housing-loan-1

August 23, 2023

[1]:
```
import numpy as np # linear algebra
import pandas as pd # data processing, CSV file I/O (e.g. pd.read_csv)

from subprocess import check_output
from keras.layers.core import Dense, Activation, Dropout
from keras.layers.recurrent import LSTM
from keras.layers import BatchNormalization
from keras.models import Sequential
from sklearn.model_selection import train_test_split
import time #helper libraries
from sklearn.preprocessing import MinMaxScaler
import matplotlib.pyplot as plt
from numpy import newaxis
import keras
from keras.optimizers import SGD
```

```
Using TensorFlow backend.
```

[8]:
```
#load the data given
loan_df=pd.read_csv('loan_data (1).csv')
loan_df.head()
```

[8]:
```
   SK_ID_CURR  TARGET NAME_CONTRACT_TYPE CODE_GENDER FLAG_OWN_CAR  \
0      100002       1         Cash loans           M            N
1      100003       0         Cash loans           F            N
2      100004       0    Revolving loans           M            Y
3      100006       0         Cash loans           F            N
4      100007       0         Cash loans           M            N

  FLAG_OWN_REALTY  CNT_CHILDREN  AMT_INCOME_TOTAL  AMT_CREDIT  AMT_ANNUITY  \
0               Y             0          202500.0    406597.5      24700.5
1               N             0          270000.0   1293502.5      35698.5
2               Y             0           67500.0    135000.0       6750.0
3               Y             0          135000.0    312682.5      29686.5
4               Y             0          121500.0    513000.0      21865.5

   …  FLAG_DOCUMENT_18 FLAG_DOCUMENT_19 FLAG_DOCUMENT_20 FLAG_DOCUMENT_21  \
0  …                 0                0                0                0
```

```
1  …                 0                0                0                0
2  …                 0                0                0                0
3  …                 0                0                0                0
4  …                 0                0                0                0

  AMT_REQ_CREDIT_BUREAU_HOUR AMT_REQ_CREDIT_BUREAU_DAY  \
0                        0.0                       0.0
1                        0.0                       0.0
2                        0.0                       0.0
3                        NaN                       NaN
4                        0.0                       0.0

   AMT_REQ_CREDIT_BUREAU_WEEK  AMT_REQ_CREDIT_BUREAU_MON  \
0                         0.0                        0.0
1                         0.0                        0.0
2                         0.0                        0.0
3                         NaN                        NaN
4                         0.0                        0.0

   AMT_REQ_CREDIT_BUREAU_QRT  AMT_REQ_CREDIT_BUREAU_YEAR
0                        0.0                         1.0
1                        0.0                         0.0
2                        0.0                         0.0
3                        NaN                         NaN
4                        0.0                         0.0

[5 rows x 122 columns]
```

[9]:
```
pd.set_option('display.max_columns',None)
pd.set_option('display.max_rows',None)
```

[10]:
```
#check for Null values in the Dataset
loan_df.isnull().sum()
```

[10]:
```
SK_ID_CURR                           0
TARGET                               0
NAME_CONTRACT_TYPE                   0
CODE_GENDER                          0
FLAG_OWN_CAR                         0
FLAG_OWN_REALTY                      0
CNT_CHILDREN                         0
AMT_INCOME_TOTAL                     0
AMT_CREDIT                           0
AMT_ANNUITY                         12
AMT_GOODS_PRICE                    278
NAME_TYPE_SUITE                   1292
NAME_INCOME_TYPE                     0
```

```
NAME_EDUCATION_TYPE                  0
NAME_FAMILY_STATUS                   0
NAME_HOUSING_TYPE                    0
REGION_POPULATION_RELATIVE           0
DAYS_BIRTH                           0
DAYS_EMPLOYED                        0
DAYS_REGISTRATION                    0
DAYS_ID_PUBLISH                      0
OWN_CAR_AGE                     202929
FLAG_MOBIL                           0
FLAG_EMP_PHONE                       0
FLAG_WORK_PHONE                      0
FLAG_CONT_MOBILE                     0
FLAG_PHONE                           0
FLAG_EMAIL                           0
OCCUPATION_TYPE                  96391
CNT_FAM_MEMBERS                      2
REGION_RATING_CLIENT                 0
REGION_RATING_CLIENT_W_CITY          0
WEEKDAY_APPR_PROCESS_START           0
HOUR_APPR_PROCESS_START              0
REG_REGION_NOT_LIVE_REGION           0
REG_REGION_NOT_WORK_REGION           0
LIVE_REGION_NOT_WORK_REGION          0
REG_CITY_NOT_LIVE_CITY               0
REG_CITY_NOT_WORK_CITY               0
LIVE_CITY_NOT_WORK_CITY              0
ORGANIZATION_TYPE                    0
EXT_SOURCE_1                    173378
EXT_SOURCE_2                       660
EXT_SOURCE_3                     60965
APARTMENTS_AVG                  156061
BASEMENTAREA_AVG                179943
YEARS_BEGINEXPLUATATION_AVG     150007
YEARS_BUILD_AVG                 204488
COMMONAREA_AVG                  214865
ELEVATORS_AVG                   163891
ENTRANCES_AVG                   154828
FLOORSMAX_AVG                   153020
FLOORSMIN_AVG                   208642
LANDAREA_AVG                    182590
LIVINGAPARTMENTS_AVG            210199
LIVINGAREA_AVG                  154350
NONLIVINGAPARTMENTS_AVG         213514
NONLIVINGAREA_AVG               169682
APARTMENTS_MODE                 156061
BASEMENTAREA_MODE               179943
```

```
YEARS_BEGINEXPLUATATION_MODE    150007
YEARS_BUILD_MODE                204488
COMMONAREA_MODE                 214865
ELEVATORS_MODE                  163891
ENTRANCES_MODE                  154828
FLOORSMAX_MODE                  153020
FLOORSMIN_MODE                  208642
LANDAREA_MODE                   182590
LIVINGAPARTMENTS_MODE           210199
LIVINGAREA_MODE                 154350
NONLIVINGAPARTMENTS_MODE        213514
NONLIVINGAREA_MODE              169682
APARTMENTS_MEDI                 156061
BASEMENTAREA_MEDI               179943
YEARS_BEGINEXPLUATATION_MEDI    150007
YEARS_BUILD_MEDI                204488
COMMONAREA_MEDI                 214865
ELEVATORS_MEDI                  163891
ENTRANCES_MEDI                  154828
FLOORSMAX_MEDI                  153020
FLOORSMIN_MEDI                  208642
LANDAREA_MEDI                   182590
LIVINGAPARTMENTS_MEDI           210199
LIVINGAREA_MEDI                 154350
NONLIVINGAPARTMENTS_MEDI        213514
NONLIVINGAREA_MEDI              169682
FONDKAPREMONT_MODE              210295
HOUSETYPE_MODE                  154297
TOTALAREA_MODE                  148431
WALLSMATERIAL_MODE              156341
EMERGENCYSTATE_MODE             145755
OBS_30_CNT_SOCIAL_CIRCLE          1021
DEF_30_CNT_SOCIAL_CIRCLE          1021
OBS_60_CNT_SOCIAL_CIRCLE          1021
DEF_60_CNT_SOCIAL_CIRCLE          1021
DAYS_LAST_PHONE_CHANGE               1
FLAG_DOCUMENT_2                      0
FLAG_DOCUMENT_3                      0
FLAG_DOCUMENT_4                      0
FLAG_DOCUMENT_5                      0
FLAG_DOCUMENT_6                      0
FLAG_DOCUMENT_7                      0
FLAG_DOCUMENT_8                      0
FLAG_DOCUMENT_9                      0
FLAG_DOCUMENT_10                     0
FLAG_DOCUMENT_11                     0
FLAG_DOCUMENT_12                     0
```

```
FLAG_DOCUMENT_13                    0
FLAG_DOCUMENT_14                    0
FLAG_DOCUMENT_15                    0
FLAG_DOCUMENT_16                    0
FLAG_DOCUMENT_17                    0
FLAG_DOCUMENT_18                    0
FLAG_DOCUMENT_19                    0
FLAG_DOCUMENT_20                    0
FLAG_DOCUMENT_21                    0
AMT_REQ_CREDIT_BUREAU_HOUR      41519
AMT_REQ_CREDIT_BUREAU_DAY       41519
AMT_REQ_CREDIT_BUREAU_WEEK      41519
AMT_REQ_CREDIT_BUREAU_MON       41519
AMT_REQ_CREDIT_BUREAU_QRT       41519
AMT_REQ_CREDIT_BUREAU_YEAR      41519
dtype: int64
```

[11]:

```
# Print percentage of default to payer of the dataset for the TARGET column
print('The total no of defaulters are : {}'.
 ↪format(loan_df[loan_df['TARGET']==0].shape[0]))
print('The Total no of payers are : {}'.format(loan_df[loan_df['TARGET']==1].
 ↪shape[0]))
print('percentage of default to payer : {}%'.
 ↪format((loan_df[loan_df['TARGET']==0].shape[0]/loan_df[loan_df['TARGET']==1].
 ↪shape[0])*100))
print('percentage of payer to defaulter : {}%'.
 ↪format((loan_df[loan_df['TARGET']==1].shape[0]/loan_df[loan_df['TARGET']==0].
 ↪shape[0])*100))
```

```
The total no of defaulters are : 282686
The Total no of payers are : 24825
percentage of default to payer : 1138.7150050352468%
percentage of payer to defaulter : 8.781828601345662%
```

[12]:

```
Cash = loan_df[loan_df['NAME_CONTRACT_TYPE']=='Cash loans']
Cash_loans = Cash.TARGET.values.astype('float32')
Cash_loans = Cash_loans.reshape(278232, 1)
Cash_loans.shape
```

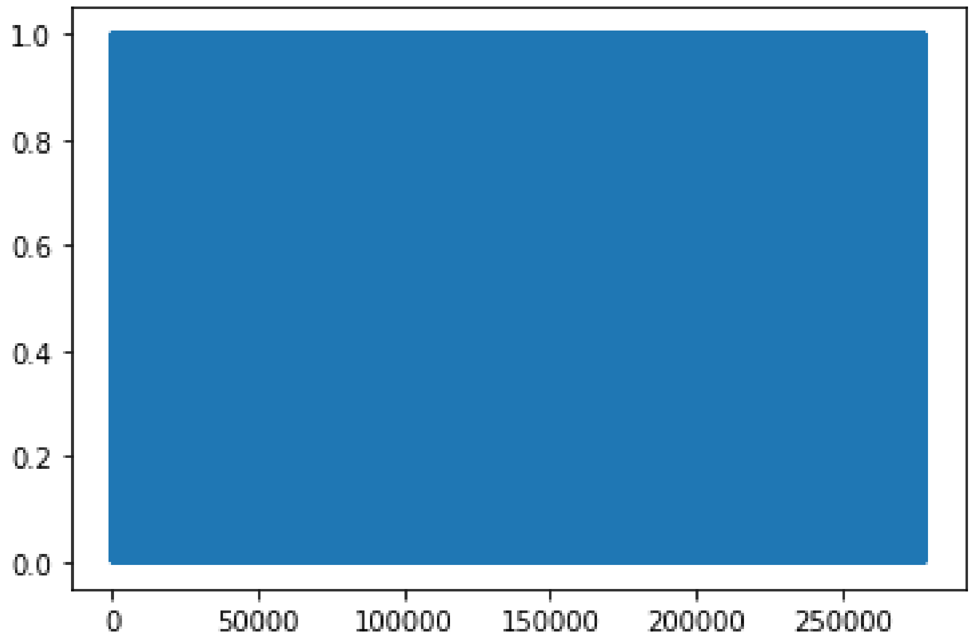
[12]:

```
(278232, 1)
```

[13]:

```
plt.plot(Cash_loans)
plt.show()

scaler = MinMaxScaler(feature_range=(0, 1))
yahoo_stk_prices = scaler.fit_transform(Cash_loans)
```



[14]:

```
train_size = int(len(Cash_loans) * 0.80)
test_size = len(Cash_loans) - train_size
train, test = Cash_loans[0:train_size,:], Cash_loans[train_size:
 ↪len(Cash_loans),:]
print(len(train), len(test))
```

```
222585 55647
```

[15]:

```
# convert an array of values into a dataset matrix
def create_dataset(dataset, look_back=1):
    dataX, dataY = [], []
    for i in range(len(dataset)-look_back-1):
        a = dataset[i:(i+look_back), 0]
        dataX.append(a)
        dataY.append(dataset[i + look_back, 0])
    return np.array(dataX), np.array(dataY)
```

[16]:

```
# reshape into X=t and Y=t+1
look_back = 1
trainX, trainY = create_dataset(train, look_back)
testX, testY = create_dataset(test, look_back)
```

[17]:

```
trainX = np.reshape(trainX, (trainX.shape[0], 1, trainX.shape[1]))
testX = np.reshape(testX, (testX.shape[0], 1, testX.shape[1]))
```

1 SOLVE USING RNN

[18]:

```
#Step 2 Build Model
model = Sequential()

model.add(LSTM(
    input_dim=1,
    output_dim=50,
    return_sequences=True))
model.add(Dropout(0.2))

model.add(LSTM(
    100,
    return_sequences=False))
model.add(Dropout(0.2))

model.add(Dense(
    output_dim=1))
model.add(Activation('linear'))

start = time.time()
model.compile(loss='mse', optimizer='rmsprop')
print ('compilation time : ', time.time() - start)
```

```
/opt/anaconda3/lib/python3.7/site-packages/ipykernel_launcher.py:7: UserWarning:
The `input_dim` and `input_length` arguments in recurrent layers are deprecated.
Use `input_shape` instead.
  import sys
/opt/anaconda3/lib/python3.7/site-packages/ipykernel_launcher.py:7: UserWarning:
Update your `LSTM` call to the Keras 2 API: `LSTM(return_sequences=True,
input_shape=(None, 1), units=50)`
  import sys
```

```
compilation time :  0.011039018630981445
```

```
/opt/anaconda3/lib/python3.7/site-packages/ipykernel_launcher.py:16:
UserWarning: Update your `Dense` call to the Keras 2 API: `Dense(units=1)`
  app.launch_new_instance()
```

[19]:

```
model.fit(
    trainX,
    trainY,
    batch_size=128,
    nb_epoch=10,
    validation_split=0.05)
```

```
/opt/anaconda3/lib/python3.7/site-packages/ipykernel_launcher.py:6: UserWarning:
The `nb_epoch` argument in `fit` has been renamed `epochs`.
```

```
Train on 211453 samples, validate on 11130 samples
Epoch 1/10
211453/211453 [==============================] - 12s 56us/step - loss: 0.0768 -
val_loss: 0.0770
Epoch 2/10
211453/211453 [==============================] - 10s 48us/step - loss: 0.0768 -
val_loss: 0.0771
Epoch 3/10
211453/211453 [==============================] - 9s 44us/step - loss: 0.0768 -
val_loss: 0.0771
Epoch 4/10
211453/211453 [==============================] - 9s 45us/step - loss: 0.0768 -
val_loss: 0.0770
Epoch 5/10
211453/211453 [==============================] - 10s 48us/step - loss: 0.0768 -
val_loss: 0.0770
Epoch 6/10
211453/211453 [==============================] - 9s 44us/step - loss: 0.0768 -
val_loss: 0.0770
Epoch 7/10
211453/211453 [==============================] - 10s 45us/step - loss: 0.0768 -
val_loss: 0.0771
Epoch 8/10
211453/211453 [==============================] - 11s 53us/step - loss: 0.0768 -
val_loss: 0.0770
Epoch 9/10
211453/211453 [==============================] - 10s 47us/step - loss: 0.0767 -
val_loss: 0.0770
Epoch 10/10
211453/211453 [==============================] - 11s 53us/step - loss: 0.0767 -
val_loss: 0.0770
```

```
[19]: <keras.callbacks.callbacks.History at 0x1a3c6249d0>
```

```
[24]: score=model.evaluate(testX,testY)
```

```
55645/55645 [==============================] - 2s 40us/step
```

```
[28]: score
```

```
[28]: 0.07547820648560895
```

```
[ ]: def plt_results_multiple(predicted_data, true_data,length):
         plt.plot(scaler.inverse_transform(true_data.reshape(-1, 1))[length:])
         plt.plot(scaler.inverse_transform(np.array(predicted_data).reshape(-1, 1))[length:])
         plt.show()
```

```
#predict length consecutive values from a real one
def predict_sequences_multiple(model, firstValue,length):
    prediction_seqs = []
    curr_frame = firstValue

    for i in range(length):
        predicted = []

        print(model.predict(curr_frame[newaxis,:,:]))
        predicted.append(model.predict(curr_frame[newaxis,:,:])[0,0])

        curr_frame = curr_frame[0:]
        curr_frame = np.insert(curr_frame[0:], i+1, predicted[-1], axis=0)

        prediction_seqs.append(predicted[-1])

    return prediction_seqs

predict_length=5
predictions = predict_sequences_multiple(model, testX[0], predict_length)
print(scaler.inverse_transform(np.array(predictions).reshape(-1, 1)))
plt_results_multiple(predictions, testY, predict_length)
```

[ ]:

```
from sklearn.preprocessing import MinMaxScaler
from sklearn.preprocessing import StandardScaler
```

2 SOLVE USING ANN

[ ]:

```
x.dtypes
```

[ ]:

```
x=x.select_dtypes(exclude='object')
train_x,test_x,train_y,test_y=train_test_split(x,y,test_size=0.25,random_state=2)
```

[ ]:

```
train_y=keras.utils.to_categorical(train_y)
test_y=keras.utils.to_categorical(test_y)
```

[ ]:

```
#BUILD THE MODEL
model=Sequential()
model.add(Dense(1000,input_shape=(105,),activation='relu',kernel_initializer='he_uniform'))
model.add(BatchNormalization())
model.add(Dropout(0.3))
model.add(Dense(100,activation='relu'))
model.add(Dropout(0.5))
model.add(Dense(2,activation='softmax'))
model.summary()
```

```
[ ]: opt=SGD(lr=0.001,momentum=0.9)
     model.compile(loss='binary_crossentropy',optimizer=opt,metrics=['accuracy'])
```

```
[ ]: history=model.fit(train_x,train_y,
                       batch_size=2000,
                       epochs=20,
                       verbose=1,
                       validation_data=(test_x,test_y),
                       validation_freq=2)
```

```
[ ]: score=model.evaluate(test_x,test_y)
```

```
[ ]: print('test Loss : {}'.format(score[0]))
     print('test Accuracy : {}'.format(score[1]))
```

```
[7]: ll *loan*
```

```
-rw-r--r--@ 1 pragyamohapatra  staff     355244 May 13 01:46 Housing_loan_1.html
-rw-r--r--@ 1 pragyamohapatra  staff  166133370 May 12 19:50 loan_data (1).csv
```

```
[ ]:
```