

Machine Learning for Finance

Dr. Yves J. Hilpisch

CQF Elective, London, 23. May 2017



SERVICES

for financial institutions globally



EVENTS

for Python quants & algorithmic traders



THE PYTHON QUANTS

TRAINING

about Python for finance & algorithmic trading



CERTIFICATION

in cooperation with university

BOOKS

about Python and finance



PLATFORM

for browser-based data analytics



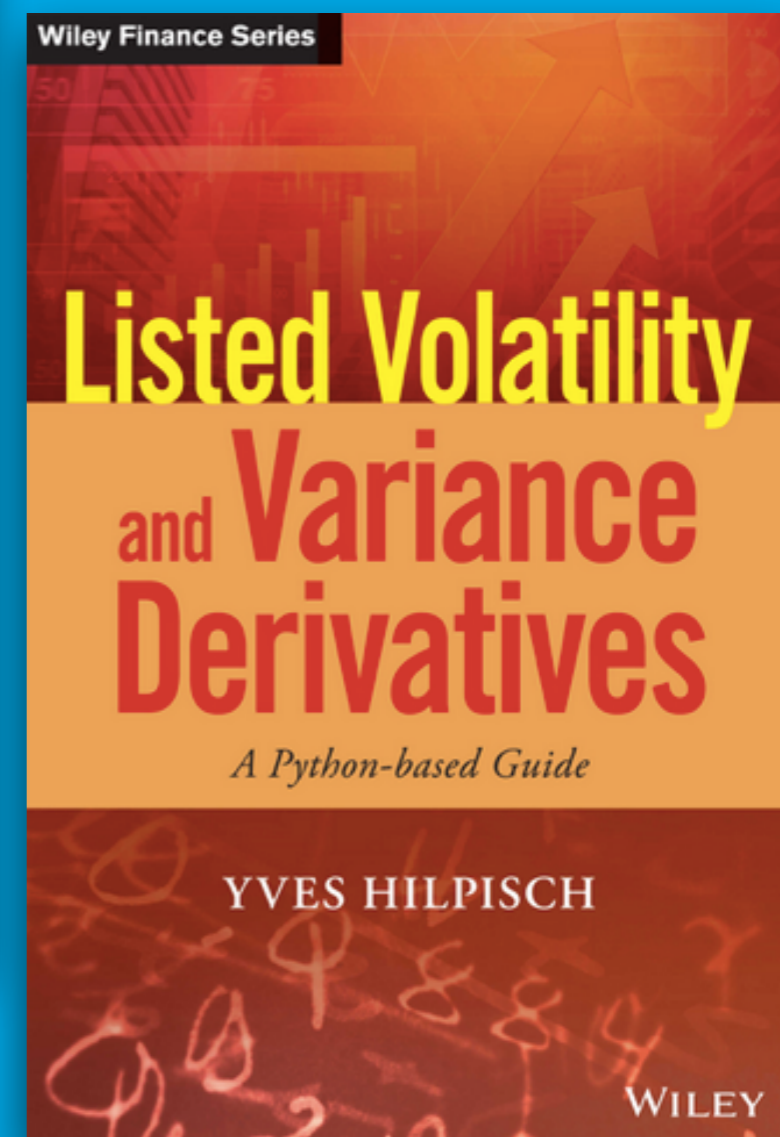
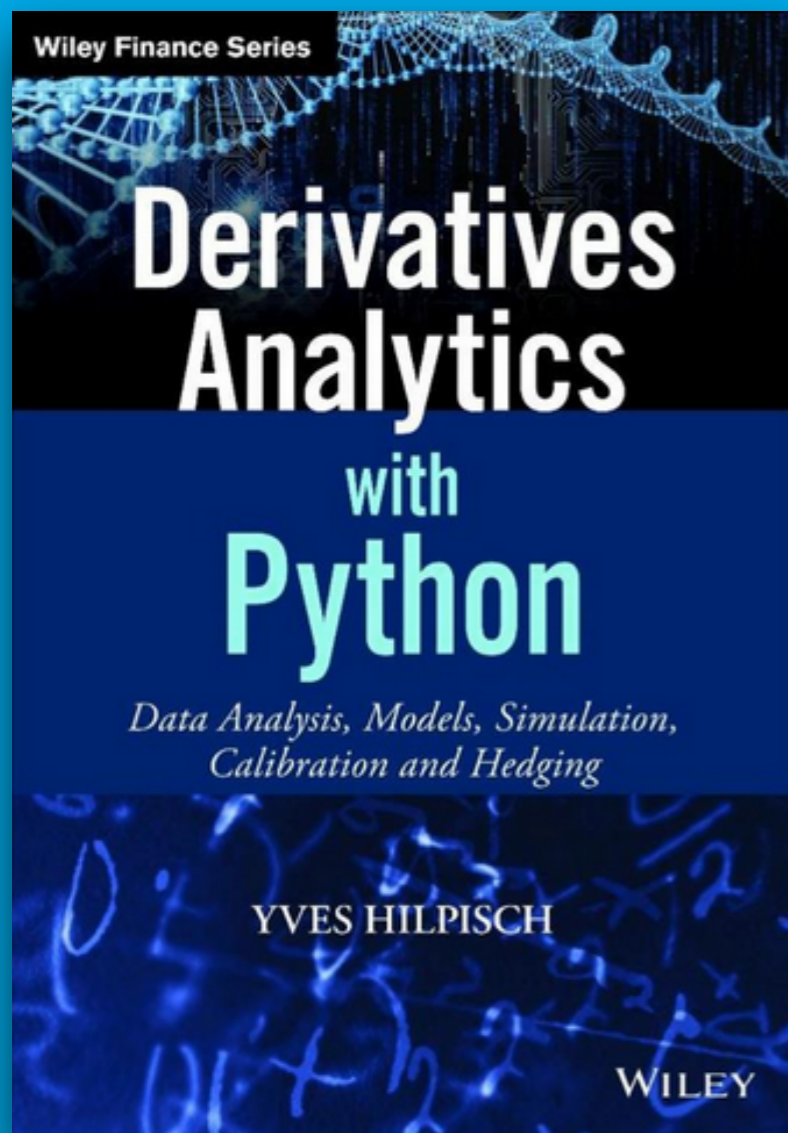
OPEN SOURCE

Python library for financial analytics









PROGRAM DIRECTOR

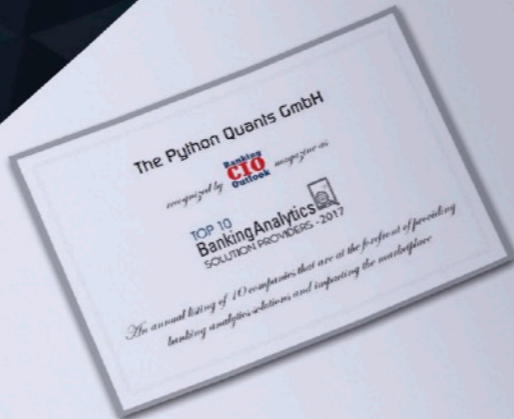
Dr. Yves J. Hilpisch is founder and managing partner of The Python Quants (<http://tpq.io>), a group focusing on the use of open source technologies for financial data science, algorithmic trading and computational finance. He is the author of the books

- He is the author of the books:
 - Python for Finance (O'Reilly)
 - Derivatives Analytics with Python (Wiley)
 - Listed Volatility and Variance Derivatives (Wiley)

He has written the financial analytics library DX Analytics (<http://dx-analytics.com>) and organizes conferences and Meetup events about Python for finance and algorithmic trading in Frankfurt, London and New York. He has given keynote speeches at technology conferences in the United States, Europe and Asia.



**UNIVERSITY CERTIFICATE
IN PYTHON FOR
ALGORITHMIC TRADING**



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April 2017

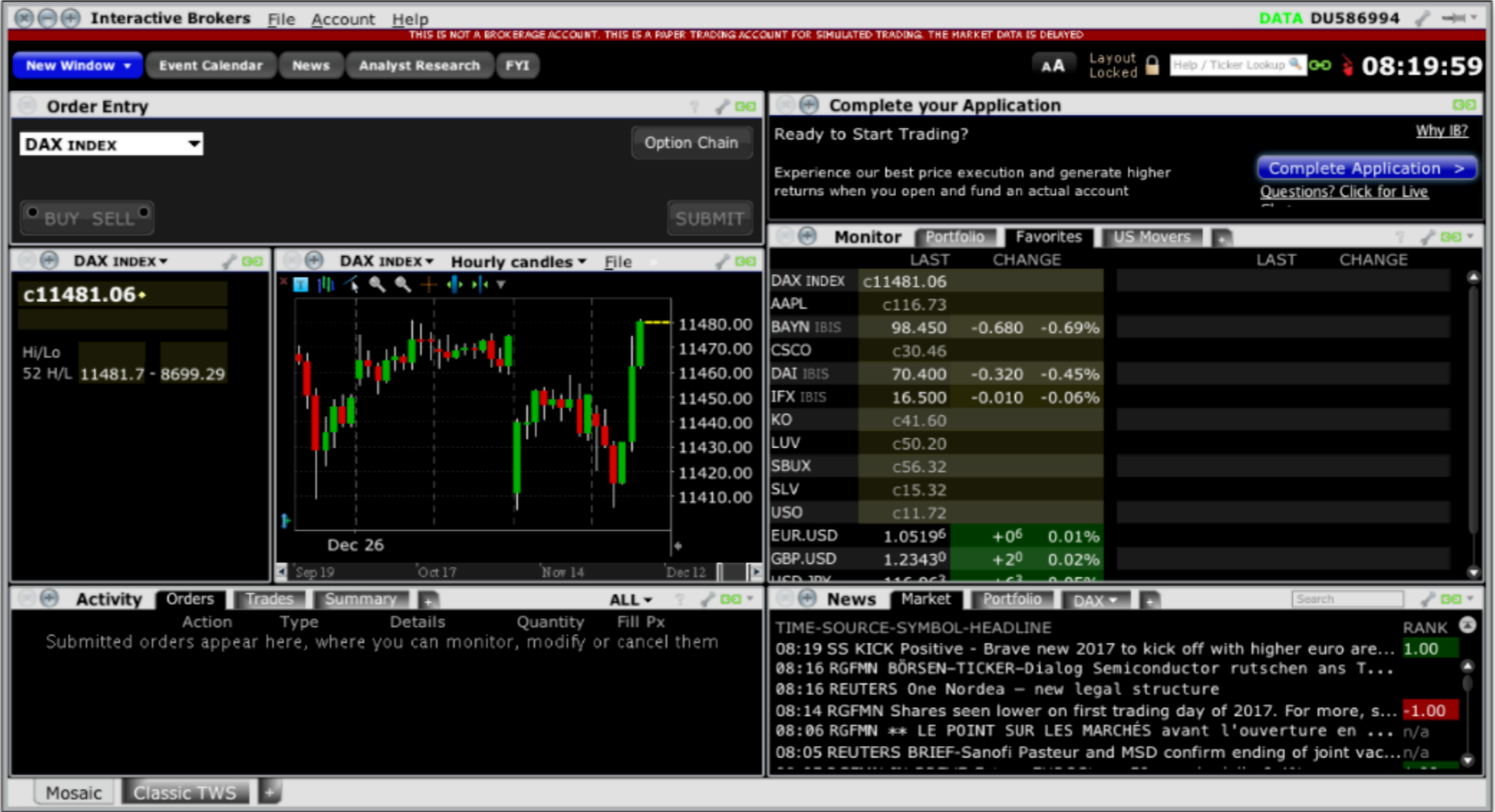
Quant Platform

https://pyalgo.pqp.io/nb/portal/login

Python for Algorithmic Trading

- 9. Stock Trading with Interactive Brokers
 - 9.1. Introduction
 - 9.2. Setting up an Account
 - 9.3. Python and the IB API
 - 9.4. A Wrapper Class for the IB API
 - 9.5. Retrieving Historical Data from IB
 - 9.6. Working with Streaming Data from IB
 - 9.7. Retrieving Account Information
 - 9.8. Implementing Trading Strategies in Real-Time
 - 9.9. Conclusions
 - 9.10. Further Resources
 - 9.11. Python Scripts
- 10. Algorithmic Trading of Cryptocurrencies
 - 10.1. Introduction
 - 10.2. Cryptocurrency Exchanges
 - 10.3. RESTful APIs and Streaming APIs
 - 10.4. Trading Strategies for Cryptocurrencies
 - 10.5. Implementing Trading Strategies in Real-Time
 - 10.6. Conclusions
 - 10.7. Further Resources
 - 10.8. Python Scripts
- 11. Automating Trading Operations
 - 11.1. Introduction
 - 11.2. Capital Management Strategies
 - 11.3. Risk Management

Once logged in, you can then download the TWS application for you operating system. Starting the application then requires the previously chosen user name and password. TWS then might show up as in [Trader Workstation after login with trial credentials](#) on your desktop.



The screenshot shows the Interactive Brokers Trader Workstation (TWS) interface. At the top, there's a header with 'Interactive Brokers' and a warning: 'THIS IS NOT A BROKERAGE ACCOUNT. THIS IS A PAPER TRADING ACCOUNT FOR SIMULATED TRADING. THE MARKET DATA IS DELAYED.' The main area is divided into several panels:

- Order Entry:** Shows 'DAX INDEX' selected, with 'BUY' and 'SELL' buttons and a 'SUBMIT' button.
- Complete your Application:** A prompt asking 'Ready to Start Trading?' with a 'Complete Application' button.
- Monitor:** A table showing stock prices and changes.

	LAST	CHANGE	LAST	CHANGE
DAX INDEX	c11481.06			
AAPL	c116.73			
BAYN IBIS	98.450	-0.680	-0.69%	
CSCO	c30.46			
DAI IBIS	70.400	-0.320	-0.45%	
IFX IBIS	16.500	-0.010	-0.06%	
KO	c41.60			
LUV	c50.20			
SBUX	c56.32			
SLV	c15.32			
USO	c11.72			
EUR.USD	1.05196	+06	0.01%	
GBP.USD	1.23430	+20	0.02%	
USD.JPY	116.863	+67	0.05%	
- DAX INDEX:** A candlestick chart showing price movement over time, with a current price of c11481.06.
- Activity:** A table for monitoring orders and trades.
- News:** A list of market news headlines.

Figure 58. Trader Workstation after login with trial credentials

The arrangement of the different panels of TWS might be changed or new windows might pop up depending on what you request from the application. [TWS break out window with option chain data](#) shows a break out window with option chain

Banking CIO Outlook

FEBRUARY, 2017

BANKINGCIOOUTLOOK.COM

Top 10 Banking Analytics Solution Providers - 2017

Today's data-driven banking industry portrays a scenario where analytics is paving a productive path for banks, by offering meaningful insights on their underlying data. Although basic reporting and descriptive analytics are prevalent in the banking sector, the need of the hour is advanced predictive and prescriptive analytics.

Sophisticated technologies—like the emerging cognitive analytics for instance—are enabling banks to make better decisions and achieve profitable growth quarter-on-quarter. At the same time, with enhanced visibility into intricate information, such as individual financial health and behavioral patterns, banks now have the upper hand in risk mitigation and fraud prevention that help them comply with mandatory regulations.

With the Blockchain gaining mainstream attraction, digital currencies such as Bitcoin and Ethereum are doing their rounds among consumers for payments and other transactions. To that end,

banks are leveraging analytics to prevent theft and fraudulent use of these digital currencies, by verifying and tracking the transactions with an unprecedented level of speed and transparency.

Identifying the numerous benefits of analytics, CIOs are on a constant quest to find solutions that deliver insightful information in a timely and accurate manner and also elevate productivity to a whole new level.

To help CIOs and CFOs find the right banking analytics solution provider, a distinguished panel comprising of CEOs, CFOs, VCs, analysts, and the Banking CIO Outlook editorial board has selected top players from the sector. The companies listed here demonstrate an ability to develop innovative technologies and methodologies along the banking value chain, while providing outstanding customer service.

We present to you Banking CIO Outlook's Top 10 Banking Analytics Solution Providers 2017.



Company:
The Python Quants Group

Description:
Focused on Python and Open Source Technologies for Financial Data Science, Algorithmic Trading and Computational Finance

Key Person:
Dr. Yves J. Hilpisch
Managing Partner

Website:
tpq.io

Banking TOP 10
CIO BankingAnalytics
Outlook SOLUTION PROVIDERS - 2017

The Python Quants Group Enhance Financial Analytics

Over the years, the ecosystem of scientific, numerical and data analytics packages available for Python has grown rapidly and has finally made it the language of choice for the finance industry. More recently, banks have been reprogramming their trading and risk systems to run off Python rather than other languages. The Python Quants Group recognized this potential of the coding language long before its huge success and started using and marketing Python for financial analytics and applications. "Our major focus has always been on the use of Python and open source technologies for financial data science, computational finance and algorithmic trading," says Yves Hilpisch, Managing Partner of The Python Quants.

Today, banks and other financial institutions cannot afford to ignore the tremendous potential that trends like open source, open data or open communities have to offer—but there are often no other big counterpart institutions to interact with. The Python Quants plays that role when it comes to Python introduction and deployment, training the people working in banks and providing ongoing support and services.

Python and open source technologies are empowering organizations and individuals to do financial and data analytics in real-time and on a highly customized basis as well as to rapidly develop new financial applications and deploy them based on weekly or even daily cycles. "We support financial institutions in introducing, training and deploying Python and a major building block in this regard is our Quant Platform," adds Hilpisch. "Our training offerings are based on more than 10 years of

experience with Python for Finance and provide a hands-on learning experience, making heavy use, for instance, also of our Quant Platform."

The company's Quant Platform makes central, standardized Python deployment an easy and efficient affair while mitigating risks and reducing maintenance costs considerably during deployment. Based on modern web technologies and deployment techniques like Docker containers, the Quant Platform provides a full-fledged suite of development tools via the web browser without the need to install any kind of open source software locally on desktop or notebook computers.

In an instance, Eurex, one of the leading derivatives exchanges, wanted to support investors, traders, market makers and quants in the understanding and trading of their listed volatility and variance products. Eurex decided to use Python for this project and The Python Quants were tasked to create the content and in particular the Python codes accompanying it. While the content itself became part of the Eurex website, all Python codes were provided to Eurex partners and other interested parties on a Eurex-labeled version of the Quant Platform for easy code access and execution. "Deploying open source technologies, like Python, is often a tedious and sometimes even a risky process, with our services and products we help our clients to make this process more efficient and mitigate risks," adds Hilpisch.

Another product of The Python Quants Group assisting organizations to model, price and risk manage complex portfolios of (multi-risk) derivatives with potentially complex correlation structures

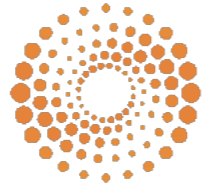


Dr. Yves J. Hilpisch

is DX Analytics. Being an open source derivatives, portfolio and risk analytics library written exclusively in Python—it makes heavy use of the capabilities of Python and the capabilities of its numerical and data analytics libraries.

“Our major focus has always been on the use of Python and open source technologies for financial data science, computational finance and algorithmic trading”

As the Python ecosystem sees tremendous momentum, The Python Quants Group's near-term focus will be on machine and deep learning techniques, technologies emerging in algorithmic trading as well as on cryptocurrencies and blockchain. "We will improve our value proposition in particular for hedge funds and other buy side players for the days to come," concludes Hilpisch. **BC**



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FitchLearning

CQF | INSTITUTE

htw saar

Hochschule für
Technik und Wirtschaft
des Saarlandes
University of
Applied Sciences

“In building a house, there is the problem of the selection of wood. It is essential that the carpenter’s aim be to carry equipment that will cut well and, when he has time, to sharpen that equipment.”

Miyamoto Musashi (The Book of Five Rings)

“Any fool can write code that a computer can understand. Good programmers write code that humans can understand.”

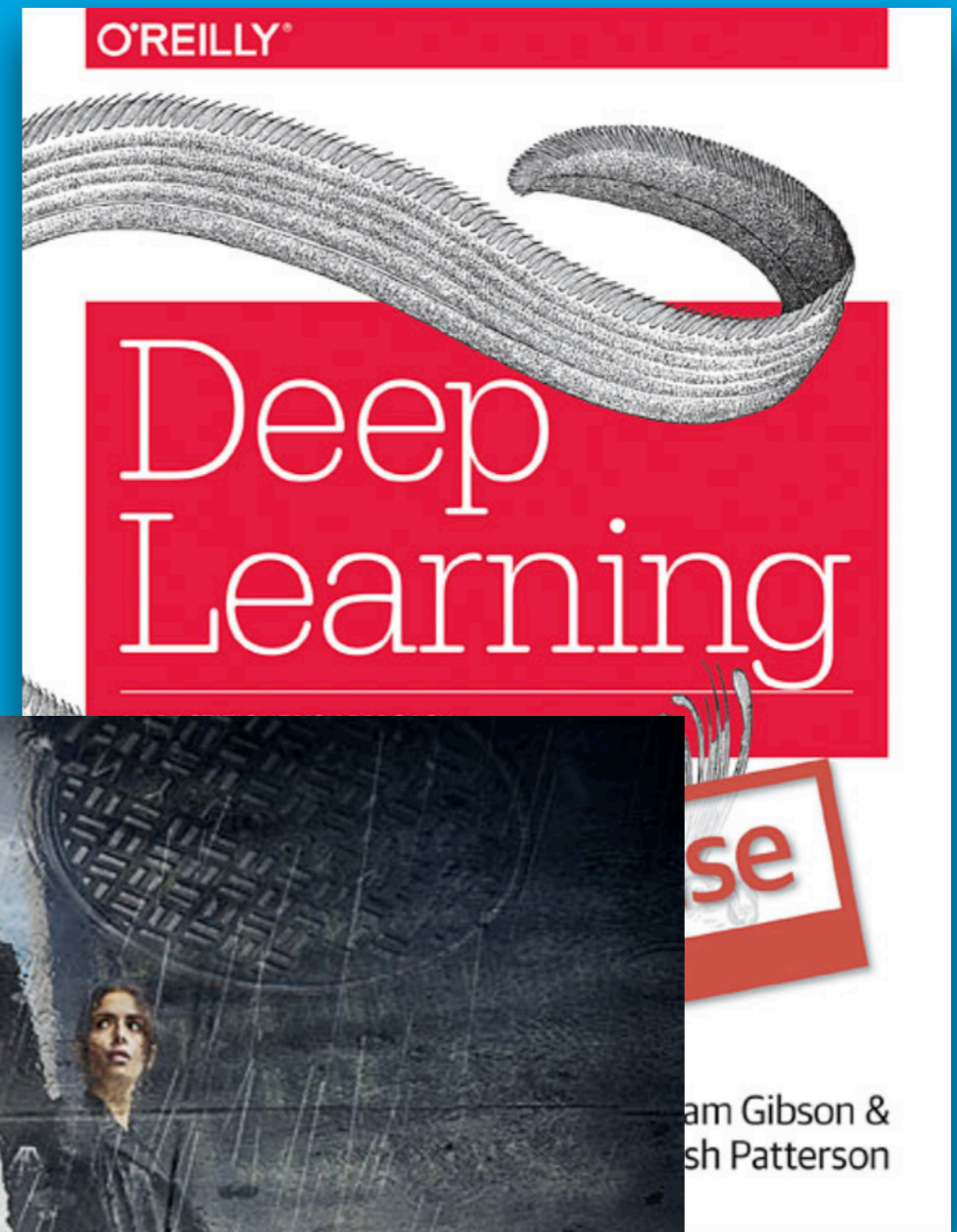
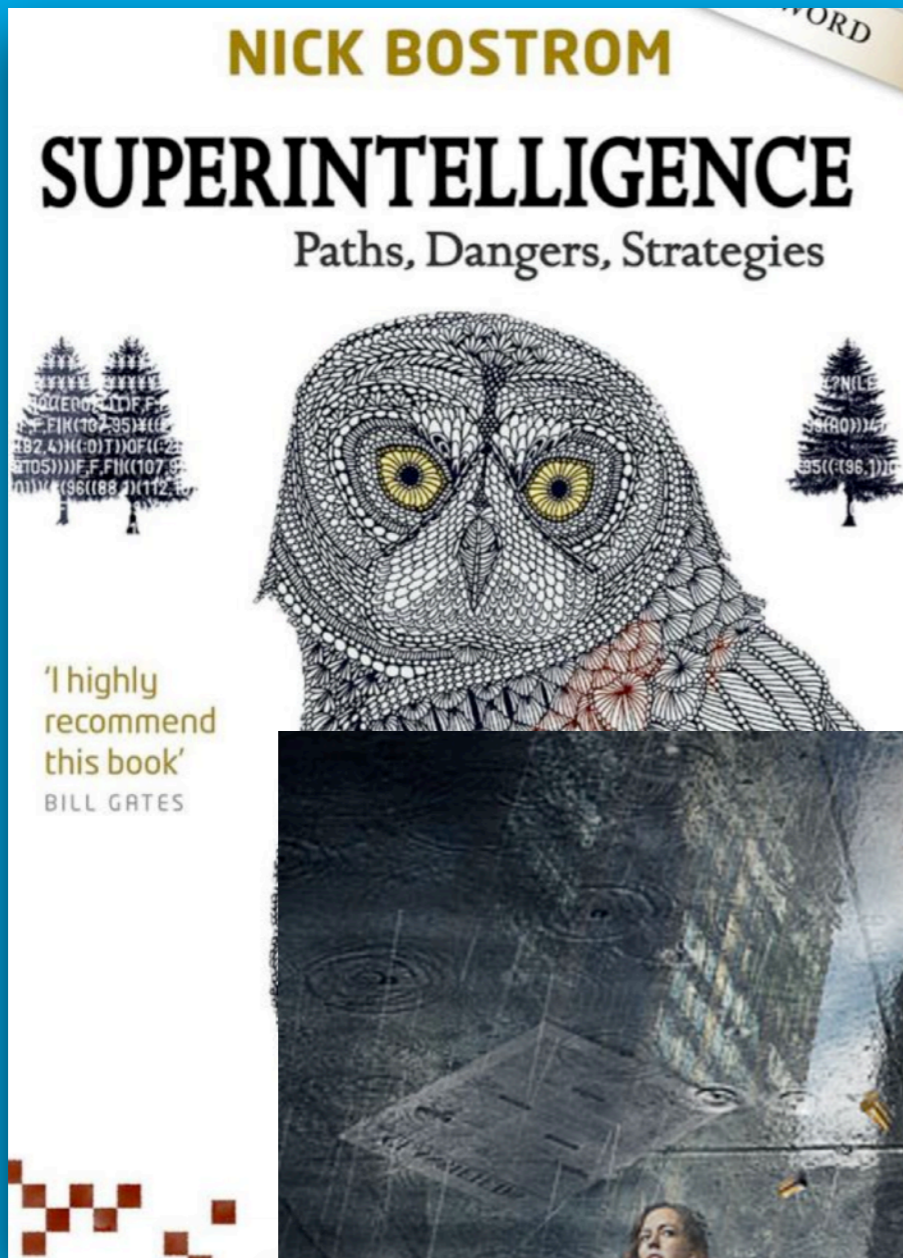
Martin Fowler

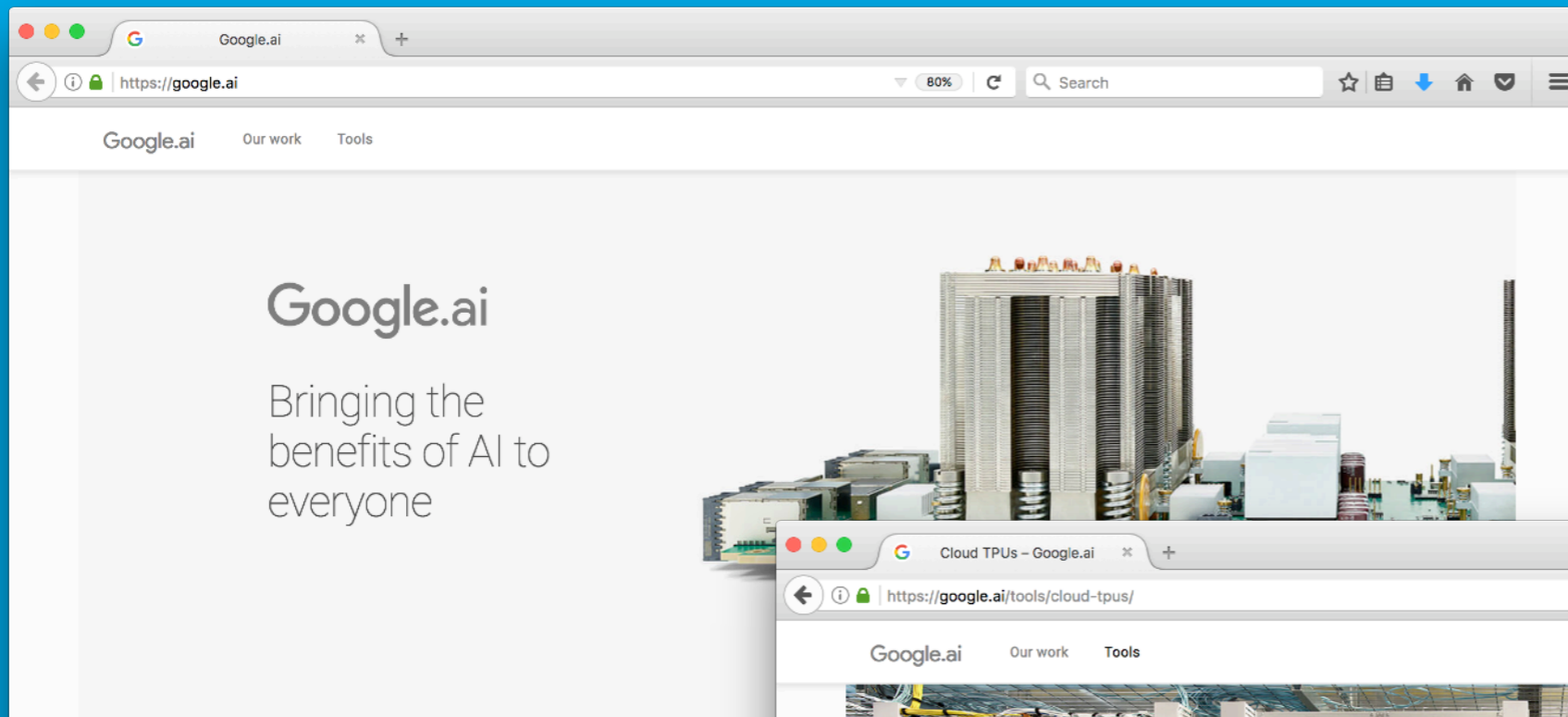
“In fact, I’m a huge proponent of designing your code around the data, rather than the other way around, ...”

Linus Torvalds

“Dataism says that the universe consists of data flows, and the value of any phenomenon or entity is determined by its contribution to data processing. ... Dataism thereby collapses the barrier between animals [humans] and machines, and expects electronic algorithms to eventually decipher and outperform biochemical algorithms.”

Yuval Noah Harari (Homo Deus)



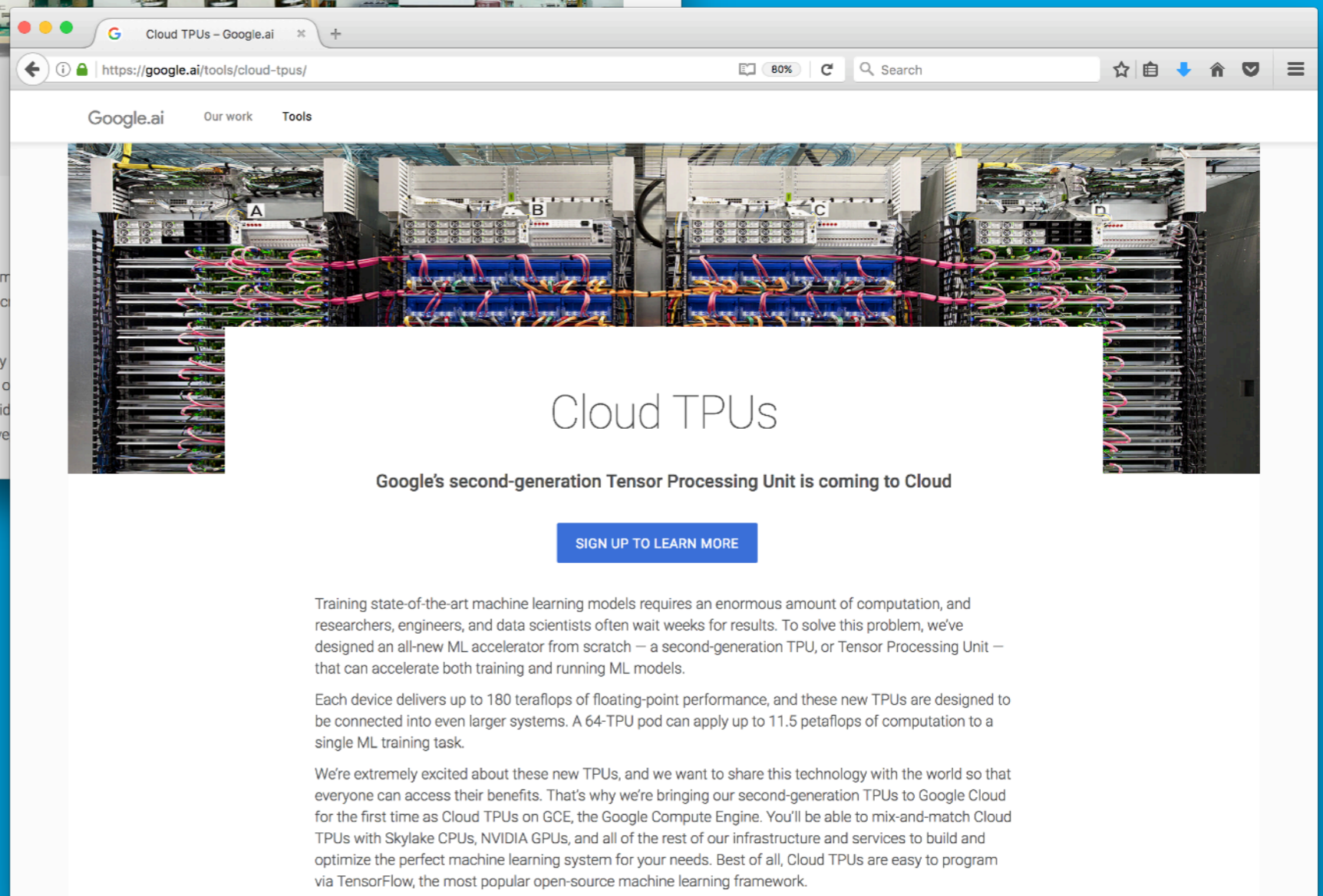


Google.ai

Bringing the benefits of AI to everyone

Our mission is to organize the world's information and make it universally accessible and useful, and AI is enabling us to do that in incredible ways for our users, our customers, and the world.

AI makes it easier for you to do things every day, from recommending movies you love to breaking down language barriers, or even acting as your personal digital assistant. But it's also providing new tools and helping transform how we work and live, and everyone can access it.



introduction
Python, tools, data

OLS regression
classification problems

pricing American options with LSM
replacing OLS regression by classification

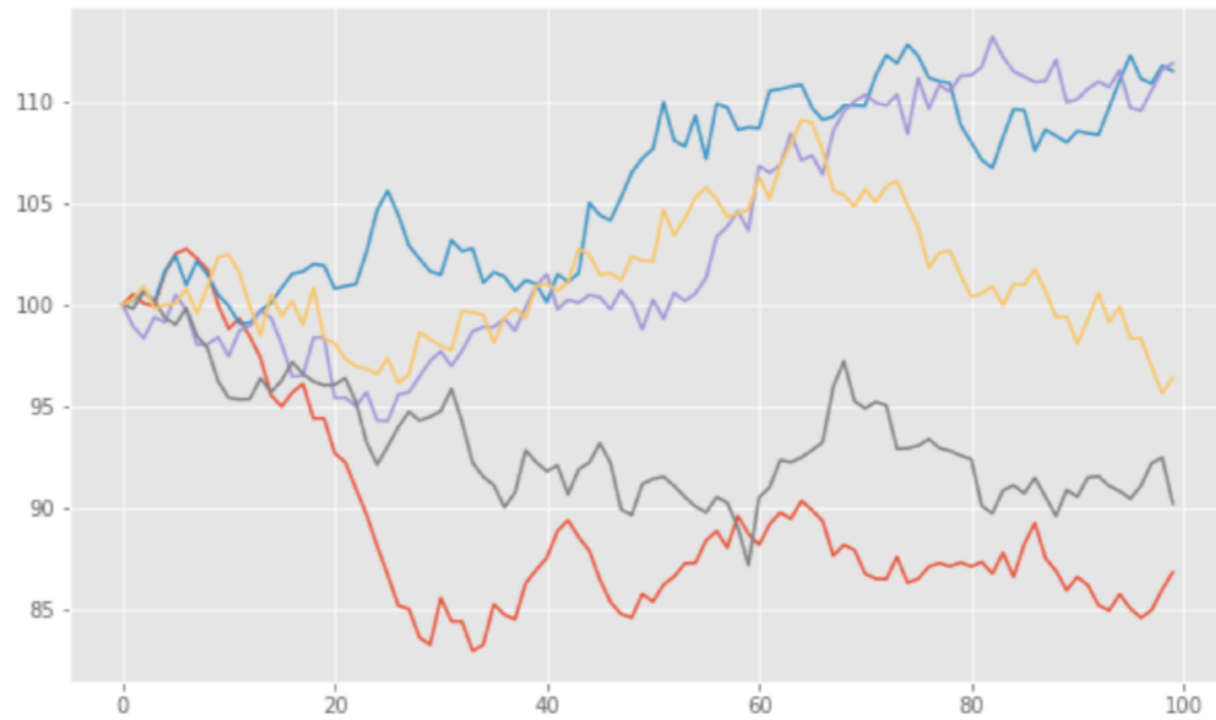
stock market prediction problem as classification
machine & deep learning to generate predictions

“Plans are nothing; planning is everything.” — *Dwight D. Eisenhower*

Interactive Style Throughout

“Making mistakes together.”

```
In [89]: plt.figure(figsize=(10, 6))
plt.plot(rw);
```



```
vim
#
# Simple Tick Data Server with
# ZeroMQ
#
import zmq
import time
import random

context = zmq.Context()
socket = context.socket(zmq.PUB)
socket.bind('tcp://0.0.0.0:5555')

AAPL = 100.

while True:
    AAPL += random.gauss(0, 1) * 0.5
    msg = 'AAPL %s' % AAPL
    tick_server.py [+]
```

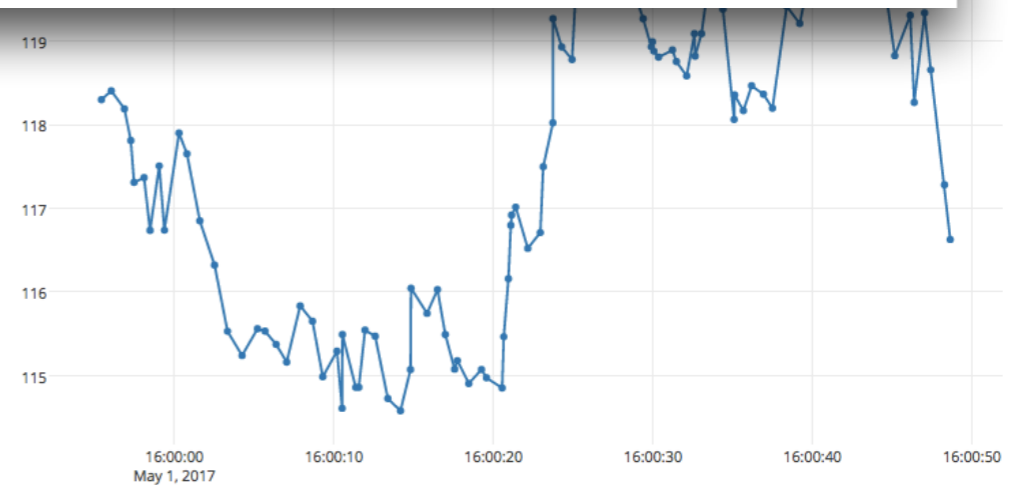
```
Python live/data (python3.6)
AAPL 107.15636235397254
AAPL 107.18612019583905
AAPL 107.4983187955743
AAPL 107.2640892475144
AAPL 107.68358829560407
AAPL 106.9232056802307
AAPL 106.55017297488794
AAPL 105.97708319698597
AAPL 106.00856053822193
AAPL 105.37221723045396
AAPL 105.09251644774177
AAPL 104.9267694947986
AAPL 105.03306681222703
AAPL 105.1223727550806
AAPL 105.29880694705703
AAPL 105.438670667864
AAPL 105.60426198517378
```

Black-Scholes difference equation for static economy:

$$S_T = S_0 \exp\left(\left(r - \frac{1}{2}\sigma^2\right)T + \sigma\sqrt{T}z\right)$$

z here a standard normally distribute variable.

```
2017-05-01 23:51:44.663153 AAPL 107.18612019583905
2017-05-01 23:51:44.707051 AAPL 107.4983187955743
2017-05-01 23:51:45.066229 AAPL 107.2640892475144
2017-05-01 23:51:45.433200 AAPL 107.68358829560407
2017-05-01 23:51:46.315111 AAPL 106.9232056802307
2017-05-01 23:51:47.040770 AAPL 106.55017297488794
2017-05-01 23:51:48.036525 AAPL 105.97708319698597
2017-05-01 23:51:48.348464 AAPL 106.00856053822193
2017-05-01 23:51:48.974186 AAPL 105.37221723045396
2017-05-01 23:51:49.019263 AAPL 105.09251644774177
2017-05-01 23:51:49.954823 AAPL 104.9267694947986
2017-05-01 23:51:50.465716 AAPL 105.03306681222703
2017-05-01 23:51:50.972619 AAPL 105.1223727550806
2017-05-01 23:51:51.609747 AAPL 105.29880694705703
2017-05-01 23:51:52.160840 AAPL 105.438670667864
2017-05-01 23:51:52.886747 AAPL 105.60426198517378
```



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