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# Analytics Reflection

## On An Algorithmic Trade Startup Company

GMMA 801 Introduction to Management Individual Assignment

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According to Coherent Market Insights, global algorithmic trading market was valued at US$ 9,297.24 million in 2017, and is projected to exhibit CAGR of 10.1% over the forecast period (2018 – 2026).

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## I. Introduction

I am working on building a startup firm running algorithmic trade business, works with a program that includes a various of financial instruments for trading purpose. Automated trading system can generate profits or losses at a higher level of efficiency. Data and data analytics for backtesting trade signals, making predictive models and trade strategies are the major business activities. So from the very beginning of the establishment of the firm, it is constructed on a foundation of data analytics to recognize the patterns of market activity and make profit from financial markets. In this big data era, building a firm reflects a growing belief that analytics revolution will transform financial investment business operation and have impact on economies and societies where they operate.

## II. Analytical Capabilities

The company is to trade using algorithms and streaming data from financial brokers' gateway. Market data feed handlers manipulate and process market data by sending exchanges orders and making profit based on the analyzed values of market demand. Setting up the limit order book and taking profit order book relay on the analytical procedures, which are pre-built automated trading mechanisms. This section describes on how each fundamental block of the trading system is built atop of each analytical function.

1. Trade infrastructure: Digital order book processing system contains all incoming buy and sell orders executed by a trade bot. Below is a screen shoot of a python script querying an open order.

```
#check trades
r = trades.OpenTrades(accountID=account_id)
client.request(r)
```

```
{'trades': [{'id': '66',
   'instrument': 'USD_JPY',
   'price': '108.603',
   'openTime': '2020-02-28T14:07:42.578073865Z',
   'initialUnits': '100',
   'initialMarginRequired': '7.5337',
   'state': 'OPEN',
   'currentUnits': '100',
   'realizedPL': '0.0000',
   'financing': '0.0000',
   'dividendAdjustment': '0.0000',
   'unrealizedPL': '-0.3232',
   'marginUsed': '7.5126',
   'stopLossOrder': {'id': '67',
    'createTime': '2020-02-28T14:07:42.578073865Z',
    'type': 'STOP_LOSS',
    'tradeID': '66',
    'price': '1.200',
    'timeInForce': 'GTC',
    'triggerCondition': 'DEFAULT',
    'state': 'PENDING'}},
```

2. Analytical rules determine trade decision

When the heartbeat of market price changes, incoming bids are at a lower price; A match appears, an ask order will be generated accordingly. Contrariwise, when the ask price is higher price, a bid order will be placed.The rule is the incoming order price level can't be competed outside a range of limit order settings. The algorithm rules the decision on when it's the best time to place a order. The python pseudo-code below demonstrates a basic logic of implementing analytical rules.

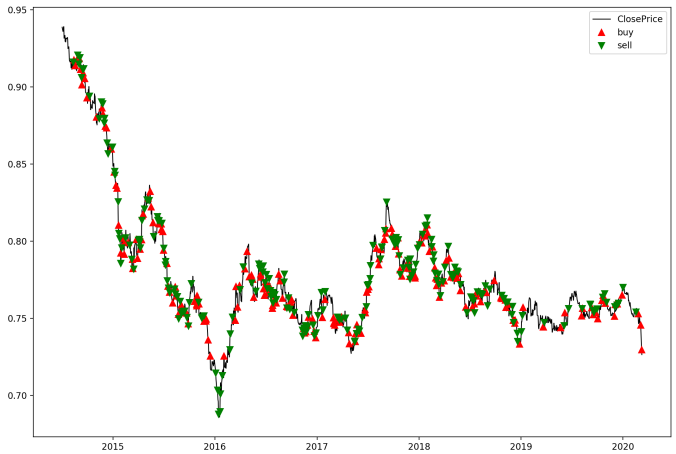
```
class BaseStrategy:

    stocks = []

    def initialize(self, context):
        pass

    def handle_data(self, context, data):
        pass

    def _test_args(self):
        pass

    def analyze(self, context, perf):
        pass
```

3. Analytics supports profit taking strategy

Setting limit order is a way to realize profit and stop risk. Build the body to pass a order restrains the price, number of units and financial instrument. Analytical indicators will support the decision making on the market entry point, for example Average True Range indicator. The indictor was introduced by J. Welles Wilder in his book New Concepts In Technical Trading Systems. It's widely used as an indicator can signal exit point. The code below shows using Average True Range Indicator when trading with Foreign Currency:

```
121 def ATR(DF,n):
122     "function to calculate True Range and Average True Range"
123     df = DF.copy()
124     df['H-L']=abs(df['h']-df['l'])
125     df['H-PC']=abs(df['h']-df['c'].shift(1))
126     df['L-PC']=abs(df['l']-df['c'].shift(1))
127     df['TR']=df[['H-L','H-PC','L-PC']].max(axis=1,skipna=False)
128     df['ATR'] = df['TR'].rolling(n).mean()
129     #df['ATR'] = df['TR'].ewm(span=n,adjust=False,min_periods=n).mean()
130     df2 = df.drop(['H-L','H-PC','L-PC'],axis=1)
131     return round(df2["ATR"][-1],5)
```

4. Simulate trade strategies maximizing profit and learning experience in a short period of time.




4.2 Trade simulation test result on Profit and Loss analysis

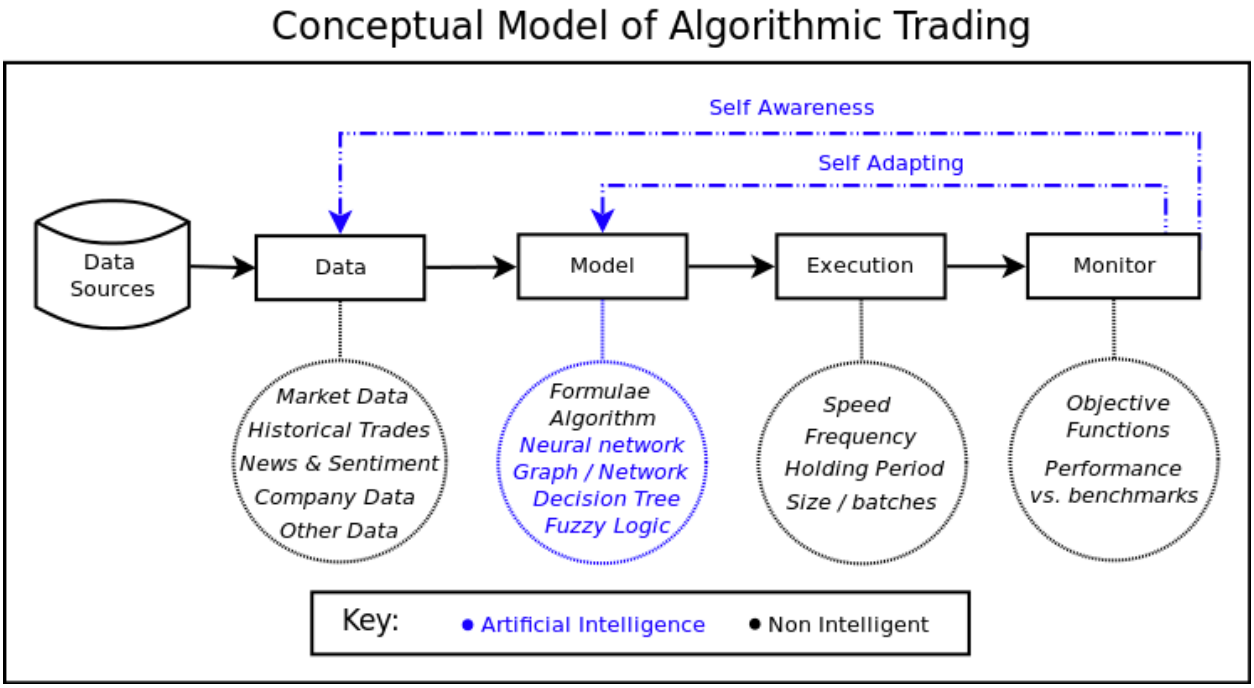

4.3 Optimized test result on Profit and Loss analysis

Graph 4.1 illustrates all the trade actions over 4 years (from March 11, 2020 back to1500 trading days) of data trading options against an financial instrument.

The next two diagrams 4.2 and 4.3 demonstrate the portfolio performance:
4.2 chart shows the Profit and Loss rate. The trade strategy only perform relatively good during 2017 and 2018;
4.3, it is an optimized result, comparing with 4.2. The strategy works well after 2017. The Profit and Loss plot shows it's a profitable strategy during the evolution of trading over the course of its lifetime.

## III. Analytical Capacities on the Organization Structure

The organization structure is designed by only hiring researchers who are capable to program using Python, C++ and Java, and who are able to frame questions in mathematics. The researchers will enhance the capabilities to implement analytical design on trading. The research results will be proved profitable in the backtests and then will be delivered in the sandbox environment, and eventually moved into production environments by a cycle of competition of profitability. Middle layer management is irrelevant to the design this type of organizational layout. The organization structure is to fit into the algorithm development research operation model that is listed as below:




(Reference to AI in Finance, by Siraj Raval, https://github.com/llSourcell/AI_in_Finance)

## IV. Revenue Increase and Optimize Trading Strategies

Optimizing the trade signals, it is the most importance tasks on increasing revenue.

Signals have various names: signals — buy and sell, up and down, pattern recognition; indictors— market entry and exit point; predictors— price, volume, derivative; calculators, features. alpha, etc.

All the signal is derived from analytical design of market price data - in general numeric, and non-numeric information. Modern statistical models including deep learning and machine learning techniques will react to changing market data and update signal values in a much faster and intelligent way than human can do in a tactical operational level. An optimization plan can be made based on the factors as below:

1. Execution strategy
2. Postion Management
3. Profit and Loss Management
4. Risk Management
5. Backtesting

Simulate algorithmic trade; weight a basket of trading instrument; prioritize orders; minimize fees; shorten development cycles and cost etc.. All of those practical issues will help capture a profitable reaction plan of the market volatility at present and in the next few seconds dynamically; or statically, lower business operation cost around development time and fees. Solutions must be built on an analytical development process.

## V. DELTA Framework

DELTA is an acronym of Data, Enterprise, Leadership, Targets and Analysts, developed by Thomas Davenport and Jeanne Harris. It's a macro-level assessment on the maturity of Analytics.

DELTA Self Assessment:

| | **Capabilities** | | | | |
|---|---|---|---|---|---|
| | Data | Enterprise | Leadership | Targets | Analysts |
| Advanced Stage 5 | Relentless search for new data for research. Process all the data may benifit the algorithms; Data cleared and accurately integrated in a central warehouse | All key analytical resources centrally managed; Due to a flat design of the organization structure and the nature of a startup company, analytical power is well managed. | Analytics is the fuel of the company operation. Analytical competition represent the core value of the firm. | Analytics supports the vital capacity of the company as a whole. | World-class professional analysts and attention to analytical amateurs. The company intends to hire the best researchers in the world. |
| | 5 | 5 | 5 | 5 | 5 |
| Total | *25/5 = 5 (Stage 5: "Adanced Analytics")* | | | | |

DELTA – Advanced (Reference to Gary Bissonette's to assignment file)
• Data is felt to be a core component of the organization's operations, customer service, marketing and strategy.
• The organization is open to new ideas when data challenges the status quo.
• The organization effectively uses analytics and disseminates it across the information value chain.
• The use of analytics has resulted in a real or perceived "power shift" within the organization's decision-making process.
• Organization routinely reaps the benefits of its efforts.

## Conclusion

As the nature of algorithmic trade, analytics transforms human intuitive to quantify trade parameters for improving the overall performance of fund management. Getting high score on DELTA assessment is the baseline of operating algorithmic trade business.