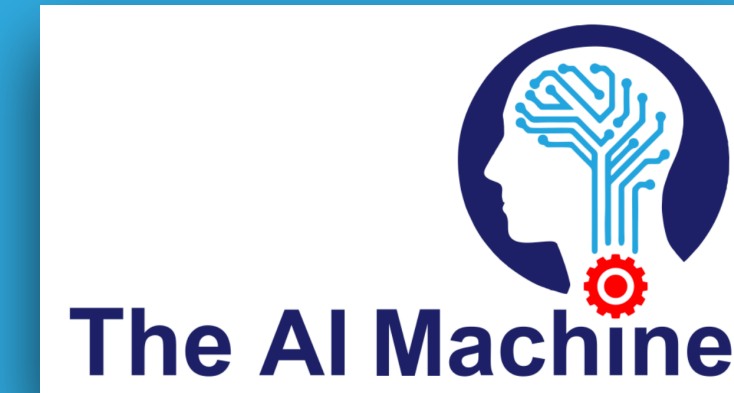


Algorithmic Trading in Less Than 100 Lines of Python Code

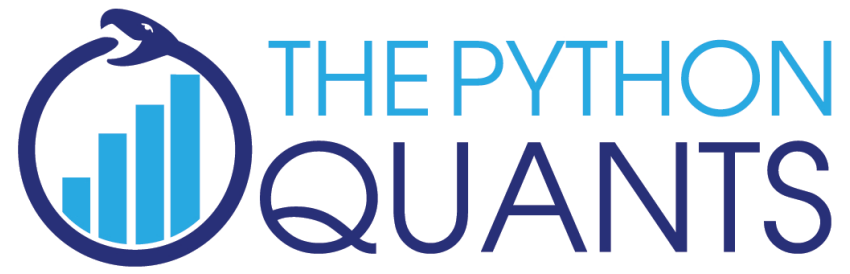
Dr. Yves J. Hilpisch



Agenda

- **Introduction**
- **Data-Driven Finance**
- **Case Study: Sentiment**
- **Trading Platform**
- **Trading Code**
- **The AI Machine**
- **Certificate Program**

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

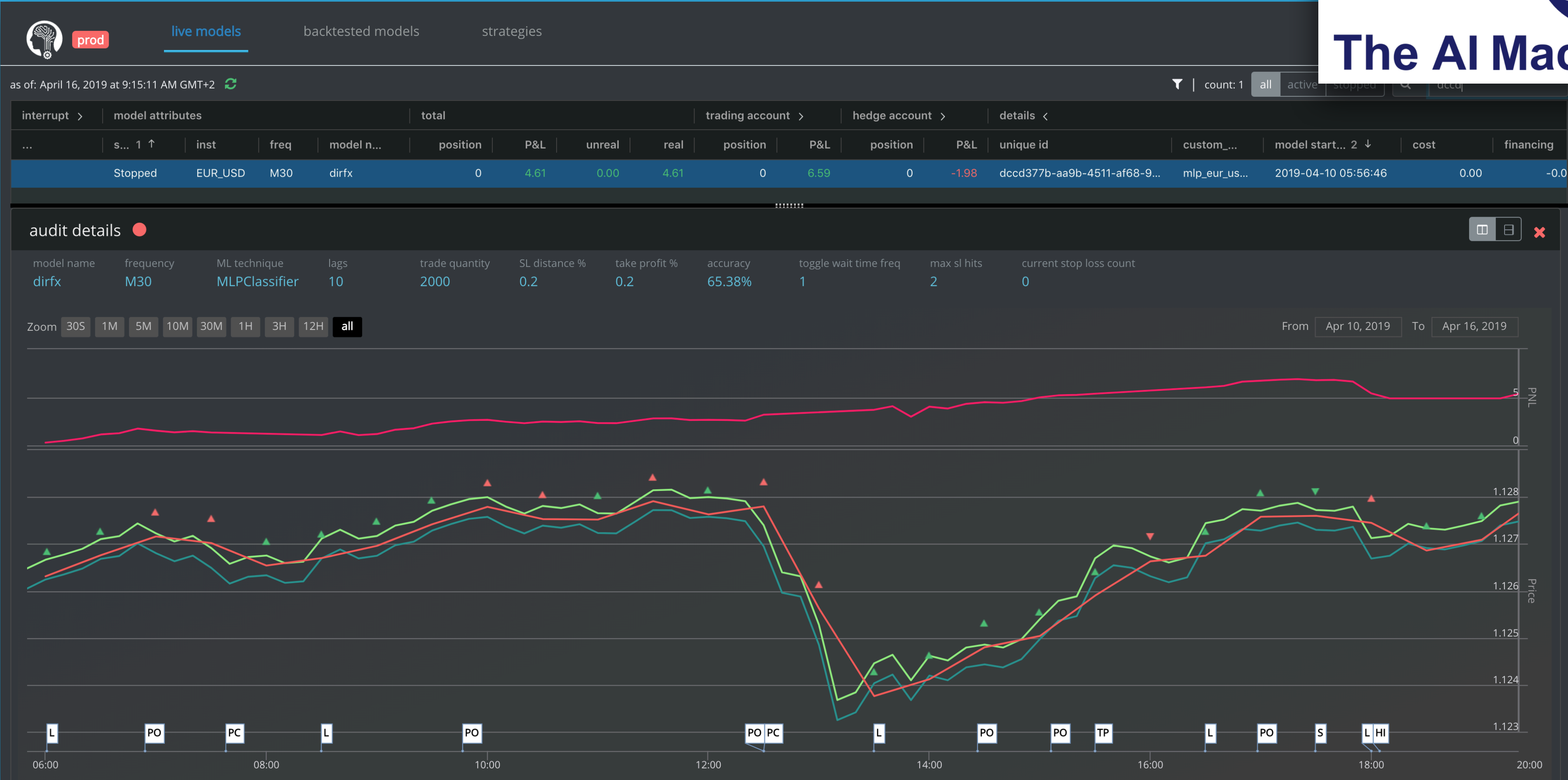


PLATFORM
for browser-based
data analytics



OPEN SOURCE
Python library
for financial analytics







recognized by **Capital Markets**
CIO magazine as
Outlook

TOP 10
ALGO TRADING
SOLUTION PROVIDERS - 2019

*An annual listing of 10 companies that are at the forefront
of providing Algo Trading solutions*

http://certificate.tpq.io/tpq_top_algo_2019.pdf

Capital Markets
CIO **TOP 10**
Outlook **ALGO TRADING**
SOLUTION PROVIDERS - 2019

The Python Quants First University Certificate in Python for Algorithmic Trading

Python programming has become a key skill in the financial industry. In areas such as financial data science, computational finance or algorithmic trading, Python has established itself as the primary technological platform. At the same time, the level of Python sophistication the industry is expecting from its employees and applicants is increasing steadily. The Python Quants Group is one of the leading providers of Python for Finance training programs.

Among others, The Python Quants have tailored a comprehensive online training program leading to the first University Certificate in Python for Algorithmic Trading. Be it an ambitious student with intrigue for algorithmic trading, or a major financial institution, The Python Quants, through this systematic training program, is equipping delegates with requisite skills and tools to formulate, backtest and deploy algorithmic trading strategies based on Python.

The topics covered in the training programs offered by The Python Quants are generally not found in the typical curriculum of financial engineering or quantitative finance Master programs. Dr. Yves Hilpisch, the firm's founder and managing partner, explains, "There are courses out there that show students how to apply machine learning for the formulation and backtesting of algorithmic trading strategies. However, none of them explains the difficulties or the skills

required in deploying such algorithmic trading strategies in the real world. Besides providing an introductory course that teaches Python and financial concepts from scratch, we train our delegates and clients on how best to deploy algorithmic trading strategies in automated fashion in the cloud, with, among others, real-time risk management and monitoring," explains Hilpisch, an author of three books on

the topic, with "Python for Finance" (2nd ed., O'Reilly) being the standard reference in the field.

The organization's "Python for Algorithmic Trading University Certificate" consists of 200 hours of instruction, 1,200 pages of documentation and 1,000s of lines of Python code. In addition to offering both online and offline Python training, Hilpisch and his team also organize bespoke training events for financial institutions, hedge funds, banks, and asset management companies. "Most of the training is online since we have students and delegates from about 65 different countries in general. Most recently, we noticed that it's not just financial firms and students who want to deepen their algorithmic trading knowledge, but even professors of finance who want to get more involved in this popular topic," says Hilpisch.

While the Quant Platform is the most popular choice, especially for users in the financial sector who don't have access to a full-fledged, interactive, financial analytics environment, the team at The Python Quants is currently developing The AI Machine—a new platform which leverages artificial intelligence to formulate and deploy algorithmic trading strategies in a standardized manner. Hilpisch explains that it's relatively easy to write Python code for an algorithmic trading strategy, but the same can't be said about the deployment of such a strategy. "There are a few platforms out there that allow the formulation and backtesting of algorithmic trading strategies by the use of Python code. However, they usually stop exactly there. With The AI Machine, it is a single click on the 'GO LIVE' button and the strategy is deployed in real-time—without any changes to the strategy code itself," adds Hilpisch.

In 2019, The Python Quants will be introducing a new university certificate titled "Python for Computational Finance," which will focus more on original quantitative finance topics, such as option pricing, Monte Carlo simulation, and hedging. As financial institutions begin to perceive Python-based analytics as a prerequisite skill, the organization will continue to provide an "efficient and structured way of mastering all the tools and skills required in Python for Financial Data Science, Algorithmic Trading, and Computational Finance." **CM**



Dr. Yves Hilpisch

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>):

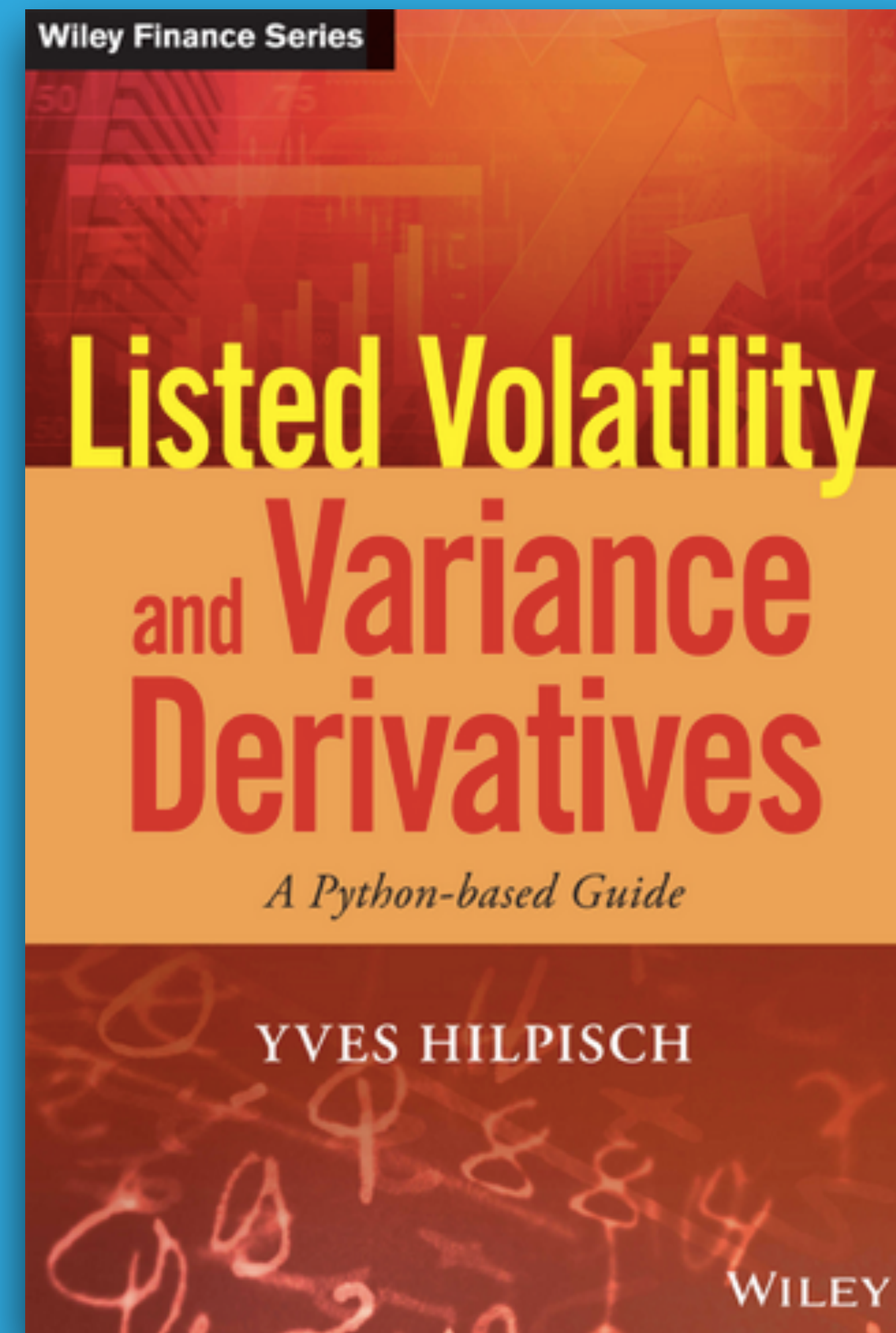
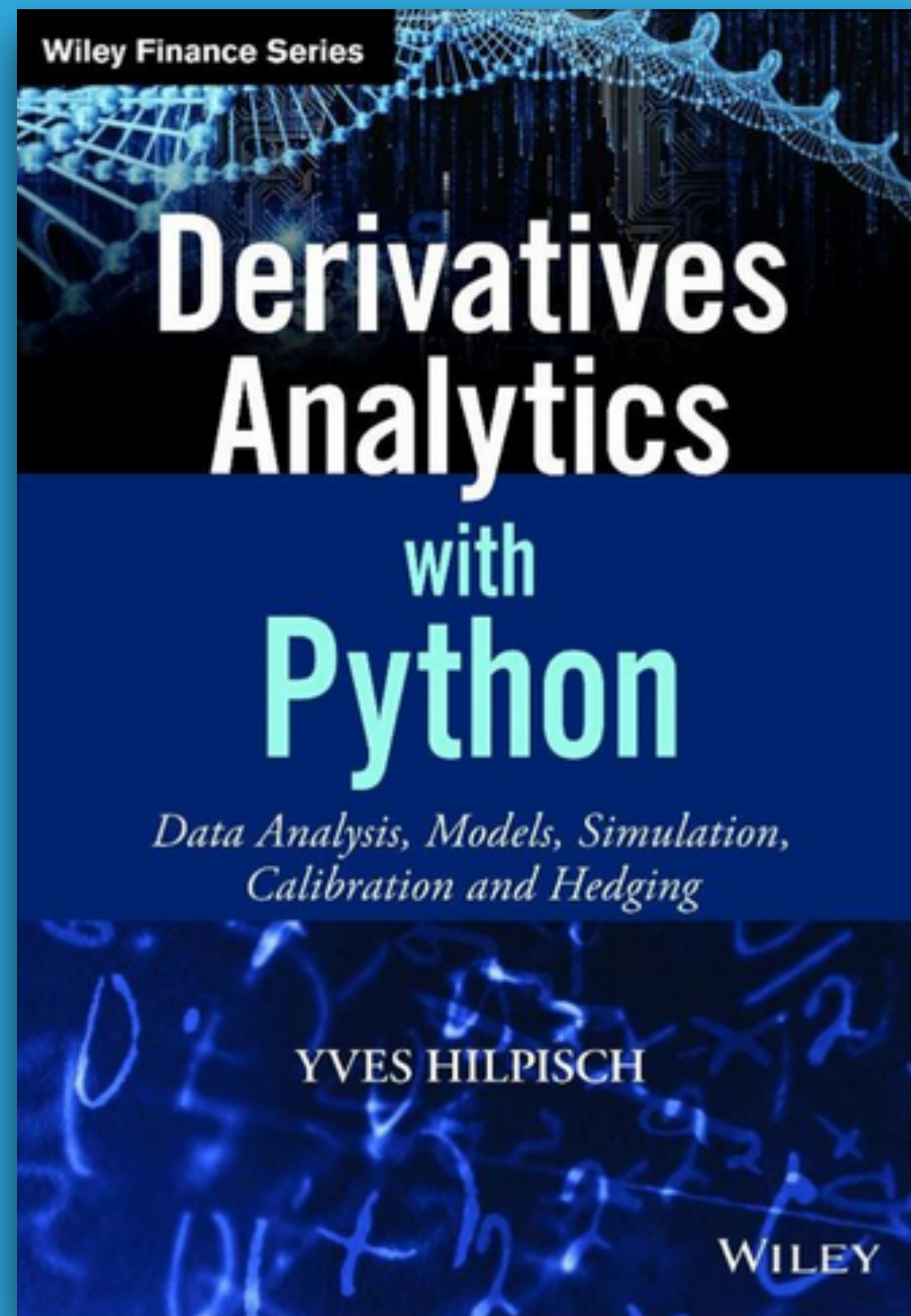
- * Finance with Python (2021, O'Reilly, forthcoming)
- * Artificial Intelligence in Finance (2020, O'Reilly)
- * Python for Algorithmic Trading (2020, O'Reilly)
- * Python for Finance (2018, 2nd ed., O'Reilly)
- * Listed Volatility and Variance Derivatives (2017, Wiley Finance)
- * Derivatives Analytics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



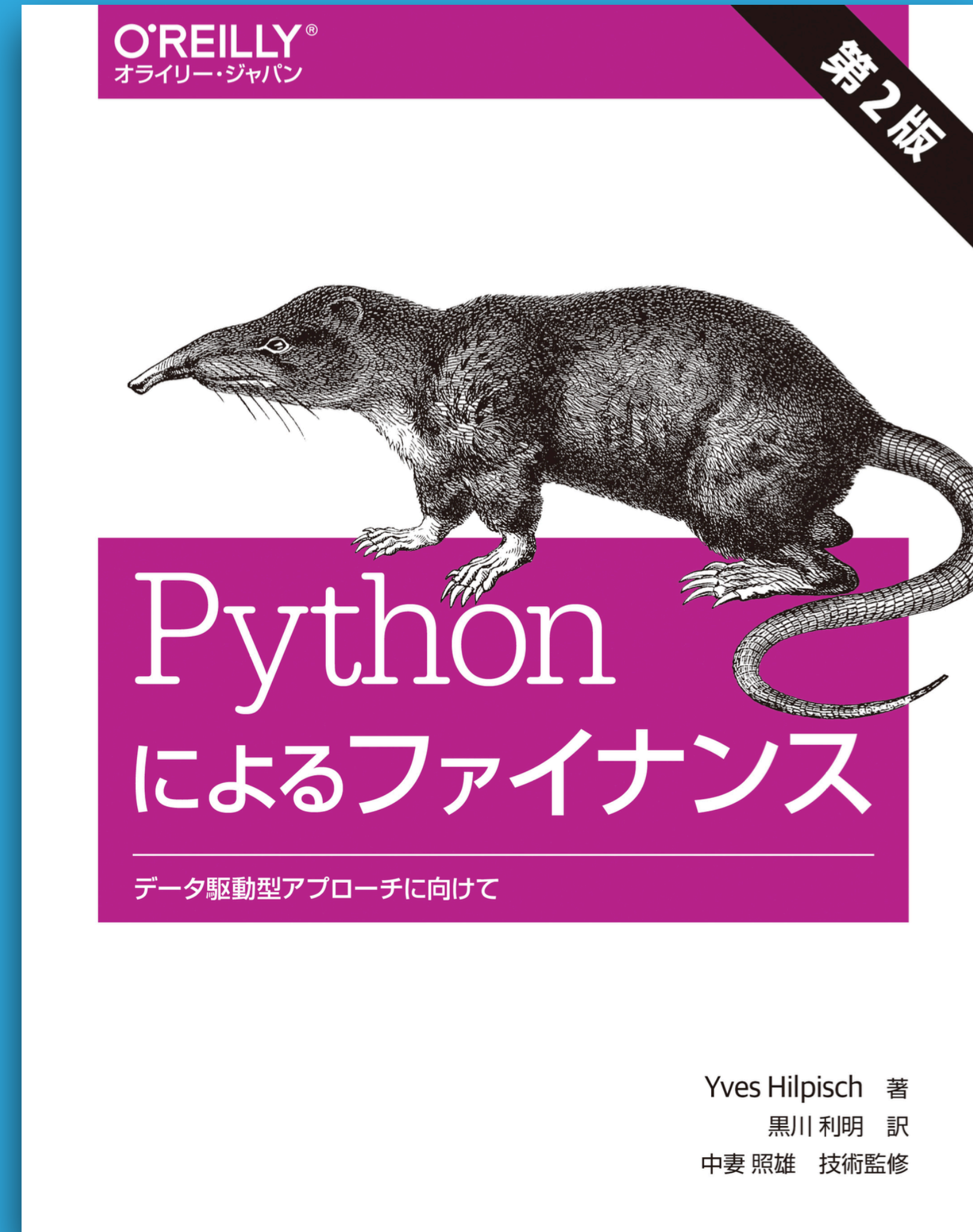
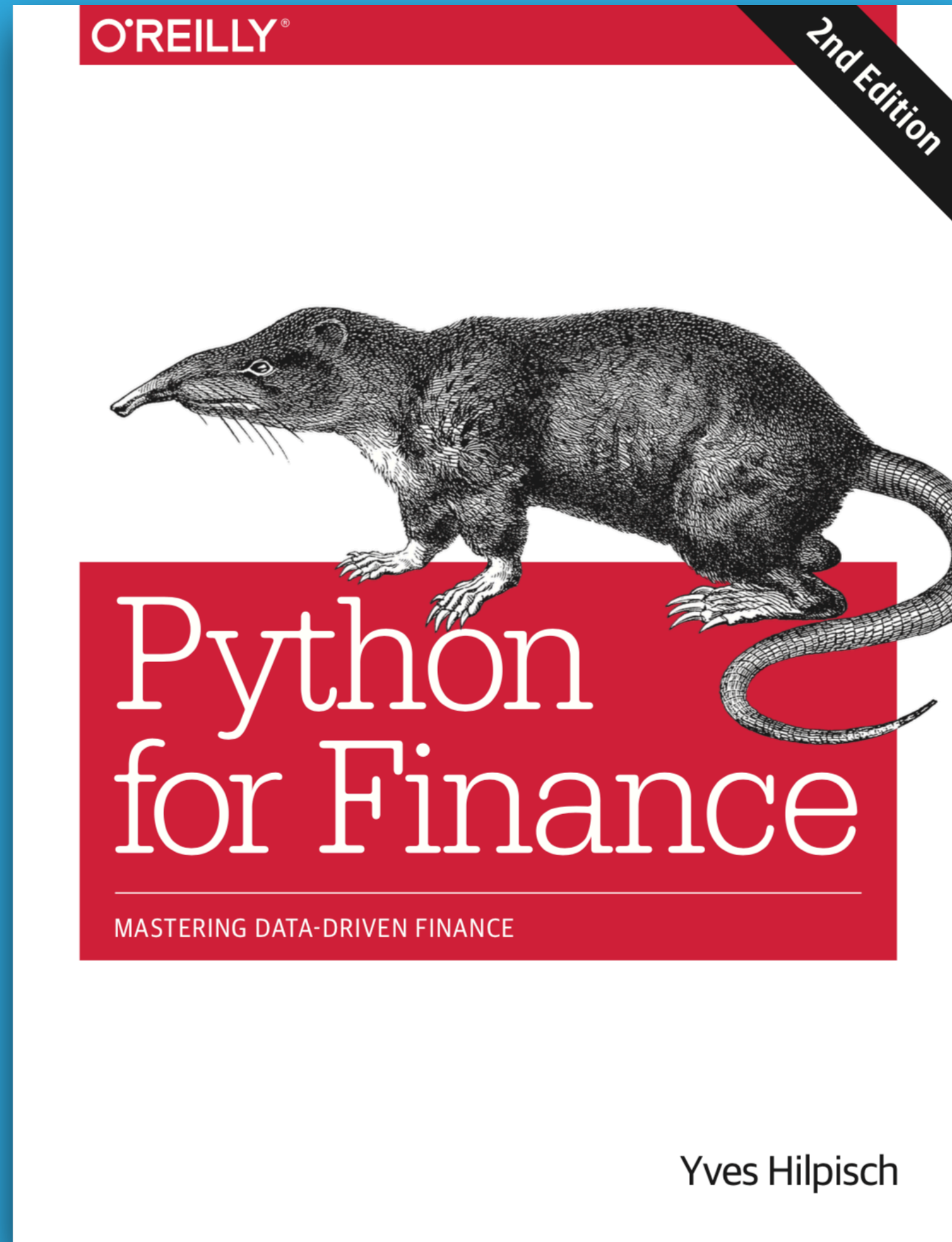
Yves is the director of the first online training program leading to **University Certificates in Python for Algorithmic Trading** (<https://home.tpq.io/certificates/pyalgo>) and **Computational Finance** (<https://home.tpq.io/certificates/compfin>). He also lectures on computational finance, machine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

Quant Finance with Python



Python for Finance

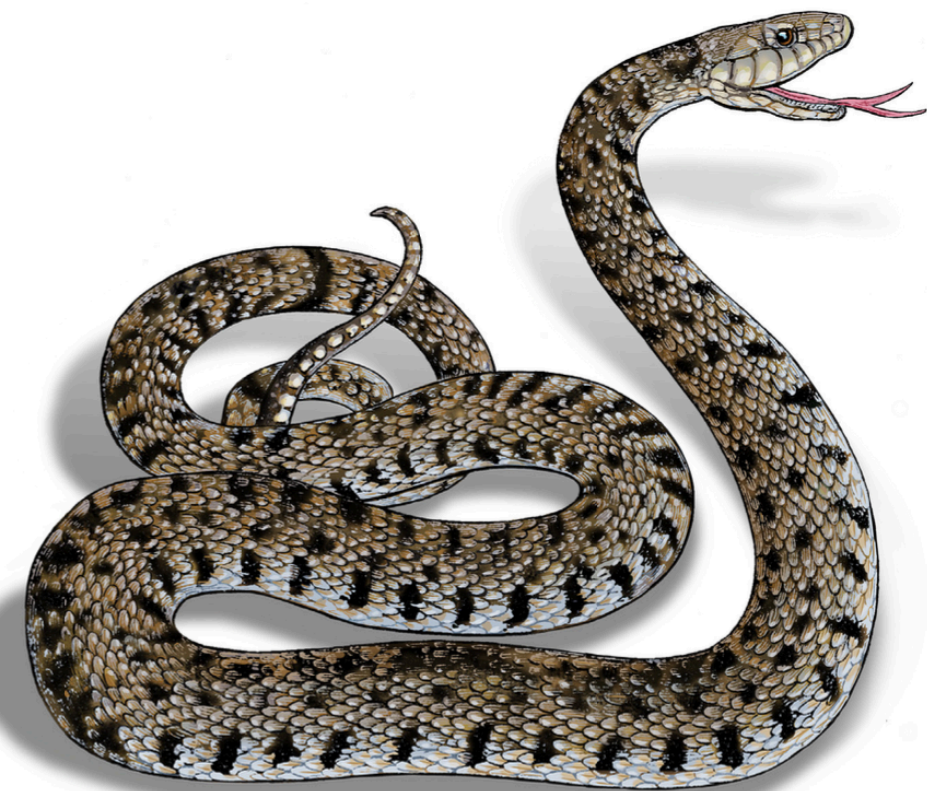


Python & AI for Finance & Trading

O'REILLY®

Python for Algorithmic Trading

From Idea to Cloud Deployment

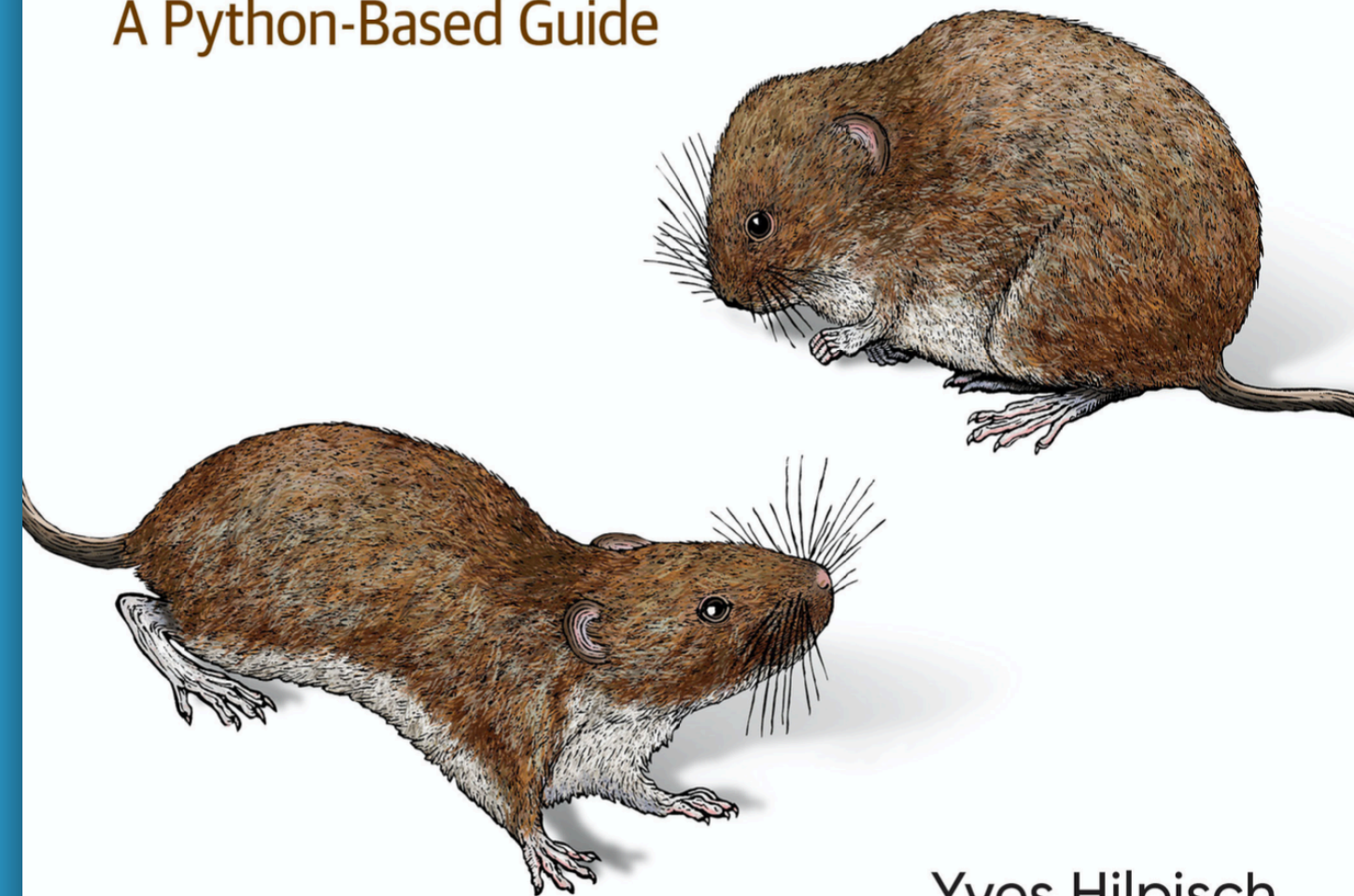


Yves Hilpisch

O'REILLY®

Artificial Intelligence in Finance

A Python-Based Guide



Yves Hilpisch

Data-Driven Finance

FINANCIAL TIMES

TUESDAY 3 OCTOBER 2017

WORLD BUSINESS NEWSPAPER

MIDDLE EAST

Mohamed El-Erian
Reasons to worry about the Fed's 'beautiful normalisation' — PAGE 20

Torturing Theresa
Boris Johnson's bid to dictate May's Brexit strategy — JANAN GANESH, PAGE 11



Confined in a circle
The myths that hold back women in Indian society — AMY KAZMIN, PAGE 10

Las Vegas reels from worst US mass shooting

A casualty is carried from the scene after a gunman opened fire on concert goers in Las Vegas on Sunday night. More than 58 people were killed and over 500 wounded, making it the deadliest mass shooting in US history.

Las Vegas police said the suspected gunman, 64-year-old Stephen Paddock, fired shots from his 32nd-floor room in the Mandalay Bay Hotel and Casino into the crowd of 22,000 people attending the Route 91 Harvest Festival.

In televised remarks, Donald Trump, the US president, called the shooting "an act of pure evil" but made no reference to guns. He plans to visit the city on Wednesday to meet the families of the victims and law enforcement officials.

Report page 2



Briefing

- **Puerto Rico calls for billions in aid**
Raul Maldonado Gantier, Puerto Rico's treasury secretary, says the island will need "tens of billions" of dollars in aid from the US as it struggles to recover after Hurricane Maria. — PAGE 2
- **Portugal's Socialists reap benefits**
Portugal's ruling Socialists reaped the rewards of a recovering economy by winning a decisive victory in local elections midway through the first term of an anti-austerity government. — PAGE 3
- **Uber's UK head quits as chief files in**
Jo Bertram, Uber's UK boss, has quit the company a day before a visit to London by Dara Khosroshahi, chief executive, to meet regulators over allegations to revoke the ride-hailing app's licence in the capital. — PAGE 15
- **Koike faces Japan election dilemma**
Tokyo governor Yukio Koike is under pressure to stand in Japan's general election later this month, amid fears she and her party lack the resources to beat Shinzo Abe, the prime minister. — PAGE 4
- **Equifax defends silence over hack**
Credit reference agency Equifax has claimed ahead of a hearing at the US congress later today that disclosing that it had been hacked would have encouraged "copycat" cyber attacks. — PAGE 13
- **Western envoys warn on Kenya re-run**
Western ambassadors have condemned President Uhuru Kenyatta and Raila Odingo, opposition leader, for undermining the electoral commission's ability to re-stage its election this month. — PAGE 4
- **Huawei beats Apple as top China choice**
Huawei has for the first time beaten Apple to top spot for intended smartphone purchases in China, according to a survey of 1,000 consumers. — PAGE 14

Catalan president urges Brussels to mediate in independence clash

Region seeks to avoid 'traumatic split' from Spain • EU says dispute is 'internal matter'

MICHAEL STOTHARD — BARCELONA

He added: "We don't want a traumatic split, Sunday's referendum, while it is necessary the suspension of Catalonia's

of law, which calls by of the liberal and Catalonia's

ended the con- the national employed to the to thwart the

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Yes

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FTSE 100	7430.54	7327.36	0.8%
FTSE All Share	4302.00	4245.00	1.0%
DAX	15104.4	15101.0	0.0%
Nikkei 225	17802.00	17830.00	-0.2%
Hang Seng	22954.92	22942.00	0.0%
FTSE MIB	331.00	331.00	0.0%

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Datawatch



World-Wide

- **Congressional negotiators struck a budget deal** that would allow more domestic and military spending and include deficit-cutting measures. **A1 A8**
- **Ukrainian forces stormed a protesters' encampment** in Kiev, hours after Western diplomats called for a nonviolent end to the political crisis. **A13**
- **Obama's disapproval rating hit 54%**, the high for his presidency, amid the flawed health-law rollout. **A Wall Street Journal/NBC poll found.** **A4**
- **World leaders gathered to honor Mandela.** In a rare encounter, Obama shook hands with Cuba's Raul Castro. **A12**
- **Senate Democrats confirmed Obama appointee** as the head of the FBI and Freddie's overseer. **A4**
- **A key Senate Democrat said he would back the Obama administration's request to delay new Iran sanctions.** **A17**
- **Supreme Court justices expressed sympathy** for the EPA approach to air pollution that crosses state lines. **A2**
- **An AIDS group called for a probe** to see if HIV-infected patients were discouraged from enrolling in health plans. **A6**
- **Uruguay's Senate voted to legalize marijuana.** The president plans to sign the bill. **A15**
- **France's leader flew to the Central African Republic** after two French troops died. **A13**
- **Singapore police charged 84 Indian citizens** in connection with a night of rioting. **A13**
- **Died: Jim Hall, 93,** acclaimed jazz guitarist.

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What's News

Business & Finance

- **House and Senate negotiators, in a rare bipartisan act, announced a budget agreement** Tuesday designed to avert another economy-rattling government shutdown and to bring a decade to end the costs.
- **Revenues to fund the higher spending** would come from changes to federal employee and military pension programs, and higher fees for airline passengers, among other sources. An extension of long-term jobless benefits wasn't included.
- **The plan is modest in scope,** compared with past budget deals and to one-year ambitions in Congress to craft a "grand bargain" to restructure the tax code and federal entitlement programs. But in a year and an institution characterized by gridlock, lawmakers were relieved they could reach even a minimal agreement.
- **"In divided government, you don't always get what you want,"** said Mr. Ryan.
- **Ms. Murray joined him** in welcoming the prospect that lawmakers would steer away from a crisis-driven budget process. "We have lurched from crisis to crisis, from one cliff to the next," she said. "That uncertainty was devastating to our fragile economic recovery."
- **The deal, which goes to the House and Senate for approval** in the coming days, marks a major change in the 2011 budget-cutting law, which set in motion 10 years of fiscal austerity, including across-the-board spending cuts known as sequestration.
- **The annual discretionary spending target** will be raised to \$669.5 billion from \$655 billion.
- **Farm groups fight limits**... **A6**
- **Pension-change pushback**... **A8**

Deal Brings Stability to U.S. Budget

Congressional Negotiators Avert January Shutdown and Soften Sequester Cuts; Airline Fees to Climb

By JAMES HOOK

House and Senate negotiators, in a rare bipartisan act, announced a budget agreement Tuesday designed to avert another economy-rattling government shutdown and to bring a decade to end the costs.

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Farm groups fight limits... A6
Pension-change pushback... A8

China Spins New Lesson From Soviet Fall

Party Discipline

BEIJING—The Communist Party boss in eastern China's Jiangsu province summoned local officials recently to a compulsory study session. Their task was to watch a six-part documentary on the Soviet Union's collapse.

The film begins with images of the Soviet Union in its heyday, but quickly cuts to graphic footage of unrest in China's northern neighbor in the 1990s, set to ominous music punctuated by Russian communists lamenting their nation's fate.

When the screening in Jiangsu ended, state media reported, local party chief Luo Zhijian exhorted the assembled officials to "correctly understand the lessons of history."

The film's message: The Soviet Union didn't fall apart because of the communist system itself, but because of individuals who betrayed it, especially Mikhail Gorbachev.

The film is part of an ideological campaign launched by China's new leader, Xi Jinping, to re-energize the party and enforce discipline among its members. It has been shown at dozens of political meetings since September.

The frequent showings suggest Mr. Xi believes China needs to reinforce its Leninist political system rather than limit the party's powers. Party insiders and academics say it is part of an effort to combat what is portrayed as an American conspiracy to overthrow the party through "peaceful evolution"—the spread of Western ideas via media, academia and popular culture.

Longtime Insider Is GM's First Female CEO

By JOY BENNETT AND SARA MURRAY

DETROIT—General Motors Co. tapped product chief Mary Barra as its next chief executive, smashing a century-old gender barrier while choosing a longtime insider who grew up steeped in Detroit's car culture.

Ms. Barra will succeed Dan Akerson as CEO next month and become the first woman to run a major global auto maker. The 51-year-old joined GM 25 years ago as a college intern, eventually becoming an engineering manager before running one of its big U.S. assembly plants. She got global experience managing human resources and, more recently, the company's world-wide product development group.

She will become the 22nd woman currently running a Fortune 500 company.

Misstone is halted, but women continue to face obstacles... B7
Heard on the Street... C14

Ukrainian Forces Confront Protesters

Government security forces cracked down on protesters in Kiev hours after U.S. and EU diplomats called for a nonviolent resolution.



Bank Rule Challenges Wall Street

A broad new government rule to limit risk-taking by Wall Street will force banks to rethink virtually every aspect of their trading activities, setting the stage for more turmoil at the largest U.S. financial institutions.

The so-called Volcker rule, approved by five financial regulatory agencies on Tuesday, could log as much as \$10 billion total in yearly pretax profit from the eight largest U.S. banks through lower revenue and higher compliance costs, according to estimates from Standard & Poor's.

The 93-page edict, part of the 2010 Dodd-Frank financial overhaul, codifies and restricts the way banks trade securities. It curbs banks' ability to bet with their own capital and forces them to disclose more information about their trading.

Mr. Conley will have 120 seconds to run unbridled through the big-box store's aisles, grabbing a plasma television, a videogame console and almost anything else that he can hoist onto his cart.

"I'm looking to break a record," he says.

Here's Your Holiday Bonus, Now Start Running

Workers Win All-They-Can-Grab Sprees From Companies; 'Supermarket Sweep'

By JEFFREY PASTER

On Thursday, Alan Conley will get the holiday gift he never saw he always wanted: two minutes at a Texas Costco.

The 27-year-old wasn't even a member of the wholesale warehouse store until a few days ago.

That his employer, coupon website RetailMeNot Inc., takes a cue from the game show "Supermarket Sweep" when it comes to rewarding employees, as well as his own work as a software engineer, Mr. Conley will have 120 seconds to run unbridled through the big-box store's aisles, grabbing a plasma television, a videogame console and almost anything else that he can hoist onto his cart.

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Overview News & Research Price & Charts Estimates Financials ESG Event Ownership Debt & Credit Peers & Valuation Derivatives Filings

PRICE PERFORMANCE >

Open	
Prev. Close	123.08
Bid / Ask	123.24 / 123.35
VWAP	
Turnover	--
Volume	13,358
Short Interest	0.500%
YTD	67.66%
Beta (5Y Monthly)	1.272
Mkt Cap - Default	USD 2.093T
PE (LTM)	37.676
Div Yield	0.666%
DR	52Wk: 53.153 - 137.980
DR Type	--
DR Bank	--
Free Float	16.99B
Outstanding	17.00B
IPO Date	12-Dec-1980



STARMINE MODELS >

Bullish		Bearish	
Price Momentum	97	Intrinsic Valuation	19
Analyst Revisions	79	Relative Valuation	23
Smart Holdings	77	Insider	27
Short Interest	95		
Earnings Quality	95		
Credit Risk - Combined	96		
Credit Risk - Smart Ratios	92		
Credit Risk - Structural	88		
Credit Risk - Text Mining	85		
Combined Alpha Model	72		

RELATIVE VALUATION >

	Global Rank	Trailing 12 Months		Next 12 Months	
		AAPL	Industry Median	AAPL	Industry Median
PE	32	36.284	8.368	30.782	13.425
EV/EBITDA	24	26.610	8.037	22.303	8.094
Div Yield	31	0.653%	1.808%	0.666%	3.242%
EV/Sales	18	7.514	1.149	6.363	1.013
P/CF	31	26.393	5.920	24.353	11.821
P/B	2	33.482	1.505	47.447	2.774

NEWS >

News		Investor Briefs		Global Press	
03-Dec-2020					
10:15:43	BUSINESS	Apple sued over old iPhones in Europe Tech giant i...			LATIME
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			HKETNN
10:12:11	《外企动向》	蘋果因舊款手機電池問題在欧洲多国面临诉讼			HKETNN
09:49:33	USPTO	ISSUES TRADEMARK: WORKS WITH APPLE IBEACON			USFEDE
09:16:24	Analysts' Weekly Ratings Updates for Apple (AAPL)				TICREP
09:11:02	Analysts' Weekly Ratings Updates for Apple (AAPL)				AMEBAN
09:00:25	《A股焦点》	欧菲光：被苹果移出相机模块供应链消息不属实			HKETNN
08:59:39	《A股焦点》	被蘋果移出相機模块供应链消息不属实			HKETNN
07:13:26	Dow Jones Selected Stocks 1710 - December 03				AAP
06:47:44	RPT-Hong Kong-Le magnat Jimmy Lai détenu pour des accusa...				RTRS

RECOMMENDATIONS >

Mean	Analysts Per Level
AAPL	Strong Buy 11
	Buy 19
	Hold 8
	Sell 1
	Strong Sell 1
Price Target (Mean)	USD 125.92 Upside 2%

ESTIMATES >

	QTR Dec-2020		FY Sep-2021	
	EPS	Rev	EPS	Rev
Mean Estimate	1.39	102.00B	3.96	315.25B
Smart Estimate	1.39	101.94B	3.95	314.43B
Predicted Surprise	0.00%	-0.06%	-0.32%	-0.26%
Mean Chg %	0.62%	0.29%	0.95%	0.33%

RESEARCH >

		Contributor		Internal	
03-Dec-2020	Equiti	Global Arabic Smart Report			Equiti
02-Dec-2020	Trefis	Report: Apple - \$99.92 Trefis Price Estimate			Trefis
02-Dec-2020	Equiti	Global Arabic Smart Report			Equiti
01-Dec-2020	Comprehensive	Technical and Fundamental Analysis...			Stock Trade...
01-Dec-2020	Equiti	Global Arabic Smart Report			Equiti
30-Nov-2020	Equiti	Global Arabic Smart Report			Equiti
29-Nov-2020	"The Economy Matters"	Report for AAPL: the econo...			MacroRisk ...

EVENTS >

		Upcoming		Past	
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		274.52B	28.17%	23.39
HP Inc	31.34B	1.97%	56.64B	8.40%	6.63

```
[4]: %%time
data = ek.get_timeseries('AAPL.O', fields='*',
                        start_date='2020-12-02 16:00:00',
                        end_date='2020-12-02 16:30:00',
                        interval='tick')
```

```
CPU times: user 115 ms, sys: 6.49 ms, total: 122 ms
Wall time: 4.65 s
```

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

```
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 32239 entries, 2020-12-02 16:00:00.010000 to 2020-12-02 16:29:59.914000
Data columns (total 2 columns):
#   Column  Non-Null Count  Dtype
---  -
0   VALUE   32191 non-null   float64
1   VOLUME  32239 non-null   Int64
dtypes: Int64(1), float64(1)
memory usage: 787.1 KB
```

```
[6]: data.head()
```

```
[6]:
```

	AAPL.O	VALUE	VOLUME
	Date		
	2020-12-02 16:00:00.010	122.00	37
	2020-12-02 16:00:00.010	122.00	2
	2020-12-02 16:00:00.010	122.01	600
	2020-12-02 16:00:00.010	122.01	300
	2020-12-02 16:00:00.010	122.00	20

```
[7]: news = ek.get_news_headlines('R:AAPL.0',
                                date_from='2020-10-13',
                                date_to='2020-10-14',
                                count=5
                                )
```

```
[8]: news
```

```
[8]:
```

	version	Created	text	storyId	sourceCode
	2020-10-13 21:40:03.235	2020-10-13 23:55:17.584000+00:00	Refinitiv Newscasts - Post-Market Wrap: Octobe...	urn:newsml:reuters.com:20201013:nRTV99mSrx:4	NS:CNBC
	2020-10-13 21:07:10.816	2020-10-13 23:17:28.661000+00:00	Refinitiv Newscasts - Apple enters 5G race wit...	urn:newsml:reuters.com:20201013:nRTV8h4JYx:4	NS:RTRS
	2020-10-13 21:05:12.773	2020-10-13 23:14:26.185000+00:00	Refinitiv Newscasts - T-Mobile CEO on 5G servi...	urn:newsml:reuters.com:20201013:nRTV3ghIDN:2	NS:CNBC
	2020-10-13 23:12:27.333	2020-10-13 23:12:27.333000+00:00	Prime Day 2020: The best deals from Apple, Mic...	urn:newsml:reuters.com:20201013:nNRAd6qnfu:1	NS:INDEPE
	2020-10-13 20:58:43.544	2020-10-13 23:10:15.457000+00:00	Refinitiv Newscasts - I feel more bullish afte...	urn:newsml:reuters.com:20201013:nRTV6vSQ8N:5	NS:CNBC

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

```
[10]: HTML(ek.get_news_story(news['storyId'].iloc[1]))
```

```
[10]: Click the following link to watch video: https://share.insider.thomsonreuters.com/link?entryId=1\_eg1wg2n1&referenceId=tag:reuters.com,2020:newsml\_0VCZYVZPN\_K15&pageId=ReutersNews
```

Source: Thomson Reuters

Description: Apple on Tuesday launched four versions of its new flagship iPhone 12 with faster 5G connectivity in hopes of sparking an upgrade cycle that will keep sales booming through the end of the year. Conway G.Gittens has more on what's coming.



The Increased Importance of Sentiment

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GameStop and BlackBerry shares soar on amateur traders' fervour

Intense enthusiasm among online message boards jolts a clutch of stocks

-
-
-
-
-



Small investors can influence share prices in companies such as GameStop by buying large amounts of call options © Christopher Dilts/Bloomberg

“All the sentiment positioning indicators are geared towards the institutional world,” said one investment bank analyst. “How do you gauge sentiment on Tik Tok? How do you gauge sentiment in gifs or memes? I don’t know.”

“**A new army of traders are not focused on valuations, but rather by momentum opportunities they see from Reddit’s Wall Street Bets, YouTubers, TikTok or Robinhood**

Edward Moya, senior market analyst with Oanda

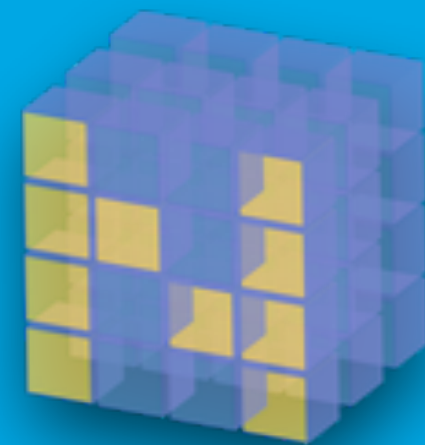
Small investors can influence share prices by buying large amounts of call options, which give the user the right but not the obligation to purchase a share later at a fixed price.

Typically, this means that wholesale brokers such as banks need to purchase shares on the open market to hedge themselves against the event that the

stock price hits the strike price of the option.



```
IP[y]:  
IPython
```

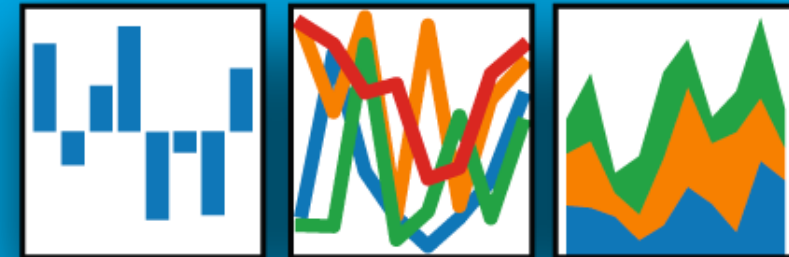


NumPy

matplotlib



pandas
 $y_{it} = \beta' x_{it} + \mu_i + \epsilon_{it}$



Keras

The Medium Article

Algorithmic Trading in Less than 100 Lines of Python Code

medium.com/oreillymedia/algorithmic-trading-in-less-than-100-lines-of-python-code-b4a4b159a485

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If You Know Trading and Python, this Is Easy

Editor's Note: *The barriers to entry for algorithmic trading have never been lower. Not too long ago, only institutional investors with IT budgets in the millions of dollars could take part, but today even individuals equipped only with a notebook and an Internet connection can get started within minutes. In this piece from [Python for Algorithmic Trading](#), author Yves Hilpisch shows you how to implement a complete algorithmic trading project, from backtesting the strategy to performing automated, real-time trading.*

Algorithmic trading refers to the computerized, automated trading of financial instruments (based on some algorithm or rule) with little or no human intervention during trading hours. Almost any kind of financial instrument — be it stocks, currencies, commodities, credit products or volatility — can be traded in such a fashion. Not only that, in certain market segments, algorithms are responsible for the lion's share of the trading volume. The books [The Quants](#) by Scott Patterson, [More Money Than God](#) by Sebastian Mallaby, and, more recently, [The Man Who Solved the Market](#) by Gregory Zuckerman paint a vivid picture of the beginnings of algorithmic trading and the personalities behind its rise.

NEW YORK TIMES BESTSELLING AUTHOR

EDWARD O. THORP

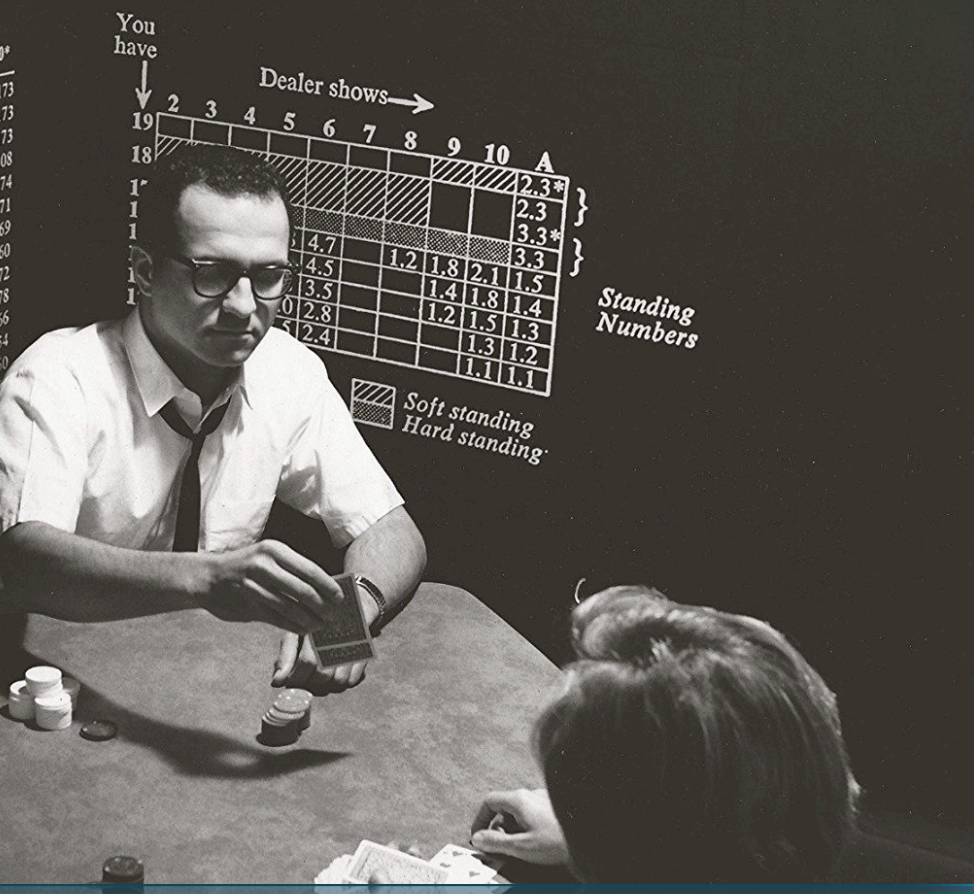
A MAN FOR ALL MARKETS

From LAS VEGAS to WALL STREET,
HOW I BEAT THE DEALER
and THE MARKET

FOREWORD BY NASSIM NICHOLAS TALEB

TABLE 5. Player's Advantage Against Various Up Cards.

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	145	056	-040	-173
-0034	-393	095	130	177	230	239	145	056	-040	-173
-0038	-351	031	065	112	157	203	061	-021	-104	-208
-0272	-373	...	...	...	...	...	...	...	...	...
0142	-371	120	195	...	...	...	...	...	...	...
0189	-374	126	240	313	370	232	141	031	-046	-169
0236	-369	184	240	289	196	176	142	038	-030	-168
0329	-385	179	236	148	181	154	117	073	-030	-168
0187	-364	159	206	124	137	317	...	...	...	...
0125	-356	131	067	089	310	317	...	...	...	...
0005	-343	024	050	259	391	391	...	...	...	...
-0091	-346	176	212	212	337	...	...	...	...	...
-0215	-385	249	284	337	...	...	...	...	...	...
0189	-404	...	...	...	...	...	...	...	...	...
0394	...	186	219	264	307	...	...	...	...	...
0070	...	...	...	...	...	...	...	...	...	...



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*

Author of *THE GREATEST TRADE EVER*

Handwritten mathematical notes and diagrams are scattered across the background, including:

- $E = \frac{1}{2}MgL$
- $-\sqrt{n} \delta_{n,n-1}$
- $\frac{d\theta}{dt} \left(\frac{g}{L}\right)^{1/2} (\theta_0 - \theta)^{1/2}$
- $\left(\frac{g}{L}\right)^{1/2} dt = \frac{d^2 r}{dt^2} \left(\frac{L}{g}\right)$
- $-\left(\frac{g}{L}\right)^{1/2} dt d\varphi^2$
- $W(\varphi) = \frac{1}{V(\varphi)}$
- $A \cos \sin \left(\frac{\sigma}{\theta_0}\right) - A \sin \left(\frac{\theta_1}{\theta_0}\right)$
- $b = \sqrt{1 - c^2}$
- $\frac{m\omega}{T} \alpha - \frac{d}{dx}$
- $f_2 = \left(\frac{F}{k_{spring}}\right)^{1/2} f_0 = \frac{\omega_0}{2\pi} = \hat{H} \left(\frac{gZ}{2\pi}\right)^{1/2} N_a = (\vec{r} \cdot \vec{F})_a = 2Hg \sin \theta$
- $J_a = (\vec{r} \cdot \vec{F})_a = -ML^2 \ddot{\theta}$
- $ML^2 \ddot{\theta} = -LMg \sin \theta$
- $F_a = -Cz$
- $M \ddot{x} = -Cx$
- $\ddot{x} + \frac{C}{M} x = 0$
- $\sin \theta = 0$
- $\ddot{z} = -\omega_0^2 A \sin(\omega_0 t + \varphi)$
- $\omega_0 A \cos(\omega_0 t + \varphi)$
- $\omega_0^2 x = 0 \rightarrow \omega_0 = \left(\frac{C}{M}\right)^{1/2}$
- $v_0 = \omega_0 A \cos \varphi$
- $A \sin(\omega_0 t + \frac{1}{2}\pi) = A \cos(\omega_0 t)$
- $K \frac{1}{2} M \dot{x}^2 = \frac{1}{2} M [\omega_0 A \cos(\omega_0 t + \varphi)]^2$
- $\int \dot{x} \dot{p} = \int \dot{x} \frac{d}{dt} (m\dot{x}) = \int m \dot{x} \ddot{x} dt = \int m \dot{x} (-\omega_0^2 A \sin(\omega_0 t + \varphi)) dt$
- $E = \langle K \rangle = \langle U \rangle = \frac{1}{2} M \omega_0^2 A^2$
- $E_0 = E + \frac{1}{2} \epsilon + \frac{1}{2} \epsilon_0$
- $\frac{d p_x}{dt} = \frac{\Delta p_x}{\Delta t} = \left(1 - \frac{v^2}{c^2}\right)^{1/2} \frac{\Delta p_x}{\Delta t}$
- $V_c = -L \frac{dI}{dt}$
- $V_c = \frac{\sigma}{\epsilon} = \frac{1}{\epsilon} \int \rho dt$
- $\int \frac{dI}{dt} = \frac{1}{\epsilon} \int I dt = V \ll c$
- $\frac{dI}{dt} + \frac{1}{c} \theta = -V$
- $\frac{d p_x}{dt} = \frac{\Delta p_x}{\Delta t} = \left(1 - \frac{v^2}{c^2}\right)^{1/2} \frac{\Delta p_x}{\Delta t}$
- $\frac{d p_x}{dt} = \frac{\Delta p_x}{\Delta t} = \left(1 - \frac{v^2}{c^2}\right)^{1/2} \frac{\Delta p_x}{\Delta t}$
- $\frac{d p_x}{dt} = \frac{\Delta p_x}{\Delta t} = \left(1 - \frac{v^2}{c^2}\right)^{1/2} \frac{\Delta p_x}{\Delta t}$

Trading Platform

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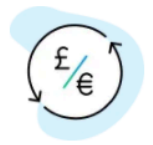
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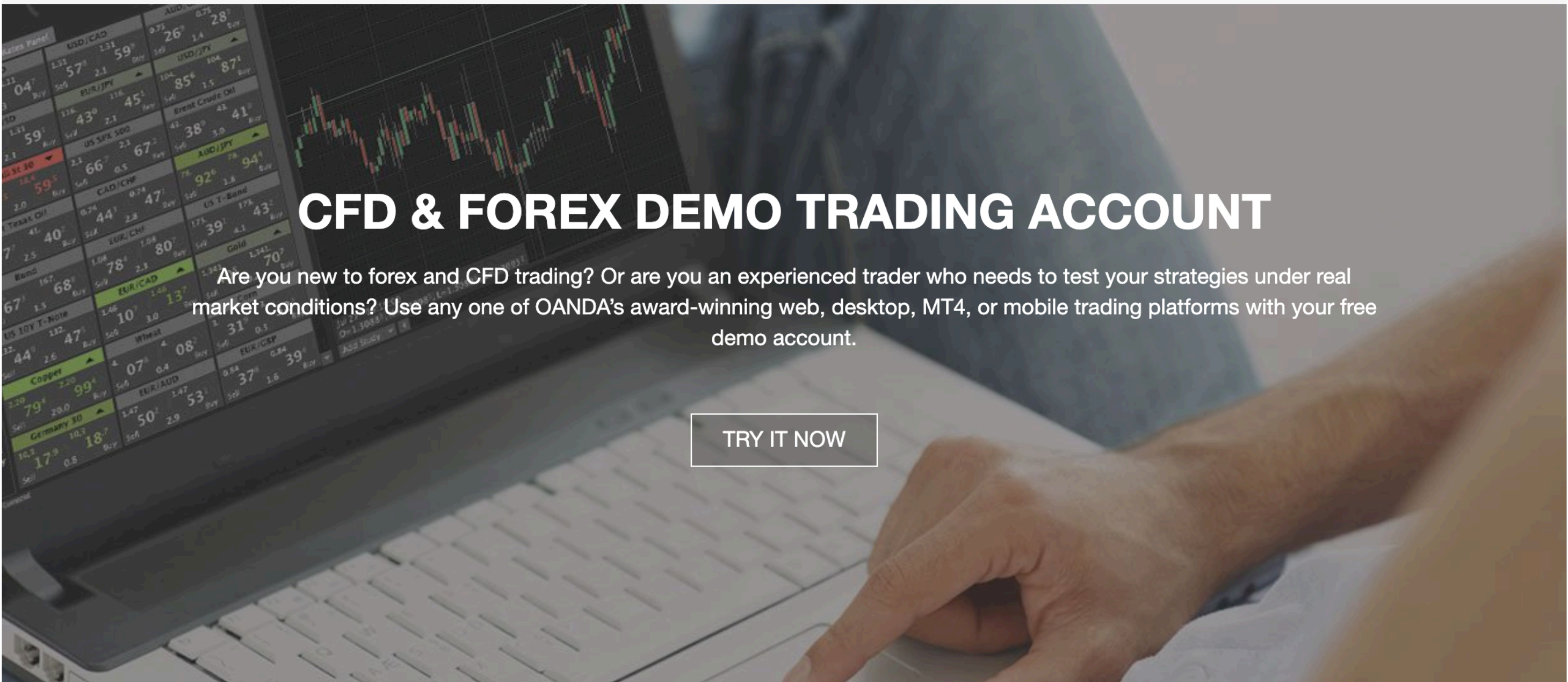
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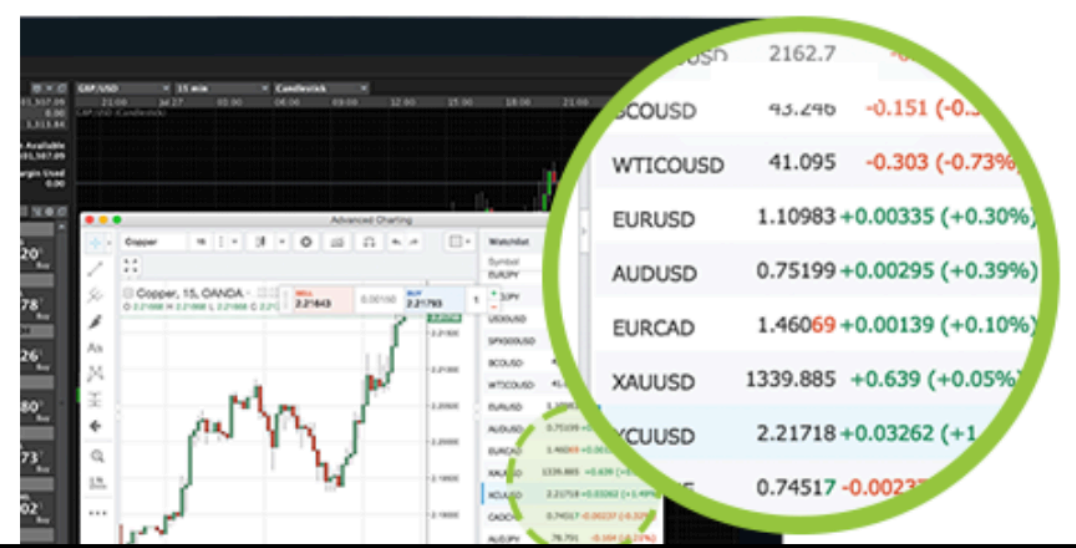


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Oanda Trading Platform

```
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
```


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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).

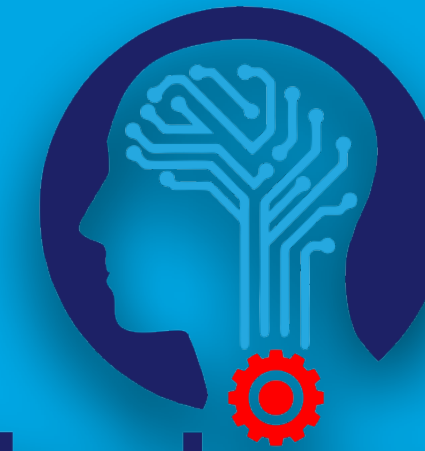
Make sure to understand and manage these risks.

Trading Code

Resources & Links

- http://bit.ly/100_algo (Article)
- http://bit.ly/algo_100_lecture (Gist)
- http://certificate.tpq.io/algo_100_lecture.pdf (Slides)
- <http://oanda.com> (trading platform)
- <http://github.com/yhilpisch/tpqoa>
(Python package)

The AI Machine



The AI Machine

Prediction Engines

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Machine Learning
Deep Learning
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 ...

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Transaction Streaming
Position Management
Profit & Loss Calculation
Visualization
Logging & Reporting
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Stop Loss
Trailing Stop Loss
Dynamic Stop Loss
Take Profit
Position Sizing
Capital Allocation
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program

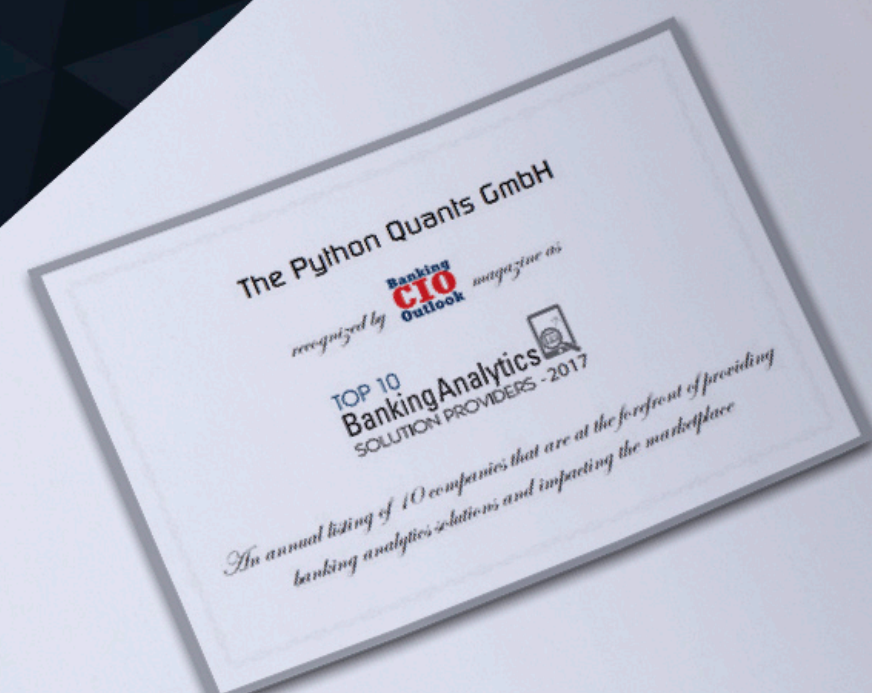
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PROGRAM DIRECTOR

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.



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10,000+ lines
of code

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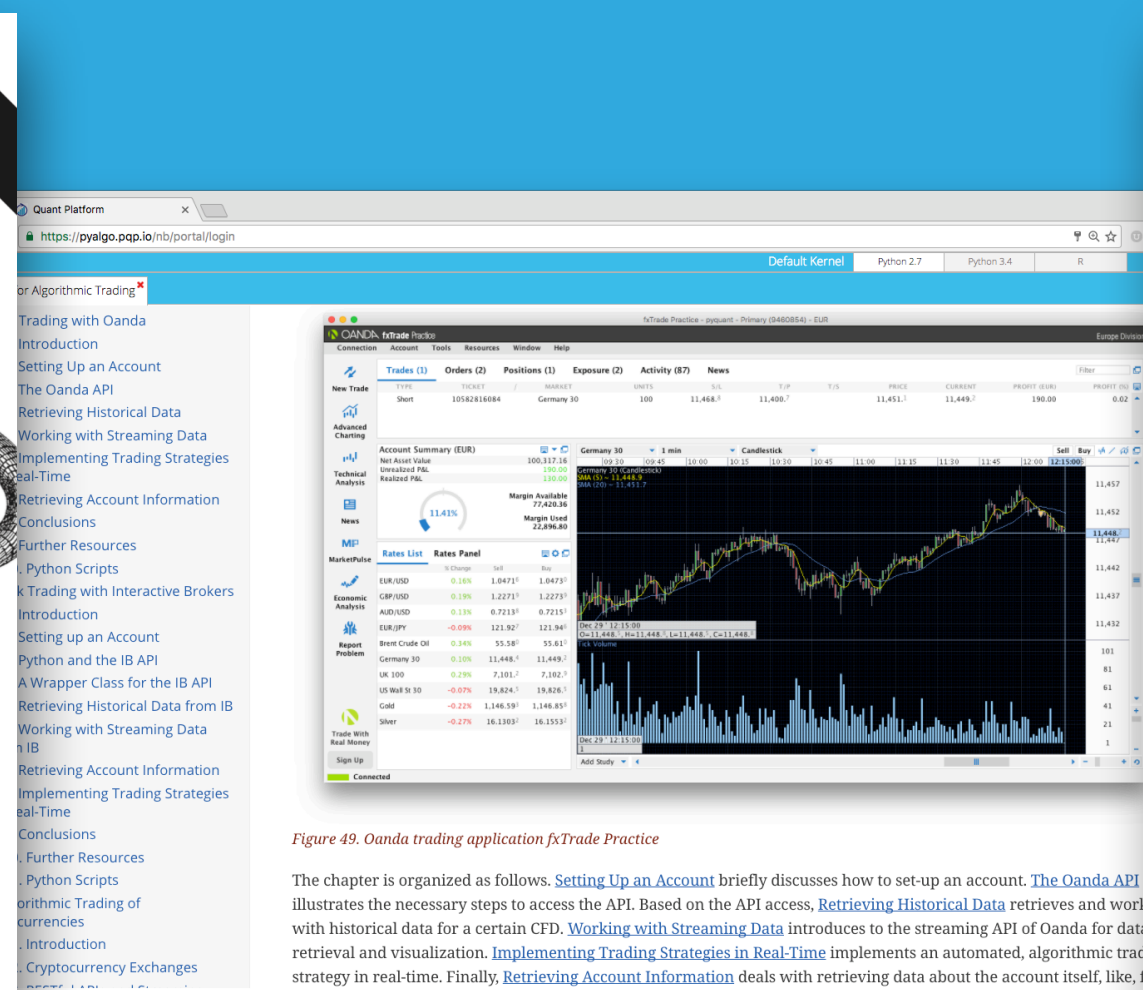
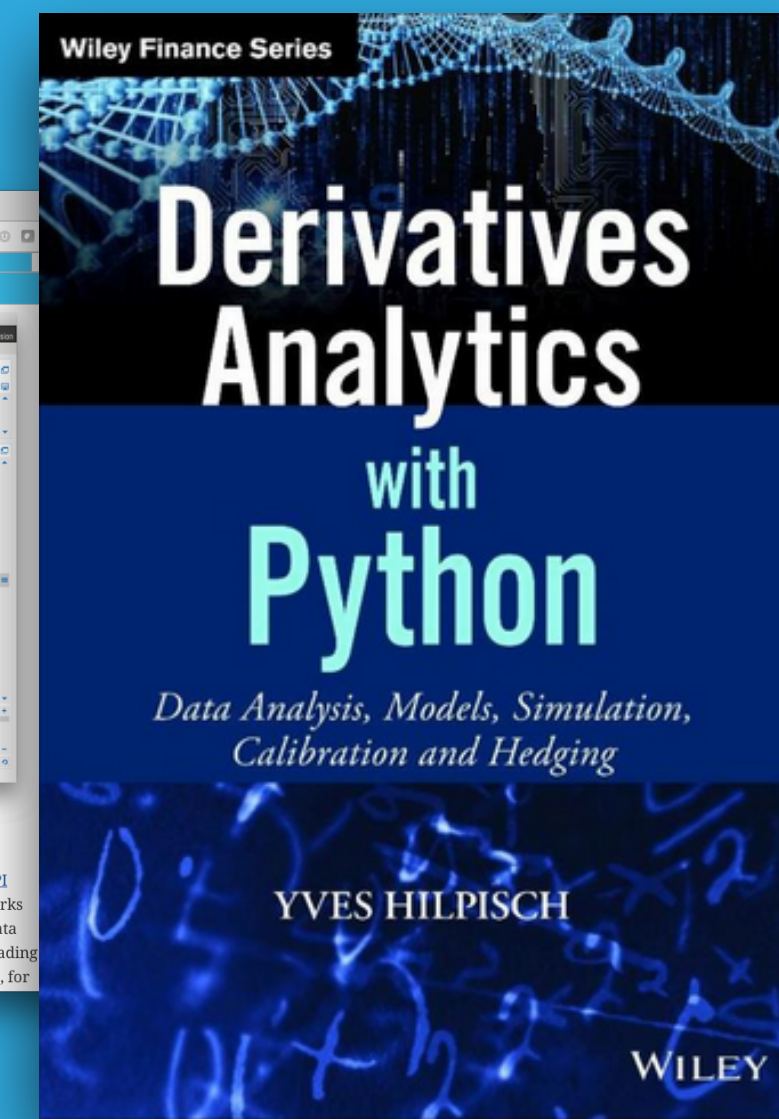


Figure 49. Oanda trading application fxTrade Practice

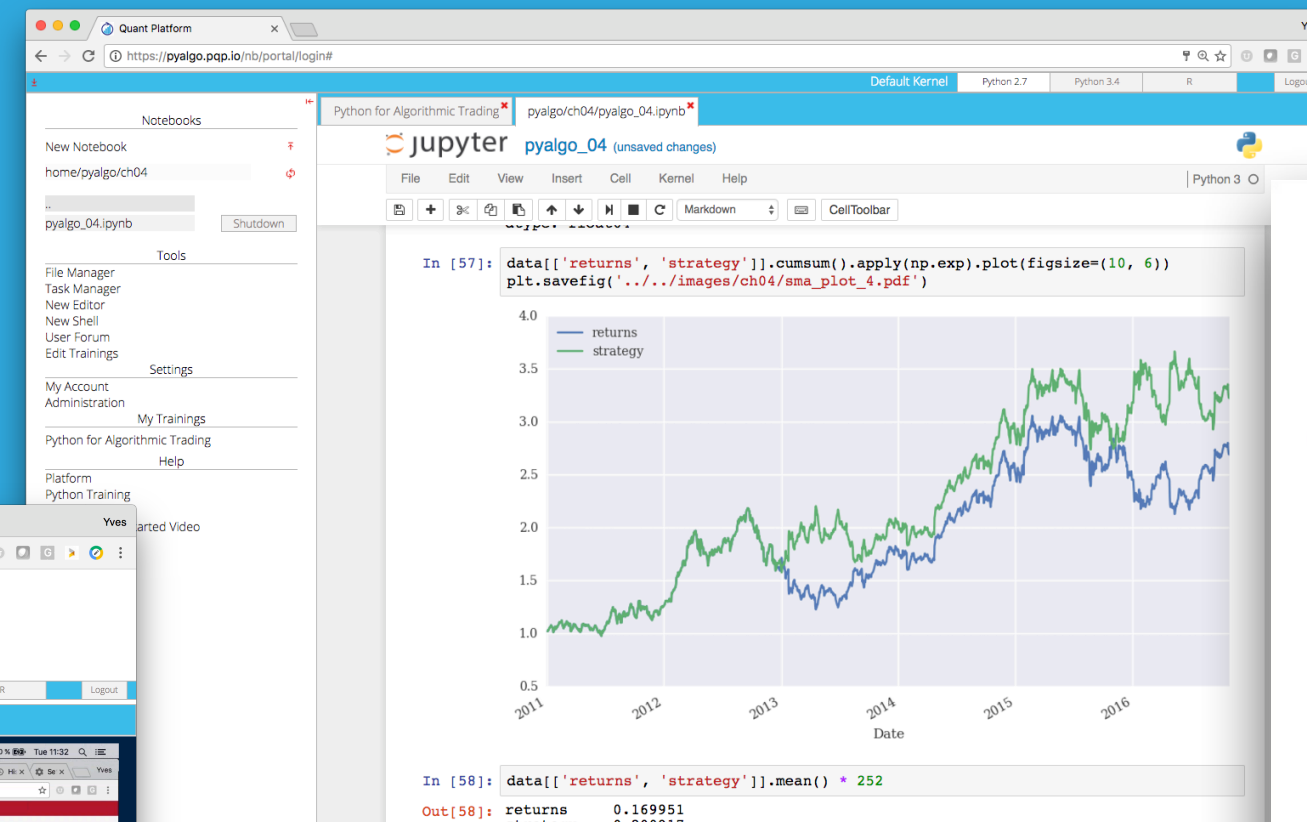
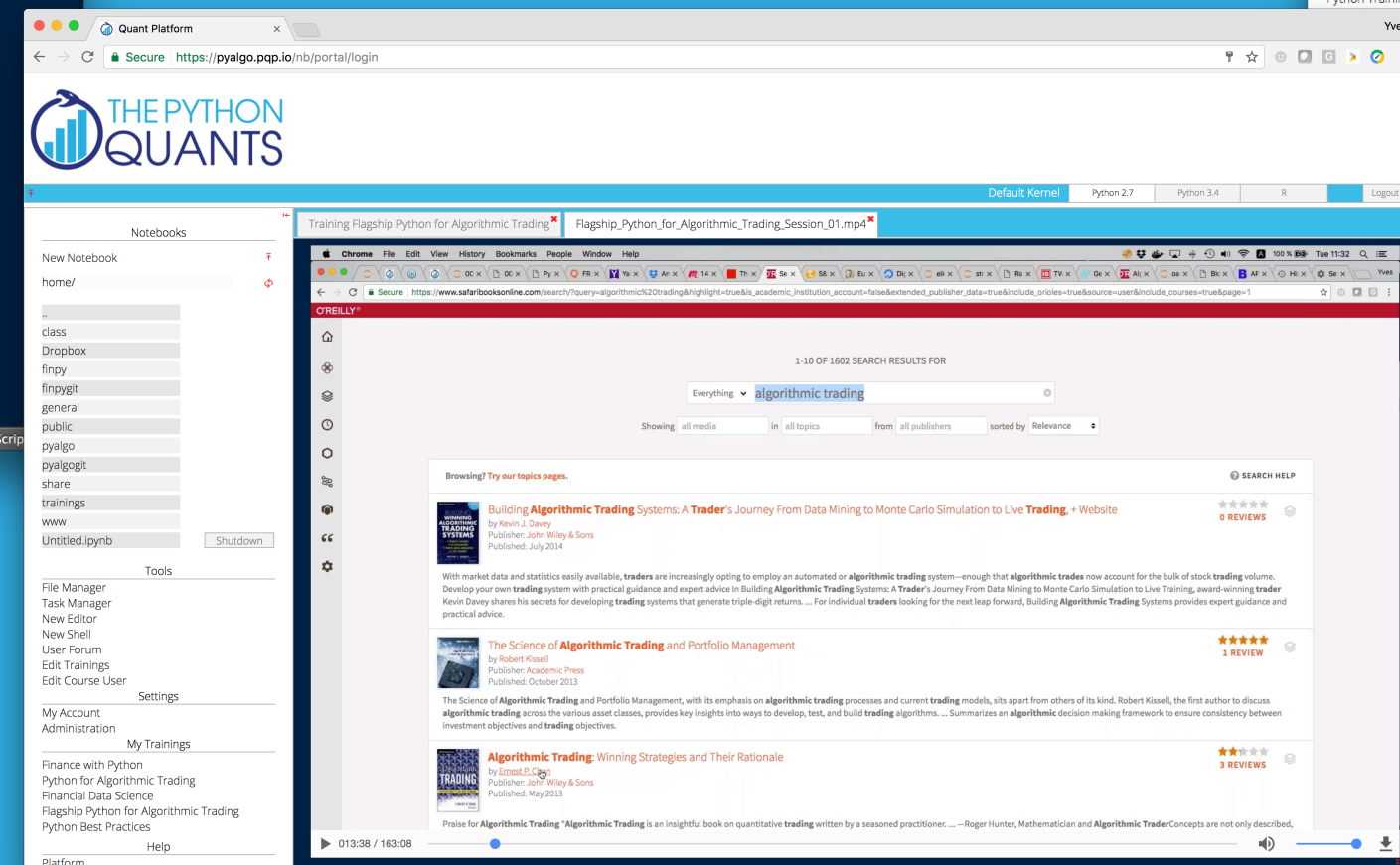
The chapter is organized as follows. **Setting Up an Account** briefly discusses how to set-up an account. **The Oanda API** illustrates the necessary steps to access the API. Based on the API access, **Retrieving Historical Data** retrieves and works with historical data for a certain CFD. **Working 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



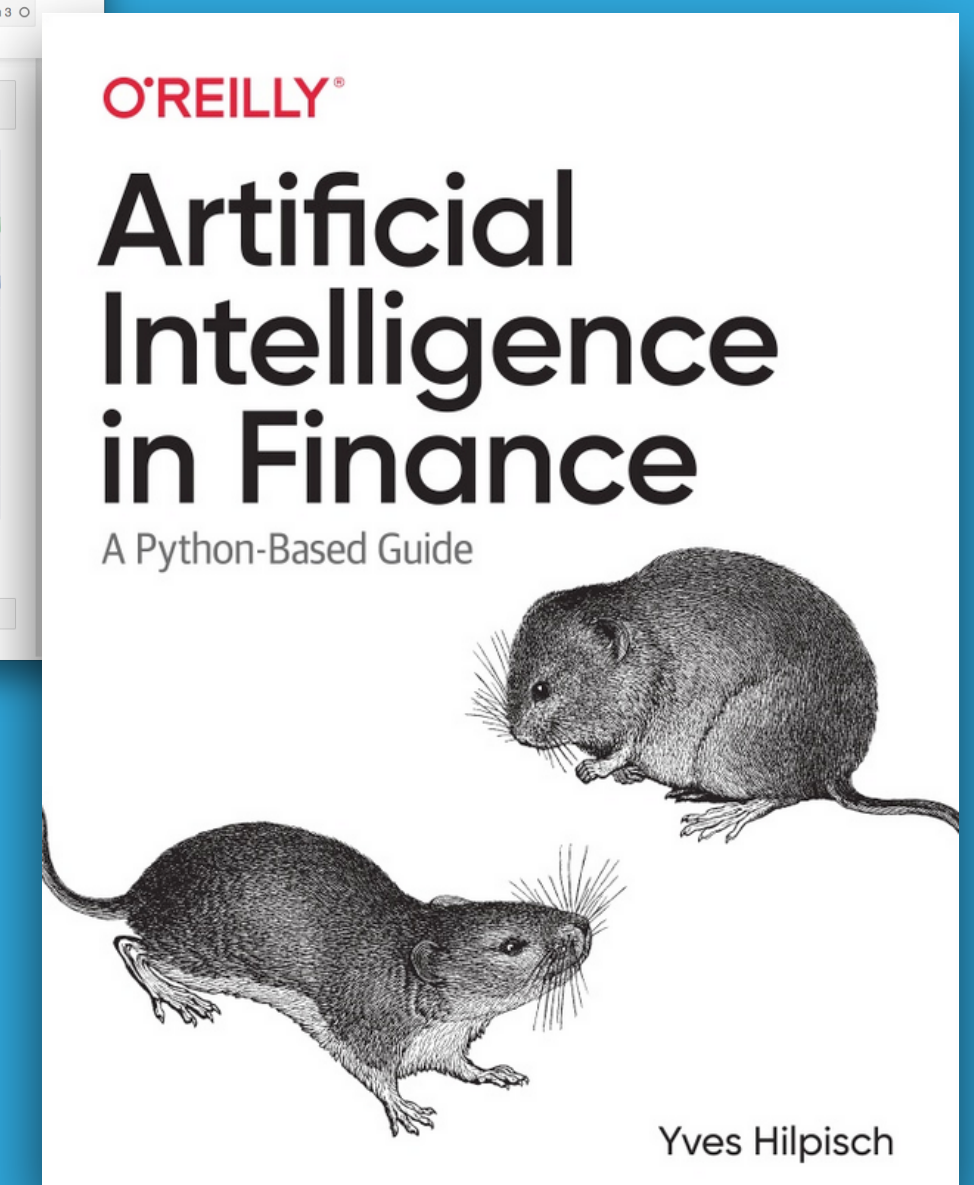
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```
droplet_install.sh
1 #
2 # Bash Script for Droplet Set-up
3 # The Python Quants GmbH
4 #
5 #
6 # Ubuntu
7 apt-get -y update
8 apt-get -y upgrade
9 apt-get -y autoremove
10 apt-get -y install screen htop vim bzip2 wget unzip
11
12 # Python 3.6
13 wget https://repo.continuum.io/miniconda/Miniconda3-latest-Linux-x86_64.sh -O miniconda.sh
14
15 bash miniconda.sh -b
16
17 export PATH="/root/.miniconda3/bin:$PATH"
18
19 conda create -y -n base python=3.6
20
21 source activate base
22
23 conda install -y pandas scikit-learn
24 conda install -y matplotlib pytables
25 conda install -y ipython jupyter
26 conda install -y requests pyyaml usjon
27
28 echo ""
29 export PATH="/root/.miniconda3/bin:$PATH"
30 source activate base"" >> ~/.bashrc
31
32 # Jupyter
33 mkdir ~/.jupyter
34
35 echo ""
36 c.NotebookApp.password='sha1:86cd78bf6306:9613d6ac1328ab7fe41f4f9b5b038d6694d6df20'
37 c.NotebookApp.port=11111
38 c.NotebookApp.ip='*'
39 c.NotebookApp.open_browser=False"" >> ~/.jupyter/jupyter_notebook_config.py
40
41 jupyter notebook --allow-root
42
```



many hours of
additional
live sessions



The Python Quants GmbH

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@dyjh

