Quantopian Getting Started 筆記 (Part1/2)

這邊使用官方的教程Getting Started的筆記。在這個教程中我們會先在筆記本環境中發掘一個策略，並在演算法環境中執行它。在這裡Quantopian網站有提供兩個研究環境

- 筆記本環境:在這個環境裡，我們有一個互動的python notebook環境，並可以載入quantopian提供的research模組
- 演算法環境:在這個環境裡，我們有一個寫腳本的環境，並支援zipline語法的回測框架。

所以第一步，我們會在筆記本環境裡載入數據，做簡單畫圖並確定想要執行的策略。

Remark: 這邊有幾個參考來源

Quantopian Help: 這邊提供zipline的api以及網站上面環境的基本介紹。

Quantopian Toturial: 這組教程提供了基本的api教學

Quantopian Forums: 裡面有一些用戶的發問，常見問題解答可以在這邊搜尋。

Step 1 如何載入資料

首先，讓我們簡單展示如何在筆記本環境載入股票資料並製作圖表。

Step 1.1 如何載入價格資料

```
# 載入資料
# 載入使用的模組
from quantopian.research import prices, symbols
import pandas as pd
# 使用quantpoian的api來呼叫蘋果股價
aapl_close = prices(
    assets=symbols("AAPL"),
    start='2013-01-01',
    end='2016-01-01',
)
#繪製圖表
# 這邊是標準的pandas api
aapl_sma20 = aapl_close.rolling(20).mean()
aapl_sma50 = aapl_close.rolling(50).mean()
# pandas 繪圖指令
pd.DataFrame({'AAPL':aapl_close,'SMA20':aapl_sma20,'SMA50':aapl_sma50}).plot(title='AAPL
Close Price/ SMA Crossover')
```

讓我們簡單講解這段程式碼，我們會把重點放在 Quantopian api的學習，pandas指令如果有問題可以在讀書會中討論(或是一些python的問題)。

首先讓我們看看 Quantopian help對這兩個函數 prices, symbols的說明:

```
prices(assets, start, end, frequency='daily', price_field='price',
symbol_reference_date=None, start_offset=0)
    Get close price data for assets between start and end.

    Parameters
    ----------
    assets : int/str/Asset or iterable of same
        Identifiers for assets to load.
        Integers are interpreted as sids. Strings are interpreted as symbols.
    start : str or pd.Timestamp
        Start date of data to load.
    end : str or pd.Timestamp
        End date of data to load.
    frequency : {'minute', 'daily'}, optional
        Frequency at which to load data. Default is 'daily'.
    price_field : {'open', 'high', 'low', 'close', 'price'}, optional
        Price field to load. 'price' produces the same data as 'close', but
        forward-fills over missing data. Default is 'price'.
    symbol_reference_date : pd.Timestamp, optional
        Date as of which to resolve strings as tickers.
        Default is the current day.
    start_offset : int, optional
        Number of periods before ``start`` to fetch.
        Default is 0. This is most often useful for calculating returns.

    Returns
    -------
    prices : pd.Series or pd.DataFrame
        Pandas object containing prices for the requested asset(s) and dates.

        Data is returned as a :class:`pd.Series` if a single asset is passed.

        Data is returned as a :class:`pd.DataFrame` if multiple assets are passed.
```

首先是prices這個函數，它接受assets, start, end, frequency, price_field, symbol_reference_date, start_offset這幾個變數，其中前三個變數是必填的，分別為要提取的資產名、提取起始時間與提取結束時間，然後回傳一個pandas dataframe物件，這邊值得注意的是在asset這邊其實也是可以直接接受字串的，但在我們的例子中先使用symbols函數轉為資產類別。

```
symbols(symbols, symbol_reference_date=None, handle_missing='log')
    Convert a string or a list of strings into Asset objects.

    Parameters
    ----------
    symbols : String or iterable of strings.
        Passed strings are interpreted as ticker symbols and resolved relative
        to the date specified by symbol_reference_date.

    symbol_reference_date : str or pd.Timestamp, optional
        String or Timestamp representing a date used to resolve symbols that
        have been held by multiple companies.  Defaults to the current time.
    handle_missing : {'raise', 'log', 'ignore'}, optional
        String specifying how to handle unmatched securities.
        Defaults to 'log'.

    Returns
    --------
    list of Asset objects
        The symbols that were requested.
```

而另一方面，symbols只是一個建構子，將字串轉為quantopian寫好的資產類別。

因此，我們的sample code只是用prices函數呼叫出apple公司的股價資料，然後使用pandas dataframe本身寫好的函數進行畫圖。

這邊我們在舉一個例子，除了price，我們可能也想直接取出回報率(return)，則我們有下列的sample code

```
# Research environment functions
from quantopian.research import returns, symbols

# Select a time range to inspect
period_start = '2014-01-01'
period_end = '2014-12-31'

# Query returns data for AAPL
# over the selected time range
aapl_returns = returns(
    assets=symbols('AAPL'),
    start=period_start,
    end=period_end,
)

# Display first 10 rows
aapl_returns.head(10)
```

Step1.2 實際使用 - 如果在回測每天自動抓取需要資料 - pipeline

但以上拉資料的例子並不能真正使用在回測中，因為在回測中，我們需要的是根據當時所能取到的資料去進行像是計算因子、分類與資料預處理等工作，這時候我們就可以利用quantopian所提供的pipeline類別，它處理我上述提到的動作，我們只需要將計算的邏輯寫好，並指定期間，pipline就可以妥善運算每次的計算。讓我們可以專心在策略的開發上面。

所以，我們真正再做拉取資料的部份都必須跟pipline配合，這也是zipline開發者希望我們採用的寫法。下面是一個簡單的例子，如何建立pipline來抓取前面提到的資料

```
from quantopian.research import run_pipeline
from quantopian.pipeline import Pipeline
from quantopian.pipeline.data import USEquityPricing

period_start = '2014-01-01'
period_end = '2014-12-31'
def make_pipeline():
    close_price = USEquityPricing.close.latest
    return Pipeline(
    columns = {

        'close_price': close_price,

    },
    )

#Pipeline execution
data_output = run_pipeline(

make_pipeline(),
    start_date=period_start,
    end_date=period_end

)
aapl_output = data_output.xs(
    symbols('AAPL'),
    level=1
)
#Plot results for AAPL
aapl_output.plot(subplots=True)
```

這邊我們先載入三個相關的模組，分別為Pipeline(pipeline的建構子)、run_pipeline(用來跑寫好的pipeline)而USEquityPricing則是我們需要載入的資料集。我們程式邏輯主要是寫在make pipeline函數裡面，它最後會回傳一個pipeline回來，我們先看一下Pipeline這個建構子的部份說明

```
class Pipeline(__builtin__.object)
 |  A Pipeline object represents a collection of named expressions to be
 |  compiled and executed by a PipelineEngine.
 |
 |  A Pipeline has two important attributes: 'columns', a dictionary of named
 |  :class:`~zipline.pipeline.term.Term` instances, and 'screen', a
 |  :class:`~zipline.pipeline.filters.Filter` representing criteria for
 |  including an asset in the results of a Pipeline.
 |
 |  To compute a pipeline in the context of a TradingAlgorithm, users must call
 |  ``attach_pipeline`` in their ``initialize`` function to register that the
 |  pipeline should be computed each trading day. The most recent outputs of an
 |  attached pipeline can be retrieved by calling ``pipeline_output`` from
 |  ``handle_data``, ``before_trading_start``, or a scheduled function.
 |
 |  Parameters
 |  ----------
 |  columns : dict, optional
 |      Initial columns.
 |  screen : zipline.pipeline.term.Filter, optional
 |      Initial screen.
 |
```

可以看到在建立Pipeline的時候，我們可以填入兩個可能的參數(columns與screen)，其中columns應該是選定要載入的因子，而screen則是指定篩選資料的規則，之後我們會更深入了解pipeline的運作規則，目前或許可以就這樣理解。

所以我們的程式一開始載入資料集 USEquityPricing 下面收盤價的latest因子(這個因子幫助我們抓出當時刻的最新值)，並取名為close_price，後面就利用Pipeline建立相應的pipeline。

在有了一個pipeline的實例後，如何運行這個pipeline勒？ 我們可以利用run_pipeline功能運行我們的pipeline，並將運行結果記錄下來。存成data_output.

Step1.4 如何載入其他官方資料集

其實在Research模組裡還有一個類別叫做Datasets，裡面有一些官方提供的其他資料集，大部份需要付費，但有一些是免費提供，我們一般的價量資料可以從上面提到的USEquityPricing這個類別中取得。而 一些基本面的資料也可以從Fundamentals這個資料集中取得。另外還有一些合作取得的資料庫，下面引用官網的文檔

Many datasets besides USEquityPricing and Morningstar fundamentals are available on Quantopian. These include corporate fundamental data, news sentiment, macroeconomic indicators, and more. All datasets are namespaced by provider under quantopian.pipeline.data.

- quantopian.pipeline.data.estimize (Estimize)
- quantopian.pipeline.data.eventVestor (EventVestor)
- quantopian.pipeline.data.psychsignal (PsychSignal)
- quantopian.pipeline.data.quandl (Quandl)
- quantopian.pipeline.data.sentdex (Sentdex)

Similar to USEquityPricing, each of these datasets have columns (BoundColumns) that can be used in pipeline computations. The columns, along with example algorithms and notebooks can be found on the Data page. The dtypes of the columns vary.

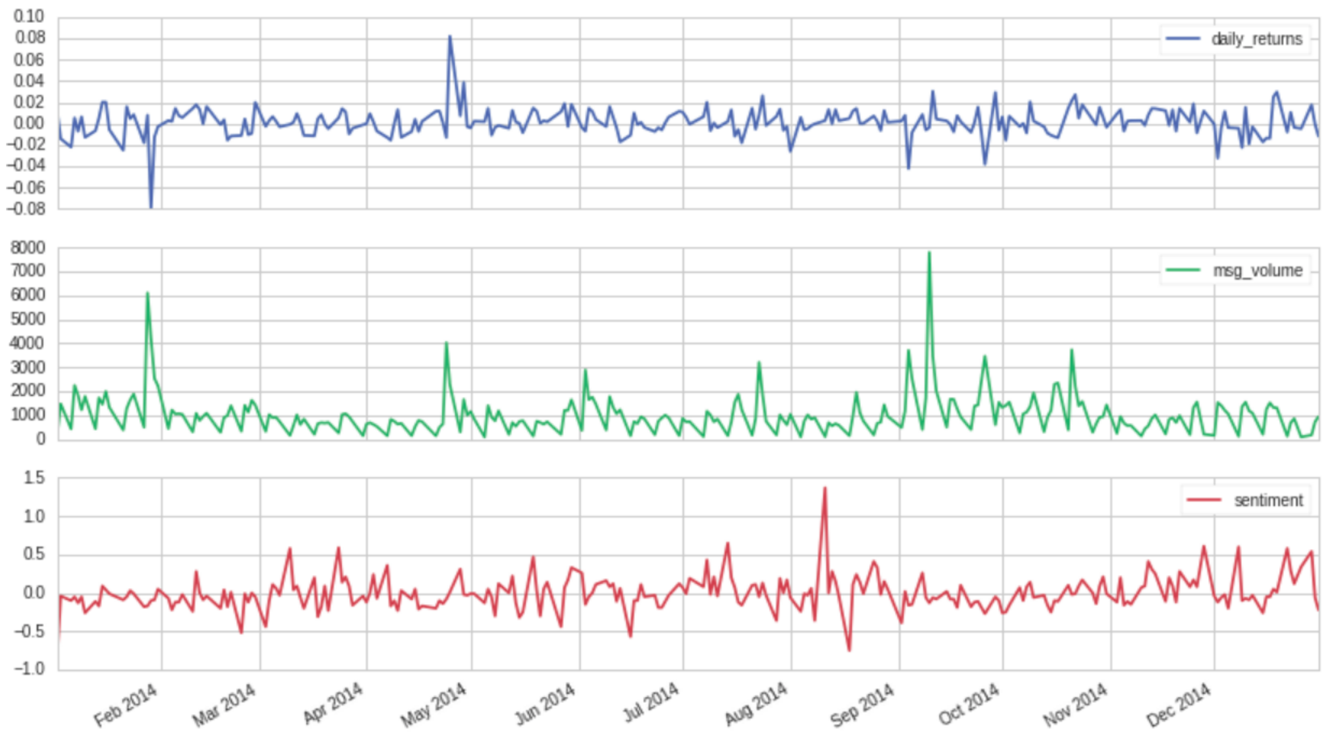
我們在這個教學將會使用到 Twitter and StockTwits Trader Mood (All fields, with Retweets) (quantopian.pipeline.data.psychsignal (PsychSignal) 這個類別)這個資料集。

首先我們模仿前面拉出幾個資料出來，基本上整體程式的架構與上面pipline例子一致，只是我們這次載入不同的資料。

```
from quantopian.research import run_pipeline
from quantopian.pipeline import Pipeline
from quantopian.pipeline.factors import Returns
from quantopian.pipeline.data.psychsignal import stocktwits

period_start = '2014-01-01'
period_end = '2014-12-31'

def make_pipeline():

    returns = Returns(window_length=2)
    sentiment = stocktwits.bull_minus_bear.latest
    msg_volume = stocktwits.total_scanned_messages.latest

    return Pipeline(
        columns = {
```

```
        'daily_returns':returns,
        'sentiment': sentiment,
        'msg_volume':msg_volume,
        }
    )

#Pipeline execution
data_output = run_pipeline(

make_pipeline(),
    start_date=period_start,
    end_date=period_end

)

#Filter results for AAPL

aapl_output = data_output.xs(
    symbols('AAPL'),
    level=1
)
#Plot results for AAPL
aapl_output.plot(subplots=True)
```

最後我們會得到下列的圖表



我們觀察到某些大幅增加的情緒似乎伴隨return的峰值，我們可以建立一些策略。

Step 2 建立策略

這邊我們要建立一個簡單的 long-short equity strategy，簡單來說，就是如果我們對一個資產的評價增加，我們便增加下注(long)，反之則減少下注(short)

Strategy: 我們會考慮如果三天情緒分數的移動平均為高，則我們把資產當作高資產，如果三天情緒分數的移動平均為低，則把資產當作低資產。

這邊我們先建立相對應的pipeline，以下是sample code

```python
# Pipeline imports
from quantopian.pipeline import Pipeline
from quantopian.pipeline.data.psychsignal import stocktwits
from quantopian.pipeline.factors import SimpleMovingAverage
from quantopian.pipeline.experimental import QTradableStocksUS

# Pipeline definition
def  make_pipeline():

    base_universe = QTradableStocksUS()

    sentiment_score = SimpleMovingAverage(
        inputs=[stocktwits.bull_minus_bear],
        window_length=3,
    )

    # Create filter for top 350 and bottom 350
    # assets based on their sentiment scores
    top_bottom_scores = (
        sentiment_score.top(350) | sentiment_score.bottom(350)
    )

    return Pipeline(
        columns={
            'sentiment_score': sentiment_score,
        },
        # Set screen as the intersection between our filter
        # and trading universe
        screen=(
            base_universe
            & top_bottom_scores
        )
    )
# Import run_pipeline method
from quantopian.research import run_pipeline

# Specify a time range to evaluate
period_start = '2013-01-01'
period_end = '2016-01-01'

# Execute pipeline over evaluation period
pipeline_output = run_pipeline(
    make_pipeline(),
    start_date=period_start,
    end_date=period_end
)
```

我們利用SimpleMovingAverage 計算移動平均，然後為了簡化問題，我們只取了top 350 and bottom 350 stocks ranked by sentiment_score，這也是screen所作的工作，這樣pipeline就會幫我們每次選取適合投資的資產。

我們同時也必須載入價格歷史資料來結合分析，這邊我們直接使用之前的prices函數來做

```
# Import prices function
from quantopian.research import prices

# Get list of unique assets from the pipeline output
asset_list = pipeline_output.index.levels[1].unique()

# Query pricing data for all assets present during
# evaluation period
asset_prices = prices(
    asset_list,
    start=period_start,
    end=period_end
)
```

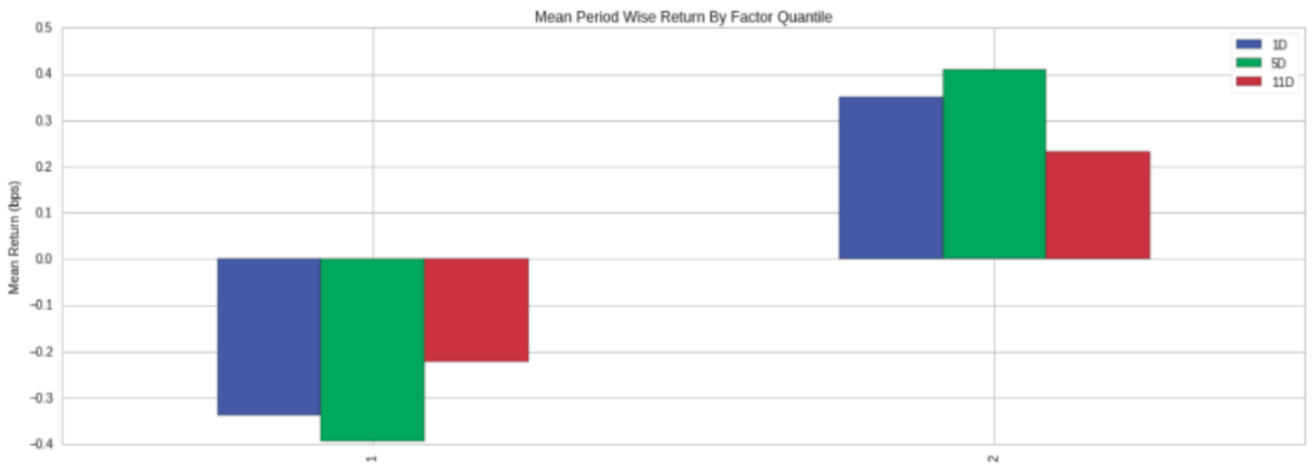
然後下面我們就可以直接用quantopian所提供的Alphalens來分析我們的策略，這個類別在給定怎麼rank資產後，可以直接計算long - short equity strategy的效率。

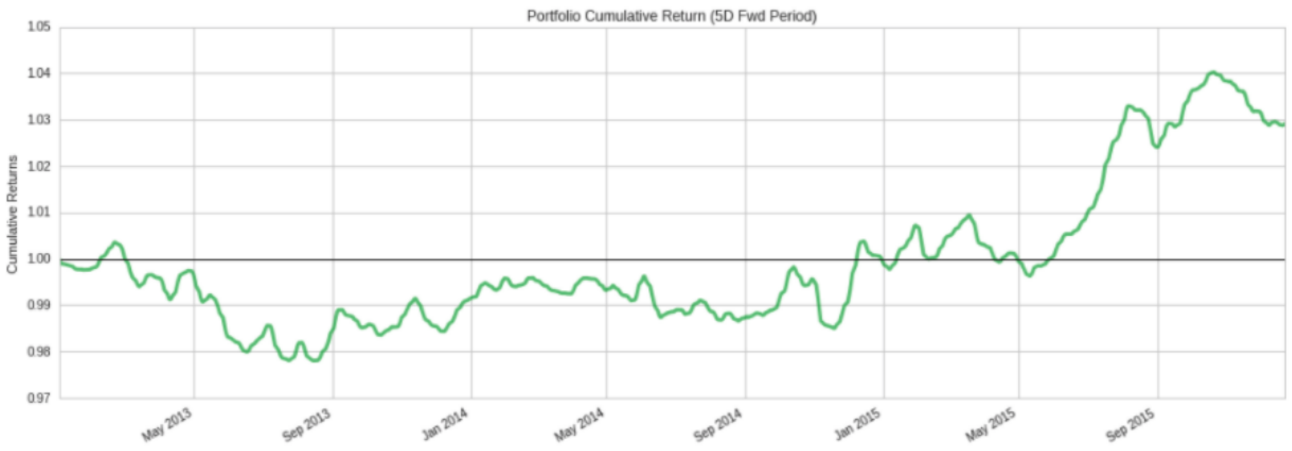
```
# Import Alphalens
import alphalens as al

# Get asset forward returns and quantile classification
# based on sentiment scores
factor_data = al.utils.get_clean_factor_and_forward_returns(
    factor=pipeline_output['sentiment_score'],
    prices=asset_prices,
    quantiles=2,
    periods=(1,5,10),
)

# Display first 5 rows
factor_data.head(5)
```

這邊我們使用情緒分數當作因子，對應的價格資料集為前面拉出的asset_prices，根據因子數值，我們將quantiles分成2(top and bottom)，並考慮1天、5天、和10天的持有時間。接下來我們把結果畫出來。

```
# Calculate mean return by factor quantile
mean_return_by_q, std_err_by_q = al.performance.mean_return_by_quantile(factor_data)

# Plot mean returns by quantile and holding period
# over evaluation time range
al.plotting.plot_quantile_returns_bar(
    mean_return_by_q.apply(
        al.utils.rate_of_return,
        axis=0,
        args=('1D',)
    )
);
```

```
import pandas as pd
# Calculate factor-weighted long-short portfolio returns
ls_factor_returns = al.performance.factor_returns(factor_data)

# Plot cumulative returns for 5 day holding period
al.plotting.plot_cumulative_returns(ls_factor_returns['5D'], '5D',
freq=pd.tseries.offsets.BDay());
```





在mean return好像有那麼一回事，但是如果看累積報酬，可以發現有很長一段都在賠錢，考慮到交易成本等等，這基本上是一個不好的策略，需要進一步完善，但我們這邊只是教程，所以會進入下一步，如何把在notebook上發現的策略轉為演算法環境下進行回測?