Sigma Internship Coding Challenge

Goal

This exercise will help familiarize you with the Quantrocket platform and also test your coding & algorithms knowledge while giving you a flavor of how to set up a minimalist trading workflow.

Getting Started

1. Install Quantrocket on your local or on cloud of your choice. Go through a few quick tutorials to understand how to use the basic capabilities of the platform.
2. Ensure you are able to pull price data (daily close prices only) for Apple stock (sid='AAPL') for the year 2023 (01-01-2023 to 12-31-2023). This should be available as part of their freely available us-stock price data.

Daily Stock Trading Prompt

Objective is to build a simple model to make decisions on certain days using the below pre-specified logic and publish the output (along with the code).

Let for a day d in [1,2,,,,N], p(d) represent the close price of that day. We want to build a model to decide whether to place a buy order trade for the day d+1 to maximize the portfolio value. Let r(d) be the % returns on day d. That is, r(d) = (p(d) - p(d-1))/p(d-1). Conduct the following state classification:

if r(d) >= 0.1, s(d) = +1
else if r(d) > -0.1, s(d) = 0
else, s(d) = -1

That is, depending on whether the returns on day d are high, medium or low, we classify the state as Bull (+1), Flat (0) or Bear (-1). Let's define a simplistic value function as below.

Assuming we decide to place a buy order trade for the day d+1,
if s(d+1) = 1 & s(d) = 0, then V(d+1) = V(d) + 1
else if s(d+1) = -1 & s(d) = 0, then V(d+1) = V(d) -1
and V(d+1) = V(d) in all other cases (including when we decide not to place a buy order trade for the day d+1). That is on day d+1, assuming we executed a buy, our portfolio value increases by 1 if the observed returns for d+1 is in the Bull state, decreases by 1 if it is in the Bear state, and stays unchanged for all other scenarios.

Now based on the previous observations [1,..,d], you can calculate the probability distribution of going from the state s(d) to different possible states.

Write the code to calculate the transition distribution in a streaming manner while making decisions on the optimal points where you'll place buy orders with the ultimate goal to maximize V(N). Submit the value V(N), the optimal buy indices & code in your github repository.

Feel free to join Sigma Slack group (it's an open group) and ping @Arpit Goel directly if you have any specific questions during the coding challenge duration.