AlgoBulls Python Developer Coding Assignment

June 2023

Project: Design a simple Algorithmic Trading Strategy

Description: You need to code a simple trading strategy in a Jupyter Notebook as per the given requirements:

1. Define a Class **ScriptData** which can fetch US Stock data using Alpha Vantage. [Use this link to get your FREE API Key].
   The class should implement the following methods:
   a. **fetch_intraday_data**: (method arguments: script)
      Fetches intraday data for given "script" (Example for script: "GOOGL", "AAPL", "NVDA") and stores as it is.
   b. **convert_intraday_data**: (method arguments: script)
      Converts fetched intraday data (in point a.) as a pandas DataFrame (hereafter referred as *"df"*) with the following columns:
      i. timestamp (data type: pandas.Timestamp)
      ii. open (data type: float)
      iii. high (data type: float)
      iv. low(data type: float)
      v. close (data type: float)
      vi. volume (data type: int)
   c. **Additional methods for overloading the following operations:**
      i. getitem
      ii. setitem
      iii. contains

Sample code showing how the above class will be used:

```
In [18]:  1  script_data = ScriptData()
```

In [19]:
```
script_data.fetch_intraday_data('GOOGL')
script_data.convert_intraday_data('GOOGL')
script_data['GOOGL']
```

Out[19]:

	timestamp	open	high	low	close	volume
0	2021-11-02 13:00:00	2909.620	2915.120	2898.65	2912.210	126686
1	2021-11-02 14:00:00	2911.155	2916.720	2900.54	2900.540	110407
2	2021-11-02 15:00:00	2901.310	2901.775	2887.56	2896.155	131824
3	2021-11-02 16:00:00	2896.790	2913.000	2890.37	2908.290	365383
4	2021-11-02 17:00:00	2908.650	2908.650	2905.04	2905.050	21430
...	...	...	...	...	...	...
95	2021-11-12 15:00:00	2971.240	2971.610	2963.14	2968.350	65223
96	2021-11-12 16:00:00	2968.140	2977.000	2967.65	2974.240	214453
97	2021-11-12 17:00:00	2973.560	2975.330	2972.51	2974.650	44087
98	2021-11-12 18:00:00	2973.560	2973.560	2973.56	2973.560	953
99	2021-11-12 19:00:00	2972.510	2972.510	2970.00	2970.000	635

100 rows × 6 columns

(The output data may differ for you based on which date you run this code, but the format should be the same)

In [20]:
```
script_data.fetch_intraday_data('AAPL')
script_data.convert_intraday_data('AAPL')
script_data['AAPL']
```

Out[20]:

	timestamp	open	high	low	close	volume
0	2021-11-04 17:00:00	150.7408	150.8606	150.6210	150.7608	1914822
1	2021-11-04 18:00:00	150.7907	150.8107	150.6409	150.6709	57101
2	2021-11-04 19:00:00	150.7008	150.8107	150.7008	150.7707	21546
3	2021-11-04 20:00:00	150.7707	150.7807	150.6709	150.7308	37790
4	2021-11-05 05:00:00	150.9400	151.1200	150.5500	150.7500	18607
...	...	...	...	...	...	...
95	2021-11-12 16:00:00	149.9000	150.4000	149.7500	149.9900	9358141
96	2021-11-12 17:00:00	149.9900	150.0600	149.9500	149.9900	3585851
97	2021-11-12 18:00:00	150.0000	150.0000	149.9700	149.9800	78011
98	2021-11-12 19:00:00	150.0000	150.0000	149.8700	149.9400	24201
99	2021-11-12 20:00:00	149.9600	149.9800	149.7300	149.7300	61456

100 rows × 6 columns

(The output data may differ for you based on which date you run this code, but the format should be the same)

```
In [21]: 'GOOGL' in script_data
Out[21]: True

In [22]: 'AAPL' in script_data
Out[22]: True

In [23]: 'NVDA' in script_data
Out[23]: False
```

2. Define a function called **indicator1**. It should take “df” and ‘timeperiod’ (integer) as inputs and give another pandas DataFrame as an output with two columns:
    a. *timestamp*: Same as ‘timestamp’ column in ‘df’
    b. *indicator:* Moving Average of the ‘close’ column in ‘df’. The number of elements to be taken for a moving average is defined by ‘timeperiod’. For example, if ‘timeperiod’ is 5, then each row in this column will be an average of total 5 previous values (including current value) of the ‘close’ column.

Some sample code has been given below which shows how the above function will be used:

```
In [17]: indicator1(script_data['GOOGL'], timeperiod=5)
```

Out[17]:

	timestamp	indicator
0	2021-11-02 13:00:00	NaN
1	2021-11-02 14:00:00	NaN
2	2021-11-02 15:00:00	NaN
3	2021-11-02 16:00:00	NaN
4	2021-11-02 17:00:00	2904.449
...	...	...
95	2021-11-12 15:00:00	2959.472
96	2021-11-12 16:00:00	2966.768
97	2021-11-12 17:00:00	2970.364
98	2021-11-12 18:00:00	2972.434
99	2021-11-12 19:00:00	2972.160

100 rows × 2 columns

```
In [18]: 1 indicator1(script_data['AAPL'], timeperiod=5)
```

Out[18]:

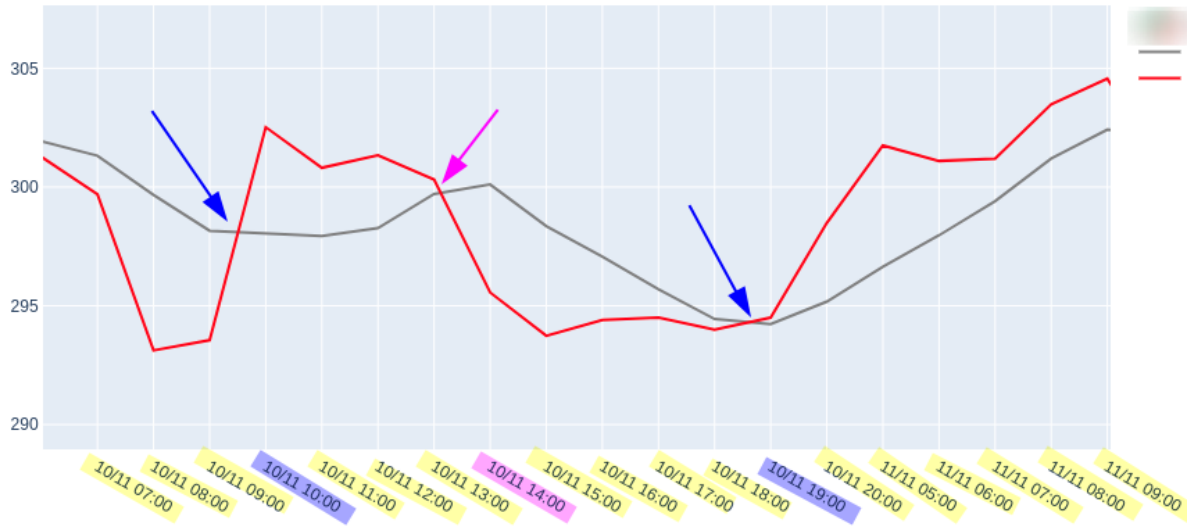
	timestamp	indicator
0	2021-11-04 17:00:00	NaN
1	2021-11-04 18:00:00	NaN
2	2021-11-04 19:00:00	NaN
3	2021-11-04 20:00:00	NaN
4	2021-11-05 05:00:00	150.73664
...	...	...
95	2021-11-12 16:00:00	149.84100
96	2021-11-12 17:00:00	149.87900
97	2021-11-12 18:00:00	149.96000
98	2021-11-12 19:00:00	149.96000
99	2021-11-12 20:00:00	149.92600

100 rows × 2 columns

3. Define a class Strategy, which can do the following, given a script name:
    a. Fetch intraday historical day (*'df'*) using **ScriptData** class.
    We'll refer to the *'close'* column of *'df'* as *close_data*.
    b. Compute indicator data on *'close'* of *'df'* using **indicator1** function.
    We'll refer to the *'indicator'* column of this data as *indicator_data*.
    c. Generate a pandas DataFrame called *'signals'* with 2 columns:
        i. *'timestamp'*: Same as *'timestamp'* column in *'df'*
        ii. *'signal'*: This column can have the following values:
            1. BUY (When: If *indicator_data* cuts *close_data* upwards)
            2. SELL (When: If *indicator_data* cuts *close_data* downwards)
            3. NO_SIGNAL (When: If *indicator_data* and *close_data* don't cut each other)

            <u>Example of 'Cut Upwards', 'Cut Downwards', 'Do not cut each other':</u>
            As an example, for the below graph, if the RED line is *close_data* and GREY line is *indicator_data*, then:
                1. The BLUE points represent the instances when *indicator_data* has cut *close_data* 'downwards'
                2. The PINK points represent the instances when *indicator_data* has cut *close_data* 'upwards
                3. The YELLOW points represent when *indicator_data* and *close_data* don't cut each other.

            So, there will be a SELL signal for BLUE timestamps, 'BUY' signal for PINK timestamp and 'NO_SIGNAL' for yellow timestamps.



d. Print the ‘signals’ DataFrame with only those rows where the signal is either ‘BUY’ or ‘SELL’.

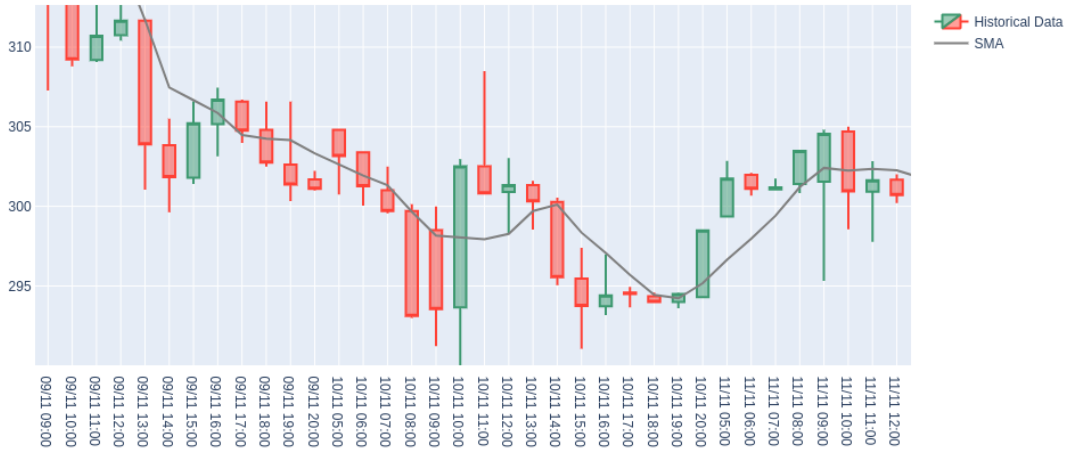
Sample code showing how the above class will be used (##):

```
In [16]:  1  strategy = Strategy('NVDA')

In [17]:  1  strategy.get_script_data()

In [24]:  1  strategy.get_signals()
```

Out[24]:

	timestamp	signal
0	2021-11-05 09:00:00	BUY
1	2021-11-05 11:00:00	SELL
2	2021-11-05 13:00:00	BUY
3	2021-11-05 20:00:00	SELL
4	2021-11-08 08:00:00	BUY
5	2021-11-08 11:00:00	SELL

4. **[OPTIONAL]** Plot a candlestick chart of ‘df and ‘indicator’. You can use the ‘pyalgotrading’ package to do so. The chart will look like this.



You may use the following to complete the assignment:

1. Python 3.8+
2. Jupyter Notebook (latest)
3. 3rd party Python packages:
    a. alpha_vantage
    b. pandas
    c. numpy
    d. pyalgotrading

Objective:

1. Please come up with a git repo containing a Jupyter Notebook that can accommodate all the requirements.
2. The Jupyter Notebook should run seamlessly. Just calling the **Kernel -> Restart & Run All** option to do all that is necessary. There should be no errors and no unnecessary code in the notebook.
3. The dependent Python packages must be captured in a *requirements.txt* file which can be installed inside a *virtualenv* easily. The Jupyter Notebook should also be run after sourcing the virtualenv.

Duration:

The ideal time is 3 days. If you need extra time, please request the same with appropriate reasoning.

Submission Guidelines:

1. Please ensure the following before submission:
    a. Ensure that the code is cleaned up as per PEP8 standards
    b. Add sufficient comments for complex logic
    c. Upload your code on a private GitHub repo

    d. Include a README in your repo that includes basic documentation on how to run the code
    e. It is okay to keep pushing any number of intermediate code commits on your repo
2. For submission:
    a. Upload your Jupyter notebook, requirements.txt file and any other resources on the private GitHub repo and share it with the following GitHub ids: **algobulls-dev**, **akhil-jain-algobulls**.
    b. Send an email to developers@algobulls.com & akhil.jain@algobulls.com, mentioning your name and GitHub ID, requesting a review. Attach this coding assignment pdf to the mail as well.
    c. Reply on the internshala chatbox with an image attachment containing the signals for NVDA on a 5-min candle. This should be same as the output marked as (##) for strategy.get_signals() above

Asking for clarification/hints:
You can send an email to developers@algobulls.com & akhil.jain@algobulls.com with your query. We will get back to you.