

An introduction to individual algorithmic trading project

Louis Wan

February 2, 2023

1 Introduction

This project aims to build a fully automated trading system with SPtrader C++ API assisted with cloud-based automation system. Back-testing engine will also be implemented with the aid of python packages. Seeking for trading edges with statistical analysis and machine learning tools. This report will go through the data source, software design and data visualization tools of cloud-based automation system.

2 Data source

2.1 HKEX

Here are the data collected from HKEX

- HKEX Stock market Daily Quotations Data
- HSI Futures, Options Daily Market Report
- HSI Market Share data
- Warrant, Inline Warrant and Callable Bull Bear Contracts data
- Stock Connect Southbound CCASS data

2.2 CME

Here are the data collected from CME

- CME Futures, Options Settlement data

2.3 Yahoo! Finance

Here are the data collected from Yahoo! Finance

- Earnings and Stock Split calendar data

3 Trading Products

Since the limitation of capital size. For better risk control, following products are the main focus.

- Mini Heng Seng Index Futures (MHI)
- Micro E-mini Nasdaq-100 Index (MNQ)

Initial margin is set at 50000 HKD cash equivalent for every contract above.

4 Software Design and technology

4.1 Cloud-based automation system

This automation system is built and deployed on digital ocean. It is updating and delivering analysis report on daily basis. The application can be divided into two parts, service layer and model layer.

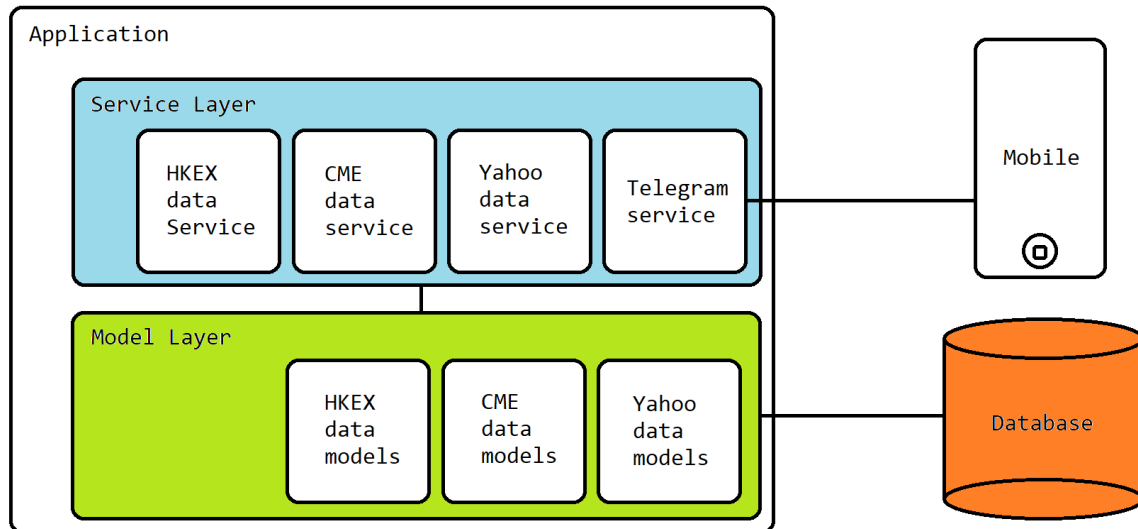


Figure 1: Architecture of automated financial data application

Service layer involving download data, data transformation, report generation and report delivery with telegram API.

```
13
14
15 class HKEXWarrentCBBCDownloadData(object):
16     def __init__(self, config: GlobalConfig, db_session: sqlalchemy.orm.session.Session, logger: logging.Logger):
17         self.config = config
18         self.logger = logger
19         self.db_session = db_session
20         self.dw_url = self.getUrl('dw')
21         if not os.path.isdir(os.path.join(self.config.wd, "copied/hkex_tmp")):
22             if not os.path.isdir(os.path.join(self.config.wd, "copied")):
23                 os.mkdir(os.path.join(self.config.wd, "/copied"))
24                 os.mkdir(os.path.join(self.config.wd, "copied/hkex_tmp"))
25
26     @staticmethod
27     def getUrl(type):
28         if type == 'dw':
29             return "https://www.hkex.com.hk/eng/dwrc/search/dwFullList.csv"
30         elif type == 'cbbc':
31             return "https://www.hkex.com.hk/eng/cbbc/search/cbbcFullList.csv"
32         elif type == 'iw':
33             return "https://www.hkex.com.hk/eng/iwrc/search/iwFullList.csv"
34         else:
35             return None
```

Figure 2: Script of HKEX warrant and CBBCs service

Model Layer contains the database schema and act as an agent let services connect with database.

```

class HKEX_CBBCData(Base):
    __tablename__ = "HKEX_CBBC_DATA"
    ID = Column(BigInteger, primary_key=True, autoincrement=True)
    DATE = Column(Date)
    CBBC_CODE = Column(String)
    ISSUER = Column(String)
    UNDERLYING_ASSET = Column(String)
    BULL_BEAR = Column(String)
    CBBC_TYPE = Column(String)
    CBBC_CATEGORY = Column(String)
    LISTING = Column(Date)
    MATURITY = Column(Date)
    STRIKE_CALL_CURR = Column(String)
    STRIKE_PRICE = Column(Float)
    CALL_PRICE = Column(Float)
    ENTITLEMENT_RATIO = Column(Float)
    TOTAL_ISSUE_SIZE = Column(Float)
    OUTSTANDING_QTY_PCT = Column(Float)
    TRADING_CURR = Column(String)
    DAY_HIGH = Column(Float)
    DAY_LOW = Column(Float)
    CLOSING_PRICE = Column(Float)
    TURNOVER_IN_THOUSAND = Column(Float)
    UNDERLYING_CURR = Column(String)
    UNDERLYING_PRICE = Column(Float)

```

Figure 3: Script of HKEX warrant and CBBCs data model

Database store all the financial data and telegram user group data

Table Name	Size
CME_CONTRACT_DETAILS	400K
CME_FUTURES_DATA	6.6M
CME_OPTION_DATA	159M
CME_PRODUCT	32K
CME_QUOTE_DATA	16K
HKEX_CBBC_DATA	351M
HKEX_DAILY_QUOTATION_DATA	16K
HKEX_DERIVATIVE_WARRANT_DATA	707M
HKEX_FUTURES_DATA	1.3M
HKEX_OPTIONS_DATA	237M
HKEX_STOCK_CCASS	25M
HKEX_STOCK_CCASS_SUMMARY	16K
HKEX_STOCK_CONNECT_DAILY	456K
HKEX_STOCK_CONNECT_SOUTHBOUND_CCASS	46M
HKEX_STOCK_CONNECT_TOP_TEN_ACTIVE_STOCK	6.1M
HSI_MARKET_SHARE_DATA	88K
HSI_MARKET_SHARE_DATA_ANALYSIS	56K
LIN_REG_BACKTEST_RESULT	121M
LIN_REG_SENSITIVITY_ANALYSIS	840K
LIN_REG_SIGNAL	208K
TELEGRAM_CHAT_ID	32K
USER	48K
YAHOO_EARNING_CALENDAR	13M
YAHOO_SPLITS_CALENDAR	1.7M
YAHOO_STOCK_DATA	539M
YAHOO_STOCK_DERIVED_DATA	594M
YAHOO_STOCK_OPTIONS_DATA	1G
YAHOO_STOCK_SYMBOL	144K
test	8K

Figure 4: Screenshot of database schema

5 Signals and Data visualization

For HKEX and CME data summary, data analysis report will generated before 9:00 am and 8:30 pm. Some of the screenshot is generated below



Figure 5: Screenshot of message generated by Telegram bot

6 Performance

Here is the trade record of 2022 Nov for reference.

POSITION(S) CLOSED 平倉記錄

TRADE DATE 交易日期	ORDER NO. 交易編號	MARKET 市場	DESCRIPTION 說明	BUY 買入	SELL 沽出	TRADE/STRIKE PRICE 成交價/行使價	TRADED PREMIUM 期權金成交價	PROFIT/LOSS 盈/虧
GLOBAL MARKET 環球市場								
02/11/2022	911924	CME	MNQ	DEC 22	1	USD 11260.000000		
27/10/2022	628330	CME	MNQ	DEC 22		USD 11406.250000	USD	292.50
02/11/2022	914730	CME	MNQ	DEC 22		USD 11403.500000		
02/11/2022	911889	CME	MNQ	DEC 22	1	USD 11270.000000	USD	267.00
02/11/2022	914767	CME	MNQ	DEC 22		USD 11400.000000		
02/11/2022	911889	CME	MNQ	DEC 22	1	USD 11270.000000	USD	260.00
03/11/2022	970578	CME	MNQ	DEC 22	1	USD 10806.500000		
27/10/2022	628330	CME	MNQ	DEC 22		USD 11406.250000	USD	1,199.50
03/11/2022	970578	CME	MNQ	DEC 22	1	USD 10806.500000		
31/10/2022	773954	CME	MNQ	DEC 22		USD 11514.500000	USD	1,416.00
03/11/2022	970586	CME	MNQ	DEC 22	2	USD 10815.000000		
03/11/2022	958776	CME	MNQ	DEC 22	2	USD 10913.000000	USD	392.00
03/11/2022	970586	CME	MNQ	DEC 22	1	USD 10815.000000		
03/11/2022	970578	CME	MNQ	DEC 22	1	USD 10806.500000	USD	17.00
04/11/2022	049818	CME	MNQ	DEC 22	2	USD 10776.000000		
04/11/2022	049763	CME	MNQ	DEC 22	2	USD 10766.000000	USD	40.00
04/11/2022	049819	CME	MNQ	DEC 22	1	USD 10776.000000		
04/11/2022	049763	CME	MNQ	DEC 22	1	USD 10766.000000	USD	20.00
04/11/2022	050009	CME	MNQ	DEC 22	3	USD 10776.000000		
04/11/2022	049959	CME	MNQ	DEC 22	3	USD 10766.000000	USD	60.00
07/11/2022	139652	CME	MNQ	DEC 22	1	USD 10933.000000		
07/11/2022	139290	CME	MNQ	DEC 22	1	USD 10930.000000	USD	6.00
07/11/2022	139652	CME	MNQ	DEC 22	1	USD 10933.000000		
07/11/2022	139395	CME	MNQ	DEC 22	1	USD 10929.500000	USD	7.00
07/11/2022	139653	CME	MNQ	DEC 22	1	USD 10933.000000		
07/11/2022	139493	CME	MNQ	DEC 22	1	USD 10940.000000	USD	14.00
07/11/2022	140452	CME	MNQ	DEC 22	1	USD 10861.500000		
07/11/2022	139775	CME	MNQ	DEC 22	1	USD 10907.000000	USD	91.00
07/11/2022	140452	CME	MNQ	DEC 22	1	USD 10861.500000		
07/11/2022	139938	CME	MNQ	DEC 22	1	USD 10888.250000	USD	53.50
07/11/2022	143703	CME	MNQ	DEC 22	1	USD 10925.500000		
07/11/2022	143658	CME	MNQ	DEC 22	1	USD 10918.250000	USD	14.50
08/11/2022	199524	CME	MNQ	DEC 22	1	USD 11090.000000		
08/11/2022	198855	CME	MNQ	DEC 22	1	USD 11052.500000	USD	75.00
08/11/2022	199524	CME	MNQ	DEC 22	1	USD 11090.000000		
08/11/2022	199254	CME	MNQ	DEC 22	1	USD 11060.000000	USD	60.00
09/11/2022	262965	CME	MNQ	DEC 22	1	USD 10993.750000		
09/11/2022	262430	CME	MNQ	DEC 22	1	USD 11020.500000	USD	53.50
09/11/2022	262965	CME	MNQ	DEC 22	1	USD 10993.750000		
09/11/2022	262468	CME	MNQ	DEC 22	1	USD 11012.250000	USD	37.00
11/11/2022	412188	CME	MNQ	DEC 22	1	USD 11707.250000		
11/11/2022	412047	CME	MNQ	DEC 22	1	USD 11686.000000	USD	42.50
14/11/2022	479528	CME	MNQ	DEC 22	1	USD 11786.750000		
14/11/2022	479288	CME	MNQ	DEC 22	1	USD 11757.000000	USD	59.50
14/11/2022	479529	CME	MNQ	DEC 22	1	USD 11786.750000		
14/11/2022	479351	CME	MNQ	DEC 22	1	USD 11763.500000	USD	46.50
15/11/2022	552911	CME	MNQ	DEC 22	1	USD 12025.000000		
15/11/2022	552577	CME	MNQ	DEC 22	1	USD 11993.250000	USD	63.50
15/11/2022	552911	CME	MNQ	DEC 22	1	USD 12025.000000		
*** To Be Continue ***								

Figure 6: trade record of 2022 Nov page 1

POSITION(S) CLOSED 平倉記錄

TRADE DATE 交易日期	ORDER NO. 交易編號	MARKET 市場	DESCRIPTION 說明	BUY 買入	SELL 沽出	TRADE/STRIKE PRICE 成交價/行使價	TRADED PREMIUM 期權金成交價	PROFIT/LOSS 盈/虧
15/11/2022	552676	CME	MNQ	DEC 22	1	USD 11985.000000	USD	80.00
21/11/2022	811196	CME	MNQ	DEC 22	1	USD 11643.000000		
21/11/2022	811055	CME	MNQ	DEC 22	1	USD 11650.500000	USD	15.00
				30	30		USD	3,284.50
LOCAL MARKET 本地市場								
07/11/2022	101093	HKFE	MH	NOV 22	1	HKD 16308.000000		
07/11/2022	099303	HKFE	MH	NOV 22	1	HKD 16385.000000	HKD	770.00
07/11/2022	102247	HKFE	MH	NOV 22	2	HKD 16388.000000		
07/11/2022	099303	HKFE	MH	NOV 22	2	HKD 16385.000000	HKD	60.00
10/11/2022	290865	HKFE	MH	NOV 22	1	HKD 15960.000000		
10/11/2022	289096	HKFE	MH	NOV 22	1	HKD 15991.000000	HKD	310.00
14/11/2022	437331	HKFE	MH	NOV 22	1	HKD 17895.000000		
14/11/2022	436761	HKFE	MH	NOV 22	1	HKD 17930.000000	HKD	350.00
14/11/2022	453316	HKFE	MH	NOV 22	1	HKD 17874.000000		
14/11/2022	453031	HKFE	MH	NOV 22	1	HKD 17840.000000	HKD	340.00
14/11/2022	453933	HKFE	MH	NOV 22	1	HKD 17912.000000		
14/11/2022	453844	HKFE	MH	NOV 22	1	HKD 17937.000000	HKD	250.00
21/11/2022	786063	HKFE	MH	NOV 22	1	HKD 17531.000000		
21/11/2022	784474	HKFE	MH	NOV 22	1	HKD 17460.000000	HKD	710.00
21/11/2022	786063	HKFE	MH	NOV 22	1	HKD 17531.000000		
21/11/2022	785607	HKFE	MH	NOV 22	1	HKD 17531.000000	HKD	0.00
				9	9		HKD	1,350.00

Figure 7: trade record of 2022 Nov page 2

7 Planning

In 2023, following task is planned to be finished

- Back-testing and performance analysis tools (python, backtrader)
- live-trading application (C++, SPtrader API)
- Implement Swing trade strategy by study of co-integration between markets (VECM, machine learning tools)

Thanks for reading and it would be grateful if I am able to present my idea directly. Please feel free to reach me via Email(chwanlouis@gmail.com) or mobile (+852 63018527)