Introduction to Algorithmic Trading

A Beginner's Guide to Automating Investing Strategies

www.quantconnect.com

Outline

- What is QuantConnect?
- What is Algorithmic Trading? How can it help?
- Algorithm Development Process
- Creating An Investment Hypothesis
- Testing Our Hypothesis with QuantConnect Research
- Coding and Backtesting A Strategy
- Deploying Live

What is QuantConnect?

QUANTCONNECT

We empower investors with powerful

investment tools and connect the brightest

minds from around the world with capital they need.

What is QuantConnect?

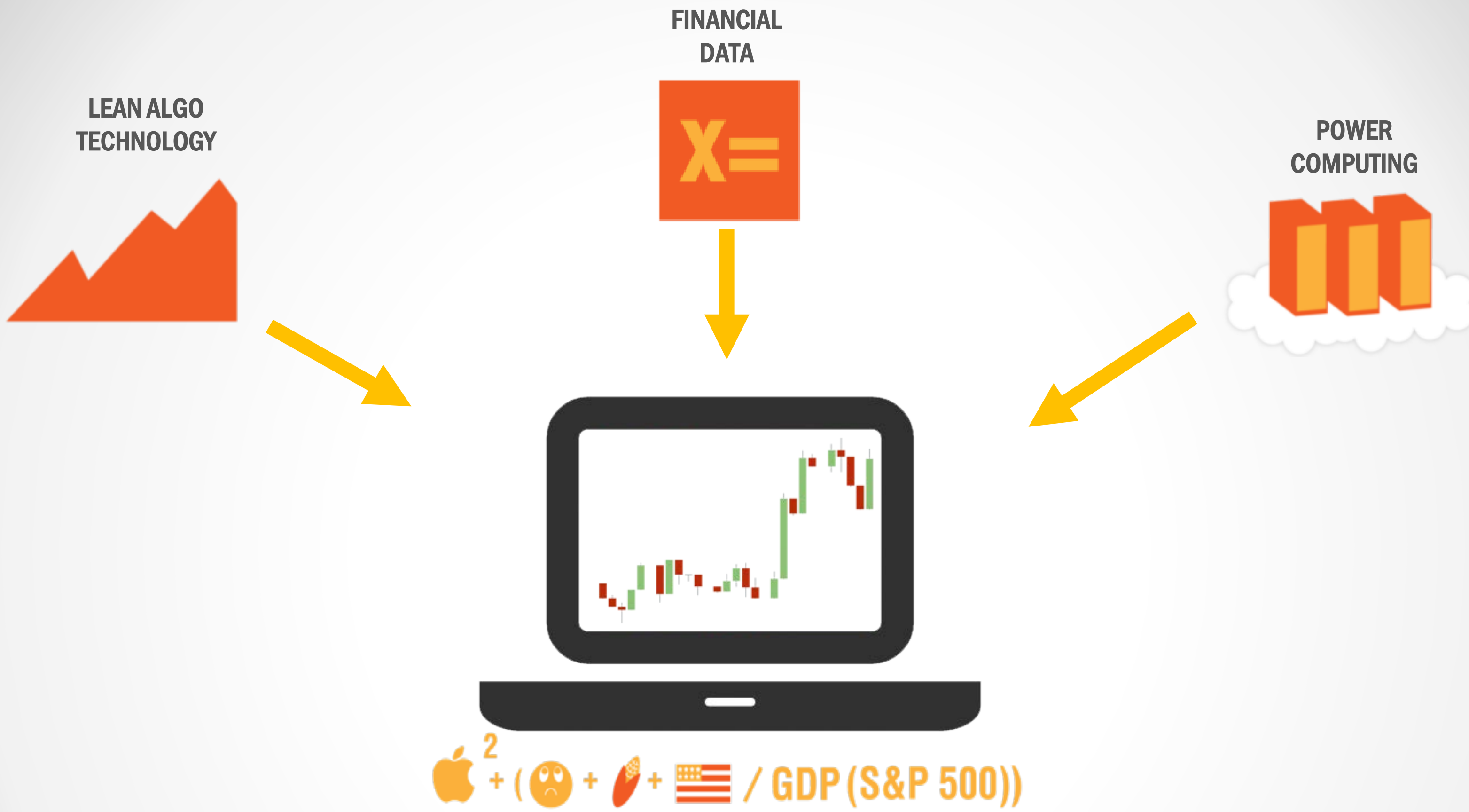
QuantConnect is a community of 40,000 Engineers, Data Scientists, Programmers

From 6,100 Cities and 173 Countries

Building Thousands of Algorithms Every Day

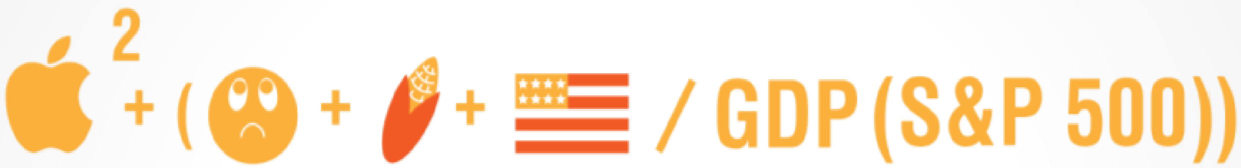
```
class ChewHistory(QCAlgorithm):
      def Initialize(self):
      '''Initialise the data and resolution required, as well as the cash and start-end dates
      for your algorithm. All algorithms must initialized.''
      self.SetStartDate(2011, 01, 02)    #Set Start Date
      self.SetEndDate(2016, 12, 23)      #Set End Date
      self.SetCash(100000)               #Set Strategy Cash
      self.symbols = ["SPY"]
      for s in self.symbols:
            self.AddEquity(s,Resolution.Minute)
       self.window=128
      self.SetWarmup(self.window)
      self.calc_len=self.window
      for i in range(16):
            self.Schedule.On(self.DateRules.EveryDay("SPY"), self.TimeRules.AfterMarketOpen("SPY",140+i*15), Acti
      def runAndTrade(self):
            # wait for warmu
            if self.IsWarmingUp: return

            for s in self.symbols:
                  history = self.History(s,self.calc_len,Resolution.Minute)
                  data=[]
                  index=[]
                  for slice in history:
                        data.append([np.float(slice.Open),np.float(slice.High),np.float(slice.Low),np.float(slice.C
                        index.append(slice.Time.date()) df=pd.DataFrame(data,columns=['o','h','l','p','v'],index=pd
                  if len(df)==self.calc_len:
                        self.Debug("Acquired "+str(len(df))+" rows of history")
                        r=df['p'].diff().fillna(0).values
                        a=np.diff(r)
                        m1=(r[-15:].mean()-r.mean()/r.std())
                        m2=(a[-15:].mean())/a.std()
                        #self.Debug("Finished calculations")
                        signal=np.sign(m1)+np.sign(m2)
                        self.SetHoldings(s,signal/self.Securities.Count)
```

How do we do it?



We've built a web algorithm lab where thousands of people test their ideas on financial data we provide; for free.

What is Algorithmic / Quantitative Trading?



- Using code for the implementation of your investment strategies.
- Wide variety of investment time horizons.
- Using math or scientific techniques in the investment process.

What Algorithmic Trading Is *Not*

- Get rich quick vehicle, or quick pathway to retirement.
- Not Solely HFT. *High Frequency Trading is one type of algorithmic trading.*

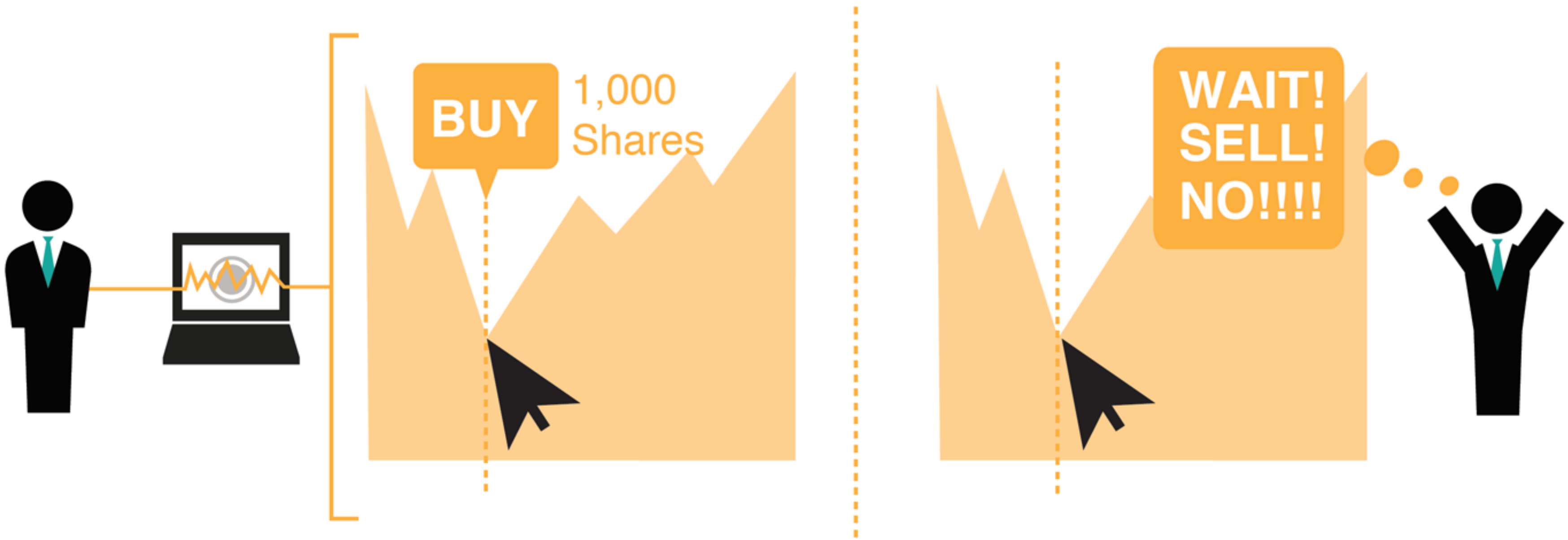
Process More, and Faster

Algorithms take advantage of computers' ability to process data. They can compare price and metrics of millions of financial instruments faster than individuals.

#1. Using computers to do things people find boring and time consuming.

Emotionless

Emotions can get in the way of sound investing, causing many to buy when prices are going up and sell when they are going down.



#2. Enforce discipline in your investment strategy through automating execution.

Execute Faster

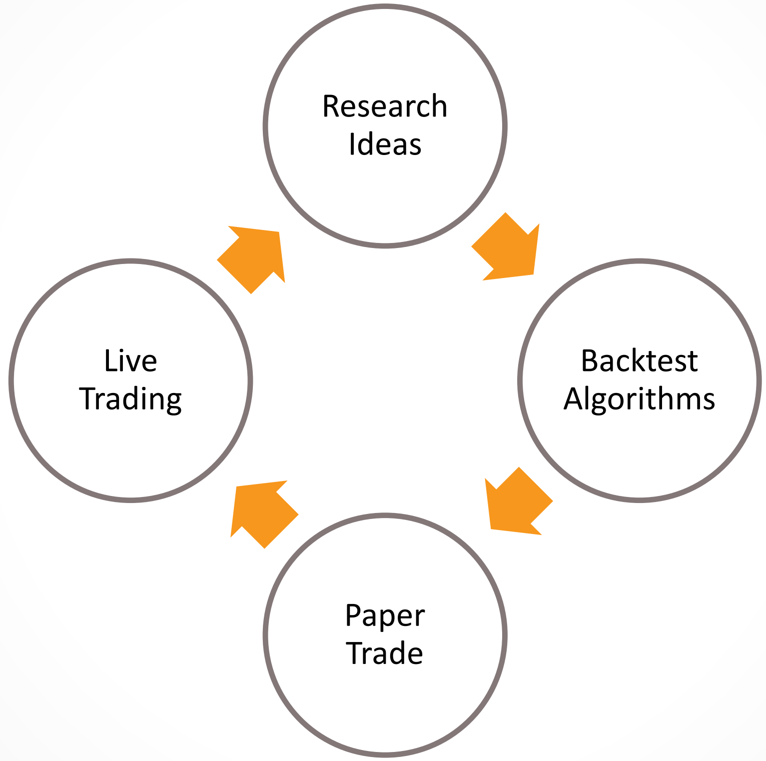
Algorithms are operated on computers, which react faster than humans to market changes.

#3. Monitor portfolio 24/7 and control your risk.

Development Process

Research

Quickly test ideas in a command line environment.



Live Trade

Deploy the strategy live in a real money account.

Backtest

Codify and run full simulation in the Algorithm Lab.

Paper Trade

Run idea on live market data.

Examples of an Investment Hypothesis

- Will rise of electric cars will make solely traditional manufacturers fall in value?
- Does the elected political party impact market stability, dynamics?
- Does consumer discretionary income and savings indicate better retail sales?

For Our First, Lets Keep It Simple

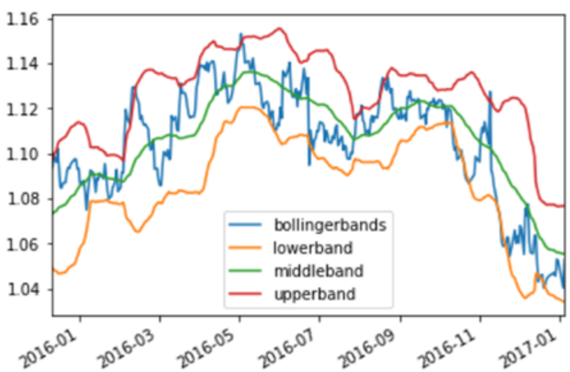
- The markets are smoothest when they're going up; and higher volatility is normally from panic. Should we wait on sidelines when there's panic?

QUANTCONNECT Research BETA | Pricing | Data | Community | Algorithm Lab | Research | Documentation | Jared Broad

File Edit View Insert Cell Kernel Help | Not Trusted | Python 2

In [14]:
```python
# For EURUSD
bbdf = qb.Indicator(bb, "EURUSD", 360, Resolution.Daily)
bbdf = bbdf.drop('standarddeviation', 1)
bbdf.plot()
```

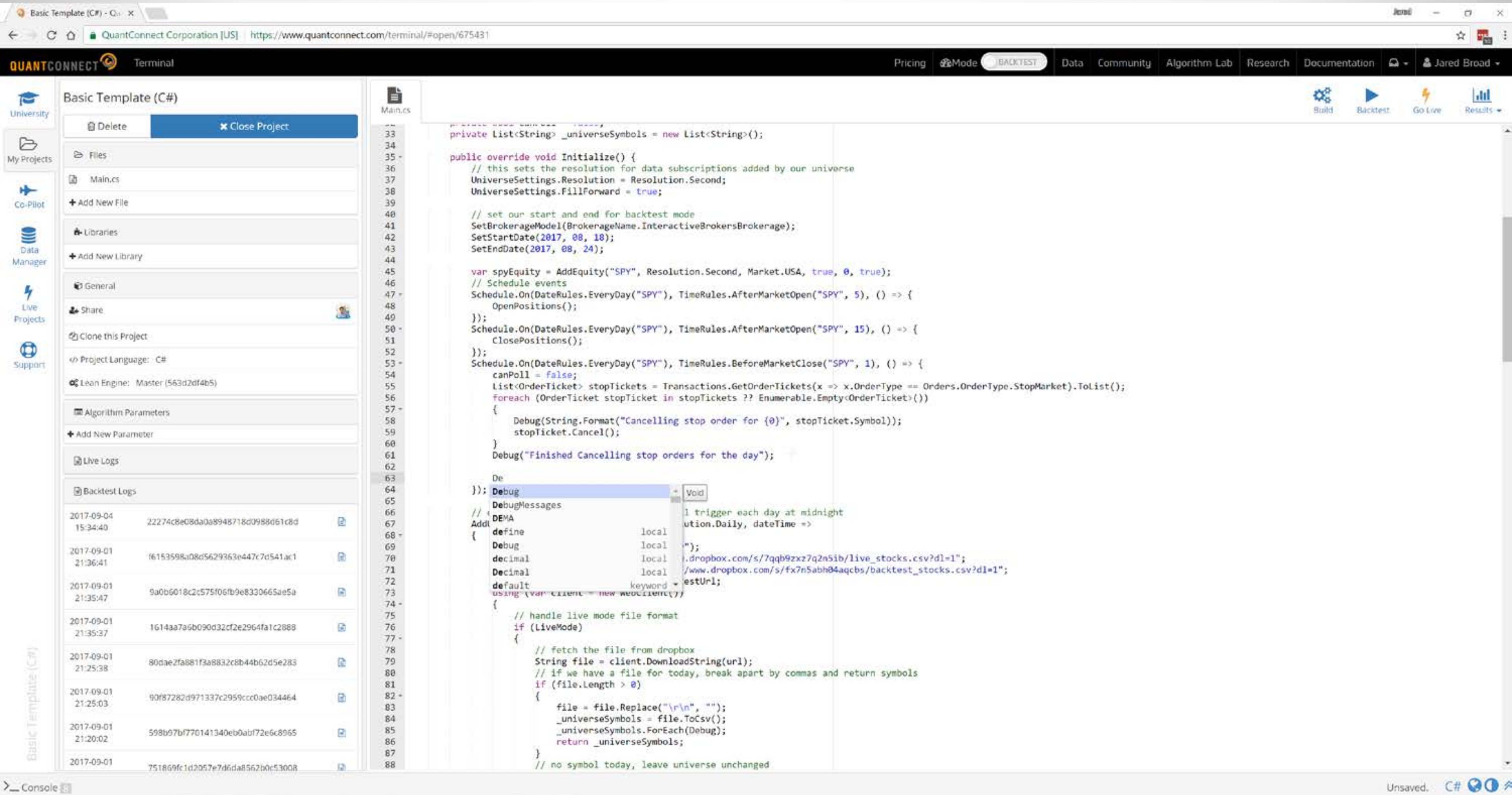
Out[14]: `<matplotlib.axes._subplots.AxesSubplot at 0x7efce87ea250>`



In [ ]:
```python
# Example with ADX, it is a bar indicator
adx = AverageDirectionalIndex("adx", 14)
adxdf = qb.Indicator(adx, "SPY", 360, Resolution.Daily)
adxdf.plot()
```

Out[15]: `<matplotlib.axes._subplots.AxesSubplot at 0x7efce8439650>`

Coding the Idea, The Algorithm Lab



Going Live, Deploying to Live Trading