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1. Download/search the Stock market dataset from https://www.kaggle.com/datasets/rohanrao/nifty50-stock-market-data. You have given the flexibility to use any other stock dataset if found suitable.
2. Apply any two Preprocessing technique to the above datasets.
3. Apply the GRU architecture to the above dataset.
4. Demonstrate the results with various learning rates.
5. Demonstrate the results with various Activation functions.
6. Demonstrate the results with all possible evaluation criteria.
7. Demonstrate the learning results in all possible visualizing ways.
8. Predict the stock market value based on your implemented model.

```
import itertools
import pandas as pd
import numpy as np
import os
import random

from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, LSTM,GRU,SimpleRNN, RNN, Input, Bidirectional
from sklearn.preprocessing import MinMaxScaler, RobustScaler
from tensorflow.keras.callbacks import ModelCheckpoint, EarlyStopping, ReduceLROnPlateau, LearningRateScheduler
from sklearn.model_selection import GroupKFold
from tensorflow.keras.optimizers import Adam

from tensorflow.keras.optimizers.schedules import ExponentialDecay

from sklearn.metrics import mean_squared_error as mse

import matplotlib.pyplot as plt
plt.style.use('fivethirtyeight')

import warnings
warnings.simplefilter(action='ignore', category= FutureWarning)
```

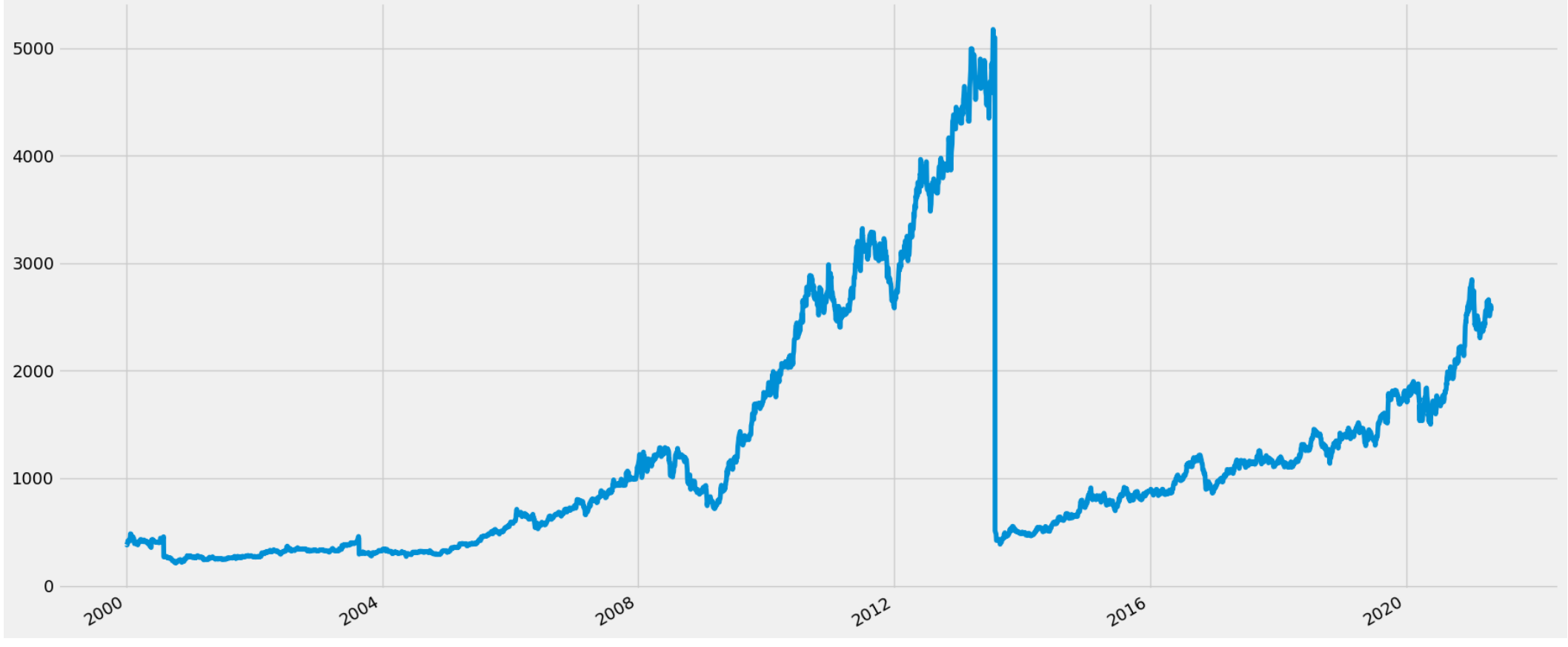
```
2023-11-09 21:56:15.271323: I tensorflow/core/platform/cpu_feature_guard.cc:182] This TensorFlow binary is optimized to use available CPU
To enable the following instructions: AVX2 FMA, in other operations, rebuild TensorFlow with the appropriate compiler flags.
2023-11-09 21:56:16.035729: W tensorflow/compiler/tf2tensorrt/utils/py_utils.cc:38] TF-TRT Warning: Could not find TensorRT
```

```
# general settings
class CFG:
    data_folder = 'archive'
    img_dim1 = 20
    img_dim2 = 10
    nepochs = 6
    seed = 42
    EPOCH = 300
    bsize = 16
    BATCH_SIZE = 1024


# adjust the parameters for displayed figures
plt.rcParams.update({'figure.figsize': (CFG.img_dim1,CFG.img_dim2)})


def seed_everything(seed: int = 42) -> None:
    np.random.seed(seed)
    os.environ["PYTHONHASHSEED"] = str(seed)

seed_everything(CFG.seed)
```

Load Dataset

```
# load the dataset
stock_name = 'CoalIndia'
df = pd.read_csv('archive/'+stock_name+'.csv', usecols = ['Date', 'VWAP'])
df['Date'] = pd.to_datetime(df['Date'])
df.set_index("Date",  inplace=True)
df.VWAP.plot(xlabel = '')
```

```
<Axes: >
```



Preprocessing Data

```
scaler = MinMaxScaler()
df = scaler.fit_transform(df)
```

```
def create_dataset(dataset, look_back, look_ahead):
    xdat, ydat = [], []
    for i in range(len(df) - look_back -look_ahead):
        xdat.append(df[i:i+ look_back ,0])
        ydat.append(df[i+ look_back : i + look_back + look_ahead,0])
    xdat, ydat = np.array(xdat), np.array(ydat).reshape(-1,look_ahead)
    return xdat, ydat
```

```
# use 50 historical observations, predict 1 step ahead
look_back = 50
look_ahead = 1

xdat, ydat = create_dataset(df, look_back = look_back, look_ahead = look_ahead)

# We only want to forecast a single value for each series => target is a column
print(xdat.shape, ydat.shape)
```

```
(5255, 50) (5255, 1)
```

```
def prepare_split(xdat, ydat, cutoff = 5000, timesteps = 50):
    xtrain, xvalid = xdat[:cutoff,:], xdat[cutoff:,]
    ytrain, yvalid = ydat[:cutoff,:], ydat[cutoff:,]

    # reshape into [batch size, time steps, dimensionality]
    xtrain = xtrain.reshape(-1, timesteps, 1)
    xvalid = xvalid.reshape(-1, timesteps, 1)

    return xtrain, ytrain, xvalid, yvalid
```

```
xtrain, ytrain, xvalid, yvalid = prepare_split(xdat, ydat, cutoff = 5000, timesteps = look_back)

print(xtrain.shape, xvalid.shape, ytrain.shape, yvalid.shape)
```

```
(5000, 50, 1) (255, 50, 1) (5000, 1) (255, 1)
```

GRU

```
def create_model(activation, learning_rate):

```

```
    model=Sequential()
    model.add(GRU(10,input_shape= [None,1], return_sequences = True, activation=activation))
    model.add(GRU(10,input_shape= [None,1]))
    model.add(Dense(look_ahead))

    model.compile(loss='mean_squared_error',optimizer=Adam(learning_rate=learning_rate))
    return model
```

```
look_back = 50
look_ahead = 10

xdat, ydat = create_dataset(df, look_back = look_back, look_ahead = look_ahead)

xtrain, ytrain, xvalid, yvalid = prepare_split(xdat, ydat, cutoff = 5000, timesteps= look_back)
```

Taking Different Learning Rates and Activation Functions

```
model1 = create_model('linear', 0.01)
model2 = create_model('relu', 0.001)
model3 = create_model('tanh', 0.0001)
model4 = create_model('sigmoid', 0.1)
```

```
WARNING:tensorflow:Layer gru will not use cuDNN kernels since it doesn't meet the criteria. It will use a generic GPU kernel as fallback
2023-11-09 21:56:17.918746: I tensorflow/compiler/xla/stream_executor/cuda/cuda_gpu_executor.cc:981] could not open file to read NUMA nod
Your kernel may have been built without NUMA support.
2023-11-09 21:56:18.054600: I tensorflow/compiler/xla/stream_executor/cuda/cuda_gpu_executor.cc:981] could not open file to read NUMA nod
Your kernel may have been built without NUMA support.
2023-11-09 21:56:18.054735: I tensorflow/compiler/xla/stream_executor/cuda/cuda_gpu_executor.cc:981] could not open file to read NUMA nod
Your kernel may have been built without NUMA support.
2023-11-09 21:56:18.059973: I tensorflow/compiler/xla/stream_executor/cuda/cuda_gpu_executor.cc:981] could not open file to read NUMA nod
Your kernel may have been built without NUMA support.
2023-11-09 21:56:18.060061: I tensorflow/compiler/xla/stream_executor/cuda/cuda_gpu_executor.cc:981] could not open file to read NUMA nod
Your kernel may have been built without NUMA support.
2023-11-09 21:56:18.060100: I tensorflow/compiler/xla/stream_executor/cuda/cuda_gpu_executor.cc:981] could not open file to read NUMA nod
Your kernel may have been built without NUMA support.
2023-11-09 21:56:19.258476: I tensorflow/compiler/xla/stream_executor/cuda/cuda_gpu_executor.cc:981] could not open file to read NUMA nod
Your kernel may have been built without NUMA support.
2023-11-09 21:56:19.258558: I tensorflow/compiler/xla/stream_executor/cuda/cuda_gpu_executor.cc:981] could not open file to read NUMA nod
Your kernel may have been built without NUMA support.
2023-11-09 21:56:19.258581: I tensorflow/core/common_runtime/gpu/gpu_device.cc:1726] Could not identify NUMA node of platform GPU id 0, d
2023-11-09 21:56:19.258631: I tensorflow/compiler/xla/stream_executor/cuda/cuda_gpu_executor.cc:981] could not open file to read NUMA nod
Your kernel may have been built without NUMA support.
2023-11-09 21:56:19.258666: I tensorflow/core/common_runtime/gpu/gpu_device.cc:1639] Created device /job:localhost/replica:0/task:0/devic
WARNING:tensorflow:Layer gru_2 will not use cuDNN kernels since it doesn't meet the criteria. It will use a generic GPU kernel as fallbac
WARNING:tensorflow:Layer gru_6 will not use cuDNN kernels since it doesn't meet the criteria. It will use a generic GPU kernel as fallbac
```

```
early_stop = EarlyStopping(monitor = 'val_loss', min_delta = 0.001,
                           patience = 5, mode = 'min', verbose = 1,
                           restore_best_weights = True)
```

```
model1.fit(xtrain, ytrain, validation_data=(xvalid, yvalid),
                  epochs = CFG.nepochs, batch_size = CFG.bsize, callbacks=[ early_stop], verbose=0)
```

```
2023-11-09 21:56:33.215208: I tensorflow/compiler/xla/stream_executor/cuda/cuda_blas.cc:606] TensorFloat-32 will be used for the matrix m
2023-11-09 21:56:33.645435: I tensorflow/compiler/xla/stream_executor/cuda/cuda_dnn.cc:432] Loaded cuDNN version 8600
2023-11-09 21:56:33.938139: I tensorflow/compiler/xla/service/service.cc:168] XLA service 0x7fd09f8ad410 initialized for platform CUDA (t
2023-11-09 21:56:33.938196: I tensorflow/compiler/xla/service/service.cc:176]   StreamExecutor device (0): NVIDIA GeForce RTX 3070 Laptop
2023-11-09 21:56:33.945261: I tensorflow/compiler/mlir/tensorflow/utils/dump_mlir_util.cc:255] disabling MLIR crash reproducer, set env v
2023-11-09 21:56:34.196326: I ./tensorflow/compiler/jit/device_compiler.h:186] Compiled cluster using XLA!  This line is logged at most o
Restoring model weights from the end of the best epoch: 1.
Epoch 6: early stopping
<keras.src.callbacks.History at 0x7fd2c00da8e0>
```

```
model2.fit(xtrain, ytrain, validation_data=(xvalid, yvalid),
                  epochs = CFG.nepochs, batch_size = CFG.bsize, callbacks=[ early_stop], verbose=0)
```

```
Restoring model weights from the end of the best epoch: 1.
Epoch 6: early stopping
<keras.src.callbacks.History at 0x7fd23c1a1ac0>
```

```
model3.fit(xtrain, ytrain, validation_data=(xvalid, yvalid),
                  epochs = CFG.nepochs, batch_size = CFG.bsize, callbacks=[ early_stop], verbose=0)
```

```
<keras.src.callbacks.History at 0x7fd2c84bd3d0>
```

```
model4.fit(xtrain, ytrain, validation_data=(xvalid, yvalid),
                  epochs = CFG.nepochs, batch_size = CFG.bsize, callbacks=[ early_stop], verbose=0)
```

```
Restoring model weights from the end of the best epoch: 1.
Epoch 6: early stopping
<keras.src.callbacks.History at 0x7fd1e8ec8910>
```

Predictions, Resuls, Plots

```
y_pred1 = model1.predict(xvalid)
y_pred1 = scaler.inverse_transform(y_pred1)
yvalid1 =  scaler.inverse_transform(yvalid)
```

```
8/8 [==============================] - 1s 20ms/step
```

```
y_pred2 = model2.predict(xvalid)
y_pred2 = scaler.inverse_transform(y_pred2)
```

```
8/8 [==============================] - 0s 22ms/step
```

```
y_pred3 = model3.predict(xvalid)
y_pred3 = scaler.inverse_transform(y_pred3)
```

```
8/8 [==============================] - 1s 5ms/step
```

```
y_pred4 = model4.predict(xvalid)
y_pred4 = scaler.inverse_transform(y_pred4)
```

```
8/8 [==============================] - 0s 18ms/step
```

```
def my_rmse(x,y):
    return(np.round( np.sqrt(mse(x,y)) ,4))
```

```
print('LR = 0.0001 -> ', 'RMSE: ' + str(my_rmse(y_pred1, yvalid1)))
print('LR = 0.001 -> ', 'RMSE: ' + str(my_rmse(y_pred2, yvalid1)))
print('LR = 0.01 -> ', 'RMSE: ' + str(my_rmse(y_pred3, yvalid1)))
print('LR = 0.1 -> ', 'RMSE: ' + str(my_rmse(y_pred4, yvalid1)))
```

```
LR = 0.0001 ->  RMSE: 114.9648
LR = 0.001 ->  RMSE: 124.0381
LR = 0.01 ->  RMSE: 160.4362
LR = 0.1 ->  RMSE: 106.3669
```

```
plt.plot(np.mean(yvalid1, axis=1), label = 'real')
plt.plot(np.mean(y_pred1, axis=1), label = 'predicted (LR = 0.01, AF = linear)')
plt.plot(np.mean(y_pred2, axis=1), label = 'predicted (LR = 0.001, AF = relu)')
plt.plot(np.mean(y_pred3, axis=1), label = 'predicted (LR = 0.0001, AF = tanh)')
plt.plot(np.mean(y_pred4, axis=1), label = 'predicted (LR = 0.1, AF = sigmoid)')
plt.ylabel('')
plt.legend()
plt.show()
```