

Certificate Program in Python for Algorithmic Trading

Dr. Yves J. Hilpisch

Introduction & Overview

31. May 2017

http://hilpisch.com/algo_cert_overview.pdf



Introduction



SERVICES

for financial institutions globally



TRAINING

about Python for finance & algorithmic trading



EVENTS

for Python quants & algorithmic traders



CERTIFICATION

in cooperation with university



BOOKS

about Python and finance



PLATFORM

for browser-based data analytics

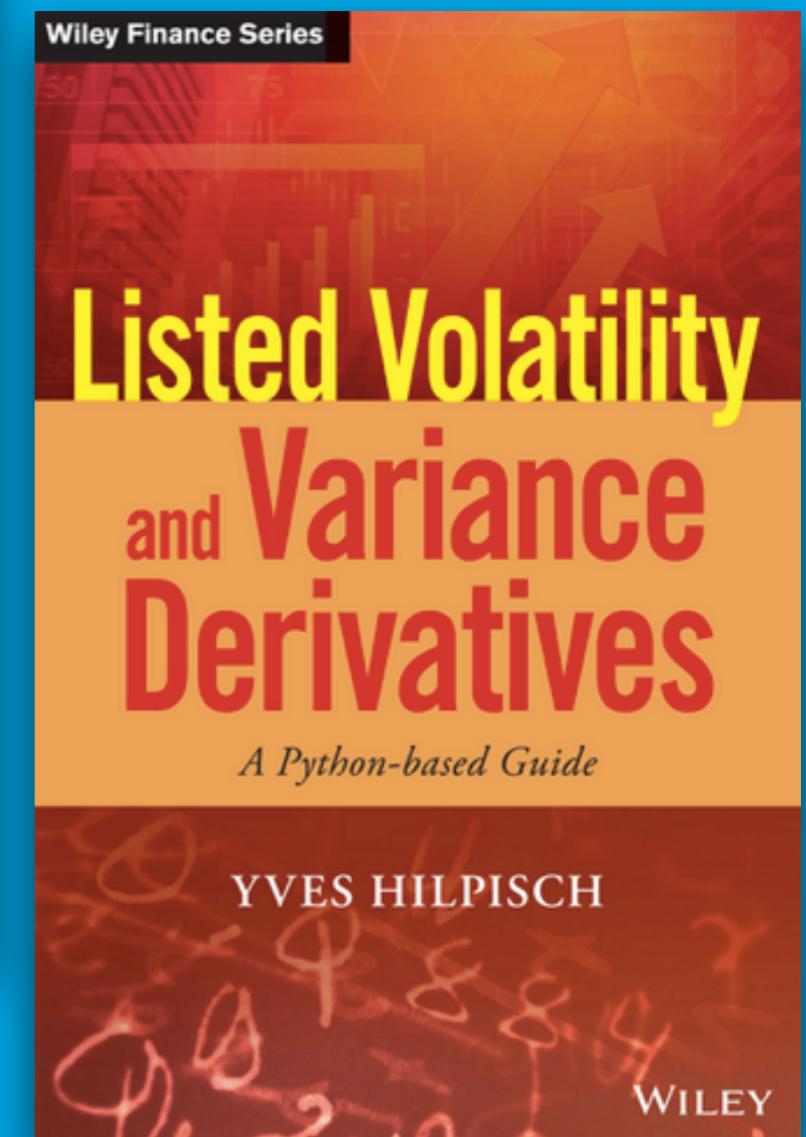
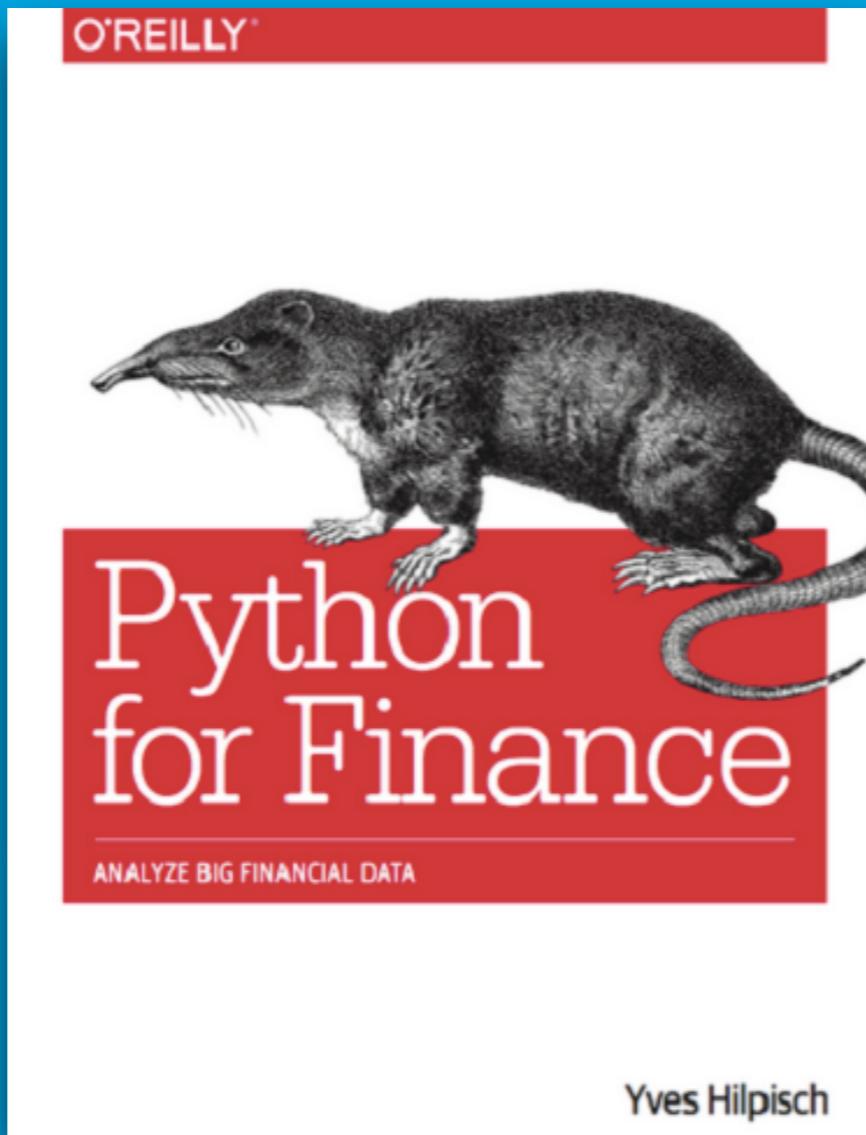
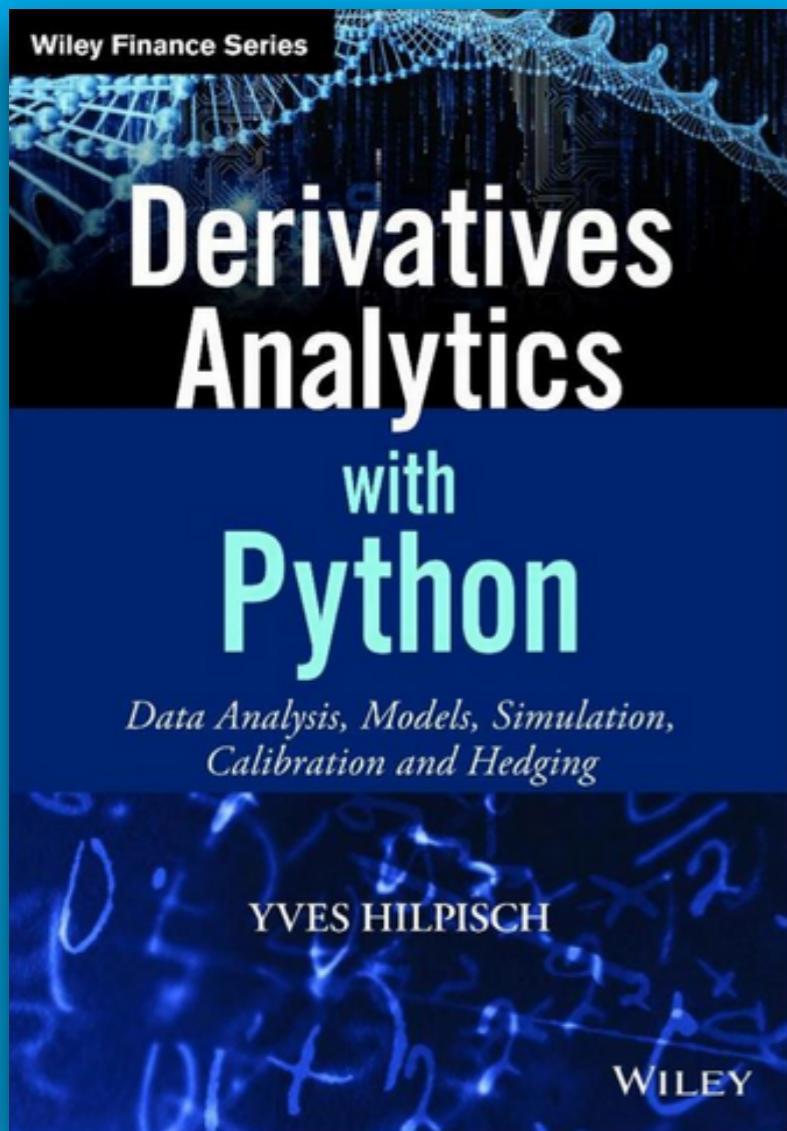


OPEN SOURCE

Python library for financial analytics







<http://books.tpq.io>

UNIVERSITY CERTIFICATE IN PYTHON FOR ALGORITHMIC TRADING



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Germany
T/F +49 3212 112 91 94
<http://training.tpq.io>
training@tpq.io

April 2017

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:

- 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.



<http://training.tpq.io>

Quant Platform Yves

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

Default Kernel Python 2.7 Python 3.4 R Logout

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 your 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.

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.

The Python Quants GmbH

Banking
CIO
Outlook
magazine
TOP 10
Banking Analytics
SOLUTION PROVIDERS - 2017

An annual listing of 10 companies that are at the forefront of providing banking analytics solutions and impacting the marketplace

Company:

The Python Quants Group

recognized by

CIO
Outlook

magazine as

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 Banking Analytics
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 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



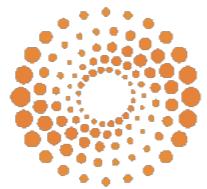
Dr. Yves J. Hilpisch

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



THOMSON REUTERS

FitchLearning

CQF | INSTITUTE

htw saar

Hochschule für
Technik und Wirtschaft
des Saarlandes
University of
Applied Sciences

Overview

mega trends

software

open source

cutting edge

hardware

open
infrastructure

specialized
hardware

data

open data

programmatic
APIs

social

open networks

specialized events



DigitalOcean

Quandl



TensorFlow

Google.ai

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EIKON™

meetup

CQF | INSTITUTE

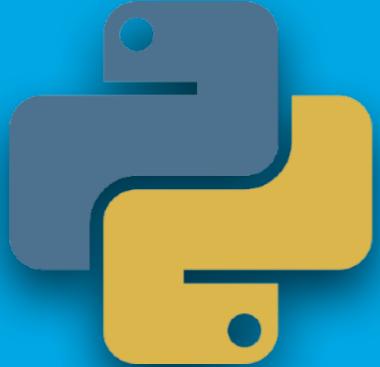
machine & deep learning

data
algorithms
hardware

optimization,
training &
learning
testing
validation

prediction
automation
trading

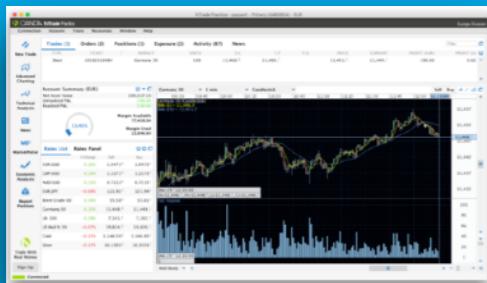
algorithmic trading



Python, tools (IPython, Jupyter), Docker container, cloud instances, basic idioms, control structures, linear algebra, basic finance



financial data science, historical financial data, machine learning (classification), deep learning (DNN), prediction, backtesting



streaming data & visualisation, real-time “online” algorithms, real-time communication (placing orders), online platforms & APIs



“do-it-yourself” (DIY), own strategies & backtesting programs, own trading code, own full week experience (incl P&L), research project

FOUNDATIONS DATA SCIENCE ALGO TRADING EXPERIENCE

introduction Quant Platform	core packages (NumPy, pandas, matplotlib)	financial data, backtesting & prediction	out-of-sample backtesting competition
Python environment & infrastructure	financial time series management	streaming data & visualization	single day live trading competition
basic finance in complete economies	stochastics & statistics	online trading platforms (Oanda, IB, Gemini)	one week live trading competition
basic finance in incomplete economies	special & advanced topics (eg symbolic mathematics)	automation of algorithmic trading operations	final project delivered as Jupyter Notebook

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

1,000+ pages of Python for Finance & Algorithmic Training



5,000+ lines of code

```
droplet_install.sh
1 #!/bin/bash
2 # Bash Script for Droplet Set-up
3 # The Python Quants GmbH
4 #
5 #
6 # Ubuntu
7 apt-get -y update
8 apt-get -y upgrade
9 apt-get -y autoremove
10 apt-get -y install screen htop vim bzip2 wget unzip
11 #
12 # Python 3.6
13 wget https://repo.continuum.io/miniconda/Miniconda3-latest-Linux-x86_64.sh -O miniconda.sh
14 bash miniconda.sh -b
15 export PATH="/root/miniconda3/bin:$PATH"
16 conda create -y -n base python=3.6
17 source activate base
18 conda install -y pandas scikit-learn
19 conda install -y matplotlib pytables
20 conda install -y ipython jupyter
21 conda install -y requests pyyaml usjson
22 echo ***
23 export PATH="/root/miniconda3/bin:$PATH"
24 source activate base*** >> ~/.bashrc
25 #
26 # Jupyter
27 mkdir ~/.jupyter
28 echo """"
29 c.NotebookApp.password='sha1:86cd78bf6306:9613d6ac1328ab7fe41f4f9b5b038d6694d6df20'
30 c.NotebookApp.port=1111
31 c.NotebookApp.ip='*'
32 c.NotebookApp.open_browser=False"" >> ~/.jupyter/jupyter_notebook_config.py
33 jupyter notebook --allow-root
34 
```

55+ hours
of pre-recorded
video instruction

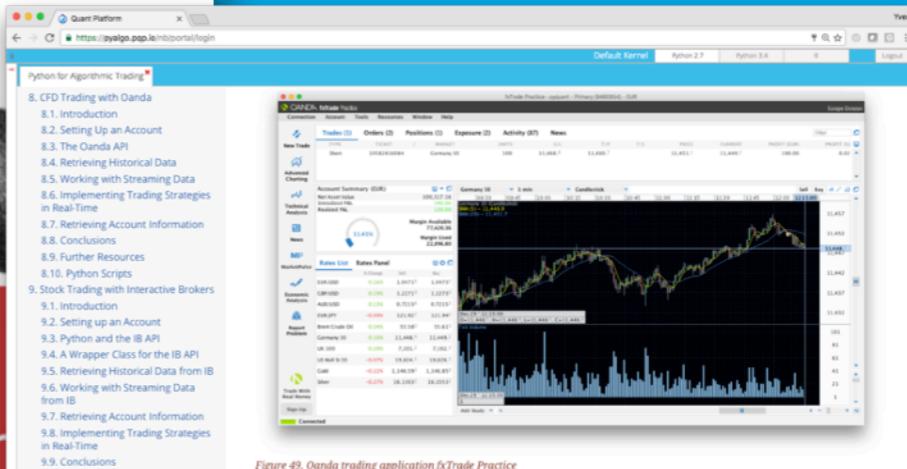
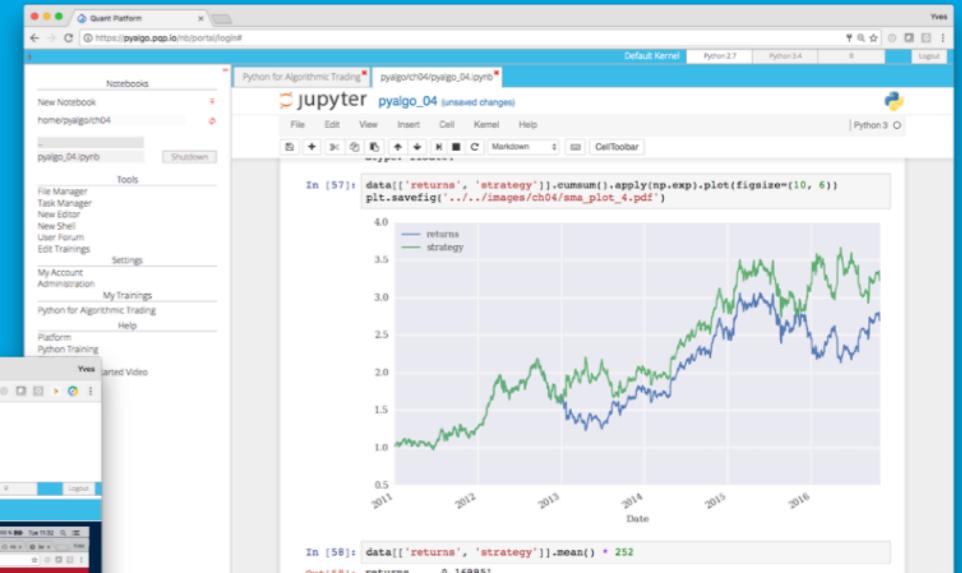


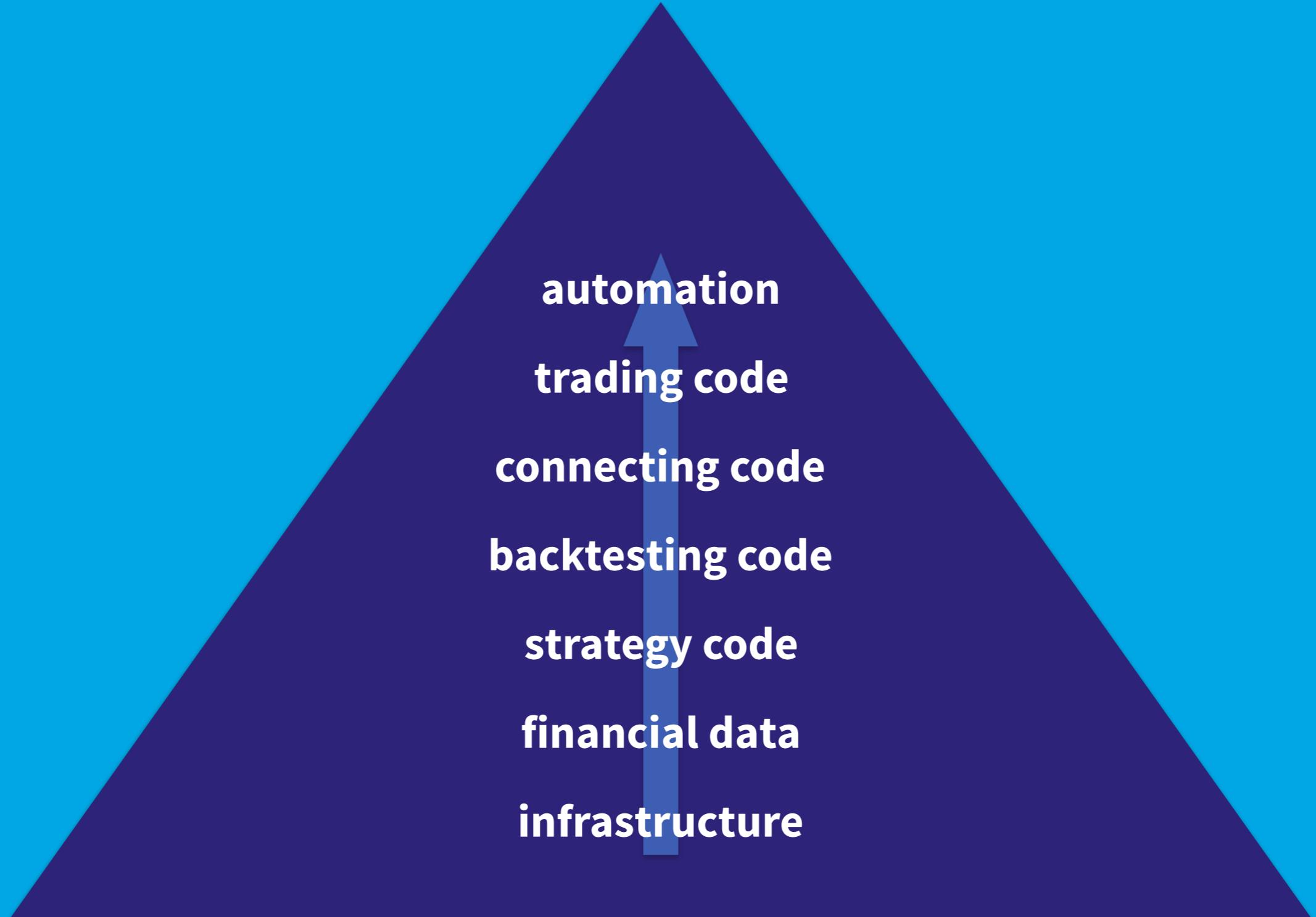
Figure 49. Oanda trading application fxTrade Practice

The chapter is organized as follows. [Setting Up an Account](#) briefly discusses how to set up an account. [The Oanda API](#) illustrates the necessary steps to access the API. Based on the API access, [Retrieving Historical Data](#) retrieves and works with historical data for a certain CFD. [Working with Streaming Data](#) introduces to the streaming API of Oanda for data retrieval and visualization. [Implementing Trading Strategies in Real-Time](#) implements an automated, algorithmic trading strategy in real-time. Finally, [Retrieving Account Information](#) deals with retrieving data about the account itself, like, for

40+ Jupyter Notebooks



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live sessions



Singularity

NICK BOSTROM

SUPERINTELLIGENCE

Paths, Dangers, Strategies



'I highly
recommend
this book'

BILL GATES



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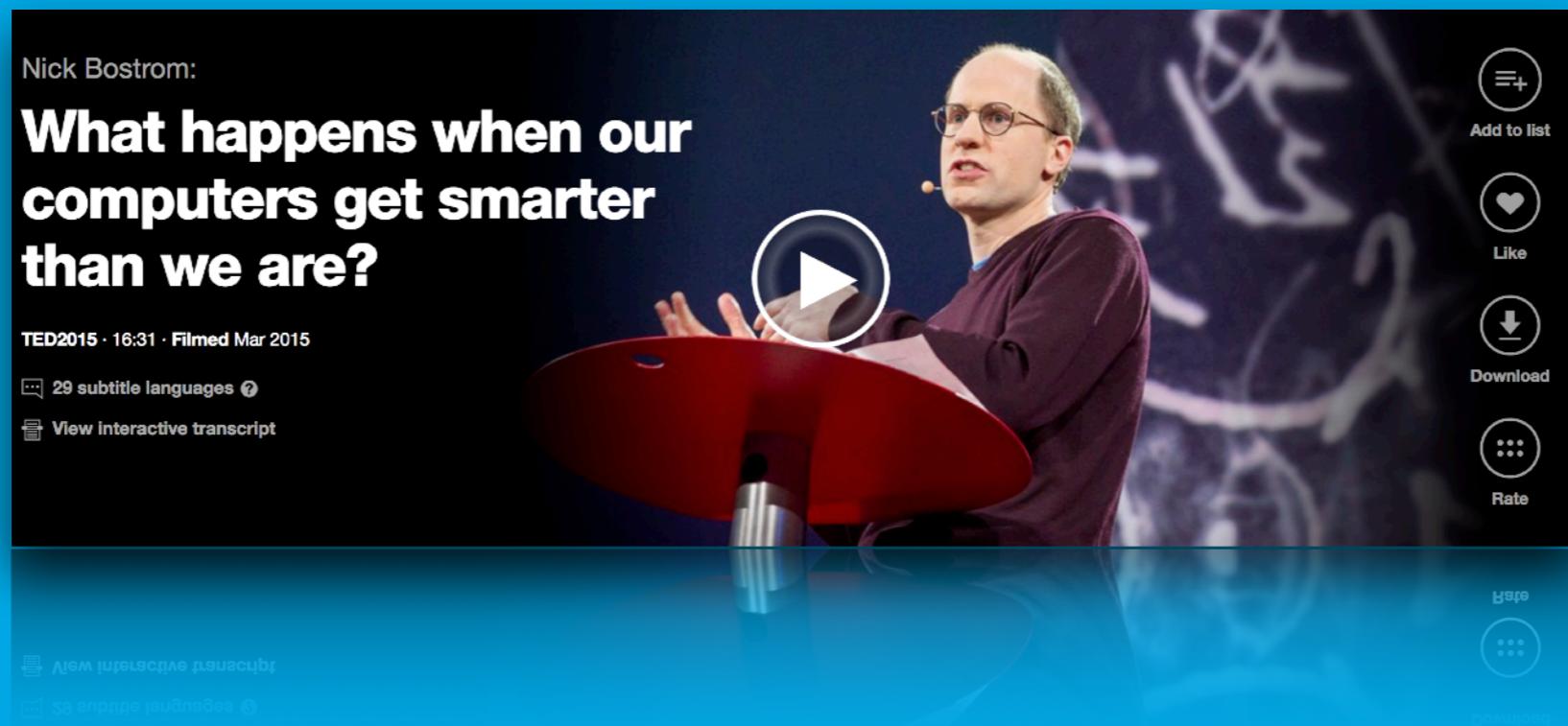
"There are things in this book that could mess with your head."

—VERNOR VINGE, computer scientist;
essayist, "The Coming Technological Singularity"

SINGULARITY RISING

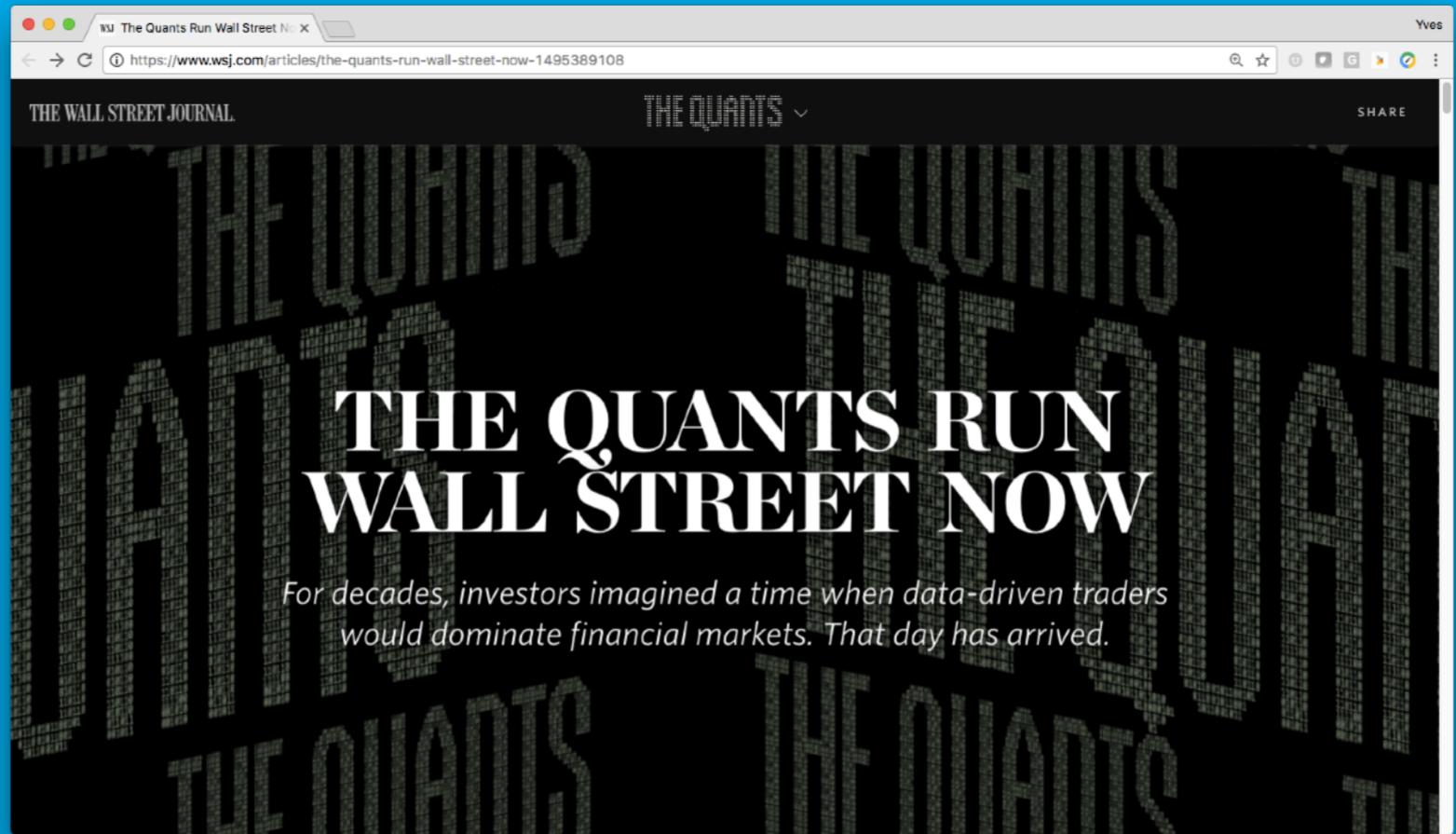
in a Smarter,
Dangerous World

Brave New
Worlds in
the Future



“Vast increases in biological and machine intelligences will create what’s being called the Singularity—a threshold of time at which AIs that are at least as smart as humans, and/or augmented human intelligence, radically remake civilization.”

James Miller (2012): Singularity Rising. BenBella Books.



“Financial singularity is the point at which all investment decisions are made by intelligent machines rather than human agents. ... When all human fallibility is eliminated from markets, efficient markets, which have only existed so far in theory, could become a reality.”

Read more: Financial Singularity Definition | Investopedia
<http://www.investopedia.com/terms/f/financial-singularity.asp>

Google.ai

Bringing the benefits of AI to everyone

Our mission is to organize the world's information in ways that are useful, and AI is enabling us to do that in increasingly more areas, from our users, our customers, and the world.

AI makes it easier for you to do things every day – from getting news you care about, to communicating with friends and family, to using a personal digital assistant. But it's also providing new opportunities for companies and helping transform how we work and live. And most importantly, AI is making sure that everyone can access it.

Cloud TPUs

Google's second-generation Tensor Processing Unit is coming to Cloud

[SIGN UP TO LEARN MORE](#)

Training state-of-the-art machine learning models requires an enormous amount of computation, and researchers, engineers, and data scientists often wait weeks for results. To solve this problem, we've designed an all-new ML accelerator from scratch – a second-generation TPU, or Tensor Processing Unit – that can accelerate both training and running ML models.

Each device delivers up to 180 teraflops of floating-point performance, and these new TPUs are designed to be connected into even larger systems. A 64-TPU pod can apply up to 11.5 petaflops of computation to a single ML training task.

We're extremely excited about these new TPUs, and we want to share this technology with the world so that everyone can access their benefits. That's why we're bringing our second-generation TPUs to Google Cloud for the first time as Cloud TPUs on GCE, the Google Compute Engine. You'll be able to mix-and-match Cloud TPUs with Skylake CPUs, NVIDIA GPUs, and all of the rest of our infrastructure and services to build and optimize the perfect machine learning system for your needs. Best of all, Cloud TPUs are easy to program via TensorFlow, the most popular open-source machine learning framework.

Style

“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

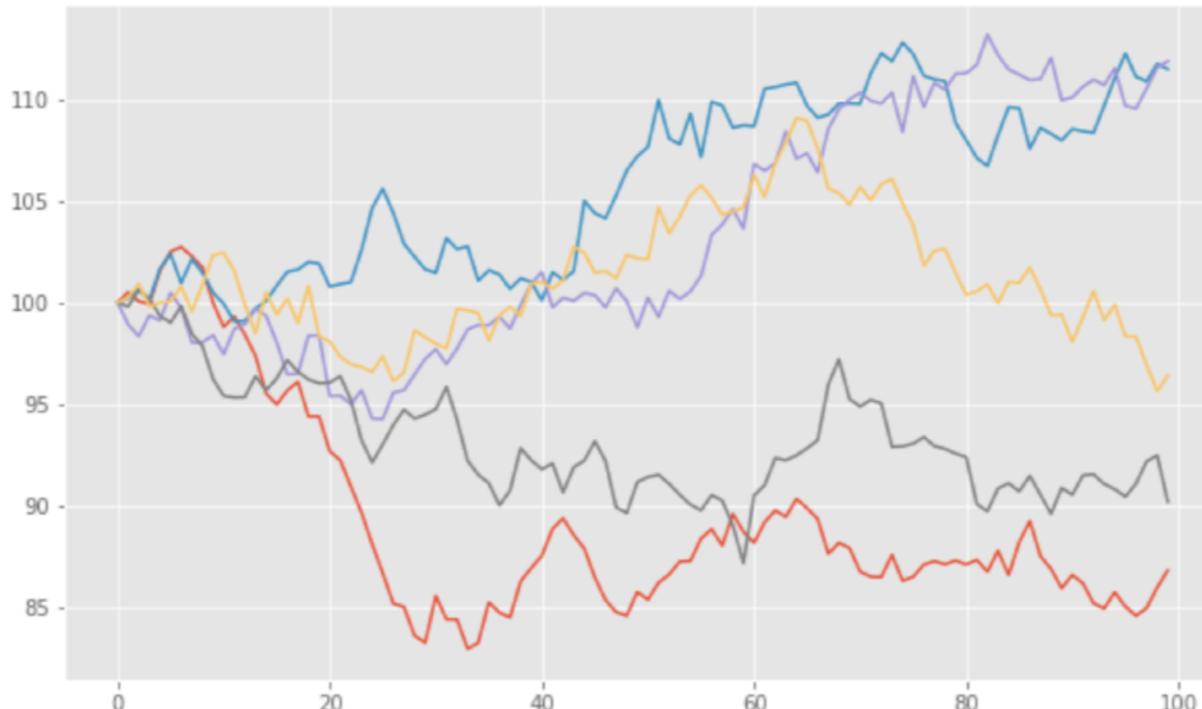
“Dataism says that the universe consists of data flows, and the value of any phenomenon or entity is determined by its contribution to data processing. ... Dataism thereby collapses the barrier between animals [humans] and machines, and expects electronic algorithms to eventually decipher and outperform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

*Yuval Noah Harari (*Homo Deus*)*

Interactive Style as a Major Element

“Making mistakes together.”

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

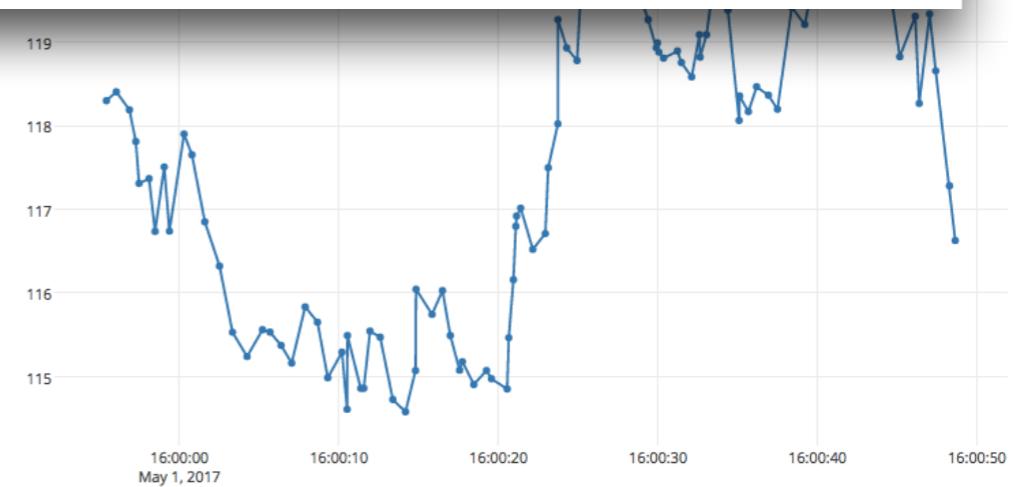


Black-Scholes difference equation for static economy:

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

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 23:51:46.315111 AAPL 106.55017297488794
2017-05-01 23:51:47.040770 AAPL 105.97708319698597
2017-05-01 23:51:48.036525 AAPL 106.00856053822193
2017-05-01 23:51:48.348464 AAPL 105.37221723045396
2017-05-01 23:51:48.974186 AAPL 105.09251644774177
2017-05-01 23:51:49.019263 AAPL 104.9267694947986
2017-05-01 23:51:49.954823 AAPL 105.03306681222703
2017-05-01 23:51:50.465716 AAPL 105.1223727550806
2017-05-01 23:51:50.972619 AAPL 105.29880694705703
2017-05-01 23:51:51.609747 AAPL 105.438670667864
2017-05-01 23:51:52.160840 AAPL 105.60426198517378
2017-05-01 23:51:52.886747
```



Skill-based Training Approach

From Anders Ericsson (2016): Peak — Secrets from the New Science of Expertise.
The Booley Head, London.

“When you look at how people are trained in the professional and business worlds, you find a tendency to focus on knowledge at the expense of skills.”

“... I believe the best approach will be to develop skills-based training programs that will supplement or completely replace the knowledge-based approaches that are the norm now in many places. The strategy acknowledges that because what is ultimately most important is what people are to do, training should focus on doing rather than on knowing.”

Skill-based Training Approach

From Anders Ericsson (2016): Peak — Secrets from the New Science of Expertise.
The Booley Head, London.

Ericsson defines **purposeful practice** as follows:

1. it has well-defined, specific **goals**
2. it is about putting a bunch of **baby steps** together to reach a longer-term goal
3. it is **focused**, it avoids any distraction
4. it involves **feedback** to see how you are doing
5. it pushes you (slightly) **out of your comfort zone**
6. it allows you to maintain your **motivation**

Offer

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2,245 EUR

<http://training.tpq.io/algopay.html>

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The Python Quants GmbH

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