Snapshot of the algorithm and data collected for the RNN-LSTM with attention

Ongoing Application: High Frequency Quant Trading strategies using machine learning.

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Algorithm Part 1: data collection

Sequential_Data_Prediction_LSTM_Attention.py

```
# -*- coding: utf-8 -*-
"""
Updated on Wed Aug  28 16:45:26 2019
@author: Yesser H. Nasser
Collect the data, pre-process the data to handle nan values
"""

import re
import time
import bs4 as bs
import pickle
import requests
import datetime as dt
import pandas as pd
import random
import numpy as np
import pandas_datareader.data as web
import os
import matplotlib.pyplot as plt
import matplotlib.dates as mdates
import matplotlib.ticker as mticker

from sklearn import preprocessing
from mpl_finance import candlestick_ohlc
from matplotlib import style
from alpha_vantage.timeseries import TimeSeries
from sklearn import preprocessing
from colle
from dat

style.

start_

# ====
SEQ_LE
TARGET
PERIOD
c = 0.

# ====
weeks
atts =
# ====
def sa
    re
    so
    ta
    ti
    fo


    with o
        pickle.dump(tickers,f)
    print(tickers)
    return tickers
tickers = save_sp500_tickers()
```

,] # weeks of data collections
culate indicators

_500_companies')

' and ticker!= 'GL' and ticker!= 'IEX'

Algorithm for data collection

Name	Type	Size	Value
X_train	float64	(2534, 15, 1298)	[[[6.55484291e-02 2.63960000e-01 8.78285995e+01 ... -1.34856543e-01 ...
X_validation	float64	(310, 15, 1298)	[[[3.00990674e-02 9.96554343e-02 -1.90386226e+00 ... 4.55702883e-02 ...
accuracy	list	20	[0.5714285845361833, 0.694554076874783, 0.7131018274784935, 0.74901342 ...
all_tickers	list	507	['MMM', 'ABT', 'ABBV', 'ABMD', 'ACN', 'ATVI', 'ADBE', 'AMD', 'AAP', 'A ...
atts	list	4	['close', 'volume', 'high', 'low']
batch_size	int	1	5
c	float	1	0.7
count	int	1	2
df	list	7	[Dataframe, Dataframe, Dataframe, Dataframe, Dataframe, Dataframe, Dat ...
elapsed_time_secs	float	1	1021.2800447940826
epochs	int	1	20
i	int	1	320
last_20pct	str	1	2019-08-19 14:22:00
loss	list	20	[0.7363361349680712, 0.5845534333807799, 0.561707640956167, 0.51201543 ...
main_data	DataFrame	(5516, 1300)	Column names: AAPL_Closes, AAPL_VWAP_diff, AAPL_Volumes, ACN_Closes, A ...
main_data_train	DataFrame	(3862, 1300)	Column names: AAPL_Closes, AAPL_VWAP_diff, AAPL_Volumes, ACN_Closes, A

Variable explorer | History log

IPython console

Console 1/A

```
250
260
270
280
290
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310
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330
340
350
360
370
380
390
400
410
420
430
440
```

IPython console | File explorer | Help

Permissions: RW | End-of-lines: CRLF | Encoding: UTF-8 | Line: 4 | Column: 16 | Memory: 48 %

Sequential_Data_Prediction_LSTM_Attention.py

```
    return tickers
tickers = save_sp500_tickers()

# append additonal tickers
symbols_1 = ['SPY','IWM','DIA','IEF','TLT','GLD','SLV','USD',]
for symbol in symbols_1:
    if symbol not in tickers:
        tickers.append(symbol)

def preprocess_price_volume (df,Keep,week):
    df = df.interpolate()
    if Keep == 'volume':
        df = df.round(0)
        df = df.fill
    else:
        for co
            d
            m
                                                    ), data_inter[~mask])

    df.colum
    print(df
    df.to_cs

# ==========
#========= o
def compile_
    with ope

        main_
        #sto
        for

                                                    all the no-alphabet i

                                                    ker name

            i

        preproces

# ====================== execute the function ==============================
for week in weeks:
    To_Keep = ['close','volume', 'high', 'low', 'open']
    for tokeep in To_Keep:
        compile_data(tokeep,week)
## ============================================================================
##========================== unit test ======================================
```

- Compiling data
- Building Dataframes
- Sequences

Name	Type	Size	Value
X_train	float64	(2534, 15, 1298)	[[[6.55484291e-02 2.63960000e-01 8.78285995e+01 ... -1.34856543e-01 ...
X_validation	float64	(310, 15, 1298)	[[[3.00990674e-02 9.96554343e-02 -1.90386226e+00 ... 4.55702883e-02 ...
accuracy	list	20	[0.5714285845361833, 0.694554076874783, 0.7131018274784935, 0.74901342 ...
all_tickers	list	507	['MMM', 'ABT', 'ABBV', 'ABMD', 'ACN', 'ATVI', 'ADBE', 'AMD', 'AAP', 'A ...
atts	list	4	['close', 'volume', 'high', 'low']
batch_size	int	1	5
c	float	1	0.7
count	int	1	2
df	list	7	[Dataframe, Dataframe, Dataframe, Dataframe, Dataframe, Dataframe, Dat ...
elapsed_time_secs	float	1	1021.2800447940826
epochs	int	1	20
i	int	1	320
last_20pct	str	1	2019-08-19 14:22:00
loss	list	20	[0.7363361349680712, 0.5845534333807799, 0.561707640956167, 0.51201543 ...
main_data	DataFrame	(5516, 1300)	Column names: AAPL_Closes, AAPL_VWAP_diff, AAPL_Volumes, ACN_Closes, A ...
main_data_train	DataFrame	(3862, 1300)	Column names: AAPL_Closes, AAPL_VWAP_diff, AAPL_Volumes, ACN_Closes, A

Variable explorer | History log

IPython console

Console 1/A

```
460
470
480
490
500
                     MMM_low  ABT_low  ABBV_low  ...   GLD_low  SLV_low    USD_low
date                                               ...
2019-08-12 09:31:00   163.02    86.11     65.20  ...  141.7165  15.8500  39.850000
2019-08-12 09:32:00   163.00    86.11     65.26  ...  141.6550  15.8450  40.037300
2019-08-12 09:33:00   162.68    86.21     65.24  ...  141.6600  15.8499  39.965475
2019-08-12 09:34:00   162.25    86.24     65.23  ...  141.7203  15.8501  39.893650
2019-08-12 09:35:00   162.60    86.24     65.08  ...  141.7495  15.8500  39.821825

[5 rows x 507 columns]
0
10
20
30
40
50
```

IPython console | File explorer | Help

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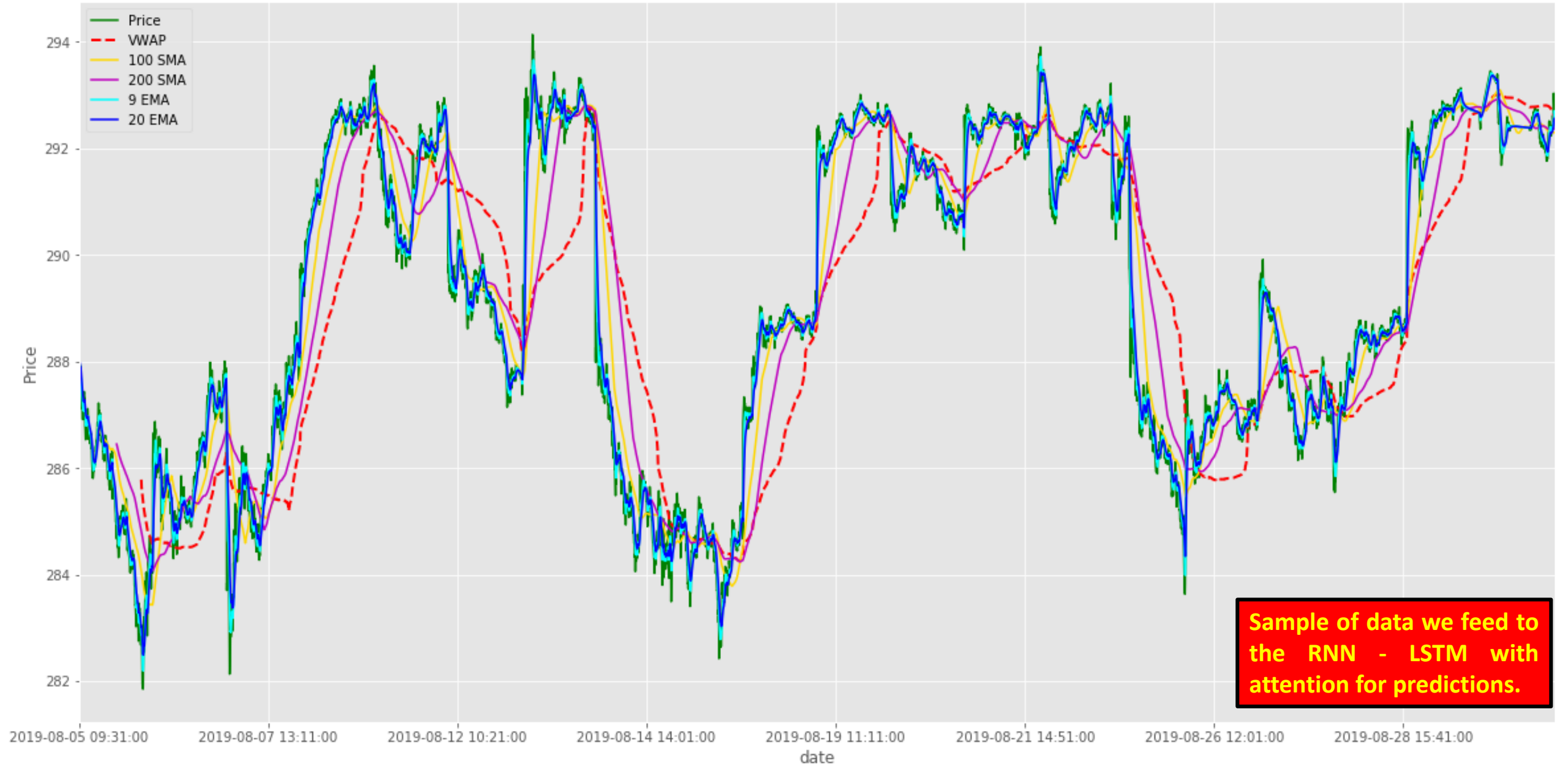
SPY

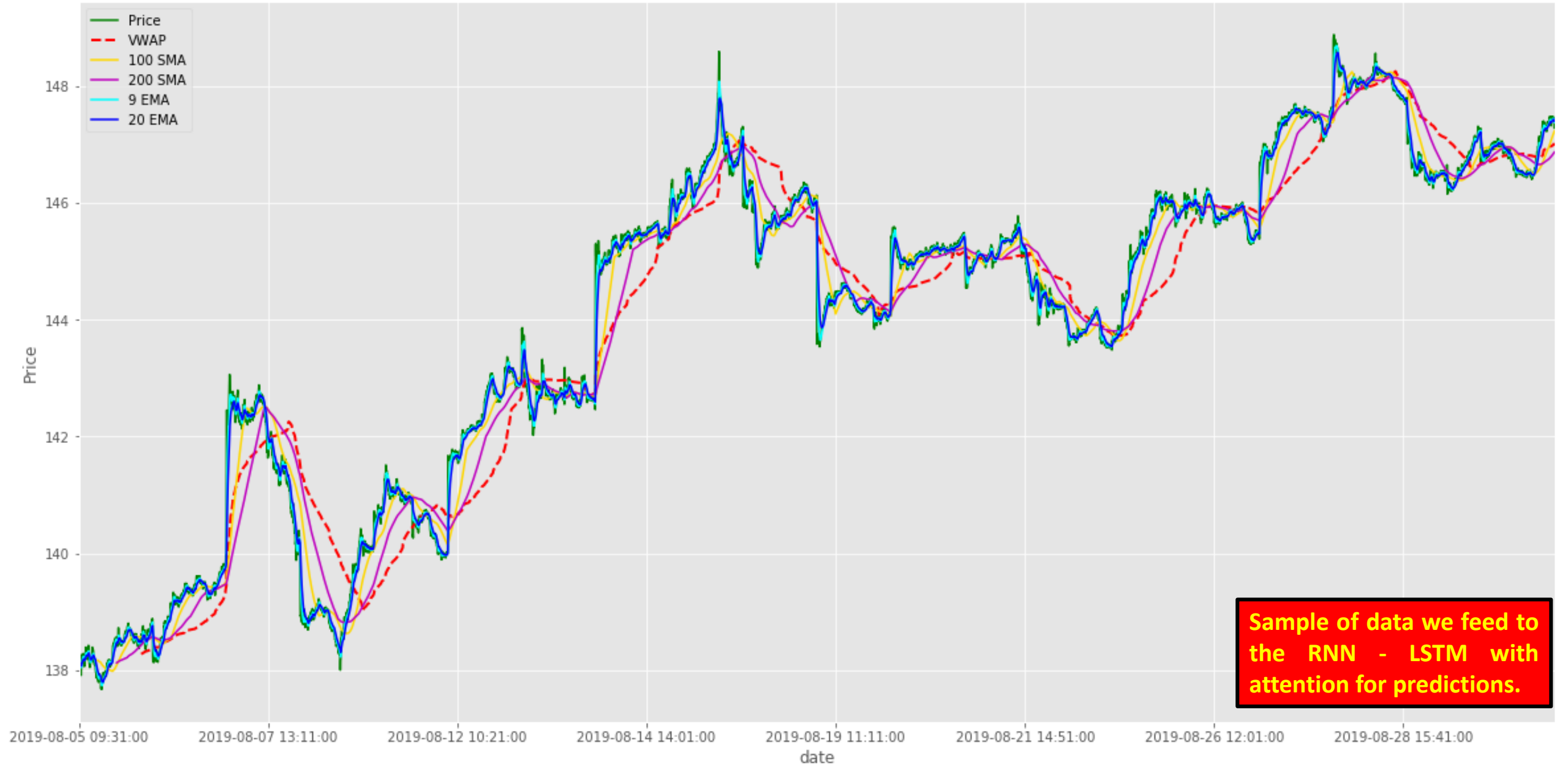


Sample of data we feed to the RNN - LSTM with attention for predictions.

Very resent data!

N.B: Time frame : 1 min

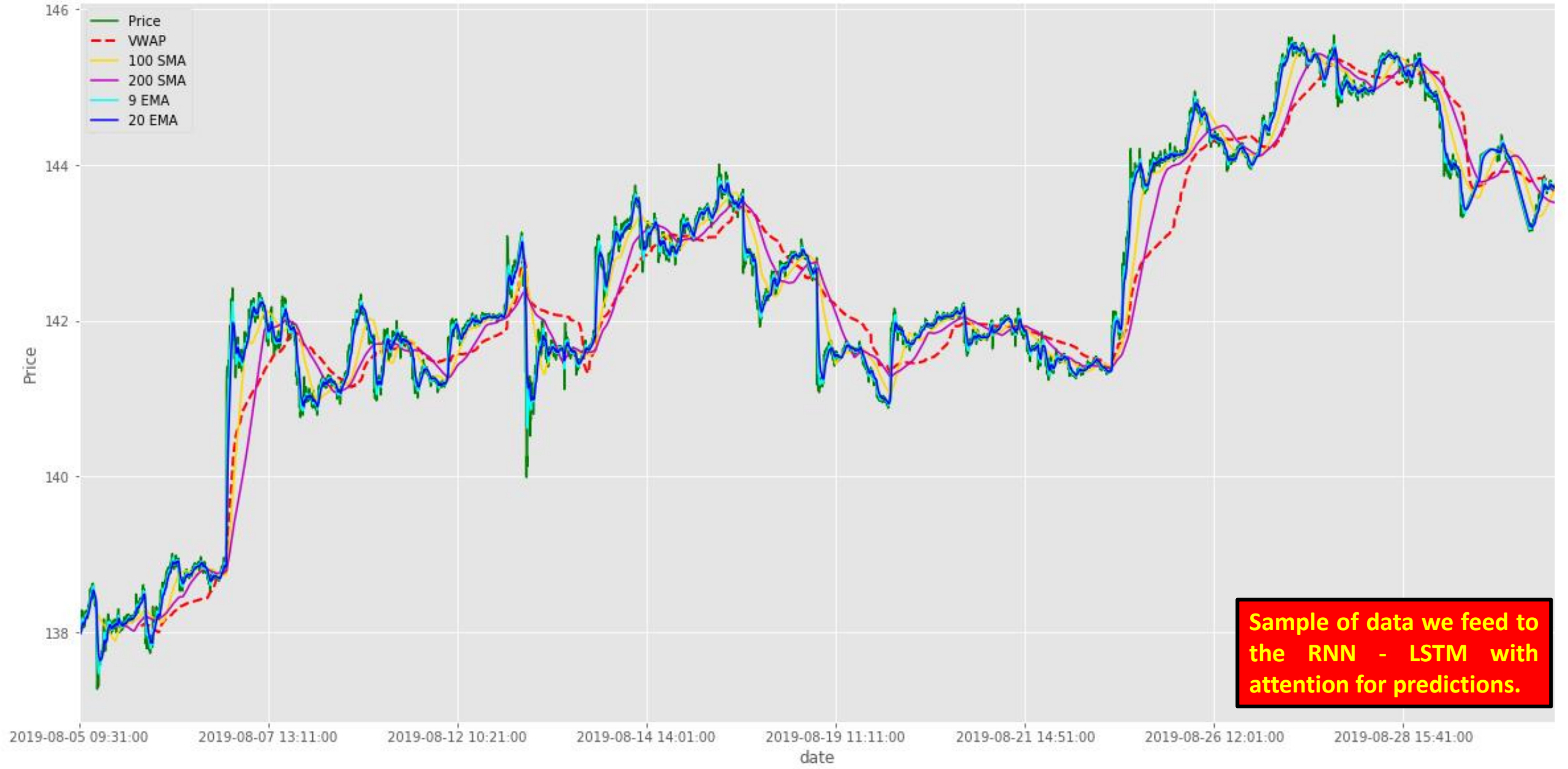
TLT



Sample of data we feed to the RNN - LSTM with attention for predictions.

N.B: Time frame : 1 min

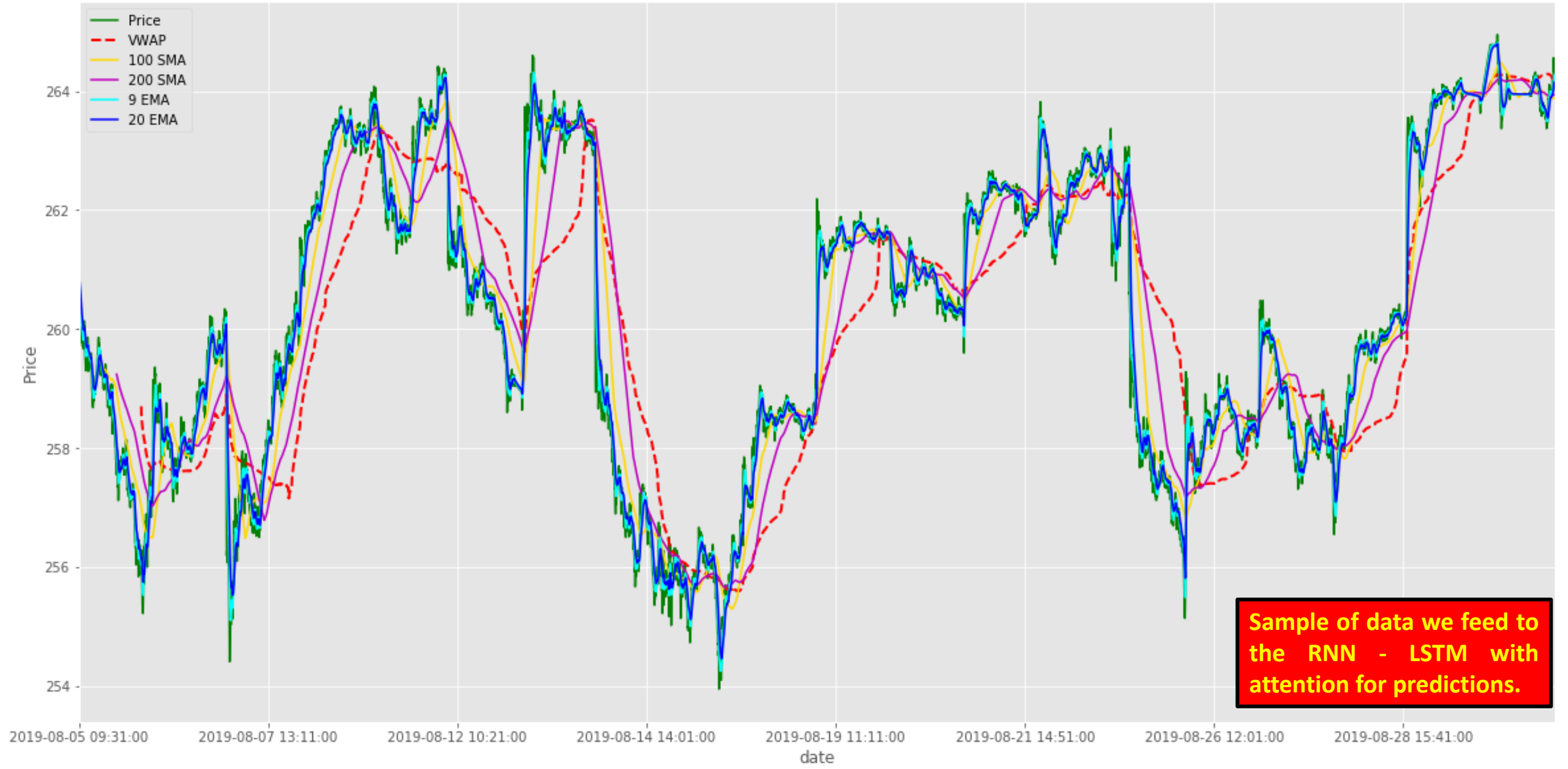
GLD



Sample of data we feed to the RNN - LSTM with attention for predictions.

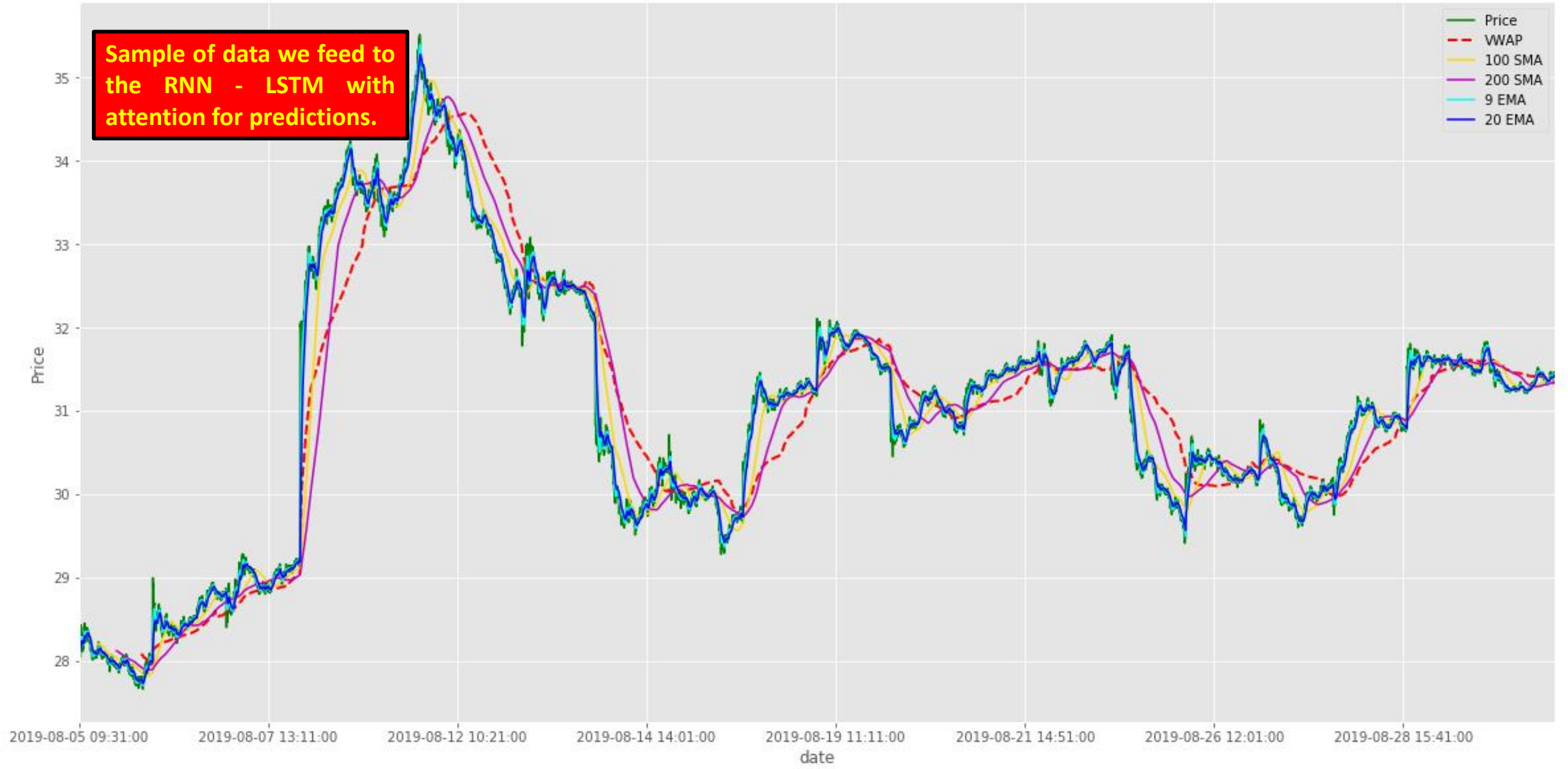
N.B: Time frame : 1 min

DIA



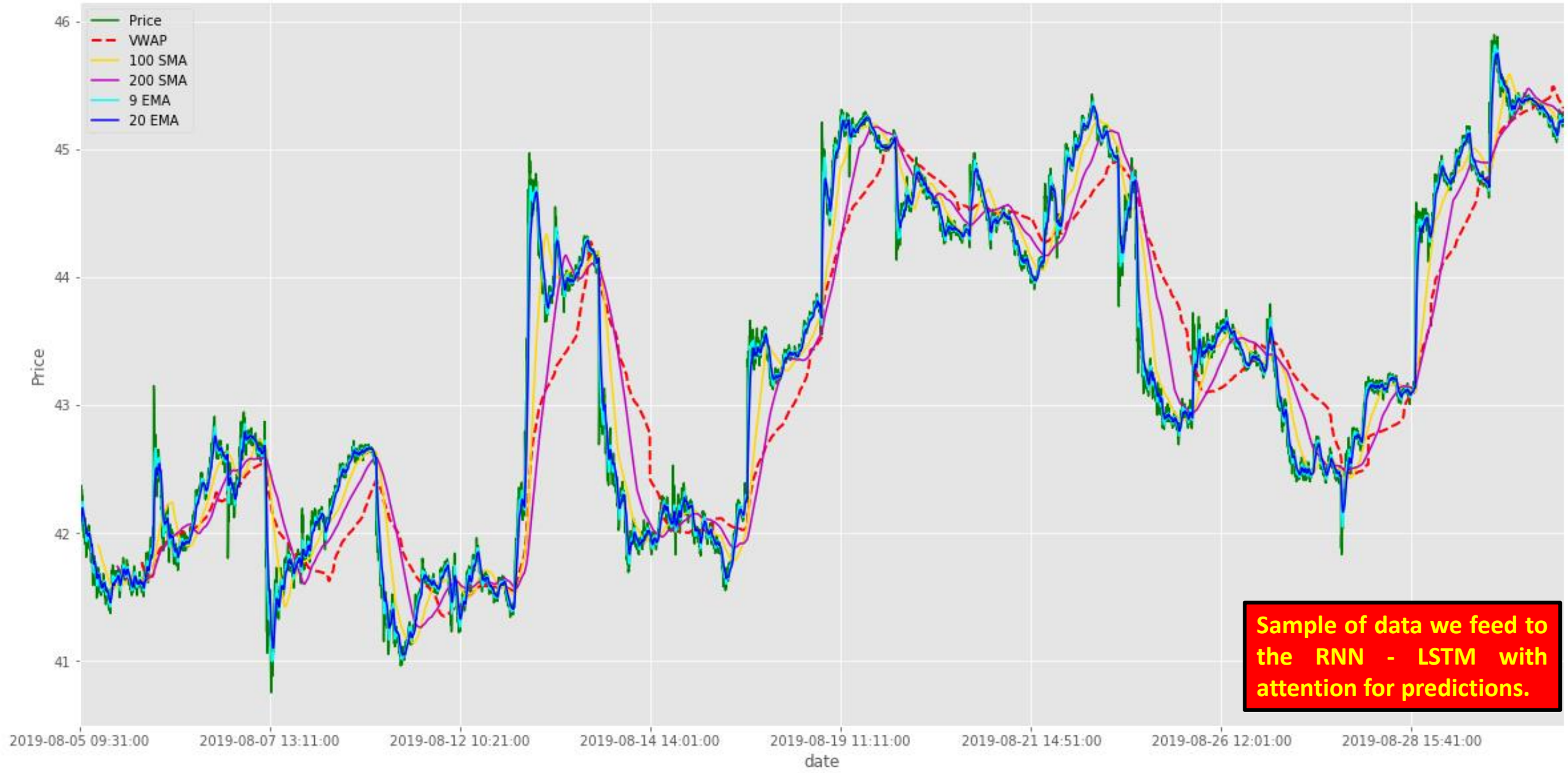
N.B: Time frame : 1 min

Stock Price - AMD



N.B: Time frame : 1 min

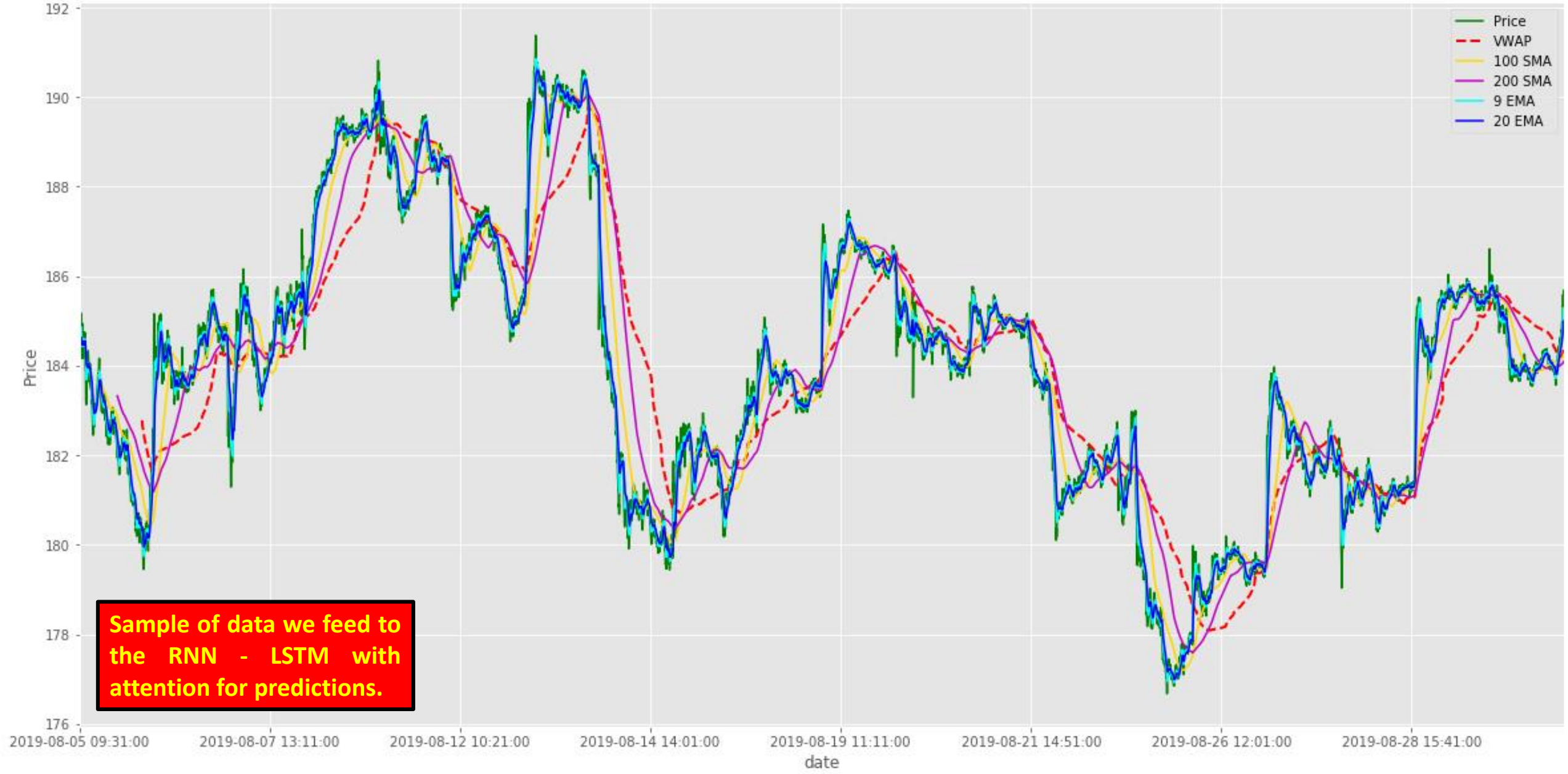
Stock Price - MU



Sample of data we feed to the RNN - LSTM with attention for predictions.

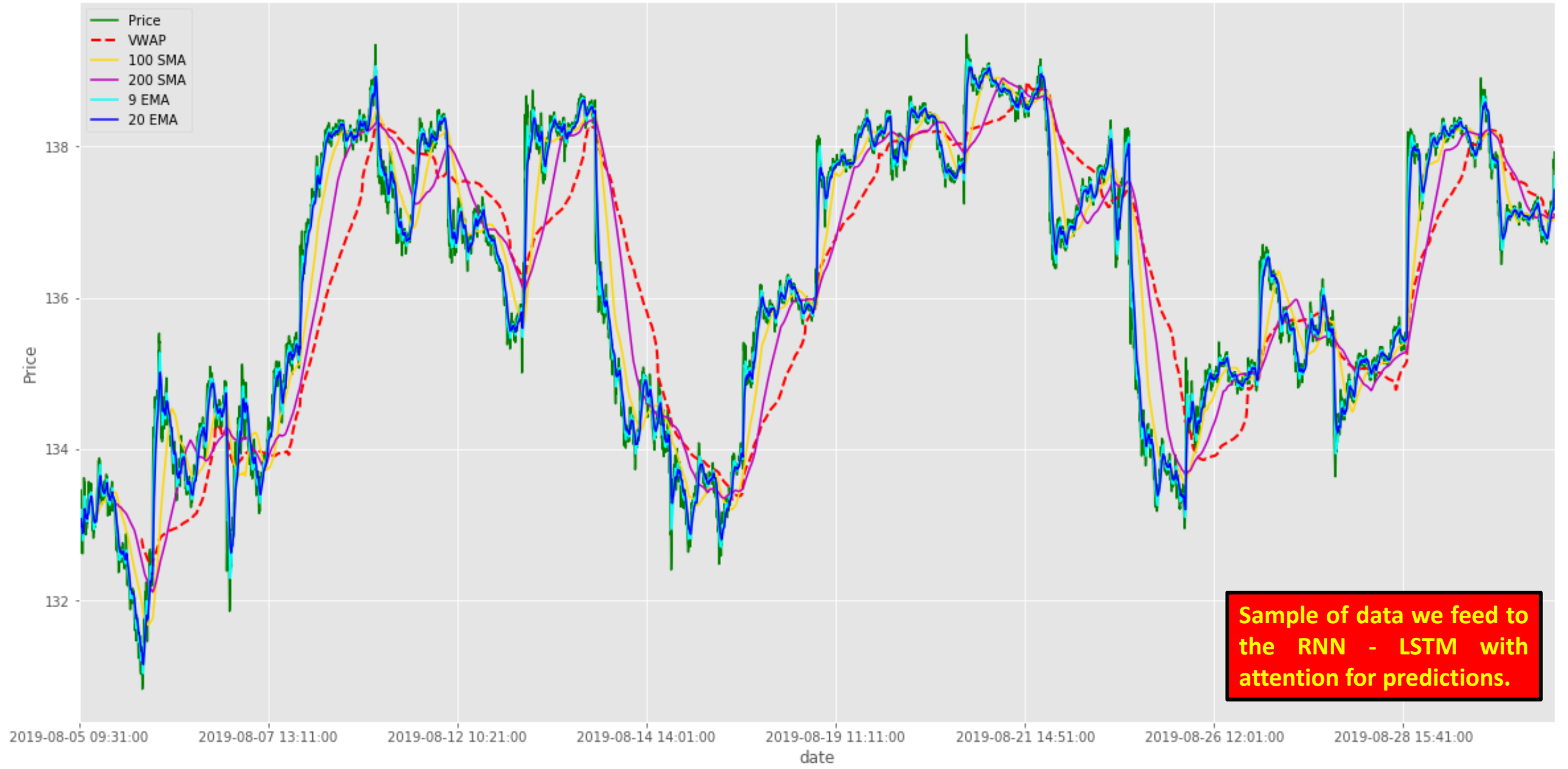
N.B: Time frame : 1 min

Stock Price - FB



N.B: Time frame : 1 min

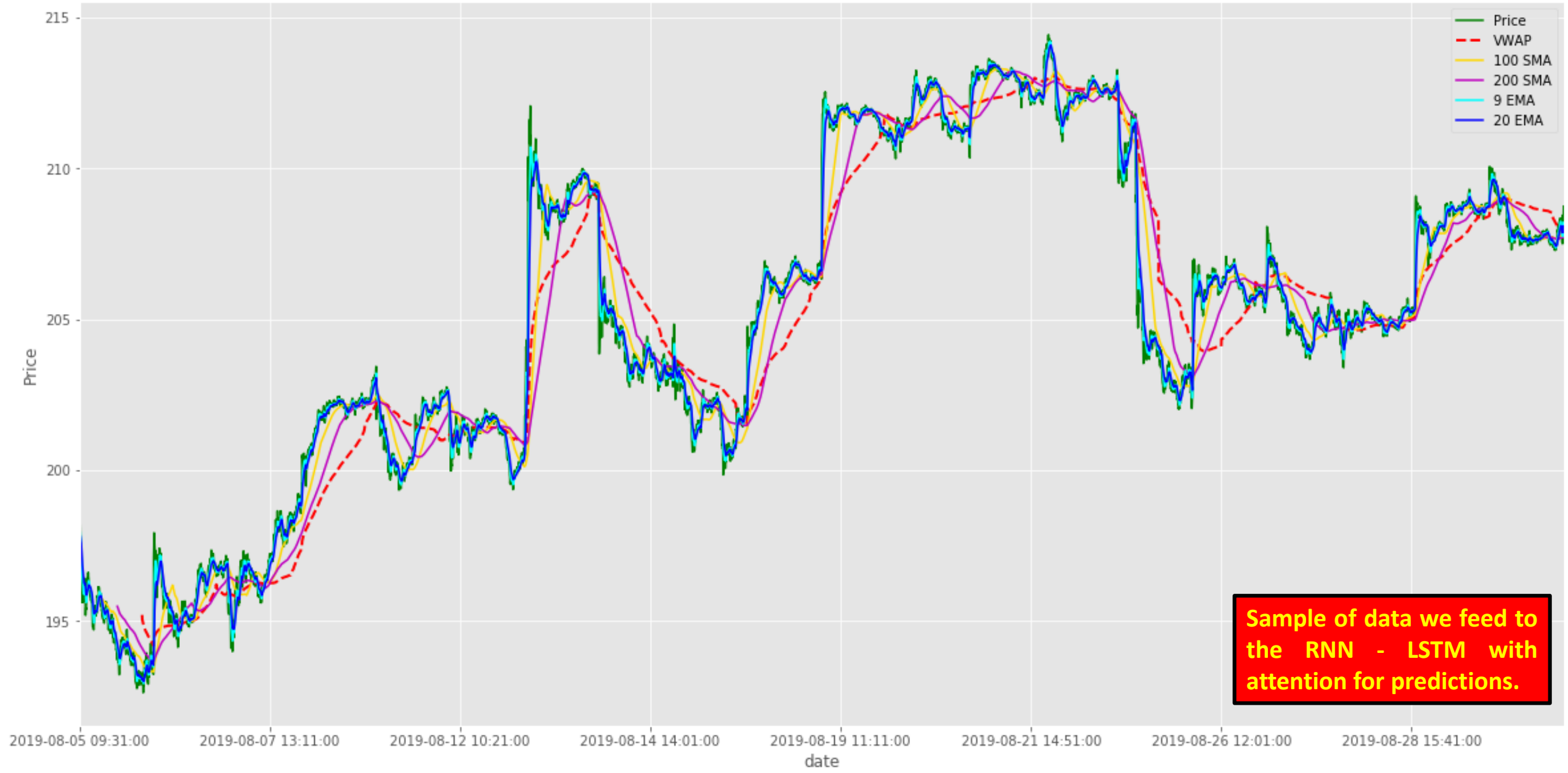
Stock Price - MSFT



Sample of data we feed to the RNN - LSTM with attention for predictions.

N.B: Time frame : 1 min

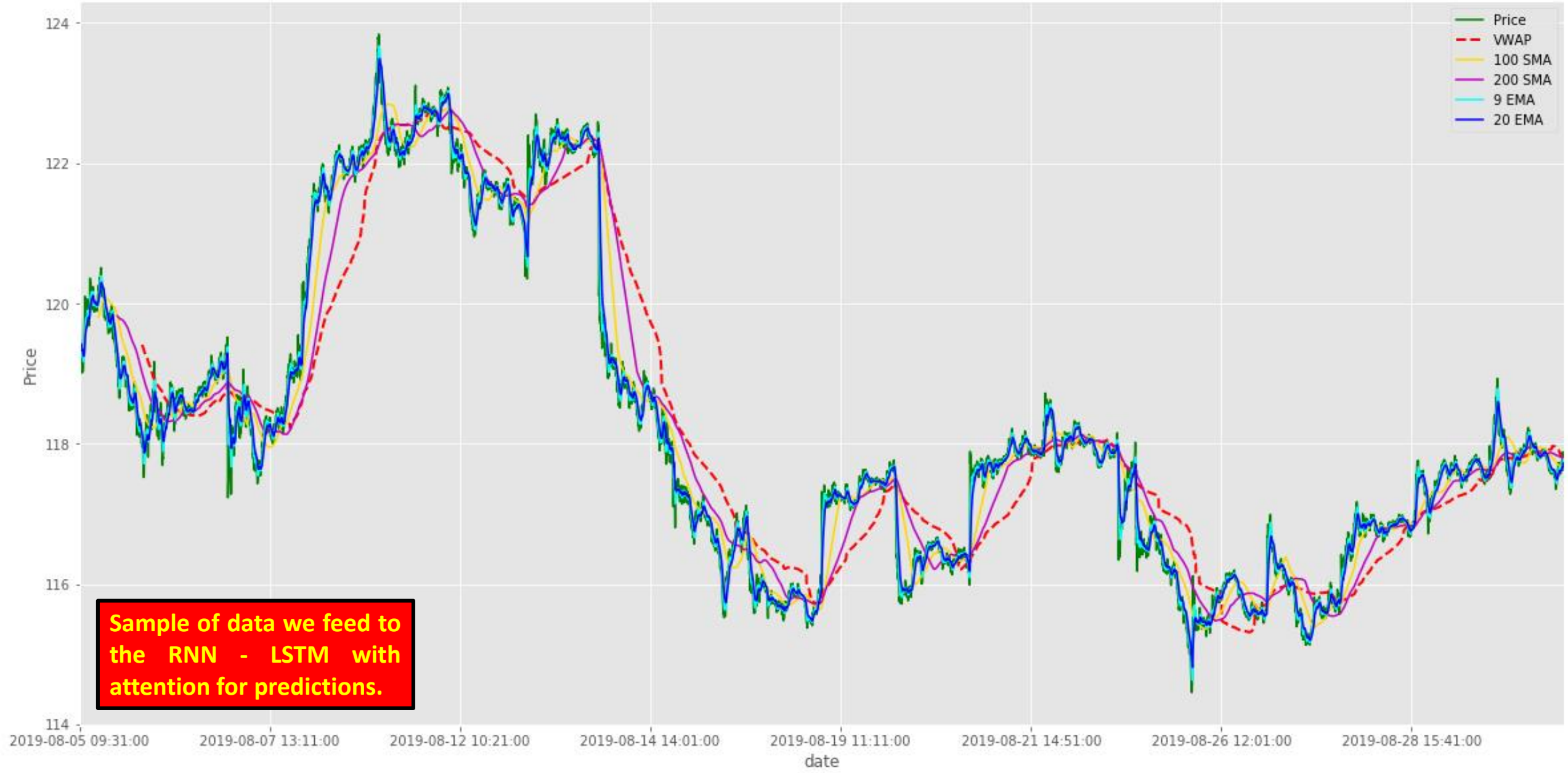
Stock Price - AAPL



Sample of data we feed to the RNN - LSTM with attention for predictions.

N.B: Time frame : 1 min

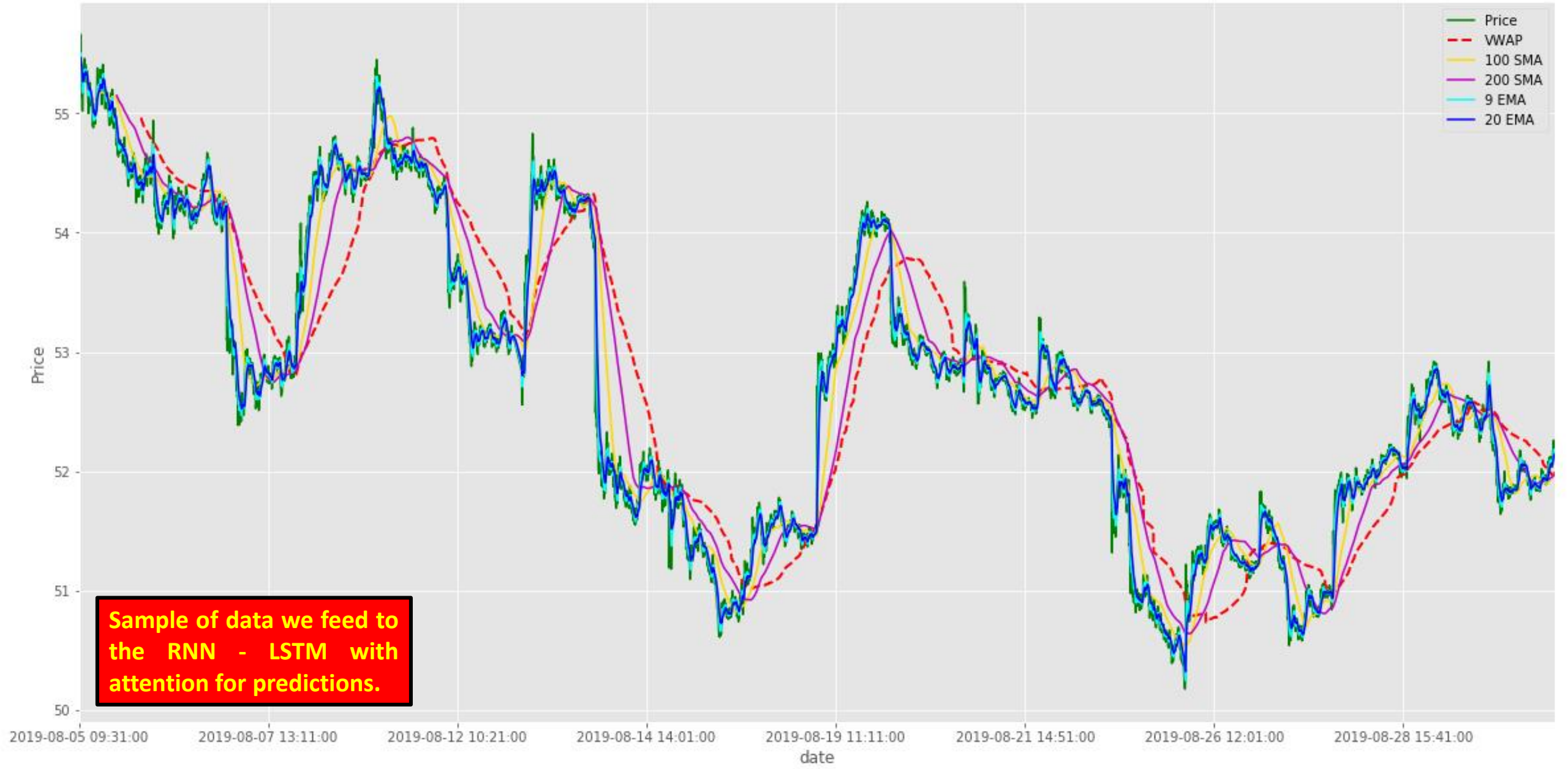
Stock Price - CVX



Sample of data we feed to the RNN - LSTM with attention for predictions.

N.B: Time frame : 1 min

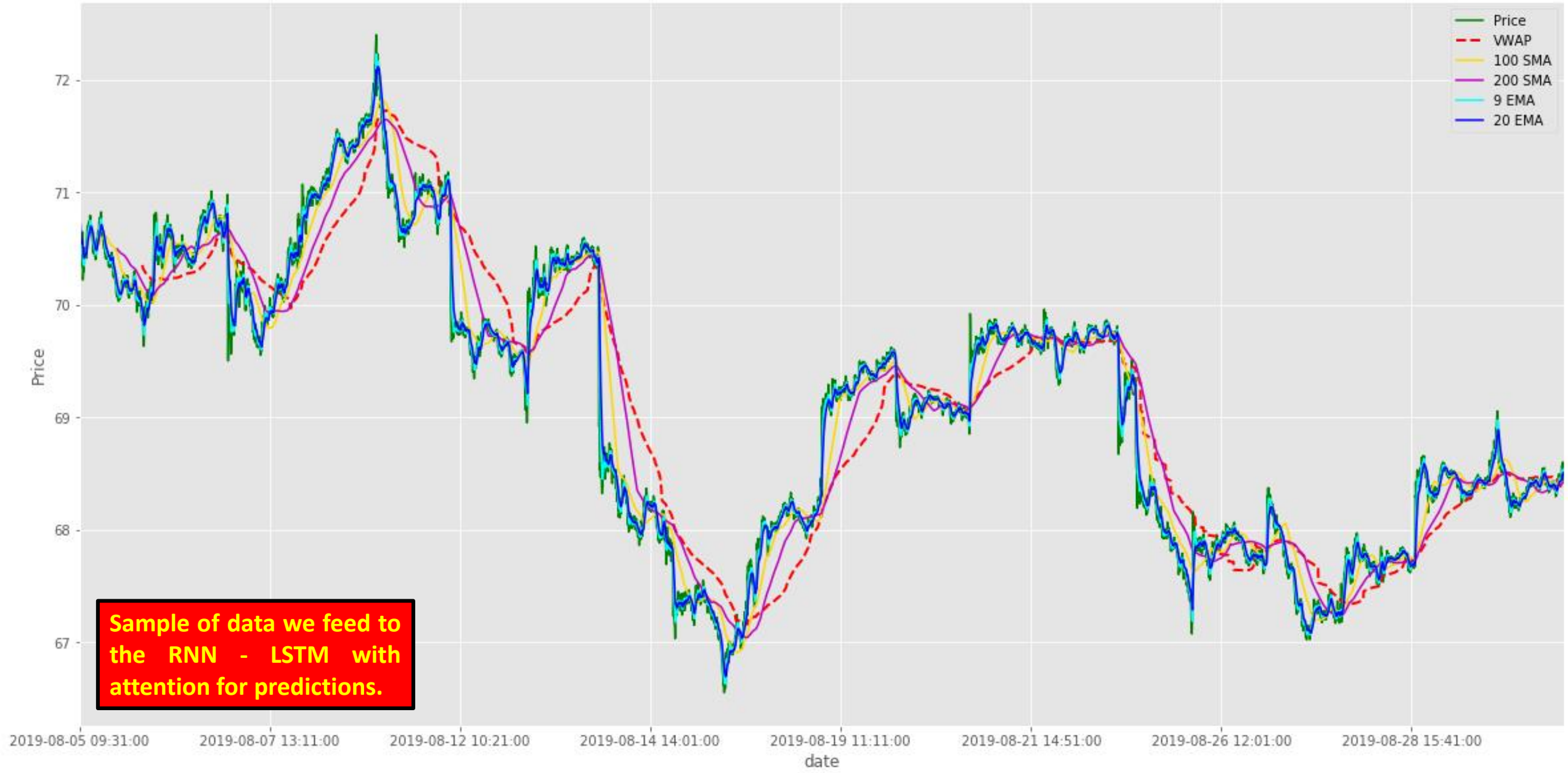
Stock Price - COP



Sample of data we feed to the RNN - LSTM with attention for predictions.

N.B: Time frame : 1 min

Stock Price - XOM



Sample of data we feed to the RNN - LSTM with attention for predictions.

N.B: Time frame : 1 min

Algorithm Part 2: Data preprocessing

Sequential_Data_Prediction_LSTM_Attention.py

```
241             df.dropna(inplace=True)
242     df.dropna(inplace=True)
243
244     sequential_data = []
245     prev_period = deque(maxlen=SEQ_LENGTH)
246
247     for i in df.values:
248         prev_period.append([n for n in i[:-1]])
249         if len(prev_period) == SEQ_LENGTH:
250             seq                                    ])
251
252     random.sh
253
254     '''# bal
255     buys=[]
256     sells=[]
257     for seq,
258         if t
259
260         elif
261
262     random.s
263     random.s
264
265     # look e
266     lower =
267     buys = b
268     sells =
269     sequenti
270     random.s
271
272     # seper
273     X = []
274     y = []
275     for seq,
276         X.ap
277         y.ap
278     return n
279
280 # ==========
281 Vol_Wei_Avr_
282 Spl_Mov_Avr_
283 Spl_Mov_Avr_
284 Exp_Mov_Avr_
285 Exp_Mov_Avr_
286
287 # ==========
288 Closes_corr
289 target_corr
290 target_corr
291 tickers_corr
292
293 all_tickers
294
295 tickers_to_dr
296 # ==========
297 for i in range(len(tickers_to_drop)):
298     Closes.drop(tickers_to_drop[i], axis=1, inplace=True)
```

Algorithm for:

- Data processing;
- Scaling;
- Balancing;
- Shifting;
- Shuffling;
- …
- …

Name	Type	Size	Value
X_train	float64	(2534, 15, 1298)	[[[6.55484291e-02 2.63960000e-01 8.78285995e+01 ... -1.34856543e-01 ...
X_validation	float64	(310, 15, 1298)	[[[3.00990674e-02 9.96554343e-02 -1.90386226e+00 ... 4.55702883e-02 ...
accuracy	list	20	[0.5714285845361833, 0.694554076874783, 0.7131018274784935, 0.74901342 ...
all_tickers	list	507	['MMM', 'ABT', 'ABBV', 'ABMD', 'ACN', 'ATVI', 'ADBE', 'AMD', 'AAP', 'A ...
atts	list	4	['close', 'volume', 'high', 'low']
batch_size	int	1	5
c	float	1	0.7
count	int	1	2
df	list	7	[Dataframe, Dataframe, Dataframe, Dataframe, Dataframe, Dataframe, Dat ...
elapsed_time_secs	float	1	1021.2800447940826
epochs	int	1	20
i	int	1	320
last_20pct	str	1	2019-08-19 14:22:00
loss	list	20	[0.7363361349680712, 0.5845534333807799, 0.561707640956167, 0.51201543 ...
main_data	DataFrame	(5516, 1300)	Column names: AAPL_Closes, AAPL_VWAP_diff, AAPL_Volumes, ACN_Closes, A ...
main_data_train	DataFrame	(3862, 1300)	Column names: AAPL_Closes, AAPL_VWAP_diff, AAPL_Volumes, ACN_Closes, A

Variable explorer | History log

IPython console

Console 1/A

```
460
470
480
490
500
                  MMM_low  ABT_low  ABBV_low  ...   GLD_low  SLV_low    USD_low
date                                          ...
2019-08-12 09:31:00   163.02    86.11     65.20  ...  141.7165  15.8500  39.850000
2019-08-12 09:32:00   163.00    86.11     65.26  ...  141.6550  15.8450  40.037300
2019-08-12 09:33:00   162.68    86.21     65.24  ...  141.6600  15.8499  39.965475
2019-08-12 09:34:00   162.25    86.24     65.23  ...  141.7203  15.8501  39.893650
2019-08-12 09:35:00   162.60    86.24     65.08  ...  141.7495  15.8500  39.821825

[5 rows x 507 columns]
0
10
20
30
40
50
```

IPython console | File explorer | Help

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Algorithm Part 2: Model building

Sequential_Data_Prediction_LSTM_Attention.py

```
      Spl_Mov_Avr_200_diff,
      Exp_Mov_Avr_9_diff,
      Exp_Mov_Avr_20_diff]

main_data = pd.concat(df, axis=1)
main_data = main_data[sorted(main_data.columns)]

# ================== define future (shift data ==============================
main_data['future'] = main_data[f'{TARGET_TO_PREDICT}_Closes'].shift(-PERIOD_TO_PREDICT)
main_data['target'] = list(map(classify, main_data[f'{TARGET_TO_PREDICT}_Closes'], main_data['future']))

# this jsut
main_data
                                                                  axis =1)
main_dat

# ======                                                          ================
times =
last_20p

main_dat                                                          )]
main_dat

X_train,
X_valida

print(f'                                                          idation)}')
print(f'                                                          data: {y_train.count(0)}')
print(f'                                                          lidation_data: {y_validation.count(0)}')

# ======                                                          ================
import k
import t
from ker                                                          TM, Input, Conv2D, MaxPool2D
from ker
from att

model =
model.ad                                                          hape[1:]), return_sequences = True))
model.ad
model.ad
#
model.ad                                                          hape[1:]), return_sequences = True))
model.ad
model.ad
#
model.ad                                                          hape[1:]), return_sequences = True))
model.ad
model.ad
model.add

model.add(D
model.add(Dropo
model.add(Dense(2, activation = 'softmax'))

model.summary()
```

Model building:
- **LSTM**
- **Attention Model**

Name	Type	Size	Value
main_data_train	DataFrame	(3862, 1300)	Column names: AAPL_Closes, AAPL_VWAP_diff, AAPL_Volumes, ACN_Closes, A ...
main_data_validation	DataFrame	(1654, 1300)	Column names: AAPL_Closes, AAPL_VWAP_diff, AAPL_Volumes, ACN_Closes, A ...
msg	str	1	Execution took: 0:17:01 secs (Wall clock time)
save_dir	str	1	saved_models
save_fname	str	1	saved_models\28082019-162523-e20.h5
start_time	float	1	1567033702.9244797
symbol	str	1	USD
symbols_1	list	8	['SPY', 'IWM', 'DIA', 'IEF', 'TLT', 'GLD', 'SLV', 'USD']
target_corr	Series	(507,)	Series object of pandas.core.series module
tckr	str	1	AAPL
tickers	list	507	['MMM', 'ABT', 'ABBV', 'ABMD', 'ACN', 'ATVI', 'ADBE', 'AMD', 'AAP', 'A ...
tickers_corr	list	186	['AAPL', 'RMD', 'CMCSA', 'FAST', 'CE', 'LRCX', 'T', 'WDC', 'VMC', 'STZ ...
tickers_to_drop	list	321	['MAS', 'JNPR', 'DD', 'RJF', 'DXC', 'NEM', 'SLV', 'AKAM', 'MPC', 'PPL' ...
times	list	5516	['2019-08-05 15:00:00', '2019-08-05 15:01:00', '2019-08-05 15:02:00', ...
tokeep	str	1	open
training_epochs	int	1	20

Variable explorer | History log

IPython console

Console 1/A

```
==================================================================
lstm_1 (LSTM)                (None, 15, 128)           730624
_________________________________________________________________
dropout_1 (Dropout)          (None, 15, 128)           0
_________________________________________________________________
batch_normalization_1 (Batch (None, 15, 128)           512
_________________________________________________________________
lstm_2 (LSTM)                (None, 15, 128)           131584
_________________________________________________________________
dropout_2 (Dropout)          (None, 15, 128)           0
_________________________________________________________________
batch_normalization_2 (Batch (None, 15, 128)           512
_________________________________________________________________
lstm_3 (LSTM)                (None, 15, 128)           131584
_________________________________________________________________
dropout_3 (Dropout)          (None, 15, 128)           0
_________________________________________________________________
batch_normalization_3 (Batch (None, 15, 128)           512
_________________________________________________________________
attention_1 (Attention)      (None, 128)               143
```

IPython console | File explorer | Help

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Algorithm Part 3: Running Model – preliminary results

Sequential_Data_Prediction_LSTM_Attention.py

```
model.add(Dense(64, activation = 'relu'))
model.add(Dropout(0.2))
model.add(Dense(2, activation = 'softmax'))

model.summary()

# ==========
batch_size = 5
training_epoch
model.compile
Sequential_pr
# ==========
epochs = trai
save_dir = '
save_fname =
if not os.pat
    os.makedi
model.save(sa
print('[Model
#model.save(
# ==========
accuracy = Se
val_accuracy
loss = Sequen
val_loss = Se
Epochs = rang
plt.figure(fi
plt.subplot(1
plt.plot(Epoc
plt.xlabel('E
plt.ylabel('A
plt.legend()
plt.grid(1)
plt.subplot(1
plt.plot(Epoc
plt.xlabel('Ep
plt.ylabel('Lo
plt.legend()
plt.grid(1)
# ======================== Elapsed time ========================
elapsed_time_secs = time.time() - start_time
msg = "Execution took: %s secs (Wall clock time)" % timedelta(seconds=round(elapsed_time_secs))
print(msg)
```

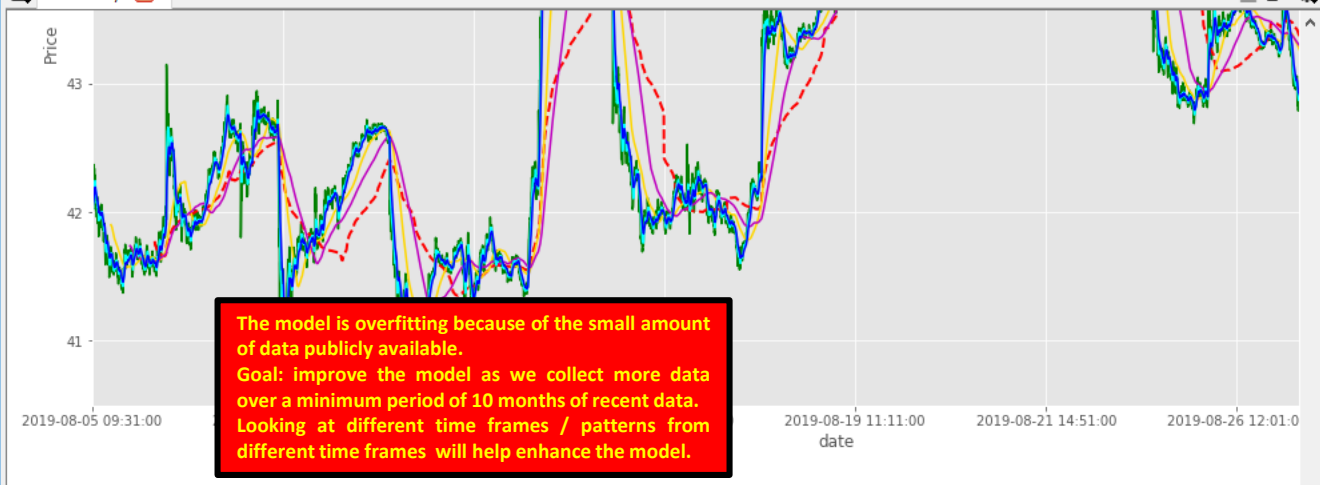
To learn more about the progress on this project and looking to apply this workflow please get in touch at:
Yesser.Nasser@icloud.com

Name	Type	Size	Value
atts	list	4	['close', 'volume', 'high', 'low']
batch_size	int	1	5

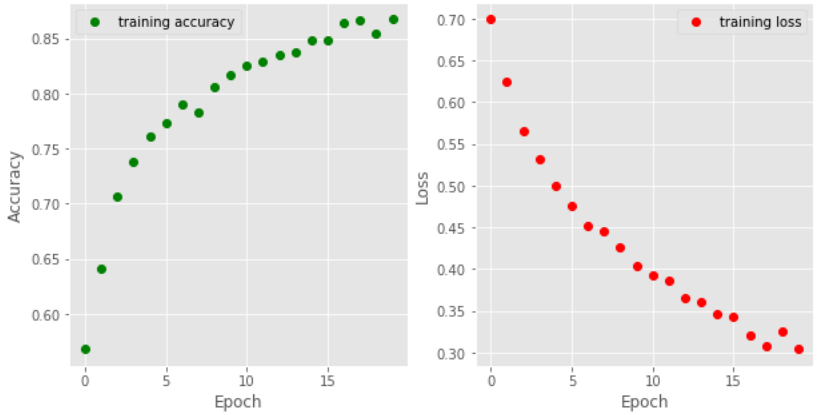
Variable explorer | History log

IPython console

Console 1/A



The model is overfitting because of the small amount of data publicly available.
Goal: improve the model as we collect more data over a minimum period of 10 months of recent data.
Looking at different time frames / patterns from different time frames will help enhance the model.




```
In [2]:
```

IPython console | File explorer | Help

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