```
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
from sklearn.preprocessing import MinMaxScaler
```

```
data = pd.read_csv('/content/2022-04-25-Train-01-Feb-22.csv', date_parser = True)
data.tail()
```

	Date	open_price	high_price	low_price	close_price	estimated_transaction_v
4774	1/28/2022	37179.62	38022.11	36173.98	37748.36	83927
4775	1/29/2022	37713.14	38741.67	37327.79	38192.65	133484
4776	1/30/2022	38176.45	38378.88	37372.59	37941.82	123921
4777	1/31/2022	37914.10	38776.33	36631.66	38491.92	42789
4778	2/1/2022	38483.56	39285.00	38033.78	38733.04	77656

```
#data_training = data[data['date']< '2022-31-01'].copy()
data_training = pd.read_csv('/content/2022-04-25-Train-01-Feb-22.csv')
len(data_training)
```

```
4779
```

```
#data_test = data[data['date']< '2022-31-01'].copy()
data_test = pd.read_excel('/content/Test-2-7-Feb.xlsx')
data_test
```

	Date	open_price	high_price	low_price	close_price	estimated_transaction_vo
0	2022-02-02	38768.08	38883.96	36618.36	36923.50	103407.2
1	2022-02-03	36924.50	37391.74	36264.55	37320.11	103723.0
2	2022-02-04	37330.75	41760.39	37064.28	41579.57	72998.7
3	2022-02-05	41608.82	41983.12	40975.00	41427.72	210121.4
	2022-					

```
data_test = data_test.drop(['Date'], axis = 1)
data_test.head()
```

	open_price	high_price	low_price	close_price	estimated_transaction_volume
0	38768.08	38883.96	36618.36	36923.50	103407.24370
1	36924.50	37391.74	36264.55	37320.11	103723.06740
2	37330.75	41760.39	37064.28	41579.57	72998.74525
3	41608.82	41983.12	40975.00	41427.72	210121.41520
4	41422.70	42701.86	41141.81	42420.24	130352.53840

```
1 training_data = data_training.drop(['Date'], axis = 1)
2 training_data.head()
```

	open_price	high_price	low_price	close_price	estimated_transaction_volume
0	0.0	0.0	0.0	0.0	0.0
1	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0

```
1   # X_train = training_data[['estimated_transaction_volume', 'open_price','high_price', 'l
2   # Y_train = training_data['close_price']
```

```
1 scaler = MinMaxScaler()
2 training_data = scaler.fit_transform(training_data)
3 training_data
4 # X_train = scaler.fit_transform(X_train )
5 # Y_train = scaler.fit_transform(Y_train )
6 # X_train
```

```
array([[0.        , 0.        , 0.        , 0.        , 0.        ],
       [0.        , 0.        , 0.        , 0.        , 0.        ],
       [0.        , 0.        , 0.        , 0.        , 0.        ],
       ...,
       [0.5651794 , 0.55621565, 0.56411457, 0.56161015, 0.02332341],
       [0.56129547, 0.5619758 , 0.55293072, 0.56975266, 0.00805355],
       [0.56972598, 0.56934783, 0.57409479, 0.57332169, 0.01461589]])
```

```
1 scaler = MinMaxScaler()
2 data_test = scaler.fit_transform(data_test)
3 data_test
```

```
array([[0.26446042, 0.18401432, 0.05496812, 0.        , 0.22176128],
       [0.        , 0.        , 0.        , 0.05533017, 0.2240645 ],
       [0.05827631, 0.53872363, 0.1242465 , 0.6495579 , 0.        ],
       [0.67196282, 0.56618976, 0.73181815, 0.62837365, 1.        ],
```

```
          [0.64526402, 0.65482177, 0.75773385, 0.76683789, 0.41826631],
          [0.78836052, 0.87954265, 0.84167516, 0.96895673, 0.71065481],
          [1.        , 1.        , 1.        , 1.        , 0.39254226]])
```

```
1 X_train = []
2 Y_train = []
3 training_data.shape[0]
4
```

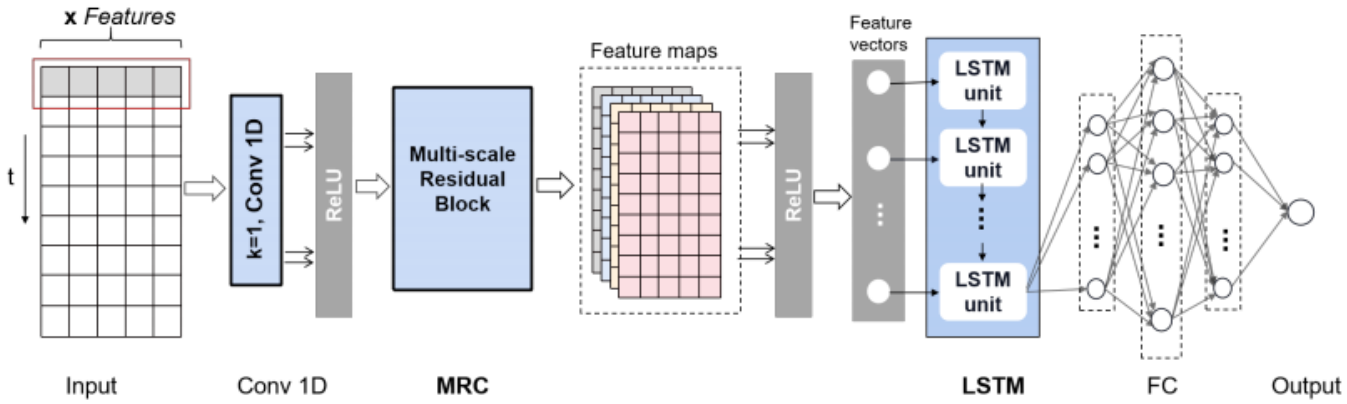
```
    4806
```

```
1 X_train = []
2 Y_train = []
3 training_data.shape[0]
4 for i in range(60, training_data.shape[0]):
5   X_train.append(training_data[i-60:i])
6   Y_train.append(training_data[i,0])
7 X_train, Y_train = np.array(X_train), np.array(Y_train)
8 Y_train.shape
```

```
    (4719,)
```

MRCLSTM neural network

- The network contains an input layer
- a 1D convolutional layer
- the multi-scale residual module
- an LSTM layer
- a fully connected layer
- an output layer




```
1 #1D kernal
2 from keras.layers import Input, Dense, LSTM, MaxPooling1D, Conv1D, Concatenate
```

```
from keras.models import Model
import tensorflow as tf
#input
input_layer = Input(shape=(X_train.shape[1], 5))
#Conv 1D Layer
conv1 = Conv1D(filters=16,
               kernel_size=1,
               strides=1,
               activation='relu',
               padding='same')(input_layer)
#MRC
l1 = Conv1D(filters=16,
               kernel_size=1,
               strides=1,
               activation='relu',
               padding='same')(conv1)
l2 = Conv1D(filters=16,
               kernel_size=2,
               strides=1,
               activation='relu',
               padding='same')(conv1)
l3 = Conv1D(filters=16,
               kernel_size=3,
               strides=1,
               activation='relu',
               padding='same')(conv1)
Multi_scale_Residual_Block = Concatenate()([l1, l2, l3]) #tf.keras.layers.
#LSTM layer
lstm1 = LSTM(50, return_sequences=True)(Multi_scale_Residual_Block)
#Fully Connected Layer
#output layer
output_layer = Dense(1, activation='sigmoid')(lstm1)
model = Model(inputs=input_layer, outputs=output_layer)

model.summary()
```

```
Model: "model_1"
__________________________________________________________________________________________________
 Layer (type)                   Output Shape         Param #     Connected to
==================================================================================================
 input_2 (InputLayer)           [(None, 60, 5)]      0           []

 conv1d_4 (Conv1D)              (None, 60, 16)       96          ['input_2[0][0]']

 conv1d_5 (Conv1D)              (None, 60, 16)       272         ['conv1d_4[0][0]']

 conv1d_6 (Conv1D)              (None, 60, 16)       528         ['conv1d_4[0][0]']

 conv1d_7 (Conv1D)              (None, 60, 16)       784         ['conv1d_4[0][0]']

 concatenate_1 (Concatenate)    (None, 60, 48)       0           ['conv1d_5[0][0]',
                                                                  'conv1d_6[0][0]',
                                                                  'conv1d_7[0][0]']
```

```
 lstm_1 (LSTM)                  (None, 60, 50)       19800       ['concatenate_1[0][0]'

 dense_1 (Dense)                (None, 60, 1)        51          ['lstm_1[0][0]']

==================================================================================================
Total params: 21,531
Trainable params: 21,531
Non-trainable params: 0
__________________________________________________________________________________________________
```

```
#opt = tf.keras.optimizers.Adam(learning_rate=0.001)
```

```
model.compile(optimizer = 'adam', loss = 'mean_squared_error')
```

```
X_train.shape
```

```
(4746, 60, 5)
```

```
Y_train.shape
```

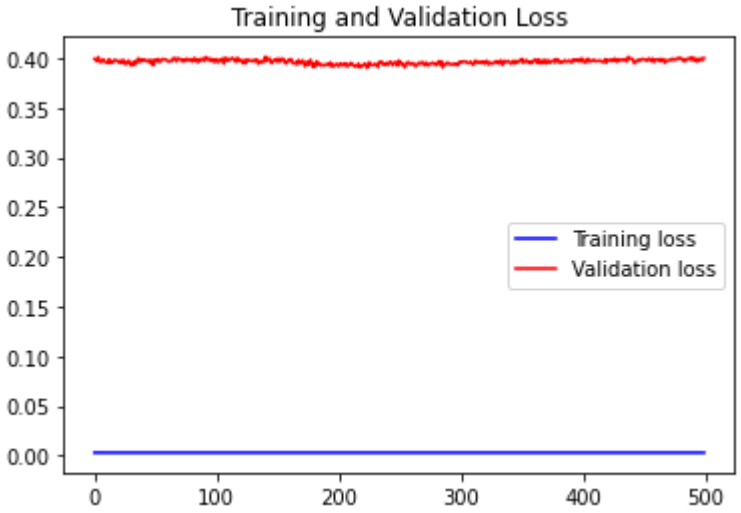
```
(4746,)
```

```
history= model.fit(X_train, Y_train, epochs = 500, batch_size =50, validation_split=0.1)
```

```
85/85 [==============================] - 1s 8ms/step - loss: 0.0030 - val_loss: 0.397
Epoch 364/500
85/85 [==============================] - 1s 8ms/step - loss: 0.0030 - val_loss: 0.394
Epoch 365/500
85/85 [==============================] - 1s 8ms/step - loss: 0.0030 - val_loss: 0.398
Epoch 366/500
85/85 [==============================] - 1s 8ms/step - loss: 0.0030 - val_loss: 0.396
Epoch 367/500
85/85 [==============================] - 1s 8ms/step - loss: 0.0030 - val_loss: 0.394
Epoch 368/500
85/85 [==============================] - 1s 8ms/step - loss: 0.0030 - val_loss: 0.395
Epoch 369/500
85/85 [==============================] - 1s 8ms/step - loss: 0.0030 - val_loss: 0.398
Epoch 370/500
85/85 [==============================] - 1s 8ms/step - loss: 0.0030 - val_loss: 0.395
Epoch 371/500
85/85 [==============================] - 1s 8ms/step - loss: 0.0030 - val_loss: 0.394
Epoch 372/500
85/85 [==============================] - 1s 9ms/step - loss: 0.0030 - val_loss: 0.397
Epoch 373/500
85/85 [==============================] - 1s 8ms/step - loss: 0.0030 - val_loss: 0.396
Epoch 374/500
85/85 [==============================] - 1s 8ms/step - loss: 0.0030 - val_loss: 0.395
Epoch 375/500
85/85 [==============================] - 1s 9ms/step - loss: 0.0030 - val_loss: 0.396
Epoch 376/500
85/85 [==============================] - 1s 8ms/step - loss: 0.0030 - val_loss: 0.396
```

```
Epoch 377/500
85/85 [==============================] - 1s 8ms/step - loss: 0.0030 - val_loss: 0.397
Epoch 378/500
85/85 [==============================] - 1s 8ms/step - loss: 0.0030 - val_loss: 0.395
Epoch 379/500
85/85 [==============================] - 1s 8ms/step - loss: 0.0030 - val_loss: 0.398
Epoch 380/500
85/85 [==============================] - 1s 8ms/step - loss: 0.0030 - val_loss: 0.396
Epoch 381/500
85/85 [==============================] - 1s 9ms/step - loss: 0.0030 - val_loss: 0.397
Epoch 382/500
85/85 [==============================] - 1s 8ms/step - loss: 0.0030 - val_loss: 0.395
Epoch 383/500
85/85 [==============================] - 1s 8ms/step - loss: 0.0030 - val_loss: 0.396
Epoch 384/500
85/85 [==============================] - 1s 8ms/step - loss: 0.0030 - val_loss: 0.395
Epoch 385/500
85/85 [==============================] - 1s 8ms/step - loss: 0.0030 - val_loss: 0.395
Epoch 386/500
85/85 [==============================] - 1s 8ms/step - loss: 0.0030 - val_loss: 0.397
Epoch 387/500
85/85 [==============================] - 1s 8ms/step - loss: 0.0030 - val_loss: 0.396
Epoch 388/500
85/85 [==============================] - 1s 9ms/step - loss: 0.0030 - val_loss: 0.395
Epoch 389/500
85/85 [==============================] - 1s 8ms/step - loss: 0.0030 - val_loss: 0.396
Epoch 390/500
85/85 [==============================] - 1s 9ms/step - loss: 0.0030 - val_loss: 0.397
Epoch 391/500
85/85 [==============================] - 1s 9ms/step - loss: 0.0030 - val_loss: 0.395
```

```
1  loss = history.history['loss']
2  val_loss = history.history['val_loss']
3  epochs = range(len(loss))
4  plt.figure()
5  plt.plot(epochs, loss, 'b', label='Training loss')
6  plt.plot(epochs, val_loss, 'r', label='Validation loss')
7  plt.title("Training and Validation Loss")
8  plt.legend()
9  plt.show()
```



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