29/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6200 -
accuracy: 0.6417 - val_loss: 0.6345 - val_accuracy: 0.6273
Epoch 30/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6199 -
accuracy: 0.6406 - val_loss: 0.6347 - val_accuracy: 0.6294
Epoch 31/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6190 -
```

```
accuracy: 0.6425 - val_loss: 0.6350 - val_accuracy: 0.6256
Epoch 32/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6188 -
accuracy: 0.6406 - val_loss: 0.6340 - val_accuracy: 0.6271
Epoch 33/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6181 -
accuracy: 0.6415 - val_loss: 0.6331 - val_accuracy: 0.6290
Epoch 34/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6171 -
accuracy: 0.6456 - val_loss: 0.6329 - val_accuracy: 0.6263
Epoch 35/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6178 -
accuracy: 0.6449 - val_loss: 0.6332 - val_accuracy: 0.6275
Epoch 36/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6159 -
accuracy: 0.6425 - val_loss: 0.6322 - val_accuracy: 0.6256
Epoch 37/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6159 -
accuracy: 0.6433 - val_loss: 0.6318 - val_accuracy: 0.6265
Epoch 38/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6149 -
accuracy: 0.6430 - val_loss: 0.6328 - val_accuracy: 0.6285
Epoch 39/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6155 -
accuracy: 0.6449 - val_loss: 0.6308 - val_accuracy: 0.6275
Epoch 40/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6140 -
accuracy: 0.6469 - val_loss: 0.6340 - val_accuracy: 0.6321
Epoch 41/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6138 -
accuracy: 0.6439 - val_loss: 0.6310 - val_accuracy: 0.6267
Epoch 42/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6136 -
accuracy: 0.6461 - val_loss: 0.6323 - val_accuracy: 0.6325
Epoch 43/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6136 -
accuracy: 0.6490 - val_loss: 0.6323 - val_accuracy: 0.6343
Epoch 44/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6132 -
accuracy: 0.6485 - val_loss: 0.6344 - val_accuracy: 0.6321
Epoch 45/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6128 -
accuracy: 0.6478 - val_loss: 0.6307 - val_accuracy: 0.6337
Epoch 46/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6125 -
accuracy: 0.6488 - val_loss: 0.6299 - val_accuracy: 0.6288
Epoch 47/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6112 -
accuracy: 0.6504 - val_loss: 0.6336 - val_accuracy: 0.6306
Epoch 48/200
```

```
44/44 [==============================] - 0s 2ms/step - loss: 0.6111 -
accuracy: 0.6496 - val_loss: 0.6304 - val_accuracy: 0.6304
Epoch 49/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6110 -
accuracy: 0.6494 - val_loss: 0.6304 - val_accuracy: 0.6335
Epoch 50/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6109 -
accuracy: 0.6495 - val_loss: 0.6296 - val_accuracy: 0.6333
Epoch 51/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6103 -
accuracy: 0.6520 - val_loss: 0.6295 - val_accuracy: 0.6364
Epoch 52/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6097 -
accuracy: 0.6530 - val_loss: 0.6295 - val_accuracy: 0.6348
Epoch 53/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6094 -
accuracy: 0.6541 - val_loss: 0.6297 - val_accuracy: 0.6352
Epoch 54/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6100 -
accuracy: 0.6498 - val_loss: 0.6289 - val_accuracy: 0.6354
Epoch 55/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6086 -
accuracy: 0.6520 - val_loss: 0.6291 - val_accuracy: 0.6370
Epoch 56/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6086 -
accuracy: 0.6537 - val_loss: 0.6286 - val_accuracy: 0.6356
Epoch 57/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6074 -
accuracy: 0.6536 - val_loss: 0.6299 - val_accuracy: 0.6370
Epoch 58/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6072 -
accuracy: 0.6542 - val_loss: 0.6298 - val_accuracy: 0.6321

Epoch 59/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6075 -
accuracy: 0.6568 - val_loss: 0.6289 - val_accuracy: 0.6379
Epoch 60/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6072 -
accuracy: 0.6546 - val_loss: 0.6282 - val_accuracy: 0.6424
Epoch 61/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6064 -
accuracy: 0.6587 - val_loss: 0.6276 - val_accuracy: 0.6358
Epoch 62/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6062 -
accuracy: 0.6585 - val_loss: 0.6290 - val_accuracy: 0.6370
Epoch 63/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6057 -
accuracy: 0.6585 - val_loss: 0.6282 - val_accuracy: 0.6381
Epoch 64/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6063 -
```

```
accuracy: 0.6576 - val_loss: 0.6282 - val_accuracy: 0.6383
Epoch 65/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6072 -
accuracy: 0.6579 - val_loss: 0.6277 - val_accuracy: 0.6358
Epoch 66/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6052 -
accuracy: 0.6591 - val_loss: 0.6270 - val_accuracy: 0.6406
Epoch 67/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6056 -
accuracy: 0.6577 - val_loss: 0.6268 - val_accuracy: 0.6428
Epoch 68/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6046 -
accuracy: 0.6593 - val_loss: 0.6271 - val_accuracy: 0.6428
Epoch 69/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6040 -
accuracy: 0.6596 - val_loss: 0.6267 - val_accuracy: 0.6397
Epoch 70/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6043 -
accuracy: 0.6607 - val_loss: 0.6281 - val_accuracy: 0.6422
Epoch 71/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6049 -
accuracy: 0.6587 - val_loss: 0.6262 - val_accuracy: 0.6424
Epoch 72/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6038 -
accuracy: 0.6607 - val_loss: 0.6274 - val_accuracy: 0.6418
Epoch 73/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6042 -
accuracy: 0.6620 - val_loss: 0.6275 - val_accuracy: 0.6410
Epoch 74/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6032 -
accuracy: 0.6591 - val_loss: 0.6294 - val_accuracy: 0.6383
Epoch 75/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6028 -
accuracy: 0.6611 - val_loss: 0.6267 - val_accuracy: 0.6422
Epoch 76/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6035 -
accuracy: 0.6589 - val_loss: 0.6268 - val_accuracy: 0.6408
Epoch 77/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6022 -
accuracy: 0.6616 - val_loss: 0.6286 - val_accuracy: 0.6364
Epoch 78/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6026 -
accuracy: 0.6590 - val_loss: 0.6271 - val_accuracy: 0.6397
Epoch 79/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6025 -
accuracy: 0.6618 - val_loss: 0.6276 - val_accuracy: 0.6366
Epoch 80/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6022 -
accuracy: 0.6627 - val_loss: 0.6267 - val_accuracy: 0.6404
Epoch 81/200
```

```
44/44 [==============================] - 0s 2ms/step - loss: 0.6013 -
accuracy: 0.6632 - val_loss: 0.6267 - val_accuracy: 0.6426
Epoch 82/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6018 -
accuracy: 0.6625 - val_loss: 0.6319 - val_accuracy: 0.6370
Epoch 83/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6024 -
accuracy: 0.6606 - val_loss: 0.6294 - val_accuracy: 0.6399
Epoch 84/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6015 -
accuracy: 0.6616 - val_loss: 0.6310 - val_accuracy: 0.6385
Epoch 85/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6020 -
accuracy: 0.6614 - val_loss: 0.6257 - val_accuracy: 0.6437
Epoch 86/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6009 -
accuracy: 0.6620 - val_loss: 0.6268 - val_accuracy: 0.6362
Epoch 87/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6004 -
accuracy: 0.6654 - val_loss: 0.6271 - val_accuracy: 0.6430
Epoch 88/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6009 -
accuracy: 0.6631 - val_loss: 0.6277 - val_accuracy: 0.6395
Epoch 89/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6001 -
accuracy: 0.6654 - val_loss: 0.6258 - val_accuracy: 0.6457
Epoch 90/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6000 -
accuracy: 0.6623 - val_loss: 0.6284 - val_accuracy: 0.6358
Epoch 91/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5999 -
accuracy: 0.6623 - val_loss: 0.6265 - val_accuracy: 0.6393
Epoch 92/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6000 -
accuracy: 0.6651 - val_loss: 0.6297 - val_accuracy: 0.6375
Epoch 93/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6007 -
accuracy: 0.6631 - val_loss: 0.6261 - val_accuracy: 0.6451
Epoch 94/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6009 -
accuracy: 0.6632 - val_loss: 0.6261 - val_accuracy: 0.6420
Epoch 95/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5998 -
accuracy: 0.6639 - val_loss: 0.6266 - val_accuracy: 0.6389
Epoch 96/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5999 -
accuracy: 0.6645 - val_loss: 0.6246 - val_accuracy: 0.6443
Epoch 97/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5989 -
accuracy: 0.6665 - val_loss: 0.6255 - val_accuracy: 0.6428
```

```
Epoch 98/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5990 -
accuracy: 0.6639 - val_loss: 0.6294 - val_accuracy: 0.6370
Epoch 99/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5989 -
accuracy: 0.6630 - val_loss: 0.6254 - val_accuracy: 0.6433
Epoch 100/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5979 -
accuracy: 0.6694 - val_loss: 0.6260 - val_accuracy: 0.6445
Epoch 101/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5984 -
accuracy: 0.6624 - val_loss: 0.6270 - val_accuracy: 0.6422
Epoch 102/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5994 -
accuracy: 0.6651 - val_loss: 0.6262 - val_accuracy: 0.6441
Epoch 103/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5994 -
accuracy: 0.6657 - val_loss: 0.6251 - val_accuracy: 0.6470
Epoch 104/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5980 -
accuracy: 0.6657 - val_loss: 0.6247 - val_accuracy: 0.6466
Epoch 105/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5975 -
accuracy: 0.6675 - val_loss: 0.6256 - val_accuracy: 0.6401
Epoch 106/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5975 -
accuracy: 0.6668 - val_loss: 0.6249 - val_accuracy: 0.6480
Epoch 107/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5971 -
accuracy: 0.6669 - val_loss: 0.6258 - val_accuracy: 0.6451
Epoch 108/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5969 -
accuracy: 0.6670 - val_loss: 0.6251 - val_accuracy: 0.6462
Epoch 109/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5969 -
accuracy: 0.6702 - val_loss: 0.6243 - val_accuracy: 0.6466
Epoch 110/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5971 -
accuracy: 0.6674 - val_loss: 0.6266 - val_accuracy: 0.6404
Epoch 111/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5976 -
accuracy: 0.6654 - val_loss: 0.6276 - val_accuracy: 0.6404
Epoch 112/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5974 -
accuracy: 0.6679 - val_loss: 0.6242 - val_accuracy: 0.6472
Epoch 113/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5963 -
accuracy: 0.6669 - val_loss: 0.6255 - val_accuracy: 0.6439
Epoch 114/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5972 -
```

```
accuracy: 0.6675 - val_loss: 0.6240 - val_accuracy: 0.6495
Epoch 115/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5974 -
accuracy: 0.6655 - val_loss: 0.6258 - val_accuracy: 0.6433
Epoch 116/200

44/44 [==============================] - 0s 2ms/step - loss: 0.5969 -
accuracy: 0.6692 - val_loss: 0.6241 - val_accuracy: 0.6466
Epoch 117/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5969 -
accuracy: 0.6663 - val_loss: 0.6249 - val_accuracy: 0.6468
Epoch 118/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5962 -
accuracy: 0.6710 - val_loss: 0.6258 - val_accuracy: 0.6410
Epoch 119/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5958 -
accuracy: 0.6696 - val_loss: 0.6248 - val_accuracy: 0.6459
Epoch 120/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5955 -
accuracy: 0.6714 - val_loss: 0.6240 - val_accuracy: 0.6464
Epoch 121/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5956 -
accuracy: 0.6682 - val_loss: 0.6254 - val_accuracy: 0.6447
Epoch 122/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5957 -
accuracy: 0.6734 - val_loss: 0.6237 - val_accuracy: 0.6464
Epoch 123/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5953 -
accuracy: 0.6702 - val_loss: 0.6254 - val_accuracy: 0.6482
Epoch 124/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5954 -
accuracy: 0.6722 - val_loss: 0.6241 - val_accuracy: 0.6433
Epoch 125/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5948 -
accuracy: 0.6716 - val_loss: 0.6262 - val_accuracy: 0.6389
Epoch 126/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5949 -
accuracy: 0.6702 - val_loss: 0.6242 - val_accuracy: 0.6445
Epoch 127/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5947 -
accuracy: 0.6713 - val_loss: 0.6235 - val_accuracy: 0.6428
Epoch 128/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5945 -
accuracy: 0.6710 - val_loss: 0.6230 - val_accuracy: 0.6484
Epoch 129/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5945 -
accuracy: 0.6702 - val_loss: 0.6240 - val_accuracy: 0.6439
Epoch 130/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5941 -
accuracy: 0.6714 - val_loss: 0.6232 - val_accuracy: 0.6435
```

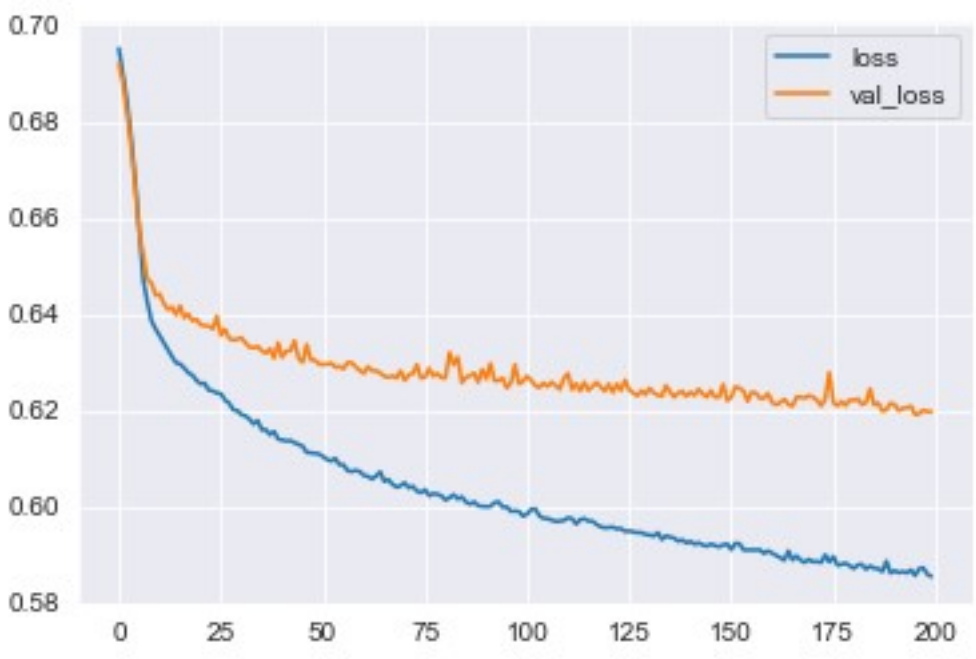
```
Epoch 131/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5940 -
accuracy: 0.6702 - val_loss: 0.6245 - val_accuracy: 0.6422
Epoch 132/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5938 -
accuracy: 0.6726 - val_loss: 0.6235 - val_accuracy: 0.6455
Epoch 133/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5945 -
accuracy: 0.6680 - val_loss: 0.6231 - val_accuracy: 0.6480
Epoch 134/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5931 -
accuracy: 0.6708 - val_loss: 0.6228 - val_accuracy: 0.6478
Epoch 135/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5939 -
accuracy: 0.6704 - val_loss: 0.6251 - val_accuracy: 0.6437
Epoch 136/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5936 -
accuracy: 0.6697 - val_loss: 0.6238 - val_accuracy: 0.6462
Epoch 137/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5934 -
accuracy: 0.6717 - val_loss: 0.6227 - val_accuracy: 0.6538
Epoch 138/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5927 -
accuracy: 0.6734 - val_loss: 0.6235 - val_accuracy: 0.6493
Epoch 139/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5930 -
accuracy: 0.6719 - val_loss: 0.6239 - val_accuracy: 0.6433
Epoch 140/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5924 -
accuracy: 0.6754 - val_loss: 0.6228 - val_accuracy: 0.6476
Epoch 141/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5927 -
accuracy: 0.6720 - val_loss: 0.6237 - val_accuracy: 0.6468
Epoch 142/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5921 -
accuracy: 0.6726 - val_loss: 0.6231 - val_accuracy: 0.6464
Epoch 143/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5924 -
accuracy: 0.6725 - val_loss: 0.6243 - val_accuracy: 0.6466
Epoch 144/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5919 -
accuracy: 0.6730 - val_loss: 0.6233 - val_accuracy: 0.6484
Epoch 145/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5917 -
accuracy: 0.6739 - val_loss: 0.6227 - val_accuracy: 0.6478
Epoch 146/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5922 -
accuracy: 0.6722 - val_loss: 0.6241 - val_accuracy: 0.6466
Epoch 147/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5919 -
```

```
accuracy: 0.6764 - val_loss: 0.6227 - val_accuracy: 0.6414
Epoch 148/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5916 -
accuracy: 0.6728 - val_loss: 0.6227 - val_accuracy: 0.6491
Epoch 149/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5920 -
accuracy: 0.6718 - val_loss: 0.6253 - val_accuracy: 0.6437
Epoch 150/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5921 -
accuracy: 0.6725 - val_loss: 0.6219 - val_accuracy: 0.6472
Epoch 151/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5910 -
accuracy: 0.6721 - val_loss: 0.6227 - val_accuracy: 0.6462
Epoch 152/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5923 -
accuracy: 0.6747 - val_loss: 0.6248 - val_accuracy: 0.6435
Epoch 153/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5922 -
accuracy: 0.6715 - val_loss: 0.6246 - val_accuracy: 0.6445
Epoch 154/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5909 -
accuracy: 0.6714 - val_loss: 0.6239 - val_accuracy: 0.6472
Epoch 155/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5909 -
accuracy: 0.6739 - val_loss: 0.6218 - val_accuracy: 0.6476
Epoch 156/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5908 -
accuracy: 0.6729 - val_loss: 0.6237 - val_accuracy: 0.6464
Epoch 157/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5909 -
accuracy: 0.6710 - val_loss: 0.6235 - val_accuracy: 0.6420
Epoch 158/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5910 -
accuracy: 0.6713 - val_loss: 0.6225 - val_accuracy: 0.6466
Epoch 159/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5902 -
accuracy: 0.6725 - val_loss: 0.6224 - val_accuracy: 0.6472
Epoch 160/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5907 -
accuracy: 0.6746 - val_loss: 0.6235 - val_accuracy: 0.6449
Epoch 161/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5902 -
accuracy: 0.6715 - val_loss: 0.6216 - val_accuracy: 0.6524
Epoch 162/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5898 -
accuracy: 0.6740 - val_loss: 0.6211 - val_accuracy: 0.6507
Epoch 163/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5893 -
accuracy: 0.6761 - val_loss: 0.6215 - val_accuracy: 0.6472
Epoch 164/200
```

```
44/44 [==============================] - 0s 2ms/step - loss: 0.5888 -
accuracy: 0.6721 - val_loss: 0.6222 - val_accuracy: 0.6443
Epoch 165/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5907 -
accuracy: 0.6699 - val_loss: 0.6211 - val_accuracy: 0.6466
Epoch 166/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5888 -
accuracy: 0.6747 - val_loss: 0.6208 - val_accuracy: 0.6495
Epoch 167/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5897 -
accuracy: 0.6700 - val_loss: 0.6227 - val_accuracy: 0.6509
Epoch 168/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5888 -
accuracy: 0.6765 - val_loss: 0.6227 - val_accuracy: 0.6497
Epoch 169/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5883 -
accuracy: 0.6759 - val_loss: 0.6225 - val_accuracy: 0.6445
Epoch 170/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5890 -
accuracy: 0.6743 - val_loss: 0.6230 - val_accuracy: 0.6484
Epoch 171/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5885 -
accuracy: 0.6736 - val_loss: 0.6227 - val_accuracy: 0.6459
Epoch 172/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5885 -
accuracy: 0.6729 - val_loss: 0.6220 - val_accuracy: 0.6491
Epoch 173/200

44/44 [==============================] - 0s 2ms/step - loss: 0.5883 -
accuracy: 0.6756 - val_loss: 0.6209 - val_accuracy: 0.6505
Epoch 174/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5899 -
accuracy: 0.6721 - val_loss: 0.6222 - val_accuracy: 0.6453
Epoch 175/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5884 -
accuracy: 0.6734 - val_loss: 0.6278 - val_accuracy: 0.6441
Epoch 176/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5896 -
accuracy: 0.6719 - val_loss: 0.6215 - val_accuracy: 0.6489
Epoch 177/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5877 -
accuracy: 0.6742 - val_loss: 0.6209 - val_accuracy: 0.6499
Epoch 178/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5879 -
accuracy: 0.6756 - val_loss: 0.6218 - val_accuracy: 0.6468
Epoch 179/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5882 -
accuracy: 0.6724 - val_loss: 0.6209 - val_accuracy: 0.6476
Epoch 180/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5876 -
```

```
accuracy: 0.6718 - val_loss: 0.6221 - val_accuracy: 0.6507
Epoch 181/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5871 -
accuracy: 0.6768 - val_loss: 0.6220 - val_accuracy: 0.6503
Epoch 182/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5878 -
accuracy: 0.6732 - val_loss: 0.6223 - val_accuracy: 0.6414
Epoch 183/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5879 -
accuracy: 0.6747 - val_loss: 0.6211 - val_accuracy: 0.6449
Epoch 184/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5869 -
accuracy: 0.6769 - val_loss: 0.6215 - val_accuracy: 0.6499
Epoch 185/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5876 -
accuracy: 0.6735 - val_loss: 0.6244 - val_accuracy: 0.6368
Epoch 186/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5871 -
accuracy: 0.6767 - val_loss: 0.6211 - val_accuracy: 0.6441
Epoch 187/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5871 -
accuracy: 0.6752 - val_loss: 0.6214 - val_accuracy: 0.6468
Epoch 188/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5864 -
accuracy: 0.6744 - val_loss: 0.6198 - val_accuracy: 0.6491
Epoch 189/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5886 -
accuracy: 0.6714 - val_loss: 0.6200 - val_accuracy: 0.6453
Epoch 190/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5861 -
accuracy: 0.6759 - val_loss: 0.6214 - val_accuracy: 0.6474
Epoch 191/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5866 -
accuracy: 0.6754 - val_loss: 0.6211 - val_accuracy: 0.6474
Epoch 192/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5862 -
accuracy: 0.6763 - val_loss: 0.6199 - val_accuracy: 0.6474
Epoch 193/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5864 -
accuracy: 0.6743 - val_loss: 0.6203 - val_accuracy: 0.6501
Epoch 194/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5861 -
accuracy: 0.6766 - val_loss: 0.6205 - val_accuracy: 0.6459
Epoch 195/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5868 -
accuracy: 0.6749 - val_loss: 0.6208 - val_accuracy: 0.6439
Epoch 196/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5856 -
accuracy: 0.6784 - val_loss: 0.6191 - val_accuracy: 0.6484
Epoch 197/200
```

```
44/44 [==============================] - 0s 2ms/step - loss: 0.5870 -
accuracy: 0.6772 - val_loss: 0.6192 - val_accuracy: 0.6464
Epoch 198/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5872 -
accuracy: 0.6729 - val_loss: 0.6200 - val_accuracy: 0.6489
Epoch 199/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5859 -
accuracy: 0.6739 - val_loss: 0.6197 - val_accuracy: 0.6557
Epoch 200/200
44/44 [==============================] - 0s 2ms/step - loss: 0.5854 -
accuracy: 0.6758 - val_loss: 0.6197 - val_accuracy: 0.6480

<keras.callbacks.History at 0x1bb363ba130>

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

<AxesSubplot:>
```




```
model_new = Sequential()

model_new.add(
        Dense(19, activation='relu')
)

model_new.add(Dropout(0.2))

model_new.add(
        Dense(10, activation='relu')
)
```

```
model_new.add(Dropout(0.2))

model_new.add(
        Dense(5, 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: 0.6993 -
binary_accuracy: 0.5133 - val_loss: 0.6907 - val_binary_accuracy:
0.5473
Epoch 2/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6882 -
binary_accuracy: 0.5391 - val_loss: 0.6839 - val_binary_accuracy:
0.5925
Epoch 3/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6836 -
binary_accuracy: 0.5639 - val_loss: 0.6770 - val_binary_accuracy:
0.6056
Epoch 4/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6763 -
binary_accuracy: 0.5889 - val_loss: 0.6711 - val_binary_accuracy:
0.6051
Epoch 5/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6744 -
binary_accuracy: 0.5969 - val_loss: 0.6686 - val_binary_accuracy:
0.6062
Epoch 6/200
```

```
44/44 [==============================] - 0s 2ms/step - loss: 0.6713 -
binary_accuracy: 0.6030 - val_loss: 0.6669 - val_binary_accuracy:
0.6076
Epoch 7/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6705 -
binary_accuracy: 0.5979 - val_loss: 0.6659 - val_binary_accuracy:
0.6122
Epoch 8/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6691 -
binary_accuracy: 0.6013 - val_loss: 0.6648 - val_binary_accuracy:
0.6101
Epoch 9/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6666 -
binary_accuracy: 0.6076 - val_loss: 0.6620 - val_binary_accuracy:
0.6053
Epoch 10/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6655 -
binary_accuracy: 0.6037 - val_loss: 0.6590 - val_binary_accuracy:
0.6145
Epoch 11/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6607 -
binary_accuracy: 0.6115 - val_loss: 0.6565 - val_binary_accuracy:
0.6157
Epoch 12/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6601 -
binary_accuracy: 0.6076 - val_loss: 0.6550 - val_binary_accuracy:
0.6159
Epoch 13/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6582 -
binary_accuracy: 0.6129 - val_loss: 0.6535 - val_binary_accuracy:
0.6138
Epoch 14/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6574 -
binary_accuracy: 0.6093 - val_loss: 0.6523 - val_binary_accuracy:
0.6153
Epoch 15/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6576 -
binary_accuracy: 0.6175 - val_loss: 0.6504 - val_binary_accuracy:
0.6201
Epoch 16/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6551 -
binary_accuracy: 0.6165 - val_loss: 0.6494 - val_binary_accuracy:
0.6244
Epoch 17/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6558 -
binary_accuracy: 0.6155 - val_loss: 0.6486 - val_binary_accuracy:
0.6281
Epoch 18/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6540 -
binary_accuracy: 0.6164 - val_loss: 0.6478 - val_binary_accuracy:
```

```
0.6265
Epoch 19/200
44/44 [==============================] - 0s 3ms/step - loss: 0.6515 -
binary_accuracy: 0.6164 - val_loss: 0.6471 - val_binary_accuracy:
0.6236
Epoch 20/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6534 -
binary_accuracy: 0.6135 - val_loss: 0.6473 - val_binary_accuracy:
0.6246
Epoch 21/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6514 -
binary_accuracy: 0.6165 - val_loss: 0.6466 - val_binary_accuracy:
0.6312
Epoch 22/200
44/44 [==============================] - 0s 3ms/step - loss: 0.6527 -
binary_accuracy: 0.6190 - val_loss: 0.6456 - val_binary_accuracy:
0.6283
Epoch 23/200
44/44 [==============================] - 0s 3ms/step - loss: 0.6498 -
binary_accuracy: 0.6252 - val_loss: 0.6452 - val_binary_accuracy:
0.6327
Epoch 24/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6504 -
binary_accuracy: 0.6224 - val_loss: 0.6438 - val_binary_accuracy:
0.6314
Epoch 25/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6495 -
binary_accuracy: 0.6170 - val_loss: 0.6434 - val_binary_accuracy:
0.6306
Epoch 26/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6480 -
binary_accuracy: 0.6215 - val_loss: 0.6435 - val_binary_accuracy:
0.6317
Epoch 27/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6484 -
binary_accuracy: 0.6201 - val_loss: 0.6423 - val_binary_accuracy:
0.6329
Epoch 28/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6478 -
binary_accuracy: 0.6267 - val_loss: 0.6424 - val_binary_accuracy:
0.6267
Epoch 29/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6481 -
binary_accuracy: 0.6219 - val_loss: 0.6418 - val_binary_accuracy:
0.6323
Epoch 30/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6477 -
binary_accuracy: 0.6208 - val_loss: 0.6410 - val_binary_accuracy:
0.6343
Epoch 31/200
```

```
44/44 [==============================] - 0s 2ms/step - loss: 0.6492 -
binary_accuracy: 0.6196 - val_loss: 0.6407 - val_binary_accuracy:
0.6352
Epoch 32/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6446 -
binary_accuracy: 0.6256 - val_loss: 0.6398 - val_binary_accuracy:
0.6370
Epoch 33/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6418 -
binary_accuracy: 0.6257 - val_loss: 0.6394 - val_binary_accuracy:
0.6350
Epoch 34/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6468 -
binary_accuracy: 0.6294 - val_loss: 0.6399 - val_binary_accuracy:
0.6352
Epoch 35/200
44/44 [==============================] - 0s 3ms/step - loss: 0.6432 -
binary_accuracy: 0.6216 - val_loss: 0.6387 - val_binary_accuracy:
0.6346
Epoch 36/200
44/44 [==============================] - 0s 3ms/step - loss: 0.6436 -
binary_accuracy: 0.6291 - val_loss: 0.6384 - val_binary_accuracy:
0.6354
Epoch 37/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6436 -
binary_accuracy: 0.6275 - val_loss: 0.6382 - val_binary_accuracy:
0.6348
Epoch 38/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6436 -
binary_accuracy: 0.6297 - val_loss: 0.6372 - val_binary_accuracy:
0.6331
Epoch 39/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6433 -
binary_accuracy: 0.6354 - val_loss: 0.6377 - val_binary_accuracy:
0.6317
Epoch 40/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6418 -
binary_accuracy: 0.6278 - val_loss: 0.6367 - val_binary_accuracy:
0.6312
Epoch 41/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6387 -
binary_accuracy: 0.6293 - val_loss: 0.6359 - val_binary_accuracy:
0.6348
Epoch 42/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6401 -
binary_accuracy: 0.6279 - val_loss: 0.6361 - val_binary_accuracy:
0.6327
Epoch 43/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6405 -
binary_accuracy: 0.6303 - val_loss: 0.6366 - val_binary_accuracy:
```

```
0.6294
Epoch 44/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6386 -
binary_accuracy: 0.6291 - val_loss: 0.6349 - val_binary_accuracy:
0.6304
Epoch 45/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6404 -
binary_accuracy: 0.6308 - val_loss: 0.6359 - val_binary_accuracy:
0.6329
Epoch 46/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6373 -
binary_accuracy: 0.6363 - val_loss: 0.6349 - val_binary_accuracy:
0.6341
Epoch 47/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6377 -
binary_accuracy: 0.6329 - val_loss: 0.6350 - val_binary_accuracy:
0.6325
Epoch 48/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6365 -
binary_accuracy: 0.6351 - val_loss: 0.6344 - val_binary_accuracy:
0.6323
Epoch 49/200
44/44 [==============================] - 0s 3ms/step - loss: 0.6377 -
binary_accuracy: 0.6297 - val_loss: 0.6340 - val_binary_accuracy:
0.6329
Epoch 50/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6404 -
binary_accuracy: 0.6278 - val_loss: 0.6338 - val_binary_accuracy:
0.6366
Epoch 51/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6382 -
binary_accuracy: 0.6297 - val_loss: 0.6350 - val_binary_accuracy:
0.6348
Epoch 52/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6378 -
binary_accuracy: 0.6344 - val_loss: 0.6338 - val_binary_accuracy:
0.6304
Epoch 53/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6370 -
binary_accuracy: 0.6346 - val_loss: 0.6332 - val_binary_accuracy:
0.6360
Epoch 54/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6354 -
binary_accuracy: 0.6322 - val_loss: 0.6333 - val_binary_accuracy:
0.6300
Epoch 55/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6345 -
binary_accuracy: 0.6394 - val_loss: 0.6334 - val_binary_accuracy:
0.6389
```

```
Epoch 56/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6370 -
binary_accuracy: 0.6350 - val_loss: 0.6332 - val_binary_accuracy:
0.6372
Epoch 57/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6322 -
binary_accuracy: 0.6394 - val_loss: 0.6324 - val_binary_accuracy:
0.6343
Epoch 58/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6363 -
binary_accuracy: 0.6361 - val_loss: 0.6320 - val_binary_accuracy:
0.6304
Epoch 59/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6360 -
binary_accuracy: 0.6356 - val_loss: 0.6324 - val_binary_accuracy:
0.6362
Epoch 60/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6360 -
binary_accuracy: 0.6364 - val_loss: 0.6323 - val_binary_accuracy:
0.6348
Epoch 61/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6356 -
binary_accuracy: 0.6382 - val_loss: 0.6325 - val_binary_accuracy:
0.6339
Epoch 62/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6365 -
binary_accuracy: 0.6374 - val_loss: 0.6327 - val_binary_accuracy:
0.6304
Epoch 63/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6335 -
binary_accuracy: 0.6356 - val_loss: 0.6315 - val_binary_accuracy:
0.6412
Epoch 64/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6339 -
binary_accuracy: 0.6421 - val_loss: 0.6313 - val_binary_accuracy:
0.6422
Epoch 65/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6361 -
binary_accuracy: 0.6402 - val_loss: 0.6312 - val_binary_accuracy:
0.6375
Epoch 66/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6326 -
binary_accuracy: 0.6388 - val_loss: 0.6313 - val_binary_accuracy:
0.6370
Epoch 67/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6341 -
binary_accuracy: 0.6421 - val_loss: 0.6320 - val_binary_accuracy:
0.6410
Epoch 68/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6298 -
```

```
binary_accuracy: 0.6444 - val_loss: 0.6305 - val_binary_accuracy:
0.6381
Epoch 69/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6328 -
binary_accuracy: 0.6399 - val_loss: 0.6309 - val_binary_accuracy:
0.6437
Epoch 70/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6366 -
binary_accuracy: 0.6366 - val_loss: 0.6316 - val_binary_accuracy:
0.6399
Epoch 71/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6354 -
binary_accuracy: 0.6353 - val_loss: 0.6306 - val_binary_accuracy:
0.6428
Epoch 72/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6322 -
binary_accuracy: 0.6406 - val_loss: 0.6303 - val_binary_accuracy:
0.6383
Epoch 73/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6326 -
binary_accuracy: 0.6423 - val_loss: 0.6315 - val_binary_accuracy:
0.6430
Epoch 74/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6334 -
binary_accuracy: 0.6391 - val_loss: 0.6311 - val_binary_accuracy:
0.6435
Epoch 75/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6348 -
binary_accuracy: 0.6437 - val_loss: 0.6301 - val_binary_accuracy:
0.6408
Epoch 76/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6317 -
binary_accuracy: 0.6390 - val_loss: 0.6300 - val_binary_accuracy:
0.6379
Epoch 77/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6317 -
binary_accuracy: 0.6399 - val_loss: 0.6301 - val_binary_accuracy:
0.6385
Epoch 78/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6300 -
binary_accuracy: 0.6400 - val_loss: 0.6290 - val_binary_accuracy:
0.6377
Epoch 79/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6330 -
binary_accuracy: 0.6418 - val_loss: 0.6296 - val_binary_accuracy:
0.6397
Epoch 80/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6305 -
binary_accuracy: 0.6449 - val_loss: 0.6289 - val_binary_accuracy:
0.6435
```

```
Epoch 81/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6327 -
binary_accuracy: 0.6410 - val_loss: 0.6287 - val_binary_accuracy:
0.6395
Epoch 82/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6294 -
binary_accuracy: 0.6449 - val_loss: 0.6286 - val_binary_accuracy:
0.6368
Epoch 83/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6318 -
binary_accuracy: 0.6427 - val_loss: 0.6286 - val_binary_accuracy:
0.6422
Epoch 84/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6301 -
binary_accuracy: 0.6433 - val_loss: 0.6282 - val_binary_accuracy:
0.6437
Epoch 85/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6294 -
binary_accuracy: 0.6446 - val_loss: 0.6282 - val_binary_accuracy:
0.6410
Epoch 86/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6309 -
binary_accuracy: 0.6473 - val_loss: 0.6286 - val_binary_accuracy:
0.6414
Epoch 87/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6320 -
binary_accuracy: 0.6400 - val_loss: 0.6281 - val_binary_accuracy:
0.6428
Epoch 88/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6305 -
binary_accuracy: 0.6437 - val_loss: 0.6282 - val_binary_accuracy:
0.6424
Epoch 89/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6314 -
binary_accuracy: 0.6425 - val_loss: 0.6275 - val_binary_accuracy:
0.6389
Epoch 90/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6313 -
binary_accuracy: 0.6451 - val_loss: 0.6273 - val_binary_accuracy:
0.6422
Epoch 91/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6311 -
binary_accuracy: 0.6420 - val_loss: 0.6273 - val_binary_accuracy:
0.6441
Epoch 92/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6279 -
binary_accuracy: 0.6482 - val_loss: 0.6270 - val_binary_accuracy:
0.6424
Epoch 93/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6279 -
```

```
binary_accuracy: 0.6504 - val_loss: 0.6273 - val_binary_accuracy:
0.6447
Epoch 94/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6298 -
binary_accuracy: 0.6469 - val_loss: 0.6274 - val_binary_accuracy:
0.6433
Epoch 95/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6318 -
binary_accuracy: 0.6458 - val_loss: 0.6268 - val_binary_accuracy:
0.6428
Epoch 96/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6289 -
binary_accuracy: 0.6440 - val_loss: 0.6271 - val_binary_accuracy:
0.6428
Epoch 97/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6299 -
binary_accuracy: 0.6448 - val_loss: 0.6277 - val_binary_accuracy:
0.6410
Epoch 98/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6276 -
binary_accuracy: 0.6433 - val_loss: 0.6267 - val_binary_accuracy:
0.6445
Epoch 99/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6300 -
binary_accuracy: 0.6407 - val_loss: 0.6269 - val_binary_accuracy:
0.6428
Epoch 100/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6306 -
binary_accuracy: 0.6420 - val_loss: 0.6262 - val_binary_accuracy:
0.6430
Epoch 101/200
44/44 [==============================] - 0s 3ms/step - loss: 0.6261 -
binary_accuracy: 0.6456 - val_loss: 0.6256 - val_binary_accuracy:
0.6457
Epoch 102/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6307 -
binary_accuracy: 0.6408 - val_loss: 0.6261 - val_binary_accuracy:
0.6414
Epoch 103/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6296 -
binary_accuracy: 0.6417 - val_loss: 0.6257 - val_binary_accuracy:
0.6439
Epoch 104/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6276 -
binary_accuracy: 0.6497 - val_loss: 0.6257 - val_binary_accuracy:
0.6478
Epoch 105/200

44/44 [==============================] - 0s 2ms/step - loss: 0.6299 -
binary_accuracy: 0.6399 - val_loss: 0.6264 - val_binary_accuracy:
```

```
0.6443
Epoch 106/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6316 -
binary_accuracy: 0.6444 - val_loss: 0.6260 - val_binary_accuracy:
0.6428
Epoch 107/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6289 -
binary_accuracy: 0.6447 - val_loss: 0.6250 - val_binary_accuracy:
0.6455
Epoch 108/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6282 -
binary_accuracy: 0.6453 - val_loss: 0.6264 - val_binary_accuracy:
0.6404
Epoch 109/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6239 -
binary_accuracy: 0.6489 - val_loss: 0.6266 - val_binary_accuracy:
0.6443
Epoch 110/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6260 -
binary_accuracy: 0.6513 - val_loss: 0.6260 - val_binary_accuracy:
0.6443
Epoch 111/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6275 -
binary_accuracy: 0.6465 - val_loss: 0.6258 - val_binary_accuracy:
0.6422
Epoch 112/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6258 -
binary_accuracy: 0.6494 - val_loss: 0.6245 - val_binary_accuracy:
0.6470
Epoch 113/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6244 -
binary_accuracy: 0.6459 - val_loss: 0.6249 - val_binary_accuracy:
0.6445
Epoch 114/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6254 -
binary_accuracy: 0.6485 - val_loss: 0.6244 - val_binary_accuracy:
0.6480
Epoch 115/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6272 -
binary_accuracy: 0.6467 - val_loss: 0.6260 - val_binary_accuracy:
0.6445
Epoch 116/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6265 -
binary_accuracy: 0.6463 - val_loss: 0.6243 - val_binary_accuracy:
0.6493
Epoch 117/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6268 -
binary_accuracy: 0.6488 - val_loss: 0.6242 - val_binary_accuracy:
0.6453
Epoch 118/200
```

```
44/44 [==============================] - 0s 2ms/step - loss: 0.6261 -
binary_accuracy: 0.6473 - val_loss: 0.6263 - val_binary_accuracy:
0.6418
Epoch 119/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6260 -
binary_accuracy: 0.6456 - val_loss: 0.6248 - val_binary_accuracy:
0.6470
Epoch 120/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6250 -
binary_accuracy: 0.6518 - val_loss: 0.6247 - val_binary_accuracy:
0.6443
Epoch 121/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6252 -
binary_accuracy: 0.6472 - val_loss: 0.6256 - val_binary_accuracy:
0.6439
Epoch 122/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6227 -
binary_accuracy: 0.6539 - val_loss: 0.6251 - val_binary_accuracy:
0.6484
Epoch 123/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6251 -
binary_accuracy: 0.6468 - val_loss: 0.6248 - val_binary_accuracy:
0.6491
Epoch 124/200
44/44 [==============================] - 0s 3ms/step - loss: 0.6258 -
binary_accuracy: 0.6480 - val_loss: 0.6242 - val_binary_accuracy:
0.6501
Epoch 125/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6264 -
binary_accuracy: 0.6521 - val_loss: 0.6238 - val_binary_accuracy:
0.6491
Epoch 126/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6249 -
binary_accuracy: 0.6510 - val_loss: 0.6247 - val_binary_accuracy:
0.6441
Epoch 127/200
44/44 [==============================] - 0s 3ms/step - loss: 0.6240 -
binary_accuracy: 0.6542 - val_loss: 0.6243 - val_binary_accuracy:
0.6499
Epoch 128/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6273 -
binary_accuracy: 0.6497 - val_loss: 0.6250 - val_binary_accuracy:
0.6443
Epoch 129/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6264 -
binary_accuracy: 0.6499 - val_loss: 0.6250 - val_binary_accuracy:
0.6503
Epoch 130/200
44/44 [==============================] - 0s 3ms/step - loss: 0.6256 -
binary_accuracy: 0.6542 - val_loss: 0.6236 - val_binary_accuracy:
```

```
0.6480
Epoch 131/200
44/44 [==============================] - 0s 3ms/step - loss: 0.6234 -
binary_accuracy: 0.6538 - val_loss: 0.6239 - val_binary_accuracy:
0.6455
Epoch 132/200
44/44 [==============================] - 0s 3ms/step - loss: 0.6238 -
binary_accuracy: 0.6530 - val_loss: 0.6238 - val_binary_accuracy:
0.6486
Epoch 133/200
44/44 [==============================] - 0s 3ms/step - loss: 0.6265 -
binary_accuracy: 0.6450 - val_loss: 0.6244 - val_binary_accuracy:
0.6503
Epoch 134/200
44/44 [==============================] - 0s 3ms/step - loss: 0.6244 -
binary_accuracy: 0.6477 - val_loss: 0.6231 - val_binary_accuracy:
0.6499
Epoch 135/200
44/44 [==============================] - 0s 3ms/step - loss: 0.6232 -
binary_accuracy: 0.6531 - val_loss: 0.6235 - val_binary_accuracy:
0.6501
Epoch 136/200
44/44 [==============================] - 0s 3ms/step - loss: 0.6219 -
binary_accuracy: 0.6544 - val_loss: 0.6226 - val_binary_accuracy:
0.6509
Epoch 137/200
44/44 [==============================] - 0s 3ms/step - loss: 0.6249 -
binary_accuracy: 0.6513 - val_loss: 0.6231 - val_binary_accuracy:
0.6511
Epoch 138/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6244 -
binary_accuracy: 0.6475 - val_loss: 0.6233 - val_binary_accuracy:
0.6486
Epoch 139/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6240 -
binary_accuracy: 0.6511 - val_loss: 0.6227 - val_binary_accuracy:
0.6472
Epoch 140/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6224 -
binary_accuracy: 0.6530 - val_loss: 0.6239 - val_binary_accuracy:
0.6441
Epoch 141/200
44/44 [==============================] - 0s 3ms/step - loss: 0.6261 -
binary_accuracy: 0.6513 - val_loss: 0.6238 - val_binary_accuracy:
0.6478
Epoch 142/200
44/44 [==============================] - 0s 3ms/step - loss: 0.6242 -
binary_accuracy: 0.6464 - val_loss: 0.6231 - val_binary_accuracy:
0.6482
Epoch 143/200
```

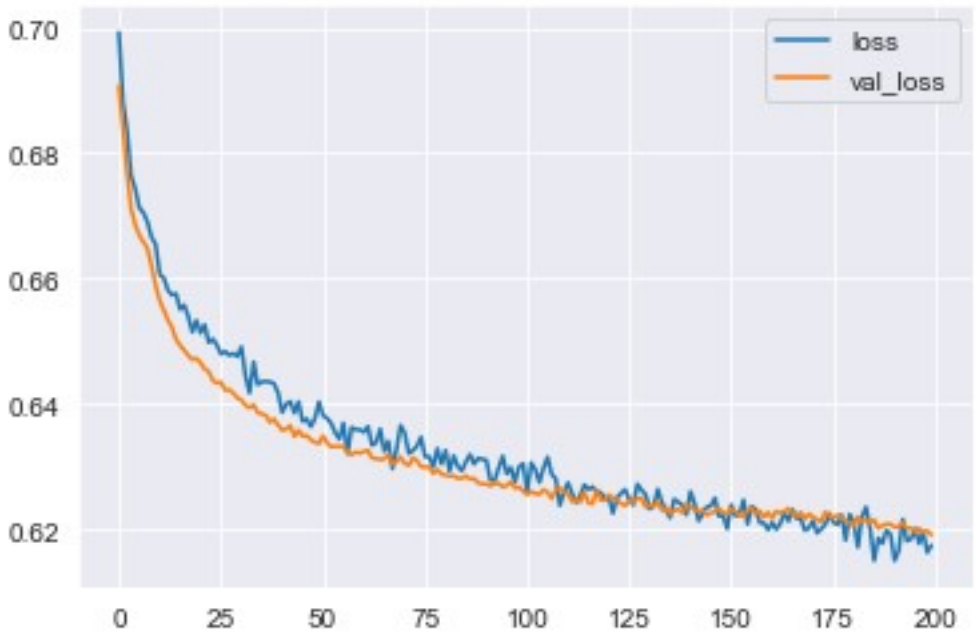
```
44/44 [==============================] - 0s 2ms/step - loss: 0.6215 -
binary_accuracy: 0.6490 - val_loss: 0.6231 - val_binary_accuracy:
0.6480
Epoch 144/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6226 -
binary_accuracy: 0.6493 - val_loss: 0.6231 - val_binary_accuracy:
0.6489
Epoch 145/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6237 -
binary_accuracy: 0.6539 - val_loss: 0.6223 - val_binary_accuracy:
0.6538
Epoch 146/200
44/44 [==============================] - 0s 3ms/step - loss: 0.6238 -
binary_accuracy: 0.6492 - val_loss: 0.6227 - val_binary_accuracy:
0.6524
Epoch 147/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6251 -
binary_accuracy: 0.6494 - val_loss: 0.6228 - val_binary_accuracy:
0.6518
Epoch 148/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6222 -
binary_accuracy: 0.6470 - val_loss: 0.6234 - val_binary_accuracy:
0.6491
Epoch 149/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6223 -
binary_accuracy: 0.6571 - val_loss: 0.6228 - val_binary_accuracy:
0.6522
Epoch 150/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6202 -
binary_accuracy: 0.6529 - val_loss: 0.6226 - val_binary_accuracy:
0.6497
Epoch 151/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6240 -
binary_accuracy: 0.6479 - val_loss: 0.6233 - val_binary_accuracy:
0.6478
Epoch 152/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6222 -
binary_accuracy: 0.6526 - val_loss: 0.6229 - val_binary_accuracy:
0.6522
Epoch 153/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6224 -
binary_accuracy: 0.6479 - val_loss: 0.6224 - val_binary_accuracy:
0.6505
Epoch 154/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6248 -
binary_accuracy: 0.6522 - val_loss: 0.6222 - val_binary_accuracy:
0.6553
Epoch 155/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6209 -
binary_accuracy: 0.6488 - val_loss: 0.6231 - val_binary_accuracy:
```

```
0.6530
Epoch 156/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6238 -
binary_accuracy: 0.6563 - val_loss: 0.6234 - val_binary_accuracy:
0.6497
Epoch 157/200

44/44 [==============================] - 0s 2ms/step - loss: 0.6232 -
binary_accuracy: 0.6506 - val_loss: 0.6225 - val_binary_accuracy:
0.6497
Epoch 158/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6211 -
binary_accuracy: 0.6569 - val_loss: 0.6230 - val_binary_accuracy:
0.6501
Epoch 159/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6211 -
binary_accuracy: 0.6546 - val_loss: 0.6220 - val_binary_accuracy:
0.6501
Epoch 160/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6200 -
binary_accuracy: 0.6576 - val_loss: 0.6228 - val_binary_accuracy:
0.6491
Epoch 161/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6212 -
binary_accuracy: 0.6490 - val_loss: 0.6218 - val_binary_accuracy:
0.6551
Epoch 162/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6201 -
binary_accuracy: 0.6552 - val_loss: 0.6230 - val_binary_accuracy:
0.6507
Epoch 163/200
44/44 [==============================] - 0s 3ms/step - loss: 0.6210 -
binary_accuracy: 0.6519 - val_loss: 0.6227 - val_binary_accuracy:
0.6447
Epoch 164/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6228 -
binary_accuracy: 0.6552 - val_loss: 0.6229 - val_binary_accuracy:
0.6486
Epoch 165/200
44/44 [==============================] - 0s 3ms/step - loss: 0.6214 -
binary_accuracy: 0.6552 - val_loss: 0.6234 - val_binary_accuracy:
0.6464
Epoch 166/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6232 -
binary_accuracy: 0.6499 - val_loss: 0.6226 - val_binary_accuracy:
0.6513
Epoch 167/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6218 -
binary_accuracy: 0.6548 - val_loss: 0.6222 - val_binary_accuracy:
0.6522
```

```
Epoch 168/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6219 -
binary_accuracy: 0.6560 - val_loss: 0.6228 - val_binary_accuracy:
0.6501
Epoch 169/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6199 -
binary_accuracy: 0.6527 - val_loss: 0.6218 - val_binary_accuracy:
0.6507
Epoch 170/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6203 -
binary_accuracy: 0.6506 - val_loss: 0.6225 - val_binary_accuracy:
0.6509
Epoch 171/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6215 -
binary_accuracy: 0.6523 - val_loss: 0.6220 - val_binary_accuracy:
0.6495
Epoch 172/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6195 -
binary_accuracy: 0.6602 - val_loss: 0.6217 - val_binary_accuracy:
0.6540
Epoch 173/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6201 -
binary_accuracy: 0.6556 - val_loss: 0.6213 - val_binary_accuracy:
0.6520
Epoch 174/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6208 -
binary_accuracy: 0.6552 - val_loss: 0.6228 - val_binary_accuracy:
0.6470
Epoch 175/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6226 -
binary_accuracy: 0.6569 - val_loss: 0.6223 - val_binary_accuracy:
0.6470
Epoch 176/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6212 -
binary_accuracy: 0.6574 - val_loss: 0.6219 - val_binary_accuracy:
0.6507
Epoch 177/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6209 -
binary_accuracy: 0.6559 - val_loss: 0.6224 - val_binary_accuracy:
0.6466
Epoch 178/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6224 -
binary_accuracy: 0.6536 - val_loss: 0.6218 - val_binary_accuracy:
0.6505
Epoch 179/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6184 -
binary_accuracy: 0.6538 - val_loss: 0.6214 - val_binary_accuracy:
0.6486
Epoch 180/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6225 -
```

```
binary_accuracy: 0.6530 - val_loss: 0.6211 - val_binary_accuracy:
0.6528
Epoch 181/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6212 -
binary_accuracy: 0.6523 - val_loss: 0.6206 - val_binary_accuracy:
0.6534
Epoch 182/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6173 -
binary_accuracy: 0.6559 - val_loss: 0.6221 - val_binary_accuracy:
0.6476
Epoch 183/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6221 -
binary_accuracy: 0.6522 - val_loss: 0.6213 - val_binary_accuracy:
0.6505
Epoch 184/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6236 -
binary_accuracy: 0.6510 - val_loss: 0.6216 - val_binary_accuracy:
0.6459
Epoch 185/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6202 -
binary_accuracy: 0.6521 - val_loss: 0.6211 - val_binary_accuracy:
0.6549
Epoch 186/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6151 -
binary_accuracy: 0.6568 - val_loss: 0.6216 - val_binary_accuracy:
0.6476
Epoch 187/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6187 -
binary_accuracy: 0.6558 - val_loss: 0.6202 - val_binary_accuracy:
0.6571
Epoch 188/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6178 -
binary_accuracy: 0.6595 - val_loss: 0.6207 - val_binary_accuracy:
0.6532
Epoch 189/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6199 -
binary_accuracy: 0.6596 - val_loss: 0.6209 - val_binary_accuracy:
0.6555
Epoch 190/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6193 -
binary_accuracy: 0.6598 - val_loss: 0.6209 - val_binary_accuracy:
0.6503
Epoch 191/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6151 -
binary_accuracy: 0.6615 - val_loss: 0.6204 - val_binary_accuracy:
0.6518
Epoch 192/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6167 -
binary_accuracy: 0.6595 - val_loss: 0.6205 - val_binary_accuracy:
0.6534
```

```
Epoch 193/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6217 -
binary_accuracy: 0.6540 - val_loss: 0.6211 - val_binary_accuracy:
0.6511
Epoch 194/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6182 -
binary_accuracy: 0.6605 - val_loss: 0.6203 - val_binary_accuracy:
0.6511
Epoch 195/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6185 -
binary_accuracy: 0.6611 - val_loss: 0.6203 - val_binary_accuracy:
0.6544
Epoch 196/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6202 -
binary_accuracy: 0.6538 - val_loss: 0.6197 - val_binary_accuracy:
0.6515
Epoch 197/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6178 -
binary_accuracy: 0.6647 - val_loss: 0.6202 - val_binary_accuracy:
0.6542
Epoch 198/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6196 -
binary_accuracy: 0.6580 - val_loss: 0.6196 - val_binary_accuracy:
0.6571
Epoch 199/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6164 -
binary_accuracy: 0.6576 - val_loss: 0.6198 - val_binary_accuracy:
0.6520
Epoch 200/200
44/44 [==============================] - 0s 2ms/step - loss: 0.6175 -
binary_accuracy: 0.6581 - val_loss: 0.6192 - val_binary_accuracy:
0.6530

<keras.callbacks.History at 0x1bb38b62160>

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

<AxesSubplot:>
```


loss
val_loss
0.70
0.68
0.66
0.64
0.62
0
25
50
75
100
125
150
175
200