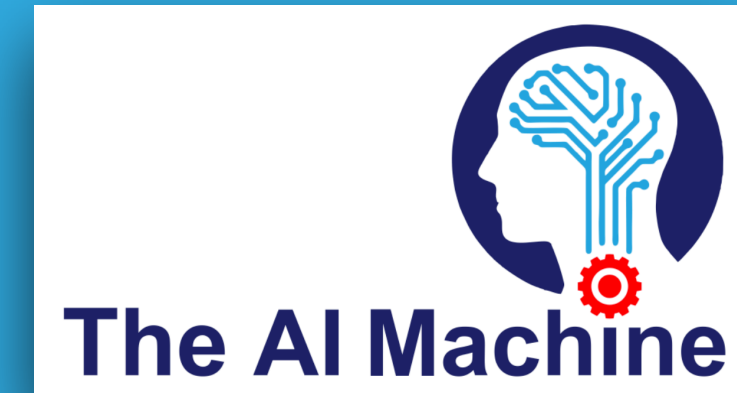


AI-Powered Algorithmic Trading with Python

Half-Day Training at ODSC London 2022

Dr. Yves J. Hilpisch



You find the Gist with the resources under

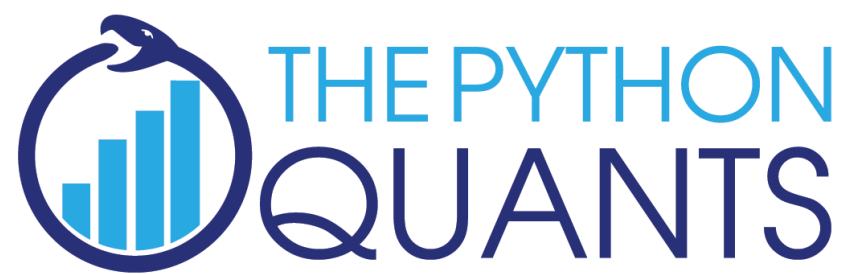
https://bit.ly/odsc_ldn_2022

(will be updated during the session)

Agenda

- Introduction
- Data-Driven Finance
- The Medium Article
- Trading Platform
- Case Study: Momentum
- Case Study: AI Strategy
- Case Study: Deployment
- The AI Machine

Introduction



SERVICES

for financial institutions globally



EVENTS

for Python quants & algorithmic traders



TRAINING

about Python for finance
& algorithmic trading



CERTIFICATION

in cooperation with university



BOOKS

about Python and
finance



PLATFORM

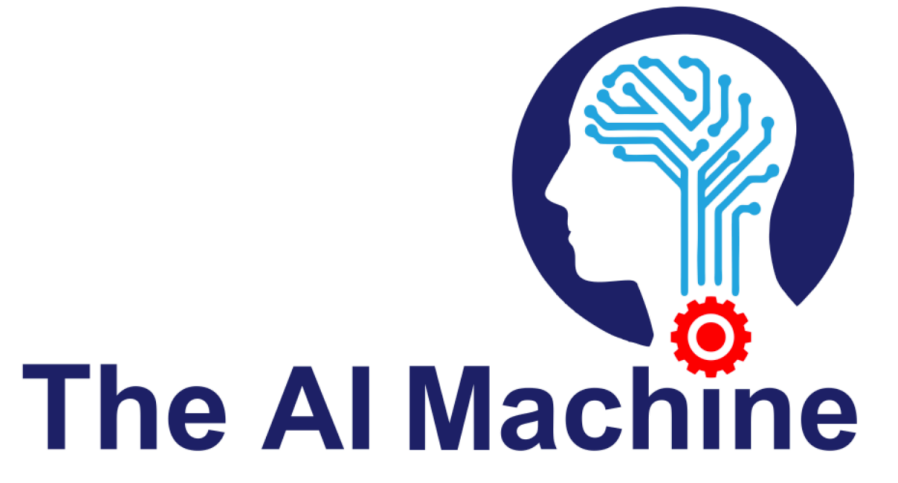
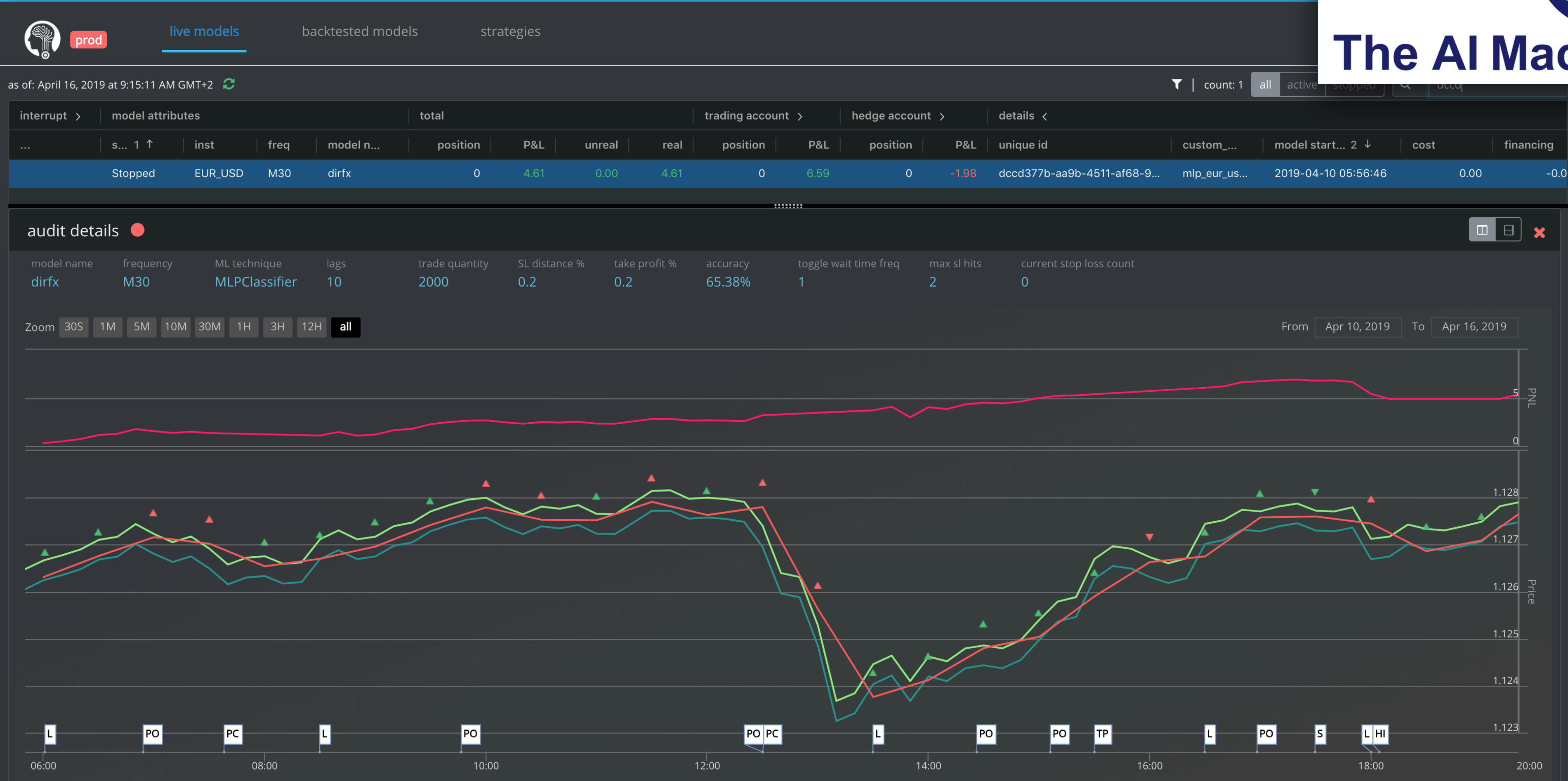
for browser-based
data analytics



OPEN SOURCE

Python library
for financial analytics





Dr. Yves J. Hilpisch is founder and CEO of **The Python Quants** (<http://tpq.io>), a group focusing on the use of open source technologies for financial data science, artificial intelligence, algorithmic trading, and computational finance. He is also the founder and CEO of **The AI Machine** (<http://aimachine.io>), a company focused on AI-powered algorithmic trading based on a proprietary strategy execution platform.

Yves has a Diploma in Business Administration, a Ph.D. in Mathematical Finance and is Adjunct Professor for Computational Finance.

Yves is the author of six books (<https://home.tpq.io/books>):

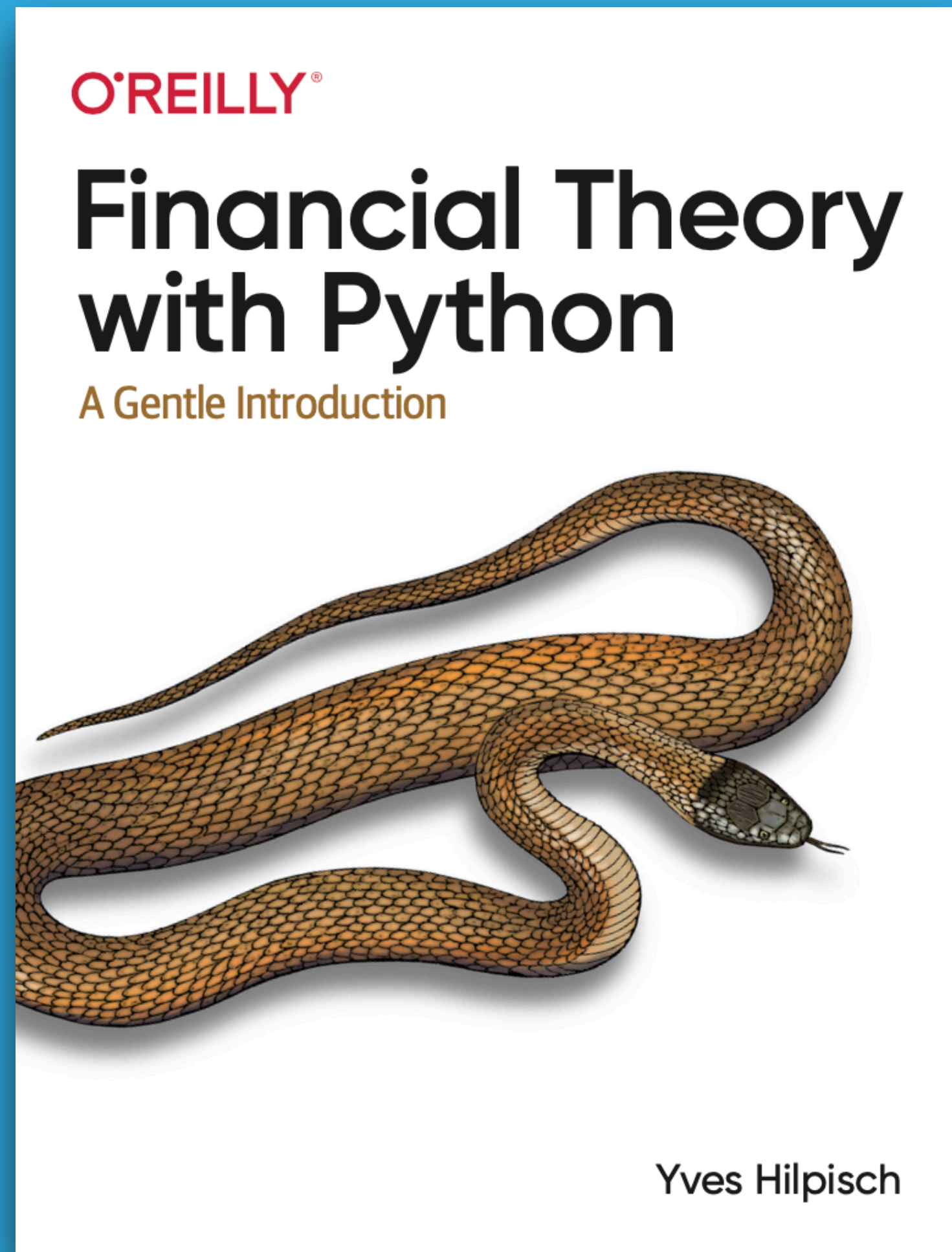
- * Financial Theory with Python (2021, O'Reilly)
- * Artificial Intelligence in Finance (2020, O'Reilly)
- * Python for Algorithmic Trading (2020, O'Reilly)
- * Python for Finance (2018, 2nd ed., O'Reilly)
- * Listed Volatility and Variance Derivatives (2017, Wiley Finance)
- * Derivatives Analytics with Python (2015, Wiley Finance)



Yves is the director of the first online training program leading to **University Certificates in Python for Algorithmic Trading** (<https://home.tpq.io/certificates/pyalgo>) and **Computational Finance** (<https://home.tpq.io/certificates/compfin>). He also lectures on computational finance, machine learning, and algorithmic trading at the **CQF Program** (<http://cqf.com>).

Yves is the originator of the financial analytics library **DX Analytics** (<http://dx-analytics.com>) and organizes Meetup group **events, conferences, and bootcamps** about Python, artificial intelligence and algorithmic trading in London (<http://pqf.tpq.io>), New York (<http://aifat.tpq.io>), Frankfurt, Berlin, and Paris. He has given **keynote speeches** at technology conferences in the United States, Europe, and Asia.

Financial Theory with Python – A Gentle Introduction



Finance with Python and Python environments

Basic Finance Concepts and Models:

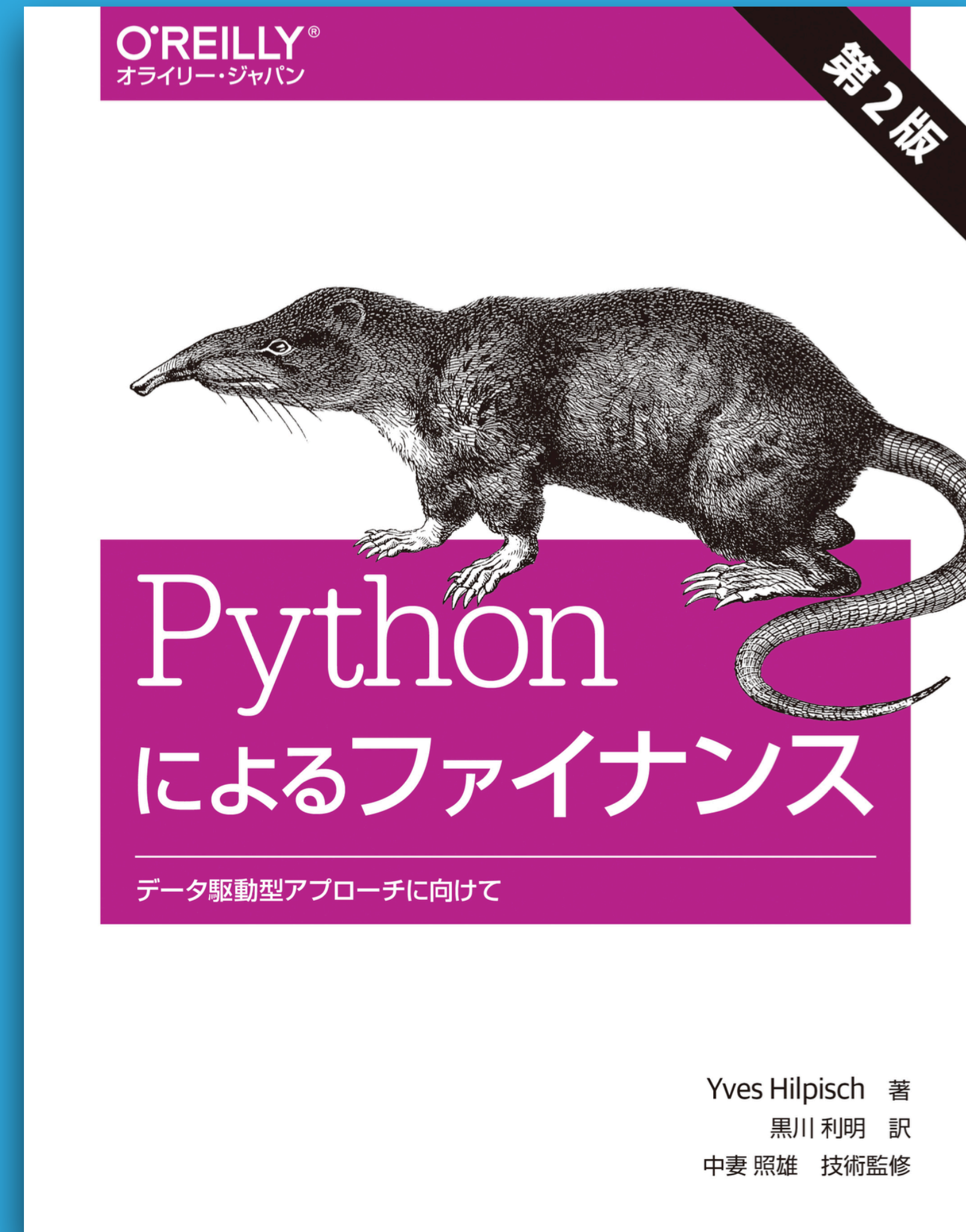
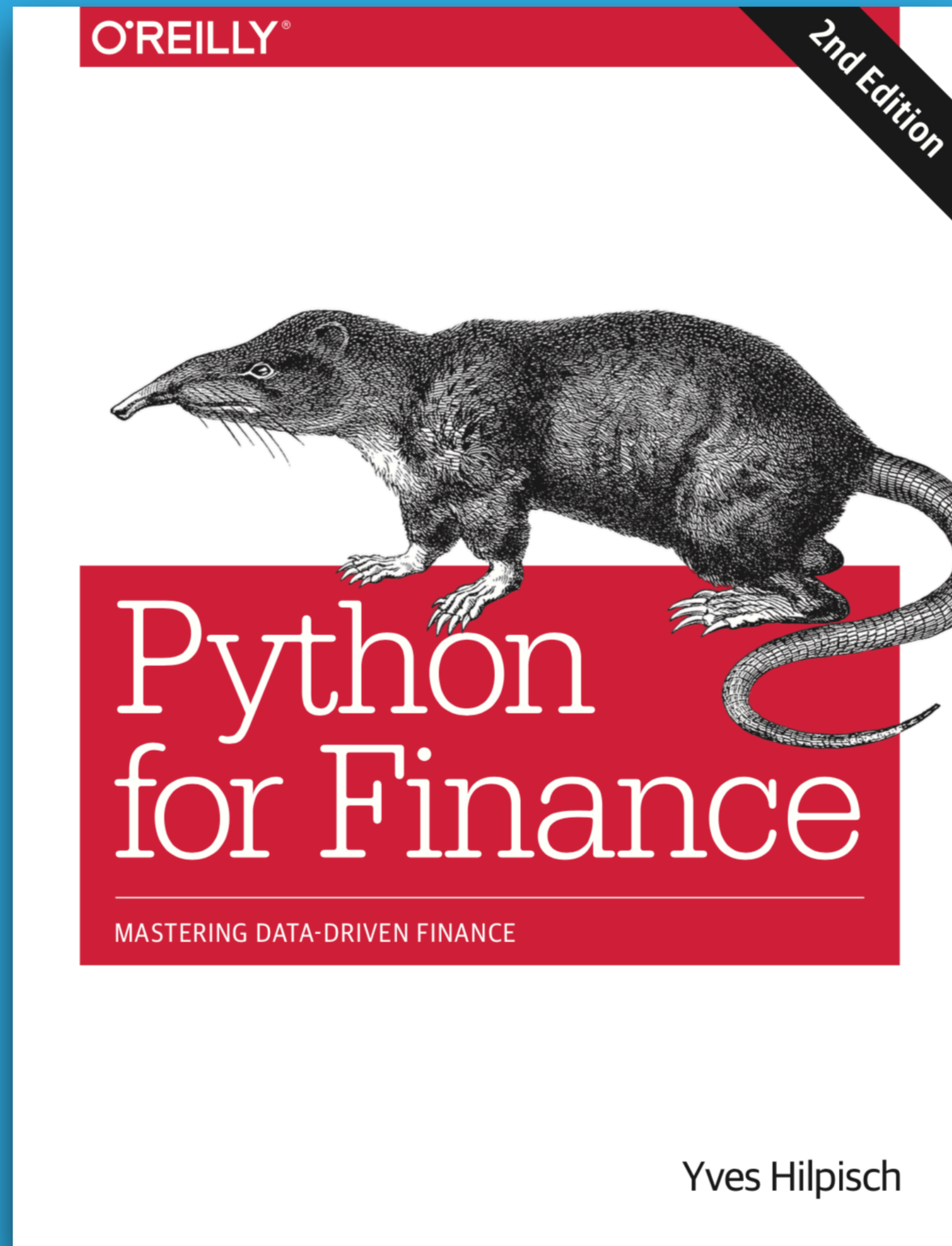
- Risk–Return
- Pricing of Instruments
- Expected Utility Theory
- Mean–Variance Portfolio Theory
- Capital Asset Pricing Model
- Portfolio Optimization

Basic Python Concepts and Packages:

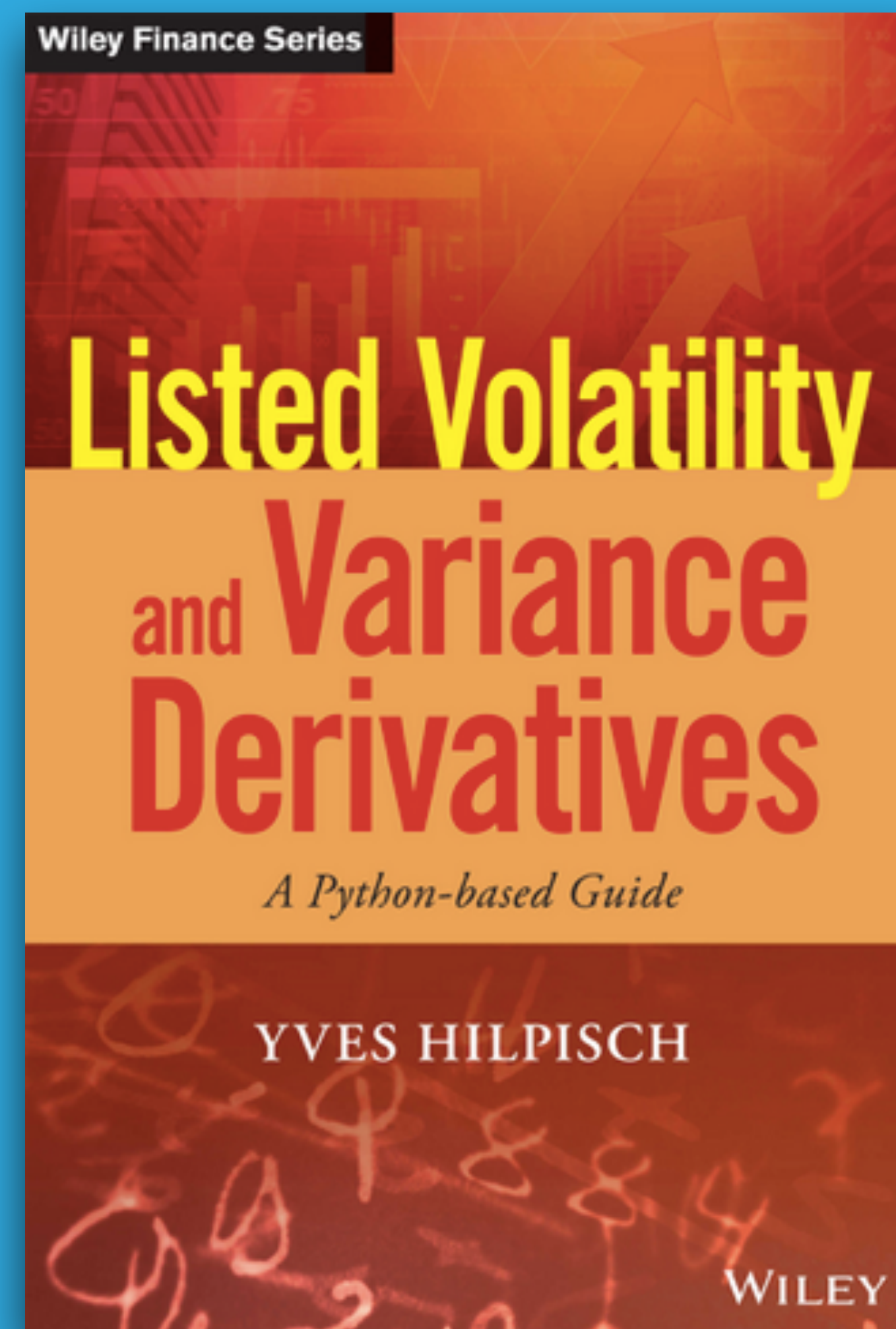
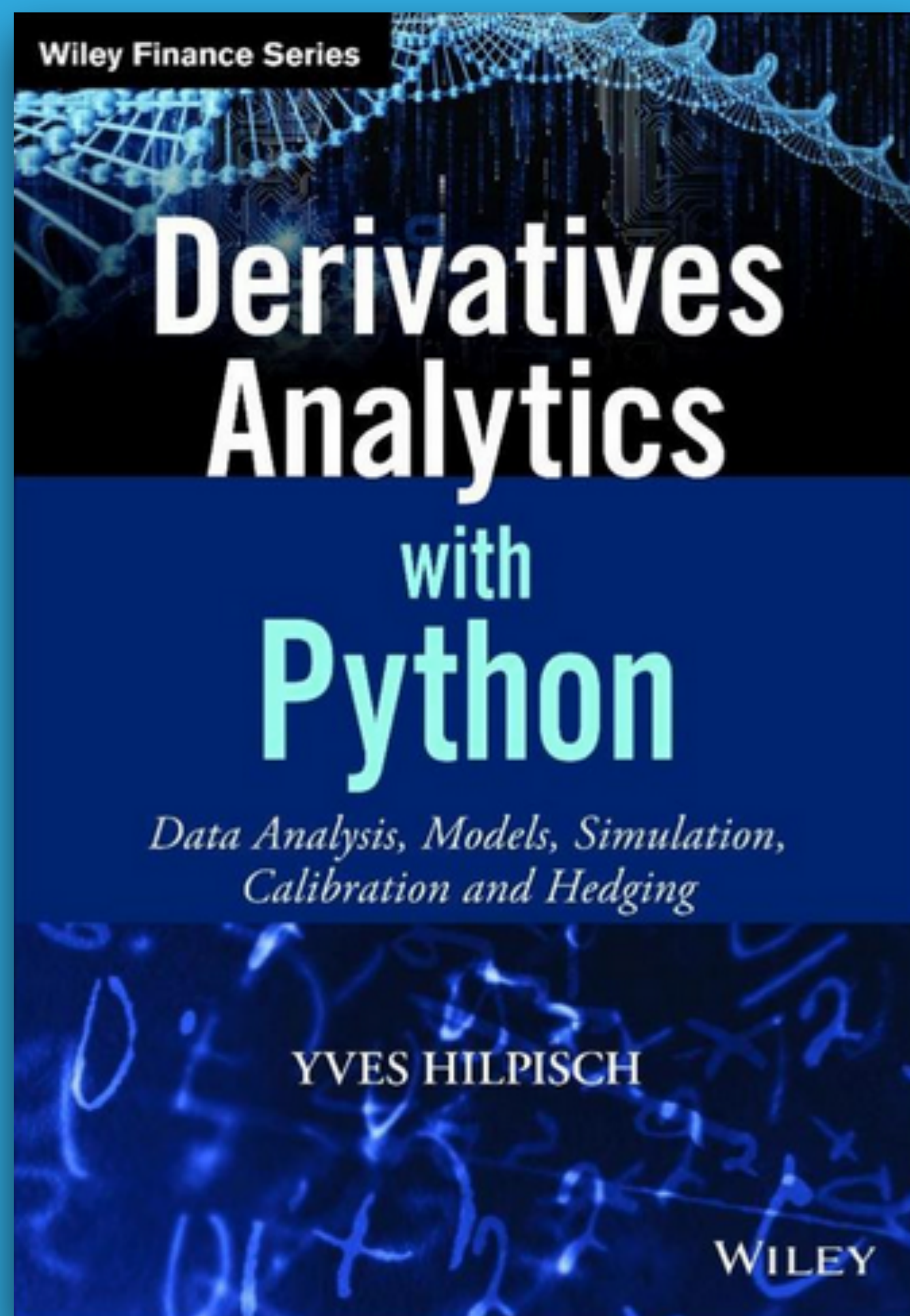
- Major Python Idioms
- NumPy Package
- SciPy & SymPy Packages

Yves Hilpisch

Python for Finance



Quant Finance with Python

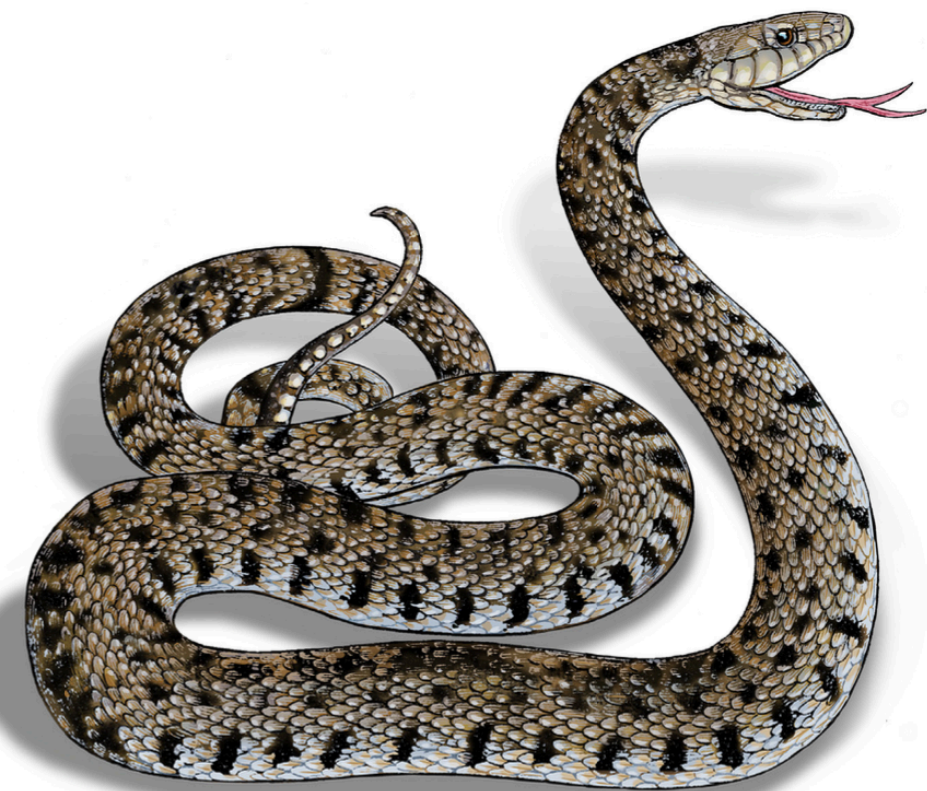


Python & AI for Finance & Trading

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Python for Algorithmic Trading

From Idea to Cloud Deployment

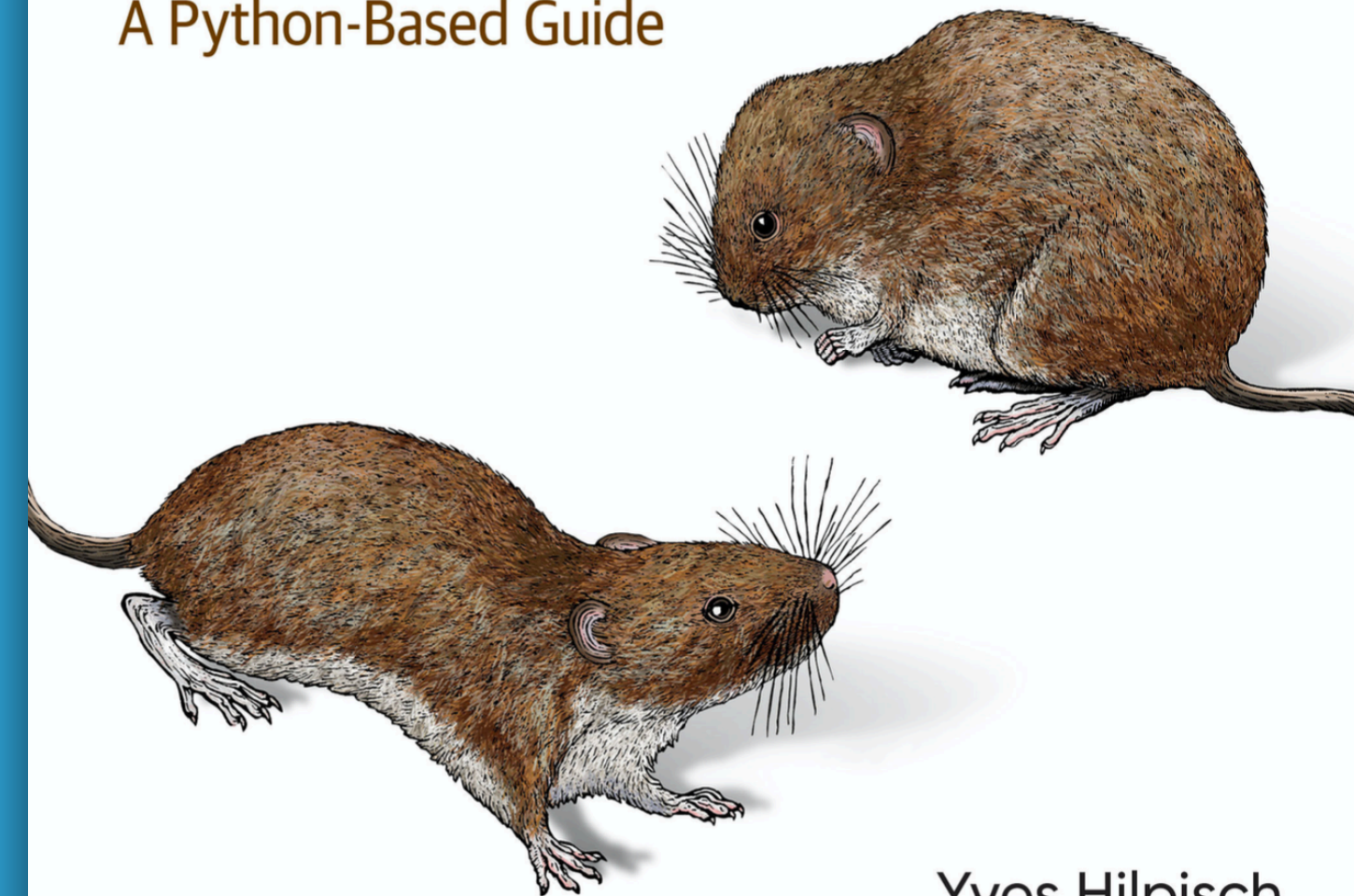


Yves Hilpisch

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Artificial Intelligence in Finance

A Python-Based Guide



Yves Hilpisch

<http://books.tpq.io>

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オライリー・ジャパン

Pythonからはじめる アルゴリズムトレード

自動売買の基礎と機械学習の本格導入に向けた
Pythonプログラミング



Yves Hilpisch 著
村上 振一郎 訳

YVES HILPISCH

Trading con Python



Creare algoritmi
per la compravendita
e l'analisi di mercato

APQEO

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Python 演算法交易

從創意發想到雲端部署



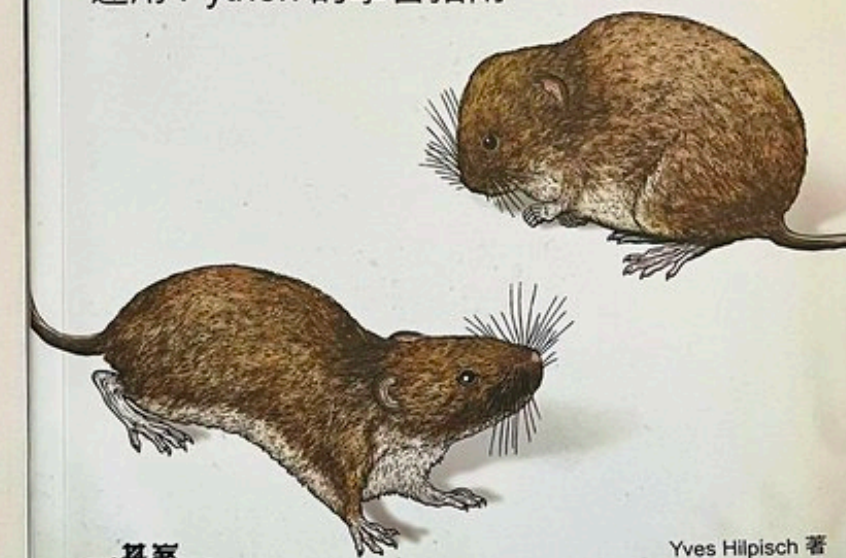
碁峯

Yves Hilpisch 著
藍子軒 譯

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金融AI 人工智慧的金融應用

運用 Python 的學習指南



碁峯

Yves Hilpisch 著
陳仁和 譯

YVES HILPISCH

Trading con Python



Creare algoritmi
per la compravendita
e l'analisi di mercato

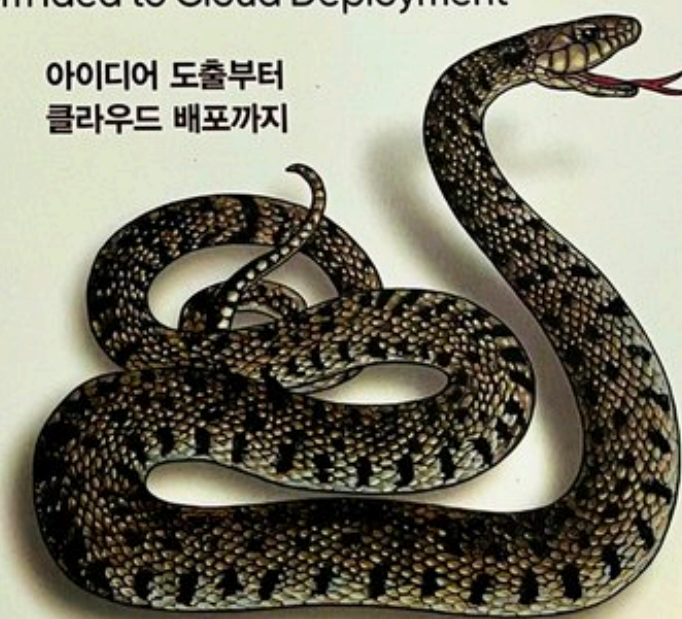
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파이썬을 이용한 알고리즘 트레이딩

Python for Algorithmic Trading
From Idea to Cloud Deployment

아이디어 도출부터
클라우드 배포까지



이브스 힐피쉬 지음
박진수 옮김

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~ \$

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and growing.

Webinar series
“Reinforcement Learning
in Finance”

https://bit.ly/quants_dev

Data-Driven Finance

Financial Times

ft.com

FTSE 100 -0.01% S&P 500 -0.00% Euro/Dollar +0.04% Pound/Dollar +0.25% Brent Crude Oil +0.96% 10 Year US Gov +2.50%

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Portfolio Settings & Account

US-China relations

Biden urges Xi not to allow competition to ‘veer into conflict’

Leaders hold first virtual meeting as ties between US and China fray over Taiwan

UPDATED 43 MINUTES AGO

Biden and Xi to tackle Taiwan and nuclear build-up in virtual meeting

Australia vows to help US defend Taiwan from Chinese attacks

Joe Biden and Xi Jinping to hold virtual summit on Monday

The Big Read

Investors pivot to India after China’s tech crackdown

4 HOURS AGO

Feedback

J.P.M

SuperReturn International

About WSJ

29808.12 0.11% ▲ U.S. 10 Yr 1/32 Yield 1.616% ▲ Crude Oil 81.53 0.80% ▲ Euro 1.1373 0.05% ▲ DJIA 36087.45 0.04% ▼

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FUTURES

1D

5D

3M

6M

1Y

DJIA 36087.45 -12.86 -0.04%

S&P 500 4682.80 -0.05 -0.00%

Nasdaq 15853.85 -7.11 -0.04%

Russell 2000 2400.93 -10.84 -0.45%

DJ Total Mkt 48582.45 -17.28 -0.04%

View Watchlist

View All Market Data →

OPINION

America Will Be Number One—in Taxes

By The Editorial Board | Review & Outlook

Beto O’Rourke Announces Bid for Texas Governor

4 min read

Kyle Rittenhouse Homicide Trial Wraps Up

5 min read

America’s Infrastructure Struggles With New Weather Forecast

Historically anomalous heat and rain have overwhelmed systems designed to withstand old meteorological patterns, and climatologists expect still worse with climate change. “We’ve never seen destruction like this before.”

523 Long read

Shell to Move Headquarters to London Amid

Virtual Meeting

The White House said the U.S. and Chinese presidents discussed a variety of topics including Afghanistan, North Korea and Iran, as well as human rights, climate change and concerns over Taiwan. 492 7 min read

How U.S. Plays Catch-Up on China’s Push for Influence

President Signs Infrastructure Bill Into Law

The passage of the \$1 trillion bill to repair roads and bridges, upgrade the electrical grid and expand access to broadband internet marks a rare bipartisan policy win for the White House. 6 min read

What’s in the Bill? From Amtrak to Roads to Water Systems

APPLIB

MARKETSCOMPANYNEWSCHARTINGPORTFOLIOS & MONITORSSEARCH TOOLS

AAPL.OQ

APPLE INC

United States | NASDAQ Stock Exchange Global Select Market | Phones & Handheld Devices

OverviewNews & ResearchPrice & ChartsEstimatesFinancialsESGEventOwnership

BUSINESS SUMMARY >

Apple Inc. designs, manufactures and markets smartphones, personal computers, tablets, wearables and acc...

Apple Inc. designs, manufactures and markets smartphones, personal computers, tablets, wearables and acc...

NEWS >

16-Nov-2021

08:51:09Refinitiv Newscasts - Evidence of Belarus providing migrants tourist visas

05:40:45S. Korea's new law on in-app payment is 'monumental': CAF chief

04:00:00KILL Singtel in Partnership with Apple Inc, Selects Nextech AR Solutions To Showcase Augme

01:48:19Apple Pty Ltd. - "Disney Melee Mania" coming this December exclusively on Apple Arcade

01:10:00iPhone Black Friday Deals 2021: Best Early Apple iPhone Sales Reported by The Consumer P

00:29:52UPDATE 1-Buffett's Berkshire cuts U.S. drugmaker stakes, invests in drug royalty company

15-Nov-2021

23:52:47EXCLUSIVE-Engine No. 1 partner leaves hedge fund after successful challenge of Exxon

23:39:51Jamf Announces Upcoming Conference Participation

23:27:41Black Friday 2021 deals at Best Buy are here, with huge savings on Samsung, Apple and mor

23:12:15How to connect any AirPods to your iPhone

EVENTS >

UPCOMING

18-Nov-2021

NTS

AAPL34.SA Final Cash Dividend of gross BRL 0.123473 paid on Nov 18, 2021 going

19-Nov-2021

NTS

AAPL.NLB Final Cash Dividend of gross CAD 0.033913 paid on Nov 19, 2021 going e

APPLIB

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AAPL.O

APPLE INC

United States | NASDAQ Global Select Consolidated | Phones & Handheld Devices

OverviewNews & ResearchPrice & ChartsEstimatesFinancialsESGEventOwnershipDebt & CreditPeers & ValuationDerivativesFilings

PRICE PERFORMANCE >

Open

Prev. Close

Bid / Ask

VWAP

Turnover

Volume

Short Interest

YTD

Beta (5Y Monthly)

Mkt Cap - Default

PE (LTM)

Div Yield

DR

DR Type

DR Bank

Free Float

Asset Ty...

Ordinary Share

5 yr CDS

Outstanding

Share Class

IPO Date

Lot Size

123.08

123.24 / 123.35

13,358

0.500%

67.66%

1.272

2.093T

37.676

0.666%

BRL AAPL34.SA (1:0.1)

--

--

16.99B

Asset Ty...

Ordinary Share

5 yr CDS

28.35 bps

17.00B

Share Class

12-Dec-1980

100

123.13

123.24 / 123.35

13,358

0.500%

67.66%

1.272

2.093T

37.676

0.666%

BRL AAPL34.SA (1:0.1)

--

--

16.99B

Asset Ty...

Ordinary Share

5 yr CDS

28.35 bps

17.00B

Share Class

12-Dec-1980

100

52Wk: 53.153

23-Mar

137.980

02-Sep

Next Earn Report: 26-Jan-2021

RECOMMENDATIONS >

Mean

Analysts Per Level

AAPL

Strong Buy

Buy

Hold

Sell

Strong Sell

Price Target (Mean)

USD 125.92

Upside

2%

11

19

8

1

1

2%

STARLINE MODELS >

Bullish

Bearish

Price Momentum

Analyst Revisions

Smart Holdings

Short Interest

Earnings Quality

Credit Risk - Combined

Credit Risk - Smart Ratios

Credit Risk - Structural

Credit Risk - Text Mining

Combined Alpha Model

97

79

77

95

95

96

92

88

85

72

RELATIVE VALUATION >

Global Rank

Trailing 12 Months

Next 12 Months

PE

EV/EBITDA

Div Yield

EV/Sales

P/CF

P/B

32

24

31

18

31

2

ESTIMATES >

Guidance

Summary

QTR Dec-2020

FY Sep-2021

EPS

Rev

Mean Estimate

Smart Estimate

Predicted Surprise

Mean Chg %

1.39

102.00B

3.96

315.25B

1.39

101.94B

3.95

314.43B

0.00%

-0.06%

-0.32%

-0.26%

0.62%

0.29%

0.95%

0.33%

NEWS >

NewsInvestor BriefsGlobal Press

03-Dec-2020

10:15:43BUSINESS Apple sued over old iPhones in Europe Tech giant i...

10:13:01《外企动向》苹果因旧款手机电池问题在欧洲多国面临诉讼

10:12:11《外企动向》蘋果因舊款手機電池問題在歐洲多國面臨訴訟

09:49:33USPTO ISSUES TRADEMARK: WORKS WITH APPLE IBEACON

09:16:24Analysts' Weekly Ratings Updates for Apple (AAPL)

09:11:02Analysts' Weekly Ratings Updates for Apple (AAPL)

09:00:25《A股焦點》歐菲光：被蘋果移出相機模塊供應鏈消息不屬實

08:59:39《A股焦點》歐菲光：被蘋果移出相機模塊供應鏈消息不屬實

07:13:26Dow Jones Selected Stocks 1710 - December 03

06:47:44RPT-Hong Kong-Le magnat Jimmy Lai détenu pour des accusa...

RESEARCH >

ContributorInternal

03-Dec-2020Equiti Global Arabic Smart ReportEquiti

02-Dec-2020Trefis Report: Apple - \$99.92 Trefis Price EstimateTrefis

02-Dec-2020Equiti Global Arabic Smart ReportEquiti

01-Dec-2020Comprehensive Technical and Fundamental Analysis...Stock Trade...

01-Dec-2020Equiti Global Arabic Smart ReportEquiti

30-Nov-2020Equiti Global Arabic Smart ReportEquiti

29-Nov-2020"The Economy Matters" Report for AAPL: the econo...MacroRisk ...

EVENTS >

UpcomingPast

26-Jan-2021

NTS

Q1 2021 Apple Inc Earnings Release

25-Feb-2021

18:00:00

Apple Inc Annual Shareholders Meeting

PEERS >

Company Name

Mkt Cap

% Chan...

Reven...

EBITD...

EV/ ...

Apple Inc

2.09T

1.97%

274.52B

28.17%

23.39

HP Inc

31.34B

1.97%

56.64B

8.40%

6.63

... to the Terminal ...

Tick Data

```
[4]: %%time
data = ek.get_timeseries('AAPL.O',
                        start_date='2021-11-15 15:00:00',
                        end_date='2021-11-15 15:30:00',
                        interval='tick',
                        fields=['*'])
```

CPU times: user 120 ms, sys: 14.5 ms, total: 135 ms
Wall time: 2.7 s

```
[5]: data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 41213 entries, 2021-11-15 15:00:00.004000 to 2021-11-15 15:29:59.936000
Data columns (total 2 columns):
#   Column  Non-Null Count  Dtype  
---  -
0   VALUE    41145 non-null    Float64
1   VOLUME    41213 non-null    Int64   
dtypes: Float64(1), Int64(1)
memory usage: 1.0 MB
```

```
[14]: data.tail()
```

```
[14]:
```

	AAPL.O	VALUE	VOLUME
	Date		
	2021-11-15 15:29:59.134	150.4456	10
	2021-11-15 15:29:59.313	150.445	1
	2021-11-15 15:29:59.588	150.4409	150
	2021-11-15 15:29:59.745	150.445	1
	2021-11-15 15:29:59.936	150.4488	5

... to powerful APIs.

Apple Event on 18. October 2021 (<https://www.apple.com/de/apple-events/october-2021/>).

```
[9]: headlines = ek.get_news_headlines(query='R:AAPL.0 macbook',  
                                       count=5,  
                                       date_from='2021-10-18',  
                                       date_to='2021-10-19')
```

```
[10]: headlines
```

```
[10]:
```

	versionCreated	text	storyId	sourceCode
2021-10-18 23:30:18.401	2021-10-18 23:30:18.401000+00:00	Apple is finally fixing the things people hate...	urn:newsml:reuters.com:20211018:nNRAh2psl1:1	NS:WASHPO
2021-10-18 23:10:18.012	2021-10-18 23:10:18.012000+00:00	Apple event – live: Macbook Pro and other new ...	urn:newsml:reuters.com:20211018:nNRAh2kj3a:1	NS:INDEPE
2021-10-18 21:41:19.927	2021-10-18 21:41:19.927000+00:00	New MacBook Pro features ultra-fast chips, ret...	urn:newsml:reuters.com:20211018:nNRAh2u38b:1	NS:EFEING
2021-10-18 21:33:50.860	2021-10-18 21:33:50.860000+00:00	Apple Event: MacBook Pro 2021 alleged pictures...	urn:newsml:reuters.com:20211018:nNRAh2u1wj:1	NS:TIMIND
2021-10-18 21:33:50.623	2021-10-18 21:33:50.623000+00:00	Apple launches new MacBook Pro: Price, specs a...	urn:newsml:reuters.com:20211018:nNRAh2u1vv:1	NS:TIMIND

... to powerful APIs.

```
[11]: story = headlines.iloc[0]
```

```
[12]: story
```

```
[12]: versionCreated      2021-10-18 23:30:18.401000+00:00  
      text               Apple is finally fixing the things people hate...  
      storyId            urn:newsml:reuters.com:20211018:nNRAh2psl1:1  
      sourceCode         NS:WASHPO  
      Name: 2021-10-18 23:30:18.401000, dtype: object
```

```
[13]: news_text = ek.get_news_story(story['storyId'])
```

```
[14]: from IPython.display import HTML
```

```
[15]: HTML(news_text)
```

```
[15]: The demise of MagSafe charging. An inelegant Touch Bar. Limited selection of ports. The laundry list of complaints about Apple's laptops has steadily grown over the past five years. Now, Apple is finally walking back those changes.
```

On Monday, the Cupertino, Calif., company unveiled a pair of new MacBook Pro laptops, powered by its latest homegrown processors and free of the many limitations that plagued earlier models. It also showed off a set of updated AirPods and colorful HomePod mini smart speakers. Riding high from record Mac sales last year, Apple made sure to make its new MacBooks the star of its virtual event Monday.

Still, computers that run Apple's MacOS software account for only a fraction of the overall PC landscape — just over 7 percent as of the end of the second quarter, according to market research firm IDC. Its market share has slipped from 8 percent in the first quarter and 7.6 percent a year earlier, IDC data showed. The changes on display Monday seem to be geared more toward

... to powerful APIs.

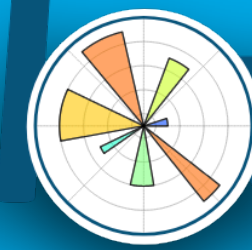


IP[y]:
IPython

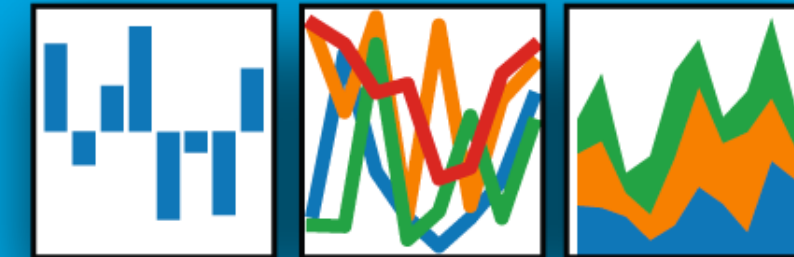


NumPy

matplotlib

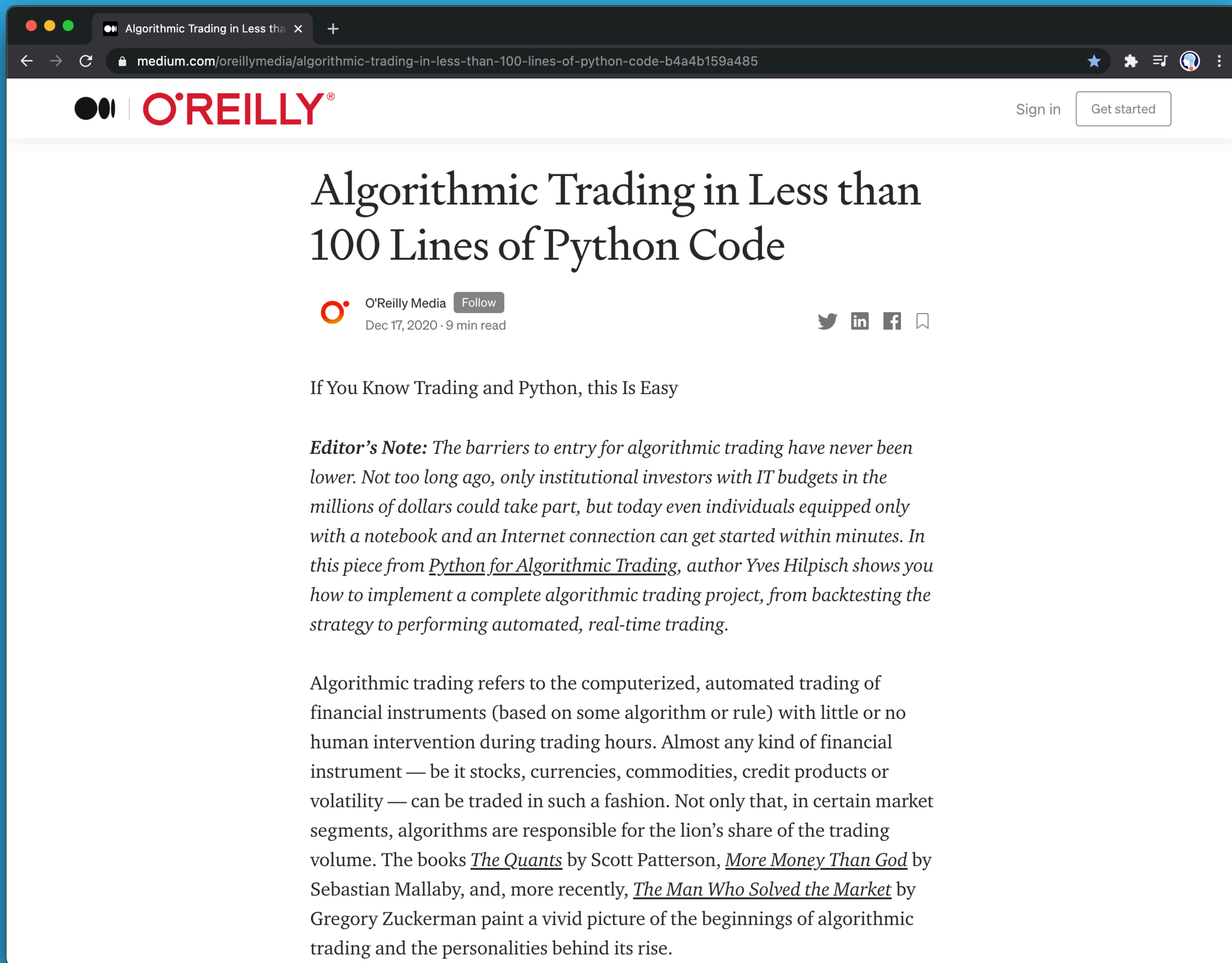


pandas
 $y_i t = \beta' x_{it} + \mu_i + \epsilon_{it}$



Keras

The Medium Article



FOREWORD BY NASSIM NICHOLAS TALEB

Player's overall advantage*	Player's advantage when the dealer's up card is										
	1*	2	3	4	5	6	7	8	9	10*	
—0021	—364	094	130	176	229	236	236	145	036	—040	—173
—0034	—393	095	130	177	230	239	239	145	036	—040	—173
—0038	—351	092	146	167	212	235	235	144	021	—104	—208
—0272	...	031	065	112	289	308	184	105	008	—174	—171
0142	—373	...	...	233	312	339	200	076	—022	—160	—169
0189	—371	126	195	315	...	...	...	...	...	—172	—172
0236	—374	126	195	315	...	...	...	...	...	—178	—178
0329	—369	179	240	289	196	215	142	038	—046	—166	—166
0187	—364	159	206	148	181	176	117	073	—030	—154	—154
0125	—356	131	050	259	310	31*	...	...	...	—170	—170
0005	—343	024	212	337	...	...	...	...	...	—014	—014
—0091	—346	176	284	...	...	...	...	...	...	...	...
—0215	—385	249	...	...	...	...	...	...	...	...	...
0189	—404	...	...	...	...	...	...	...	...	...	...
0394	...	...	...	...	...	...	...	...	...	...	...
0070	...	186	219	264	307	...	...	...	...	...	...

* If the dealer having a natural has been included in these figures.

You have ↓

Dealer shows →

19	2	3	4	5	6	7	8	9	10	A
18										2.3
17										2.3
16										3.3
15										3.3
14										3.3
13										3.3
12										3.3
11										3.3
10										3.3
9										3.3
8										3.3
7										3.3
6										3.3
5										3.3
4										3.3
3										3.3
2										3.3

Soft standing
Hard standing

Standing Numbers

$E = \frac{1}{2} M g L$ **NEW YORK TIMES BESTSELLER**

THE MAN WHO SOLVED THE MARKET

HOW JIM SIMONS

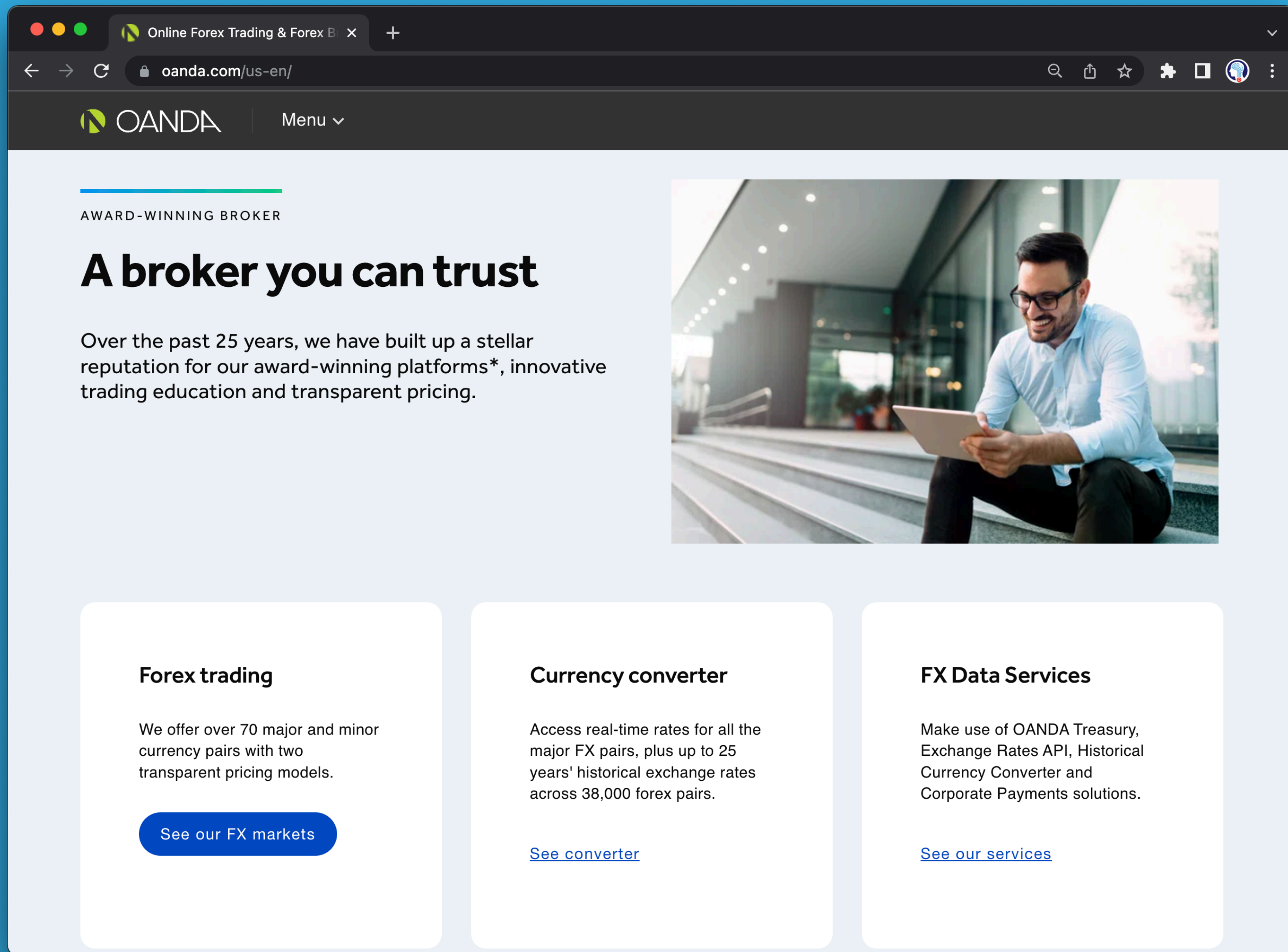
LAUNCHED THE QUANT

REVOLUTION

Gregory Zuckerman

Author of *THE GREATEST TRADE EVER*

Trading Platform



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Currency converter

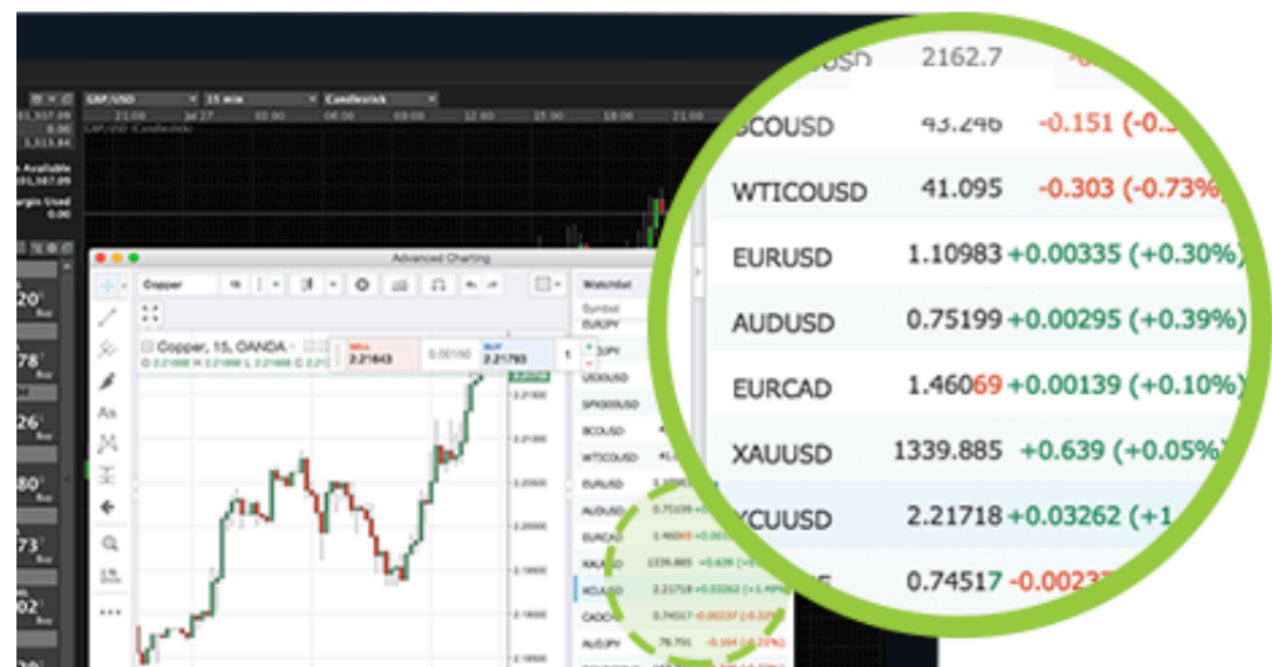
Access real-time rates for all the major FX pairs, plus up to 25 years' historical exchange rates across 38,000 forex pairs.

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Get unlimited, free access to your demo forex or CFD trading account and test trading strategies under real market conditions. Reset or adjust your 100,000-unit starting balance or profit/loss at any time, change your leverage, and use flexible trade sizes to test your comfort level.

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Oanda Trading Platform

```
pip install git+https://github.com/yhilpisch/tpqoa.git
```

oanda.cfg (configuration file)

```
[oanda]  
access_token = c71f59_YOURACCESSTOKEN_13da5b8f60fac1397232  
account_id = 101-004-YOURID-001  
account_type = practice
```

DISCLAIMER

All the content, Python code, Jupyter Notebooks and other materials (the “Material”) come without warranties or representations, to the extent permitted by applicable law.

None of the Material represents any kind of recommendation or investment advice.

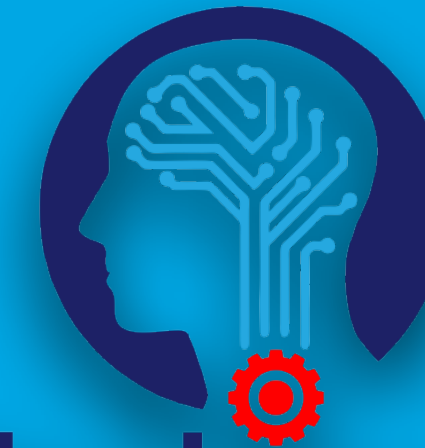
The Material is only meant as a technical illustration.

Leveraged and unleveraged trading of financial instruments, and of contracts for difference (CFDs) in particular, involves a number of risks (for example, losses in excess of deposits). Make sure to understand and manage these risks.

Case Studies

- Momentum Strategy
- AI-Powered Strategy
- Deployment of SMA Strategy

The AI Machine



The AI Machine

Prediction Engines

Technical Rules
Statistical Methods
Machine Learning
Deep Learning
Automated ML
...

Deployment & Execution

Data Streaming
Transaction Streaming
Position Management
Profit & Loss
Calculation
Visualization
Logging & Reporting
...

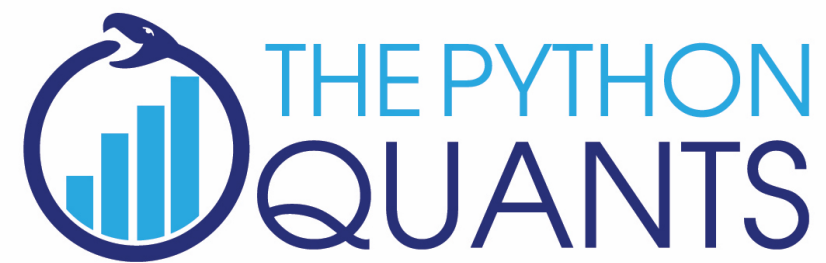
Decision Rules

Entry Rules
Stop Loss
Trailing Stop Loss
Dynamic Stop Loss
Take Profit
Position Sizing
Capital Allocation
...

The AI Machine

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