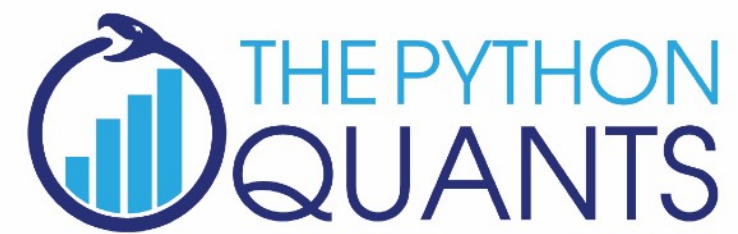


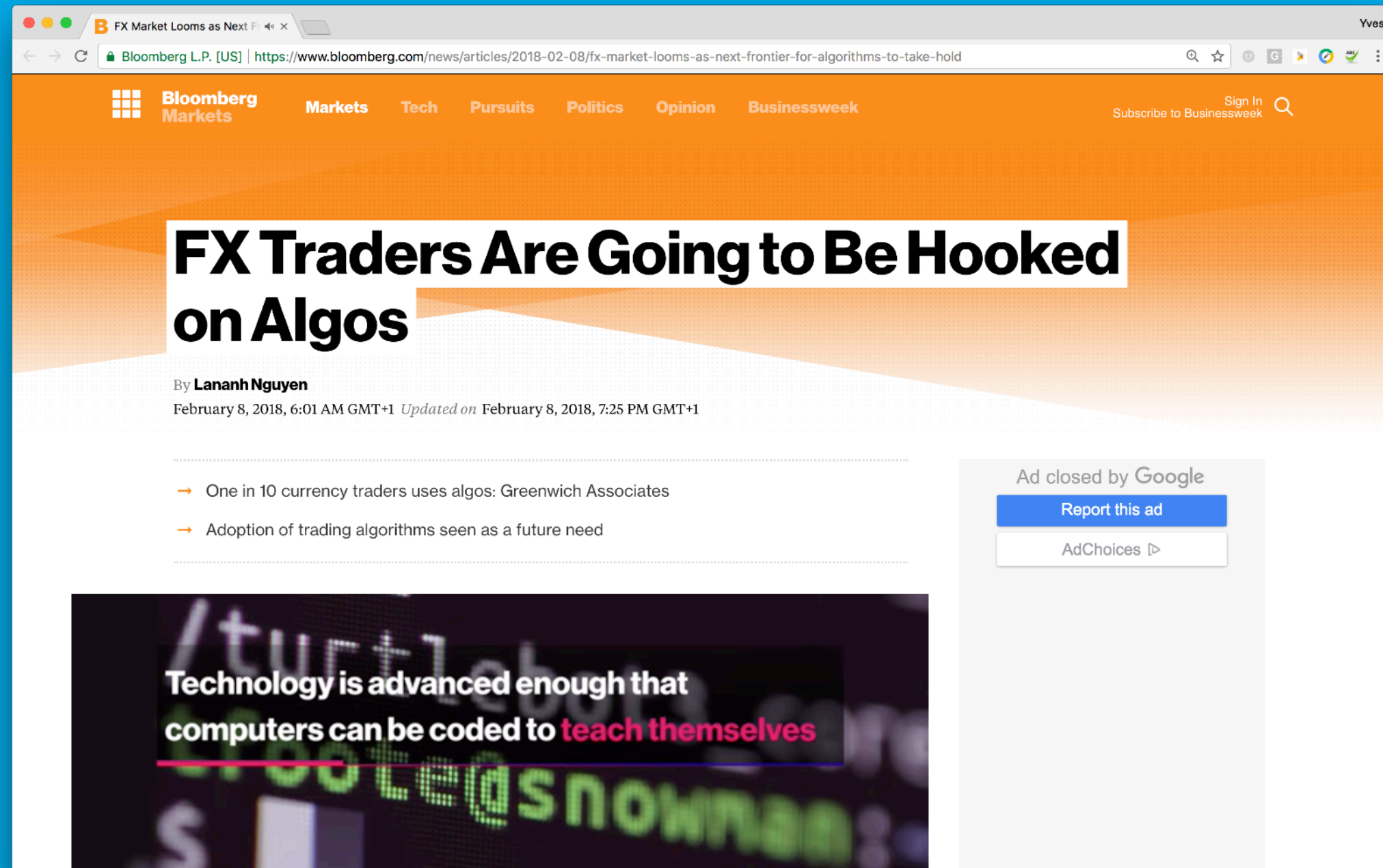
# Algorithmic Trading

## —REST API & Python Wrapper

FXCM Webinar, 04. April 2018

Dr. Yves J. Hilpisch





In a few years, currency traders will be hooked on algos like their stock-market colleagues.

That's the view of David Stryker, a principal at consulting firm Greenwich Associates LLC, who sees foreign-exchange markets following equities in the widespread adoption of computerized trading.

### Start your day with what's moving markets

While only one in 10 FX traders currently uses algos to execute trades, the adoption rate is higher at the largest institutions, with one in four deploying the systems, according to a Greenwich study released Thursday. In comparison, in equities more than half of volume is done through an algorithm. The firm surveyed 79 currency-market participants at hedge funds,

asset managers, corporations and other financial institutions in the U.S. and Europe.

“Given the myriad benefits that algos offer, FX traders currently not using algos (and not considering them) may soon have to determine whether they’re putting themselves at a disadvantage,” Stryker wrote in the study. “With all of the data available demonstrating the benefits/cost savings, the ability to execute a trade with an algo will soon become a ‘need’ as opposed to a ‘nice to have.’”

Almost 60 percent of respondents said algos had materially cut trading costs, according to the survey. The push to save money, combined with stricter regulation, will boost the appeal of trading software, Greenwich concluded.

appeal of trading software, Greenwich concluded, according to the survey. The push to save money, combined with stricter regulation, will boost the appeal of trading software, Greenwich concluded.

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Trading forex/CFDs on margin carries a high level of risk and may not be suitable for all investors as you could sustain losses in excess of deposits. Leverage can work against you. Due to the certain restrictions imposed by the local law and regulation, German resident retail client(s) could sustain a total loss of deposited funds but are not subject to subsequent payment obligations beyond the deposited funds. Be aware and fully understand all risks associated with the market and trading. Prior to trading any products, carefully consider your financial situation and experience level. Any opinions, news, research, analyses, prices, or other information is provided as general market commentary, and does not constitute investment advice. FXCM & TPQ will not accept liability for any loss or damage, including without limitation to, any loss of profit, which may arise directly or indirectly from use of or reliance on such information.

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# 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



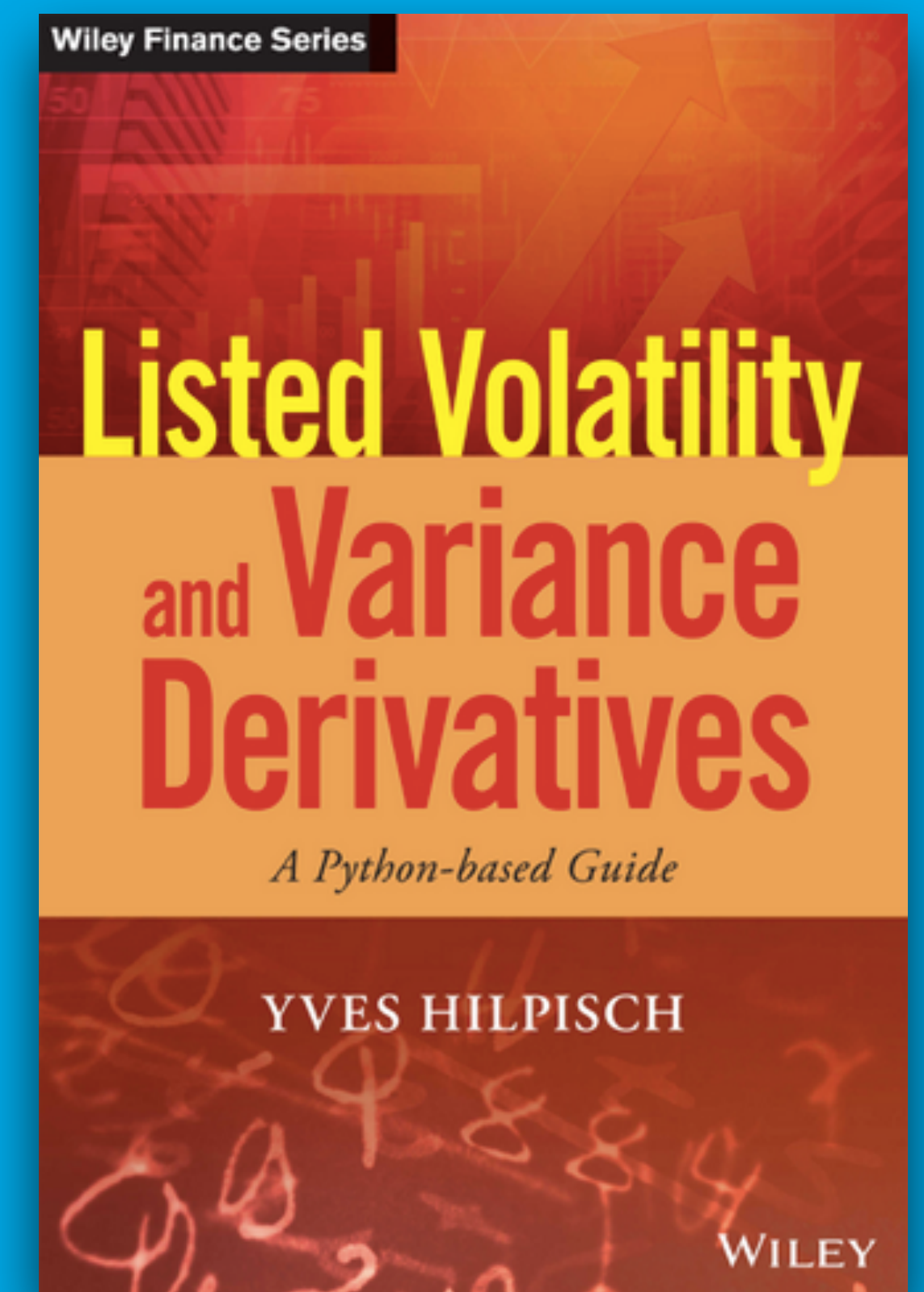
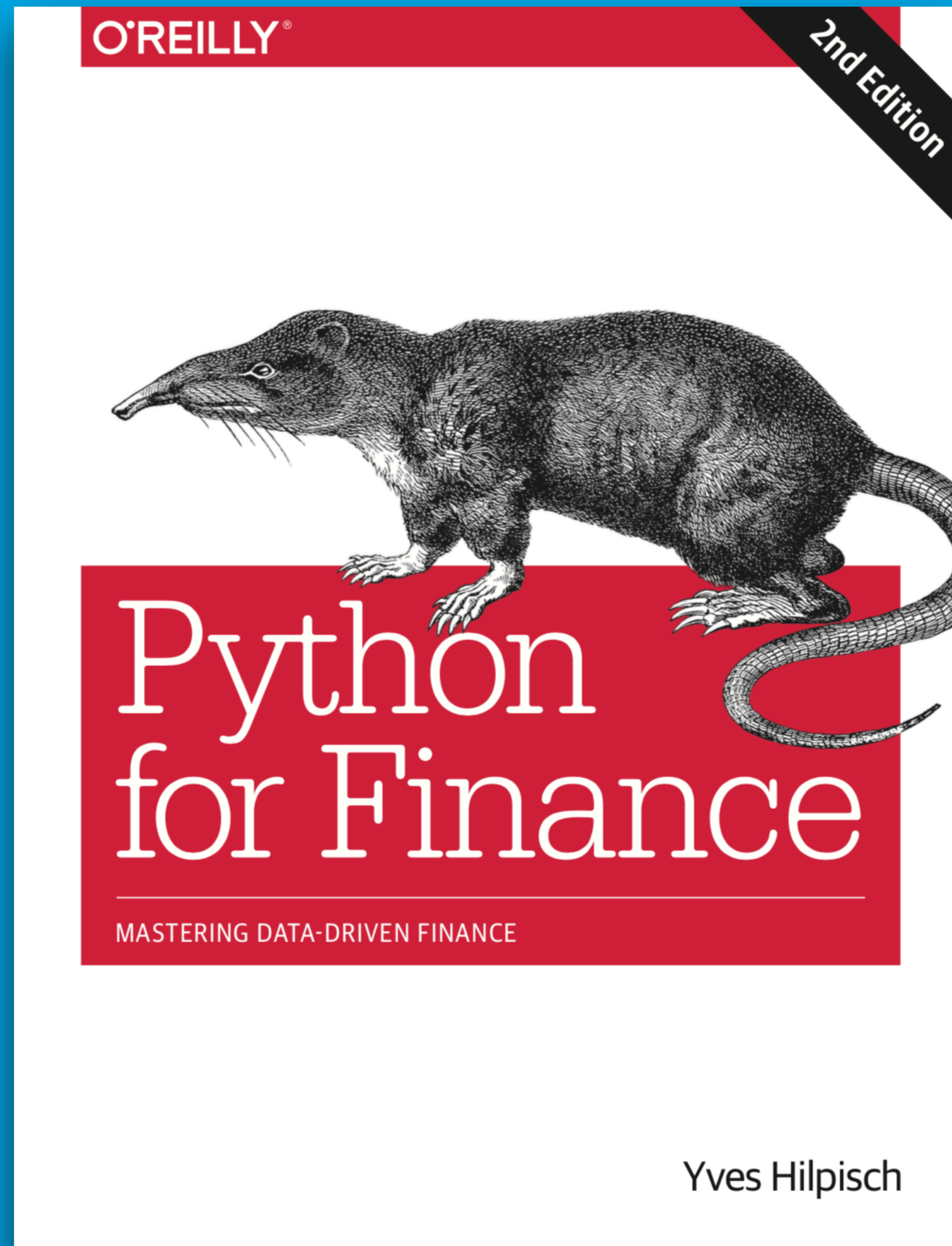
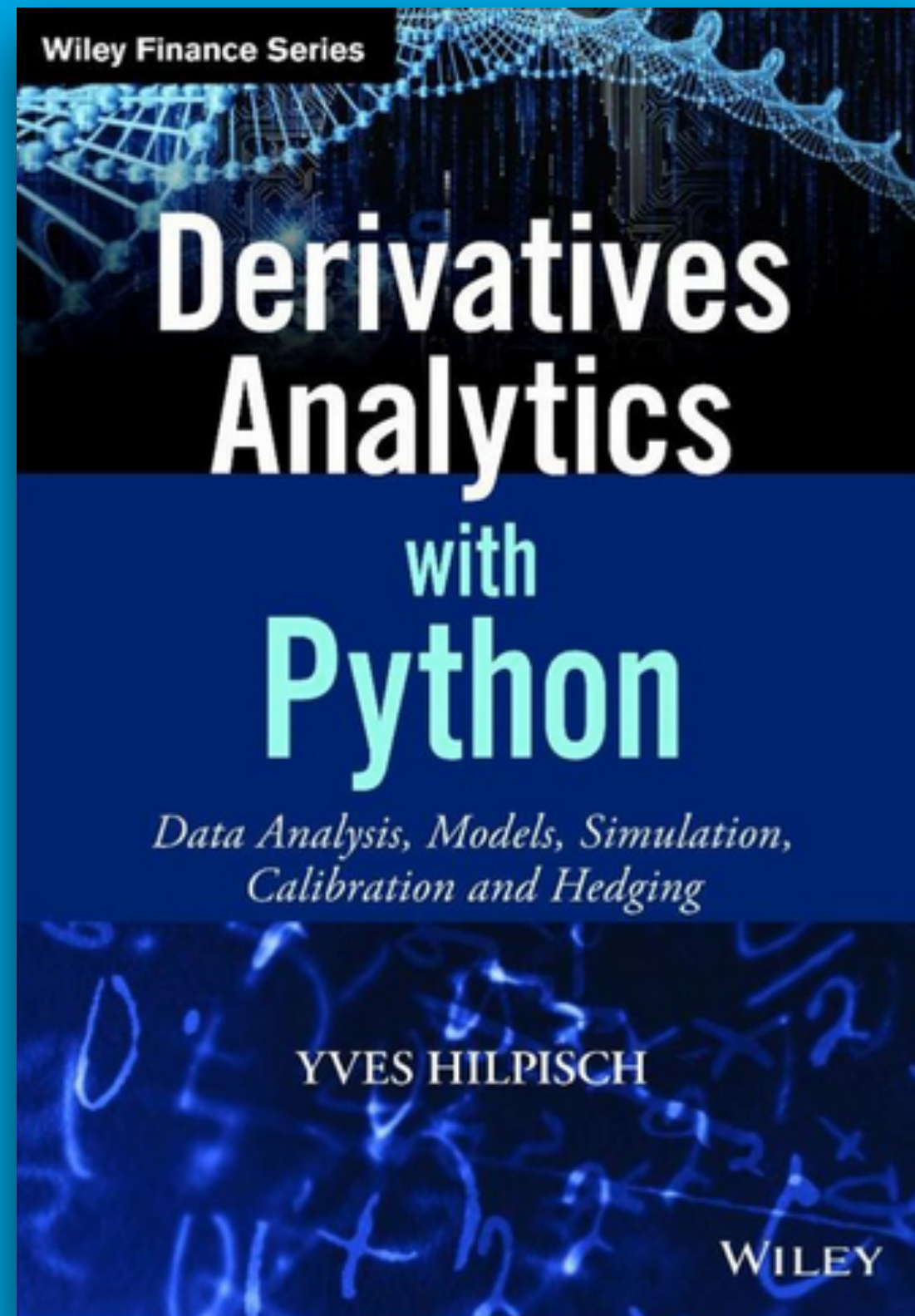
**PLATFORM**  
for browser-based  
data analytics



**OPEN SOURCE**  
Python library  
for financial analytics







<http://books.tpq.io>



16 week program

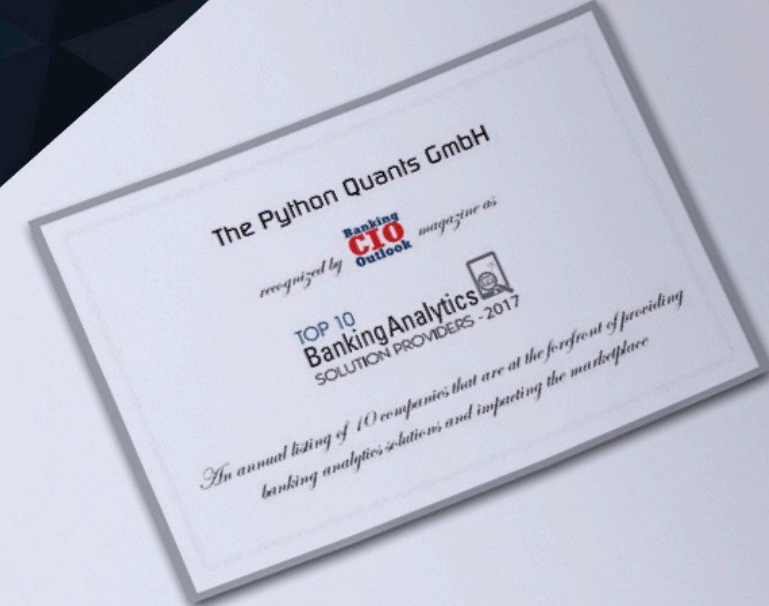
150+ hours  
of instruction

**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.



**UNIVERSITY CERTIFICATE  
IN PYTHON FOR  
ALGORITHMIC TRADING**



5,000+ lines  
of code

The Python Quants GmbH  
66333 Voelklingen  
Germany  
T/F +49 3212 112 91 94  
<http://training.tpq.io>  
[training@tpq.io](mailto:training@tpq.io)

April 2017

1,200 pages PDF

<http://certificate.tpq.io>

# 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 31

## 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 concertgoers in Las Vegas on Sunday night. More than 50 people were killed and over 115 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.



## Catalan president urges Brussels to mediate in independence clash

Catalan President Carles Puigdemont has urged the European Commission to mediate between Spain and Catalonia in the independence dispute. He said the EU should play a role in resolving the crisis, which has led to the suspension of Catalonia's autonomy and the imposition of Spanish law. He also urged the EU to help broker negotiations between the two sides.

## Scientists who unwound the workings of human body clock win Nobel Prize

Three American scientists have won the Nobel medicine prize for discovering the molecular workings of the "body clock" in humans and animals that synchronises with the Earth's cycle through night and day. Jeffrey Hall, Michael Rosbash and Michael Young worked out how a biochemical feedback mechanism maintains our circadian rhythm, the 24-hour cycle of sleep and wakefulness, feeding behavior, hormone release, blood pressure and other physiological functions.

## Knowledge. Integrity. Discretion.

At Strat & Parker, we have unrivalled knowledge of the finest properties in London's most prestigious areas. We offer access to buyers from all over the world through our affiliation with Christie's International Real Estate. We provide a trusted and personal service, which has helped us become one of the leading agents for exclusive properties in prime central London.

### World Markets

INDEX	02 Oct 2	01 Oct 2	02 Oct 2	02 Oct 2	02 Oct 2
S&P 500	2102.04	2101.58	2113.01	2114.42	2115.41
Nifty 50	10711.34	10711.34	10711.34	10711.34	10711.34
Dax Jones Ind	17450.23	17450.59	17450.59	17450.59	17450.59
FTSE 100	6120.40	6120.40	6120.40	6120.40	6120.40
Hang Seng	27594.92	27594.92	27594.92	27594.92	27594.92

## China Spins New Lesson From Soviet Fall

The Communist Party boss in eastern China's Jiangsu province summoned local officials recently to a compulsory study session to re-examine the party and enforce discipline among its members. The film begins with images of the Soviet Union in its heyday, but quickly cuts to graphic footage of unrest in China's northeast. The film also shows the rise of the Communist Party in the 1990s, set to ominous music punctuated by Russian communists lamenting their nation's fate.

## 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 top up as much as \$10 billion in new yearly profits from the eight largest U.S. banks through lower revenue and higher compliance costs.

## 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. The office in charge of Mr. Xi's campaign didn't respond to questions about the film, called "20th Anniversary of the Death of the Soviet Party and State: As the Russians Remember," but said the campaign drew on experiences from China and the rest of the world.

▲ Plan for selling banks detailed. ● Heard on the Street: Rule is a move to the end. CH



## A Celebrity Selfie Machine

PLUS Secondhand Stress at Work

# THE WALL STREET JOURNAL.

WEDNESDAY, DECEMBER 11, 2013 - VOL. CCLXII NO. 138  
WJSJ.com \*\*\*\*\* \$2.00

## 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 measure of stability to Congress's fiscal policy-making over the next two years.
- **Financial regulators approved the Volcker rule**, which curbs banks' risk-taking and could slash their profits. A1
- **The FDIC board approved a draft plan to keep parts of a failing financial firm open** without a taxpayer bailout. C2
- **Finance ministers from 16 euro-zone nations reached an understanding on winding down failing banks.** C3

### 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



## Deal Brings Stability to U.S. Budget

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

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 measure of stability to Congress's fiscal policy-making over the next two years. Sen. Patty Murray (D., Wash.) and Rep. Paul Ryan (R., Wis.), who struck the deal after weeks of private talks, said it would allow more spending for domestic and defense programs in the near term, while adopting deficit-reduction measures over a decade to offset the costs. Revenue 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.

## Thousands Honor Memory of South Africa's Liberator

A boy attended the memorial service for former South African President Nelson Mandela at a soccer stadium in Johannesburg on Tuesday that drew celebrities and dozens of heads of state, including President Obama, along with thousands of other mourners. A12

## Longtime Insider Is GM's First Female CEO

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.

IXUS ITOT IVV AGG  
IEFA iShares Core ETFs ILTB International Stocks US Stocks  
IEMG IJH IJR IYST

### Here's Your Holiday Bonus. Now Start Running

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

### Bank Rule Challenges Wall Street

Every investor is unique. That's why there's iShares Core. 10 ETFs that help you construct your personal portfolio.

### 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. A13

**BUSINESS SUMMARY** >

Apple Inc. designs, manufactures and markets mobile communication and media devices, personal computers and portable digital music players. The Company sells a range of related software, services, accessories, networking solutions, and third-party digital content and applications. The Company's segments include the Americas, Europe, Greater China, Japan and Rest of Asia Pacific. The Americas segment includes both North and South America. The Europe segment includes European countries, India, the Middle East and Africa. The Greater China segment includes China, Hong Kong and Taiwan. The Rest of Asia Pacific segment includes Australia and the Asian countries not included in the Company's other operating segments. Its products and services include iPhone, iPad, Mac, iPod, Apple Watch, Apple TV, a portfolio of consumer and professional software applications, iPhone OS (iOS), OS X and watchOS operating systems, iCloud, Apple Pay and a range of accessory, service and support offerings.

**NEWS** >

28-Dec-2016

10:24:36	Apple dominerade julhandeln mätt i antalet aktiverade enheter	FNW
10:15:18	UPDATE 3-S.Korea fines Qualcomm \$854 mln for violating competition laws	RTRS
09:42:52	Corea del Sur multa a Qualcomm con 854 mlns dlr por violar leyes de competencia	RTRS
06:00:10	RPT-Wall Street cale une fois de plus au seuil des 20.000 points	RTRS
03:30:18	Aumento del gasto de último minuto impulsa a temporada de ventas de fin de año ...	RTRS
01:50:14	Last-minute spending surge lifts U.S. holiday shopping season	RTRS

27-Dec-2016

23:33:16	Reuters Insider - Tech stocks could take the Dow to 20k	CNBC
23:32:28	Reuters Insider - History suggests Dow could hit 20k by Friday: Technician	CNBC
22:55:29	LEAD 2-Wall Street cale une fois de plus au seuil des 20.000 points	RTRS
22:09:39	Apple, Cisco Lead DJIA Higher Tuesday	WALLST

**EVENTS** > Upcoming Past


24-Jan-2017 > 30-Jan-2017

NTS	Q1 2017 Apple Inc Earnings Release	📅
-----	------------------------------------	---

24-Feb-2017 > 28-Feb-2017

**PRICE PERFORMANCE** >

Open	
Prev. Close	
Bid / Ask	
VWAP	--
Turnover	
Volume	
Short Interest	0.90%
YTD	
Beta (5Y Monthly)	1.29
Mkt Cap	USD 625.27B
PE (LTM)	14.12
Div Yield	1.94%
DR	BRL <b>AAPL34.SA</b> (1:0.1)
DR Type	--
DR Bank	--



**AAPL.O** 115.190000

Price USD

117.260000

115.00

110.00

105.00

100.00

95.00

90.00

85.00

Dec-31 Mar-31 Jun-30 Sep-14-Dec-2016

Today 5D 3M 6M 1Y 5Y No Benchmark ▼

52Wk: 89.47 12-May 118.69 11-Oct

📅 Next Earn Report: 24-Jan-2017

Free Float	5.32B	Asset Type	Ordinary Share	5 yr CDS	26.980 bps
Outstanding	5.33B	Share Class	--	Δ Today	-0.07%
IPO Date	12-Dec-1980	Lot Size		Δ 1 Week	-0.074
First Trade Da...	12-Dec-1980	Voting Rights	1		

**FUNDAMENTALS** >

	AAPL (Sep-2016)	Growth	Industry
Gross Margin	38.02%	(4.71%) 4Q	38.91%
Operating Margin	25.10%	(11.59%) 4Q	5.75%

## Tick Data

```
In [23]: tick = ek.get_timeseries(['AAPL.O'],
                                fields='*',
                                start_date='2017-07-11 16:00:0000',
                                end_date='2017-07-11 16:15:0000',
                                interval='tick')
```

```
In [24]: tick.info()
```

```
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 1898 entries, 2017-07-11 16:00:00.686000 to 2017-07-11 16:14:59.708000
Data columns (total 2 columns):
VALUE      1892 non-null float64
VOLUME     1898 non-null float64
dtypes: float64(2)
memory usage: 44.5 KB
```

```
In [25]: tick.tail()
```

```
Out[25]:
```

	AAPL.O	VALUE	VOLUME
	Date		
	2017-07-11 16:14:59.693	144.9900	100.0
	2017-07-11 16:14:59.693	144.9900	100.0
	2017-07-11 16:14:59.693	144.9900	100.0
	2017-07-11 16:14:59.707	144.9899	400.0
	2017-07-11 16:14:59.708	144.9899	1305.0

## News

```
In [29]: news = ek.get_news_headlines('R:.SPX AND "Trump" AND Language:LEN', count=5)
news
```

```
Out[29]:
```

	versionCreated	text	storyId	sourceCode
2017-08-18 16:46:19	2017-08-18 16:46:19	U.S. STOCKS EXTEND GAINS AFTER NEW YORK TIMES ...	urn:newsml:reuters.com:20170818:nL4N1L44L9:1	NS:RTRS
2017-08-18 15:53:08	2017-08-18 15:53:08	CORRECTED-U.S. STOCKS PARE LOSSES, TRADERS CIT...	urn:newsml:reuters.com:20170818:nL4N1L44IK:1	NS:RTRS
2017-08-18 15:16:27	2017-08-18 15:16:27	US STOCKS-Wall St lower on growing concerns ov...	urn:newsml:reuters.com:20170818:nL4N1L44F2:5	NS:RTRS
2017-08-18 11:24:30	2017-08-18 11:24:30	US STOCKS-Futures flat amid growing concerns o...	urn:newsml:reuters.com:20170818:nL4N1L43RR:5	NS:RTRS
2017-08-17 17:09:05	2017-08-17 17:09:05	US STOCKS-Wall St extends losses on Trump poli...	urn:newsml:reuters.com:20170817:nL4N1L34N1:5	NS:RTRS

```
In [30]: storyId = news.iloc[4, 2]
storyId
```

```
Out[30]: 'urn:newsml:reuters.com:20170817:nL4N1L34N1:5'
```

```
In [31]: from IPython.display import display, HTML
```

```
In [32]: display(HTML(ek.get_news_story(storyId)))
```

- Gary Cohn resignation rumors knocked down
- Wal-Mart drops after reporting margin fall
- Indexes down: Dow 0.81 pct, S&P 1.03 pct, Nasdaq 1.39 pct

Updates to early afternoon

By Sruthi Shankar and Tanya Agrawal

Aug 17 (Reuters) - U.S stocks hit session lows in early afternoon trading on Thursday as investors worried about President Donald Trump's ability to

**AI-First Finance**

MARCOS LOPEZ DE PRADO

ADVANCES  
*in*  
FINANCIAL  
MACHINE  
LEARNING

WILEY

“The essential tool of econometrics is multivariate linear regression, an 18th-century technology that was already mastered by Gauss before 1794 ... It is hard to believe that something as complex as 21st-century finance could be grasped by something as simple as inverting a covariance matrix.”

“... what if economists finally started to consider non-linear functions?”

“An ML algorithm can spot patterns in a 100-dimensional world as easily as in our familiar 3-dimensional one.”

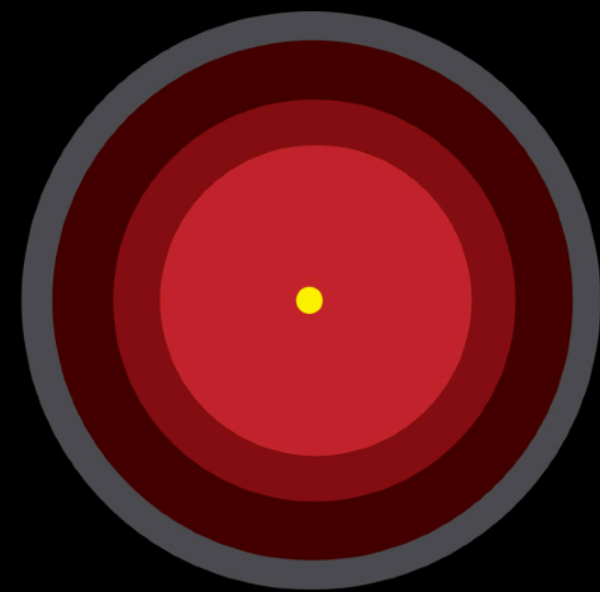
“Econometrics might be good enough to succeed in financial academia (for now), but succeeding in practice requires ML.”

*Marcos López de Prado (2018)*



# THE TECHNOLOGICAL SINGULARITY

MURRAY SHANAHAN



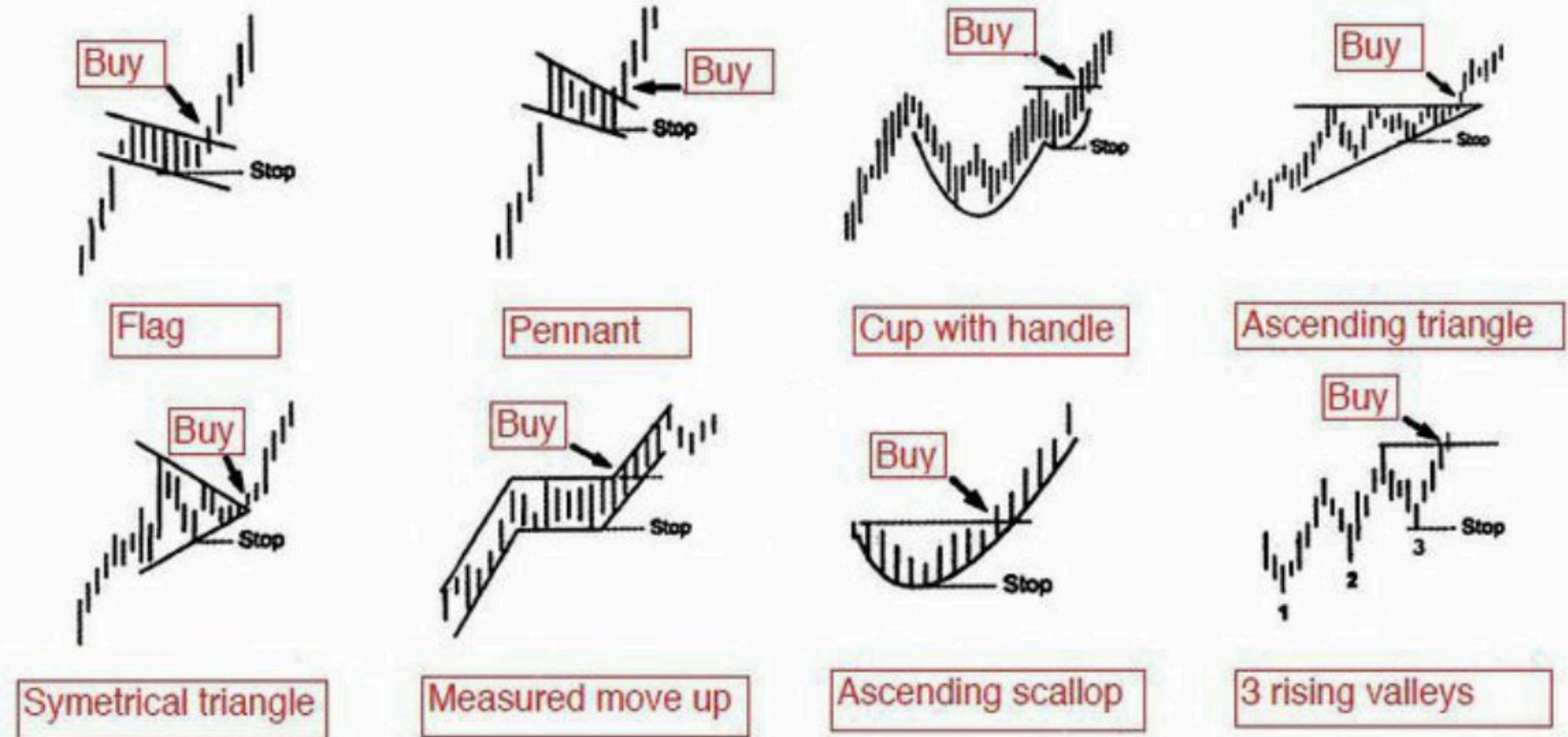
THE MIT PRESS ESSENTIAL KNOWLEDGE SERIES

THE MIT PRESS ESSENTIAL KNOWLEDGE SERIES

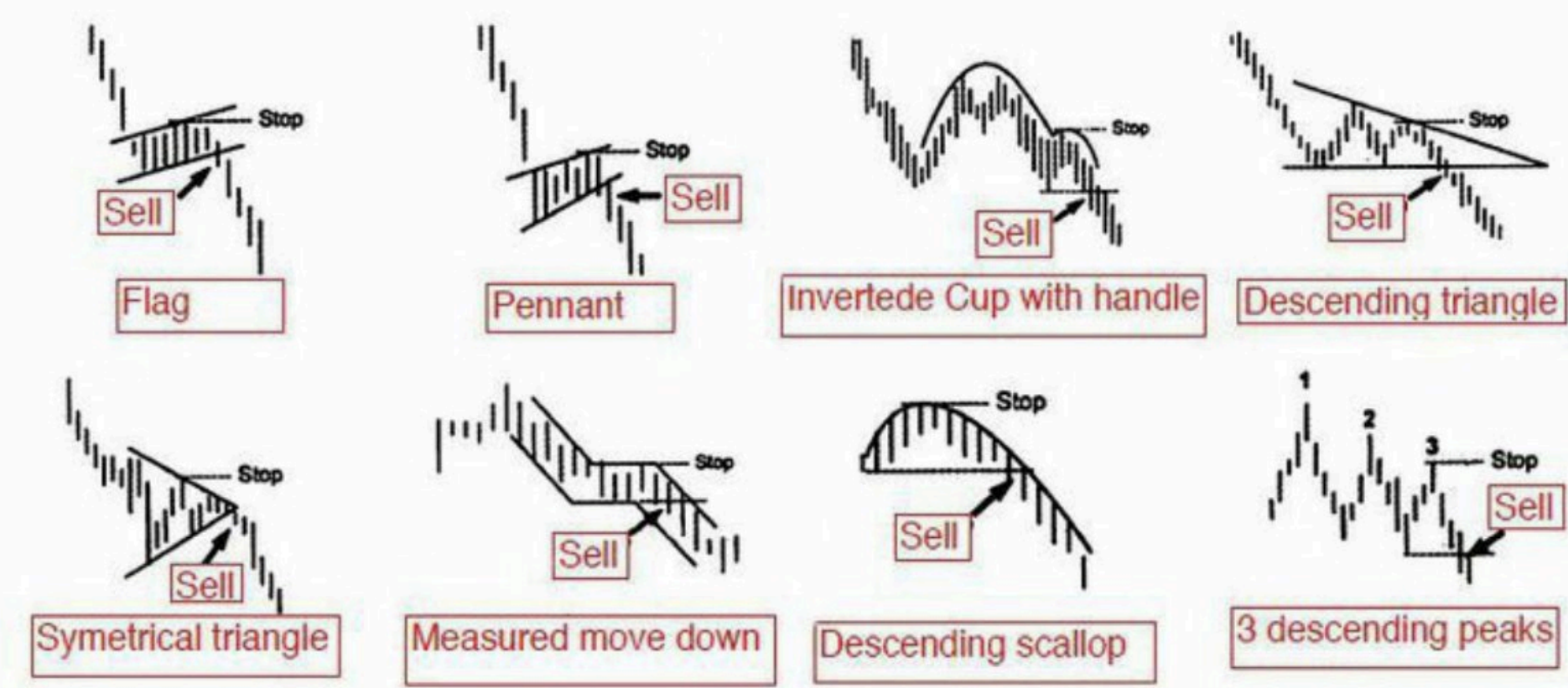
“Today’s algorithmic trading programs are relatively simple and make only limited use of AI. However, this is sure to change. Artificial intelligence is beneficial in any domain where patterns have to be found in large quantities of data and effective decisions have to be taken on the basis of those patterns, especially when the decisions have to be taken rapidly.”

*Murray Shanahan (2015)*

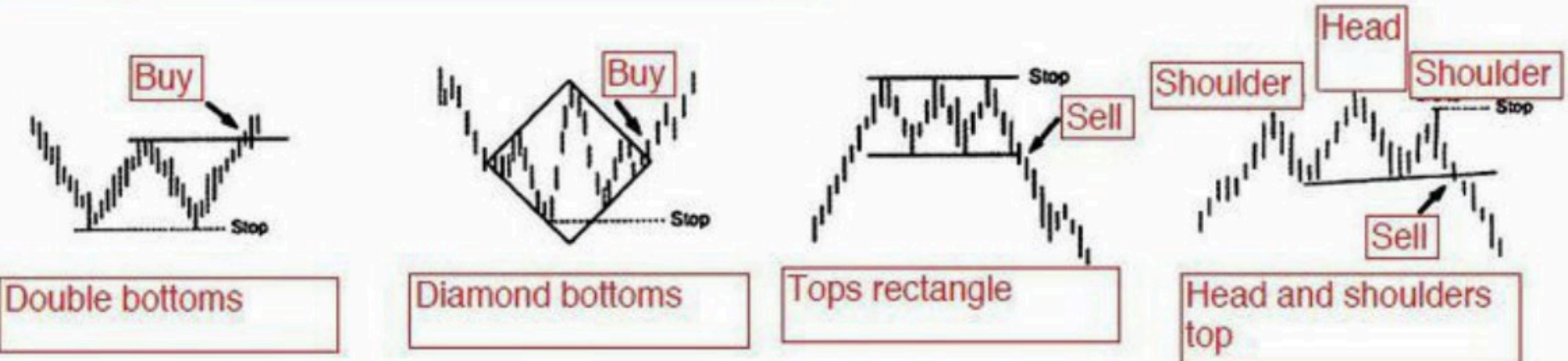
Bullish patterns (going up)

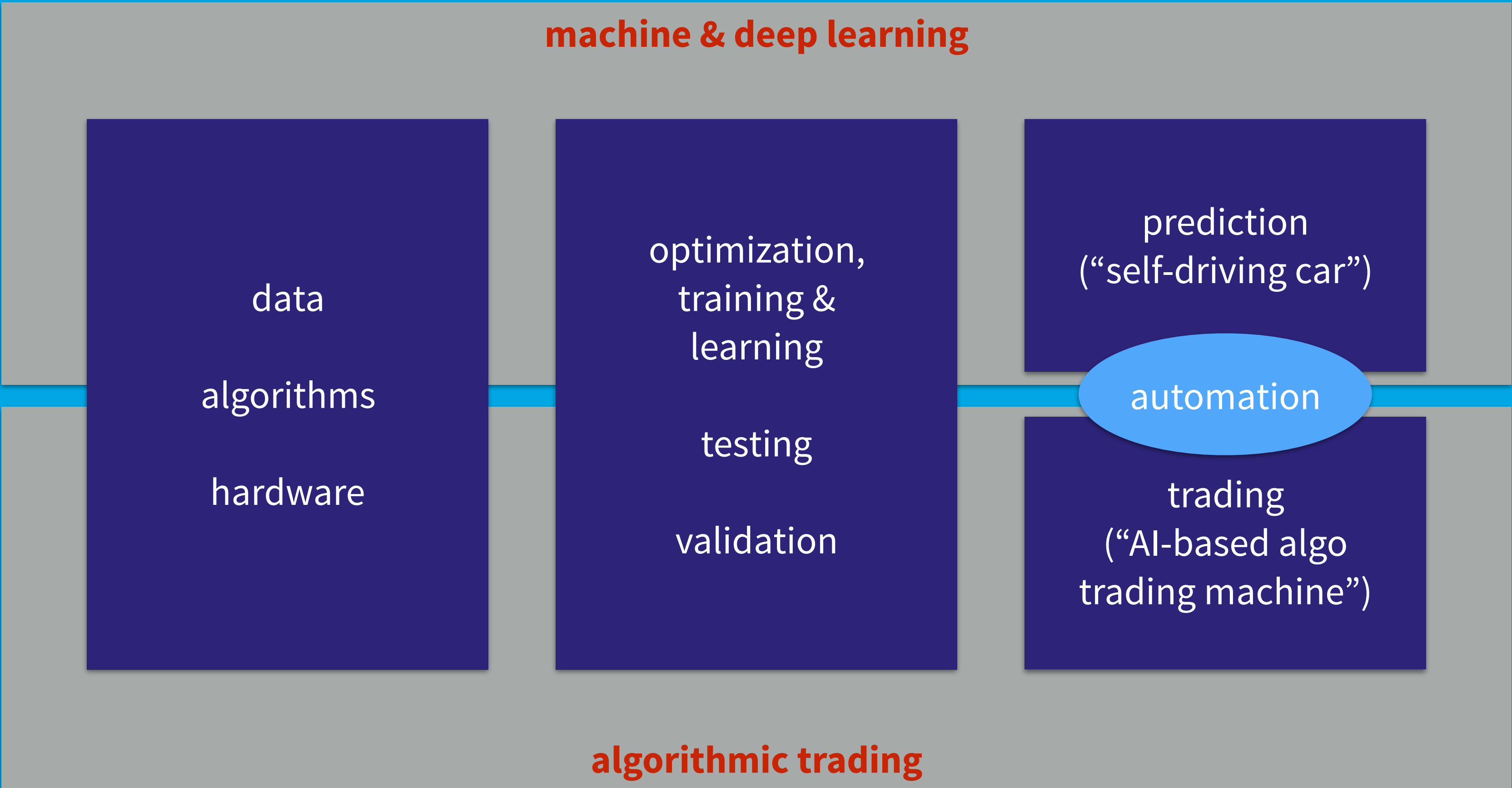


Bearish patterns (going down)



Reversal patterns





# Financial Markets



$x$

$y$

“non-linear, complex, changing”

# Finance History



$f(\cdot)$

$f(x) \neq y$

“brain-driven & beauty myth”

# AI in Finance = finance

$x$

$m(\cdot, a, b)$

$m(x, a^*, b^*) \approx y$

“data-driven & AI-first”

# **FXCM DATA & REST API Demo**

# FXCM REST API & Python Wrapper Package

<https://www.fxcm.com/uk/algorithmic-trading/forex-python/>

<http://fxcmpy.tpq.io>

`pip install fxcmpy`

## fxcmpy Python Package

FXCM offers a modern REST API with algorithmic trading as its major use case. fxcmpy is a Python package that exposes all capabilities of the REST API via different Python classes. The classes allow for a convenient, Pythonic way of interacting with the REST API on a high level without needing to take care of the lower-level technical aspects. Traders, data scientists, quants and coders looking for forex and CFD python wrappers can now use fxcmpy in their algo trading strategies.

### RESOURCES:

[→ GitHub](#)   [→ REST API documentation](#)   [→ fxcmpy documentation](#)

```
[11]: from pylab import plt
      plt.style.use('seaborn')
      %matplotlib inline

[12]: data['Bid'].plot(figsize=(10, 6))
```



### HAVE AN OPINION ON THE POUND?

Trade the global markets:  
Forex, Spread Betting and CFDs

[OPEN AN ACCOUNT](#)



### ACTIVE TRADER SPREADS

SYMBOL	BID	ASK	SPREAD
EUR/USD	1.22896	1.22898	0.2
GBP/USD	1.40761	1.40763	0.2

## 1.5. Package Installation

Installation happens via `pip install` on the command line.

```
pip install fxcmpy
```

Working in an interactive context (e.g. IPython or Jupyter), you can then check whether the package is installed via:

```
In [1]: import fxcmpy
```

```
In [2]: fxcmpy.__version__
```

```
Out[2]: '1.1.7'
```

## 1.6. API Token

To connect to the API, you need an **API token** that you can create or revoke from within your (demo) account in the Trading Station <https://tradingstation.fxcm.com/>.

**Important:** Please send an email with your user name to [api@fxcm.com](mailto:api@fxcm.com) to get RESTful API access and to activate your token, respectively.

In an interactive context, you can use e.g. a variable called `TOKEN` to reference your unique API token.

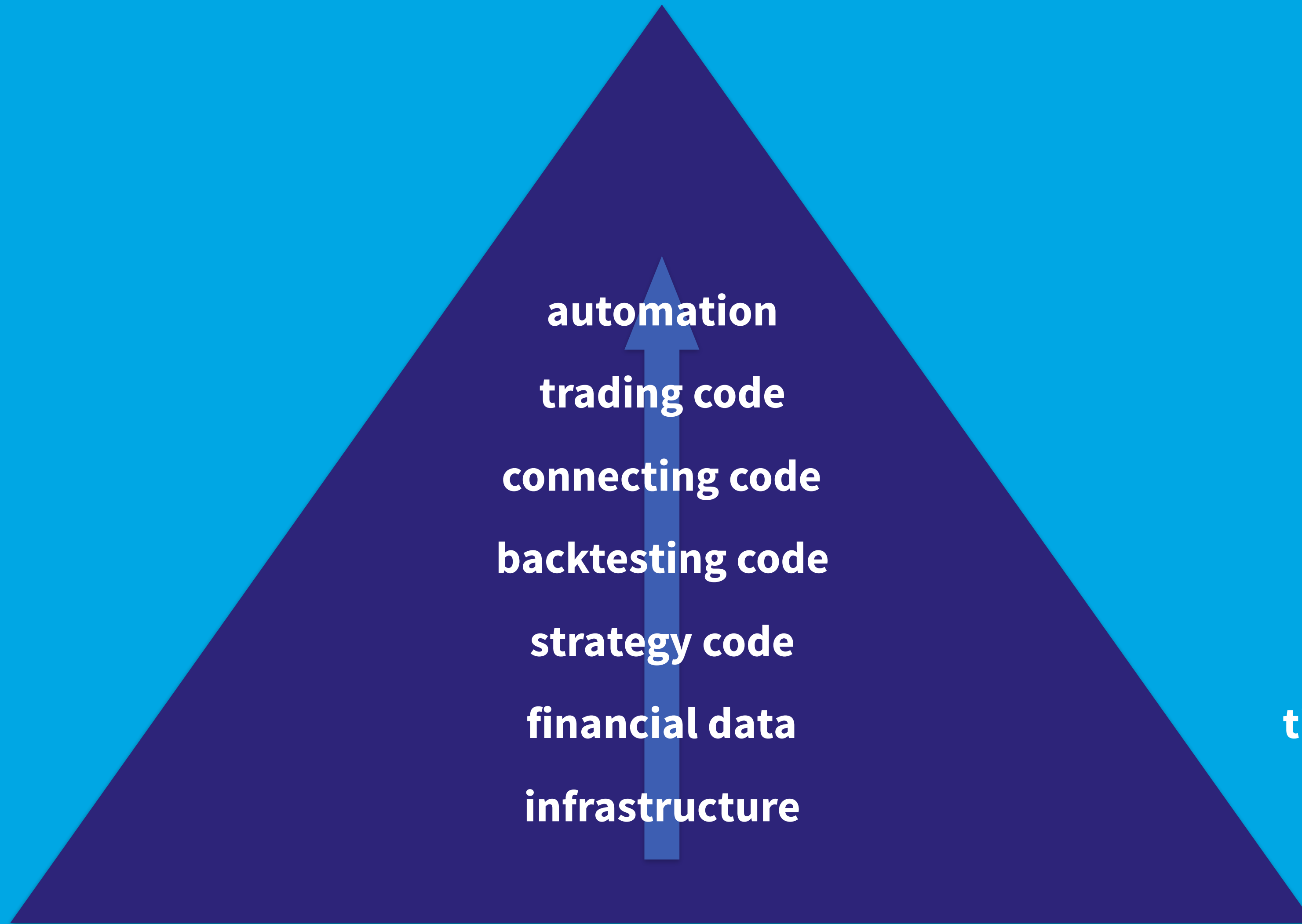
```
TOKEN = YOUR_FXCM_API_TOKEN
```

Connecting to the server, then boils down to the following line of code.

```
con = fxcmpy.fxcmpy(access_token=TOKEN, log_level='error')
```

However, it is recommended to store the API token in a **configuration file** which allows for re-usability and hides the token on the GUI level. The file should contain the following lines.

```
[FXCM]
log_level = error
log_file = PATH_TO_AND_NAME_OF_LOG_FILE
access_token = YOUR_FXCM_API_TOKEN
```



***FXCM***

**simple algorithm**

**order placement**

**streaming**

**vectorized backtesting**

**SVM classifier**

**tick, historical, real-time**

**Python, Jupyter**

**Skynet begins to learn at a geometric rate.  
It becomes self-aware at 2:14 a.m. Eastern time, August 29th.**

***—The Terminator (Terminator 2)***





**AI-based,  
Algorithmic  
Trading  
Strategies**

**The AI  
Machine**

# The AI Machine

standardized deployment  
of AI-based algorithmic  
trading strategies

The screenshot displays the 'The Machine' trading platform interface. The browser address bar shows 'machine.tpq.io:3020/home'. The main interface is divided into two primary sections: 'Trader Desk' and 'Audit Details'.

**Trader Desk:** This section shows a table of trading models. The table has columns for 'Actions', 'Status', 'Model Start Time', 'Instrument', 'Model Name', and 'Frequency'. The data is filtered for '2018-04'. The models listed are 'SimpleMovingAverageSignal...' for various instruments (EUR\_GBP, EUR\_USD) and frequencies (S5, M1). Each model has a 'Toggle' and 'Stop' button.

Actions	Status	Model Start Time	Instrument	Model Name	Frequency
Toggle Stop	Running	2018-04-04 10:9:25	EUR_GBP	SimpleMovingAverageSignal...	S5
Toggle Stop	Running	2018-04-03 18:28:19	EUR_USD	SimpleMovingAverageSignal...	M1
Toggle Stop	Stopped	2018-04-03 9:50:14	EUR_USD	SimpleMovingAverageSignal...	M1
Toggle Stop	Stopped	2018-04-03 12:7:58	EUR_GBP	SimpleMovingAverageSignal...	S5
Toggle Stop	Stopped	2018-04-03 12:12:11	EUR_GBP	SimpleMovingAverageSignal...	S5
Toggle Stop	Stopped	2018-04-03 10:3:4	EUR_GBP	SimpleMovingAverageSignal...	S5
Toggle Stop	Stopped	2018-04-02 9:29:34	EUR_GBP	SimpleMovingAverageSignal...	S5
Toggle Stop	Stopped	2018-04-02 11:41:33	EUR_GBP	SimpleMovingAverageSignal...	M1
Toggle Stop	Stopped	2018-04-02 10:32:53	EUR_USD	SimpleMovingAverageSignal...	M1

**Audit Details:** This section provides a detailed view of a specific trade. It shows the 'Instrument' as EUR\_GBP and the 'Model Name' as 'SimpleMovingAverageSignal...'. The 'Accuracy' is 56.44% and the 'Frequency' is S5. A line chart displays the price movement over time, with a red line indicating the predicted price and a black line with green triangles indicating the actual price. The chart includes a 'Zoom' menu with options for 30S, 1M, 5M, 10M, 30M, 1H, 3H, 12H, and All. The time range is set from 'Apr 4, 2018' to 'Apr 4, 2018'. Below the chart, there is a table of trade execution details.

Prediction Direction	Prediction Time	Trade Execution Time	Target Signal Time	Previ
PricePrediction.INCREASE	2018-04-04T10:09:26.997648Z	2018-04-04T10:09:27.50879...	2018-04-04T10:09:30Z	0.874
PricePrediction.DECREASE	2018-04-04T10:09:30.999865Z	2018-04-04T10:09:31.44409...	2018-04-04T10:09:35Z	0.874
PricePrediction.DECREASE	2018-04-04T10:09:35.995286Z		2018-04-04T10:09:40Z	0.874
PricePrediction.DECREASE	2018-04-04T10:09:40.986754Z		2018-04-04T10:09:45Z	0.874
PricePrediction.INCREASE	2018-04-04T10:09:26.997648Z	2018-04-04T10:09:27.50879...	2018-04-04T10:09:30Z	0.874

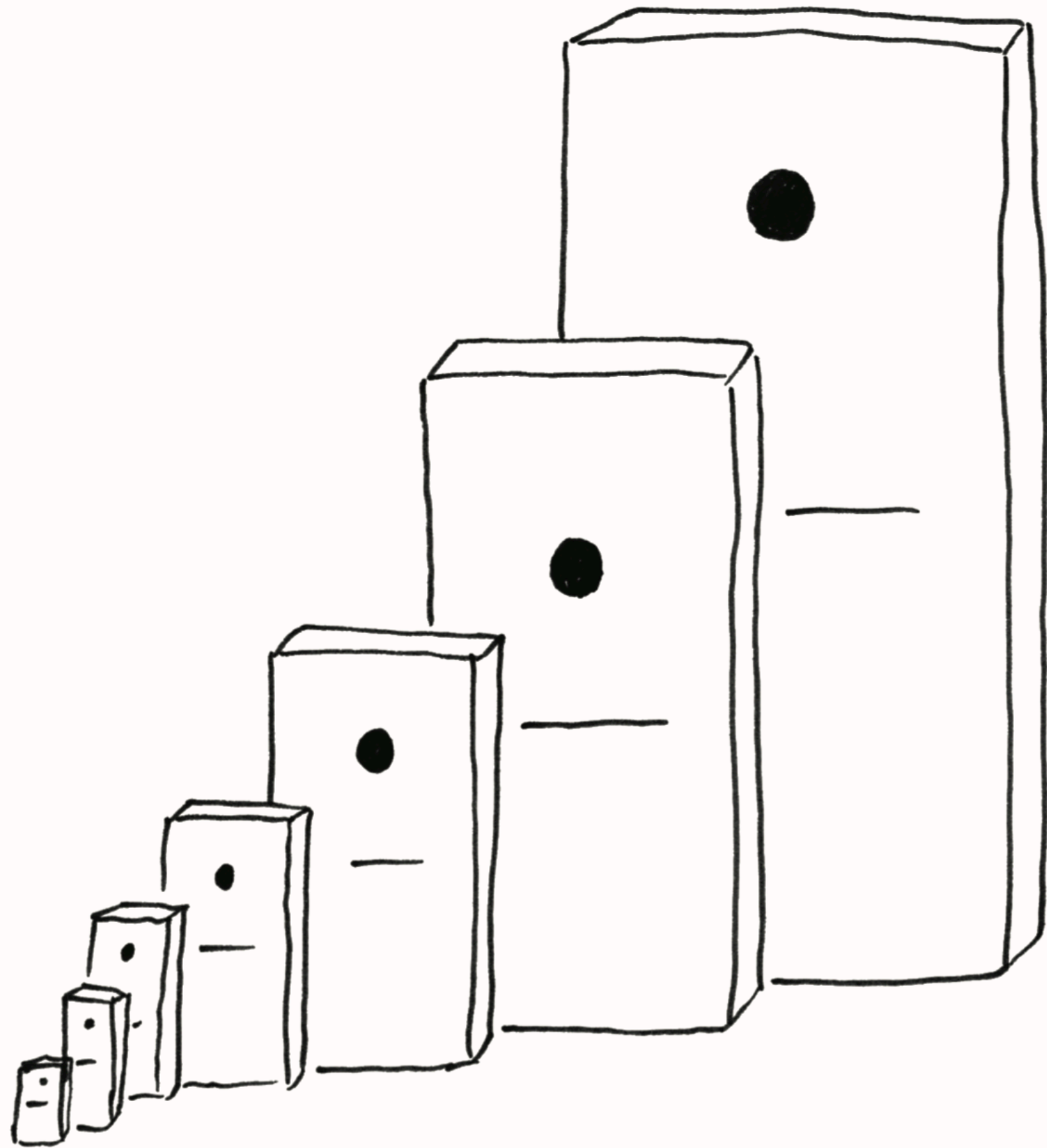
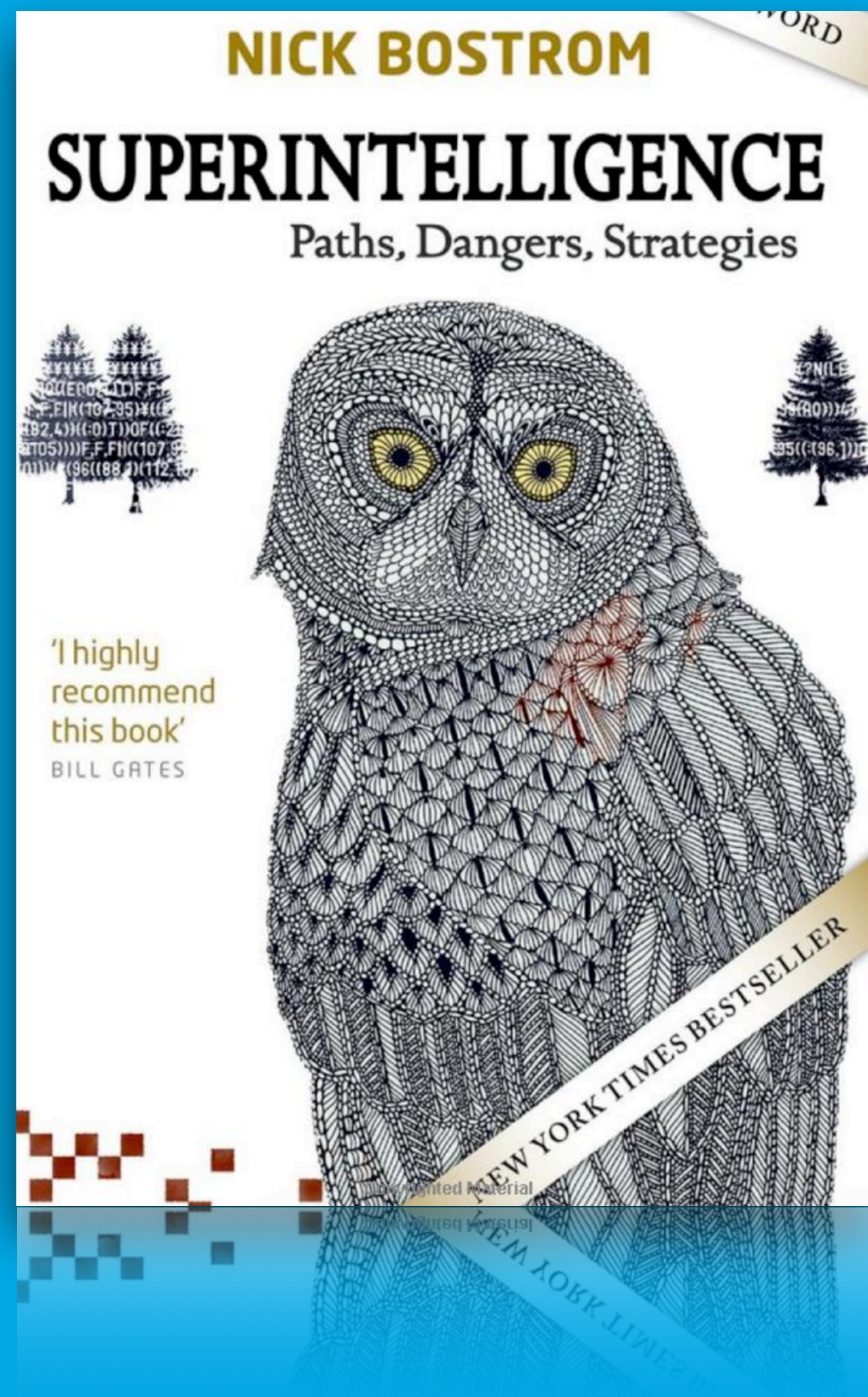


FIG 1 A geometric domino progression.

[www.the1thing.com](http://www.the1thing.com)

### **exponential forces** at work:

- technology improvements
- capital accumulation
- talent accumulation



“Go-playing programs have been improving at a rate of about 1 dan/year in recent years. If this rate of improvement continues, they might beat the human world champion in about a decade.”

*Nick Bostrom (2014): Superintelligence.*

# The story of AlphaGo so far

AlphaGo is the first computer program to defeat a professional human Go player, the first program to defeat a Go world champion, and arguably the strongest Go player in history.

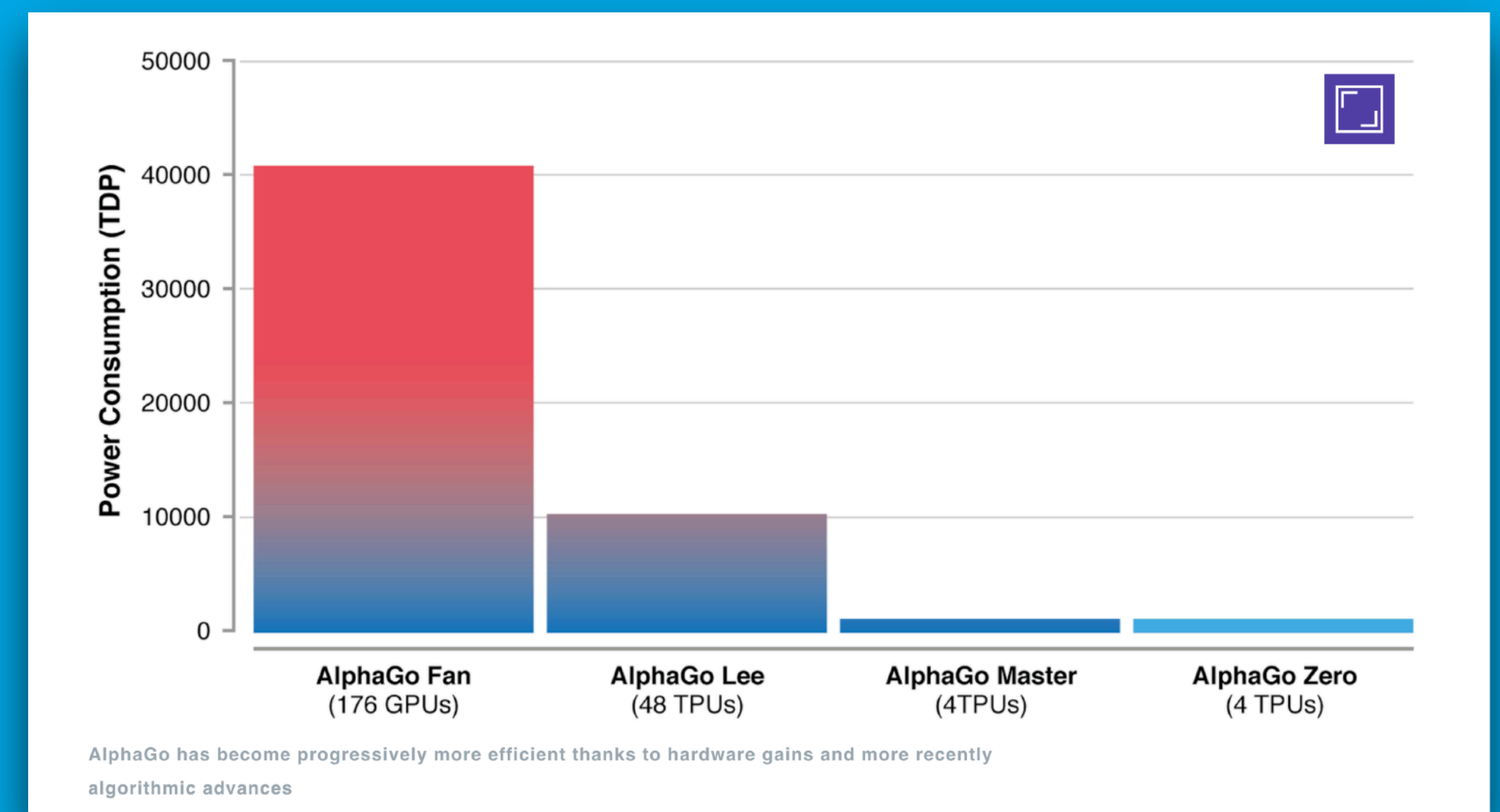
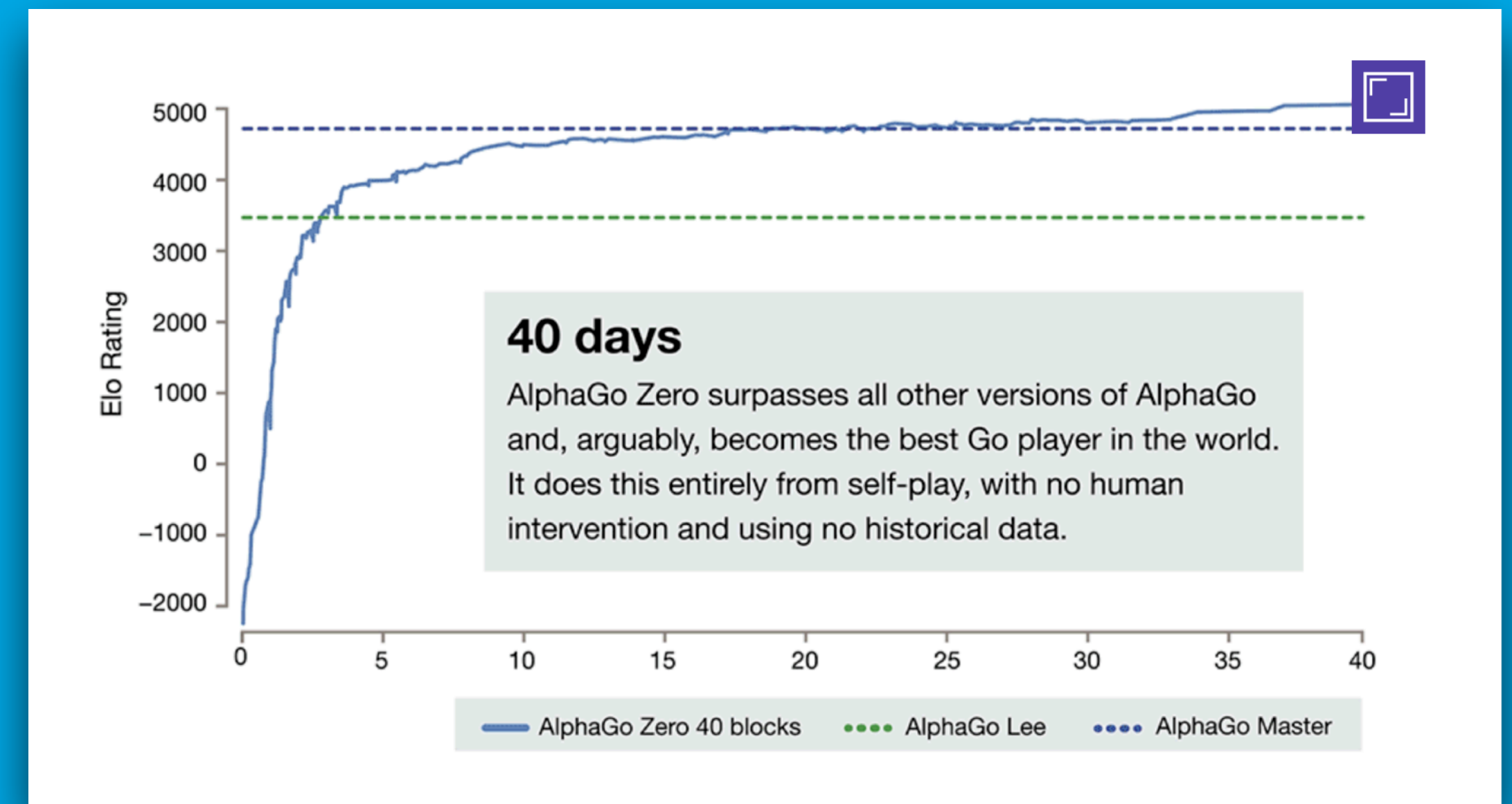
AlphaGo's first formal match was against the reigning 3-times European Champion, Mr Fan Hui, in October 2015. Its 5-0 win was the first ever against a Go professional, and the results were published in full technical detail in the international journal, [Nature](#). AlphaGo then went on to compete against legendary player Mr Lee Sedol, winner of 18 world titles and widely considered to be the greatest player of the past decade.

AlphaGo's 4-1 victory in Seoul, South Korea, in March 2016 was watched by over 200 million people worldwide. It was a landmark achievement that experts agreed was a decade ahead of its time, and earned AlphaGo a 9 dan professional ranking (the highest certification) - the first time a computer Go player had ever received the accolade.

During the games, AlphaGo played a handful of [highly inventive winning moves](#), several of which - including move 37 in game two - were so surprising they overturned hundreds of years of received wisdom, and have since been examined extensively by players of all levels. In the course of winning, AlphaGo somehow taught the world completely new knowledge about perhaps the most studied and contemplated game in history.

contemplated game in history

taught the world completely new knowledge about perhaps the most studied and extensively played game in the course of winning



# The Python Quants GmbH

Dr. Yves J. Hilpisch

+49 3212 112 9194

<http://tpq.io> | [team@tpq.io](mailto:team@tpq.io)

@dyjh

