Kivi Assignment

Samanyu Mahajan

Contents

1 Testing

lot size is taken as 1. can be changed in config.py. A simulation for a year takes about 2 min to run. To test on out of sample data, make changes in the config namely:

- DATA_FILE: path of data
- START_DATE: change to 20240101
- END_DATE: change to 20241231

and run using ./run.sh.

2 Strategy

Base Startegy handles the logging etc. DGLongShort derived from BaseStrategy has the actual logic of the strategy and works as follows. Based on Indicators we identify long and short conditions. Suppose long condition is met then we place an aggresive order. We also calculate the **Stop loss** and the Target. For a long position if the price falls below the stop loss, we exit. If the rises above the target, we lock in our gains and exit. Similar but reverse logic for a short position. Finally at the end of holding period (4 days) we exit all open positions.

3 Indicators

3.1 Initial Attempt

Tried: Only RSI and SMA
Initially, I used just RSI and a simple moving average (SMA) to capture general price direction.
Problem: It often led to false signals Why it failed: RSI is reactive but not sufficient alone; SMA smoothed too much. Finally I settled on the following:

3.2 Bollinger Bands

- Middle Band: SMA(14)
- Upper Band: SMA + 2 Standard Deviation
- Lower Band: SMA - 2 S.D

when price touches the Lower Band it indicates oversold condition. Price has hit the support and is likely to bounce back thus it is a buying signal. On the other hand if the price touches the upper band it is an overbought condition. Price has hit the resistance and is likely to drop hence it is a selling signal. Further a wider band (difference between upper and lower bands) implies higher volatility. A lower band implies sideways movement and we dont want to trade then. So we check if the band is greater than a threshold before entering into any position.

3.3 RSI

$$RSI = 100 - \frac{100}{1 + RS} \tag{1}$$

where

$$RS = \frac{AverageGainoverNperiods}{AverageLossoverNperiods} \tag{2}$$

where $N = 14$. When $RSI > 70$ then it is an overbought situation. When $RSI < 30$ it is an oversold situation. We use RSI Rate of change. When the rate of change is negative and large it means that RSI has dropped significantly, which indicates momentum to the downside or oversold conditions which is a buying signal. Similarily when Rate of change of RSI is large positive it indicate upward momentum and likely overbought situation so it is a sell signal.

3.4 +-DI

+DI is a smoothed version of +DM which indicates the strength of upward momentum, whereas as -DI indicates the strength of downward momentum. Consider the rate of change of -DI, if it is large and negative this means that -DI is decreasing at a fast rate which means that the bearish trend is fading away which is a buying signal. Similarily when rate of change of +DI is large positive this indicated strong bullish movement however this may imply an overbought position and hence considered as a selling signal.

3.5 Why this works and Threshold Selection

- RSI gives short-term momentum.
- DI+/DI- offer directional strength.
- Bollinger Bands introduce a volatility filter.
- SMA is helpful for smoothing

Together, these indicators balance each other. Thresholds were empirically chosen:

- a significant change in RSI (rsi_rc) might be ±5–10%, which indicates a clear momentum buildup or shift.
- plus_di_rc and minus_di_rc: 5% is enough change to signify a meaningful move but not too sensitive to noise.
- Bollinger Band width (band_diff) was crucial in filtering out trades during low-volatility periods (> 0.4)

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4 Updating Indicators

Running sim for year 2020. The time frame after which indicators are updated is varies from 15 minutes to 60 minutes in multiples of 5
We obtain good PNL for 60 minutes and it takes less time to run so we chose this as our 'update minutes'.

$Time(minutes)$	PNL
15	238539
20	59593
25	118137
30	152127
35	107094
40	111153
45	106238
50	105713
55	102545
60	128704

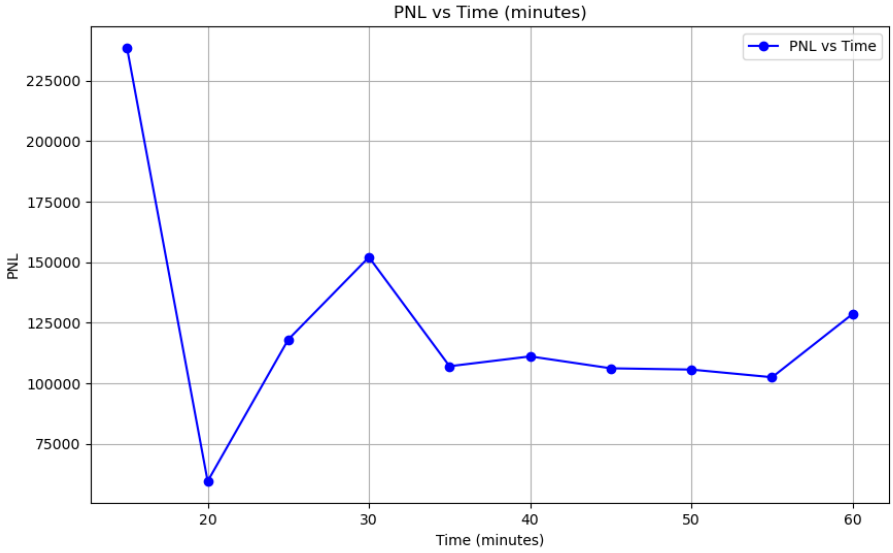

Figure 1: PNL vs Time plot

5 Execution

We run a simulation. Datastore object fetches the packets between start and end dates and then each packet is given to the exchange and then to the strategy sequentially. The startegy reads the packet and does stuff (placing order/updating indicators). Orders are stored in a list. The exchange on recieving a packet fills the orders which would have been filled, logs the order and then update the strategy. The stategy then keeps a record of this using class "Position". At the end of simulation, the pnl is calculated and displayed in the logs.

6 Logging

logs are made in folder Code/logs/start_date/update_minutes where start_date and update_minutes are as in config.py. We maintain the following logs:

- stdout.log: the final results (metrics) of the simulation
- stats.csv: same thing as above in csv format
- order_details: informative details of orders like long position met at what time and price, squaring off etc.
- orders.csv: log of placed but pending orders
- fill_orders.csv: log of filled orders.

The first three logs and maintained in base strategy and the last two in exchange(executor.py)

7 Metrics

For each simulation, the following are recorded.

- Total PNL
- Total Orders
- Total volume traded
- Winning Trades
- PNL turover ratio in bps
- Sharpe Annually
- Max Drawdown

Running for year 2023 with update minutes as 15 gave the following results:

Total PNL	122349
Start Date	20230101
End Date	20231229
Total Orders	3895
Total volume traded	4195
Winning Trades	1241
PNL turover ratio in bps	15.2
Sharpe Annually:	3.2
Max Drawdown	-5.24

Running for year 2017 with update minutes as 60 gave the following results:

Total PNL	1251.
Start Date	20170101
End Date	20171229
Total Orders	1049
Total volume traded	1142
Winning Trades	299
PNL turover ratio in bps	1.1
Sharpe Annually:	0.5
Max Drawdown	-5.22

Running for year 2020 with update minutes as 60 gave the following results:

Total PNL	128704
Start Date	20200101
End Date	20201231
Total Orders	1347
Total volume traded	1433
Winning Trades	489
PNL turover ratio in bps	79
Sharpe Annually:	8.5
Max Drawdown	-0.74