```
1 %matplotlib inline
2 !pip install backtrader --upgrade

Requirement already satisfied: backtrader in /usr/local/lib/python3.12/dist-packages (1.9.78.123)
```

```
1 import yfinance as yf
 2 import backtrader as bt
3 import matplotlib.pyplot as plt
5 # Download historical data
6 data = yf.download('AAPL', start='2020-01-01', end='2025-10-18')
7 data.columns = data.columns.get_level_values(0)
9 # Improved Strategy: Filtered SMA Cross
10 class FilteredSmaCross(bt.Strategy):
11
      params = dict(
12
                          # fast SMA period
          fast=7,
          slow=200.
13
                           # slow SMA period
14
          trend=250,
                           # trend filter SMA period
15
          atr_period=14, # ATR period
16
          risk_per_trade=0.01 # % of capital risk per trade
17
      )
18
19
      def __init__(self):
          self.sma_fast = bt.ind.SMA(period=self.p.fast)
20
21
          self.sma slow = bt.ind.SMA(period=self.p.slow)
22
          self.sma trend = bt.ind.SMA(period=self.p.trend)
23
          self.atr = bt.ind.ATR(period=self.p.atr_period)
24
          self.crossover = bt.ind.CrossOver(self.sma_fast, self.sma_slow)
25
26
      def next(self):
27
          cash = self.broker.getcash()
28
          risk = cash * self.p.risk_per_trade
29
          stop_dist = 1.5 * self.atr[0] # ATR-based stop distance
30
31
          # If we have an open position
32
          if self.position:
33
              # Exit long if crossover turns negative or price falls below trend
34
              if self.position.size > 0 and (self.crossover < 0 or self.data.close < self.sma_tree
35
                  self.close()
              # Exit short if crossover turns positive or price rises above trend
36
37
              elif self.position.size < 0 and (self.crossover > 0 or self.data.close > self.sma_tr
38
                  self.close()
39
40
          # If no position, check for new trades
41
          else:
42
              # Long entry: price above trend, bullish crossover, ATR > 1
43
              if self.data.close > self.sma_trend * 1.005 and self.crossover > 0 and self.atr[0]
44
                  size = min(risk / stop_dist, cash * 0.11)
45
                  self.buy(size=size)
46
              # Short entry: price below trend, bearish crossover
47
48
              elif self.data.close < self.sma_trend and self.crossover < 0:</pre>
49
                  size = min(risk / stop_dist, cash * 0.95)
50
                  self.sell(size=size)
51
52
53 # Backtesting setup
54 cerebro = bt.Cerebro()
55 cerebro.addstrategy(FilteredSmaCross)
56 data_feed = bt.feeds.PandasData(dataname=data)
57 cerebro.adddata(data_feed)
58 cerebro.broker.setcash(10000)
59 #cerebro.broker.setcommission(commission=0.001) # optional: add small commission
60
61 # Add analyzers
62 cerebro.addanalyzer(bt.analyzers.SharpeRatio, name='sharpe', timeframe=bt.TimeFrame.Days, annua
```

```
63 cerebro.addanalyzer(bt.analyzers.DrawDown, _name='drawdown')
 64
 65 # Run backtest
 66 results = cerebro.run()
 67 first_strategy = results[0]
 69 # Extract analyzer results
 70 sharpe = first_strategy.analyzers.sharpe.get_analysis()
 71 drawdown = first_strategy.analyzers.drawdown.get_analysis()
 73 sharpe_ratio = sharpe.get('sharperatio')
 74 if sharpe_ratio:
        print(f"Sharpe Ratio: {sharpe_ratio:.5f}")
 75
 76 else:
        print("Sharpe Ratio: N/A")
 77
 78
 79 print(f"Max Drawdown: {drawdown['max']['drawdown']:.5f}%")
 81 # Plot results
 82 %matplotlib inline
 83 import matplotlib.pyplot as plt
 84 plt.rcParams['figure.figsize'] = [9, 7] # set figure size globally
 85 cerebro.plot(iplot=False, volume=False)
 86 plt.show()
 87
Sharpe Ratio: 0.04533
Max Drawdown: 8.47030%
                                                                                       12000
                                                                                  10654.39
      Broker (None)
      cash 7334.42
     value 10654.39
                                                                                  7334.42 000
                                                                                       400
      Trades - Net Profit/Loss (True)
                                                                                       200
     Negative
                                                                                       0
                                                                                       -200
      (1 Day) C:252.29
                                                                                   252.29<sub>250</sub>
      BuySell (True, 0.015)
      buv
   sell
                                                                                   221.73 225
     SMA (7) 249.12
     SMA (200) 221.73
                                                                                       200
     SMA (250) 224.66
                                                                                       175
                                                                                       150
                                                                                       125
                                                                                       100
                                                                                       75
      CrossOver
      crossover 0.00
                                                                                  0.00
                                                                                       17
      ATR (14)
                                                                                       9
      atr 4.85
                                                                                       6
```

```
1 import yfinance as yf
2 import backtrader as bt
3 import matplotlib.pyplot as plt
4
5 # Download historical data
6 data = yf.download('MSFT', start='2020-01-01', end='2025-10-18')
7 data.columns = data.columns.get_level_values(0)
8
```

```
9 # Improved Strategy: Filtered SMA Cross
10 class FilteredSmaCross(bt.Strategy):
      params = dict(
12
          fast=7,
                         # fast SMA period
13
          slow=200,
                          # slow SMA period
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          trend=250,
                         # trend filter SMA period
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          risk_per_trade=0.01 # % of capital risk per trade
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      )
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      def __init__(self):
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          self.sma_fast = bt.ind.SMA(period=self.p.fast)
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21
          self.sma trend = bt.ind.SMA(period=self.p.trend)
22
23
          self.atr = bt.ind.ATR(period=self.p.atr_period)
24
          self.crossover = bt.ind.CrossOver(self.sma_fast, self.sma_slow)
25
26
      def next(self):
27
          cash = self.broker.getcash()
28
          risk = cash * self.p.risk per trade
29
          stop_dist = 1.5 * self.atr[0] # ATR-based stop distance
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31
          # If we have an open position
          if self.position:
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              # Exit long if crossover turns negative or price falls below trend
33
34
              35
36
              # Exit short if crossover turns positive or price rises above trend
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              elif self.position.size < 0 and (self.crossover > 0 or self.data.close > self.sma_tr
38
                  self.close()
39
40
          # If no position, check for new trades
          else:
41
42
              # Long entry: price above trend, bullish crossover, ATR > 1
43
              if self.data.close > self.sma trend * 1.005 and self.crossover > 0 and self.atr[0]
44
                  size = min(risk / stop_dist, cash * 0.11)
45
                  self.buy(size=size)
46
47
              # Short entry: price below trend, bearish crossover
48
              elif self.data.close < self.sma trend and self.crossover < 0:
49
                  size = min(risk / stop_dist, cash * 0.95)
50
                  self.sell(size=size)
51
52
53 # Backtesting setup
54 cerebro = bt.Cerebro()
55 cerebro.addstrategy(FilteredSmaCross)
56 data_feed = bt.feeds.PandasData(dataname=data)
57 cerebro.adddata(data feed)
58 cerebro.broker.setcash(10000)
59 #cerebro.broker.setcommission(commission=0.001) # optional: add small commission
61 # Add analyzers
62 cerebro.addanalyzer(bt.analyzers.SharpeRatio, _name='sharpe', timeframe=bt.TimeFrame.Days, annua
63 cerebro.addanalyzer(bt.analyzers.DrawDown, name='drawdown')
65 # Run backtest
66 results = cerebro.run()
67 first strategy = results[0]
69 # Extract analyzer results
70 sharpe = first_strategy.analyzers.sharpe.get_analysis()
71 drawdown = first_strategy.analyzers.drawdown.get_analysis()
73 sharpe_ratio = sharpe.get('sharperatio')
74 if sharpe_ratio:
75
      print(f"Sharpe Ratio: {sharpe_ratio:.5f}")
76 else:
      nnint/"Channo Datio: N/A"\
```

```
Untitled5.ipynb - Colab
  //
         hittir Suarhe varto WA )
  78
  79 print(f"Max Drawdown: {drawdown['max']['drawdown']:.5f}%")
  80
  81 # Plot results
  82 %matplotlib inline
  83 import matplotlib.pyplot as plt
  84 plt.rcParams['figure.figsize'] = [9, 7] # set figure size globally
  85 cerebro.plot(iplot=False, volume=False)
  86 plt.show()
  87
/tmp/ipython-input-479678382.py:6: FutureWarning: YF.download() has changed argument auto_adjust default to True
Sharpe Ratio: -0.79811
Max Drawdown: 12.11707%
                                                                                                 12000
      Broker (None)
cash 6820.69
                                                                                            9173.12 0000
                                                                                                 4000
      value 9173.12
                                                                                            6820.69
                                                                                                 000
                                                                                                 0
      Trades - Net Profit/Loss (True)
Positive
                                                                                                 -60
                                                                                                 -120
      Negative
                                                                                                 -180
                                                                                                 550
      (1 Day) C:513.58
                                                                                            513.58
      BuySell (True, 0.015)
      buy
      sell
                                                                                            454.88 450
      SMA (7) 514.23
      SMA (200) 454.88
                                                                                                 400
     - SMA (250) 449.05
                                                                                                 350
                                                                                                 300
                                                                                                 250
                                                                                                 200
                                                                                                 150
                                                                                                 1
      crossover 0.00
                                                                                           0.00
                                                                                                 -1
      ATR (14)
                                                                                                 12
      at 18.09
                                                                                           8.09
                                                                                                - 8
```