

AI-First Finance & Algorithmic Trading

Dr. Yves J. Hilpisch



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

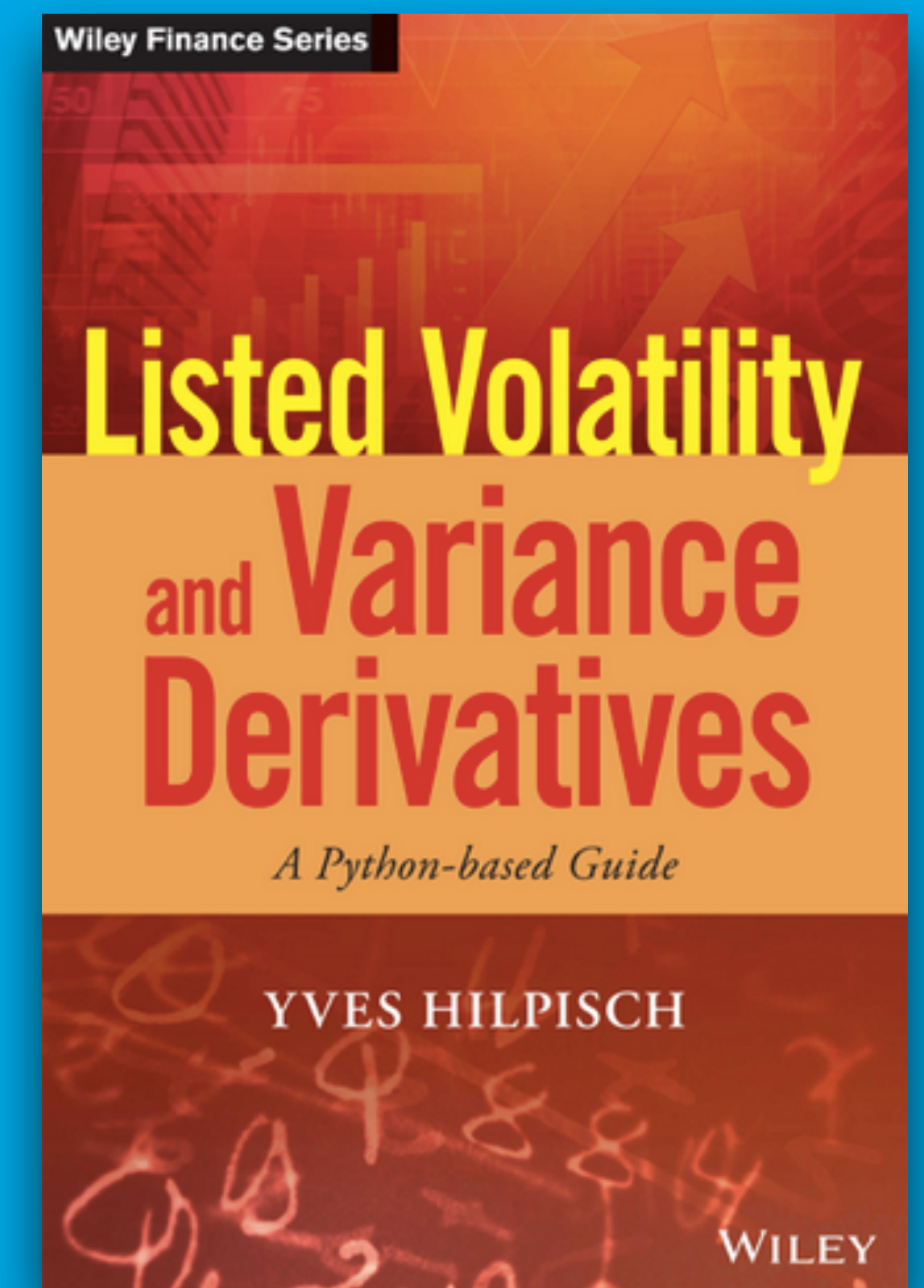
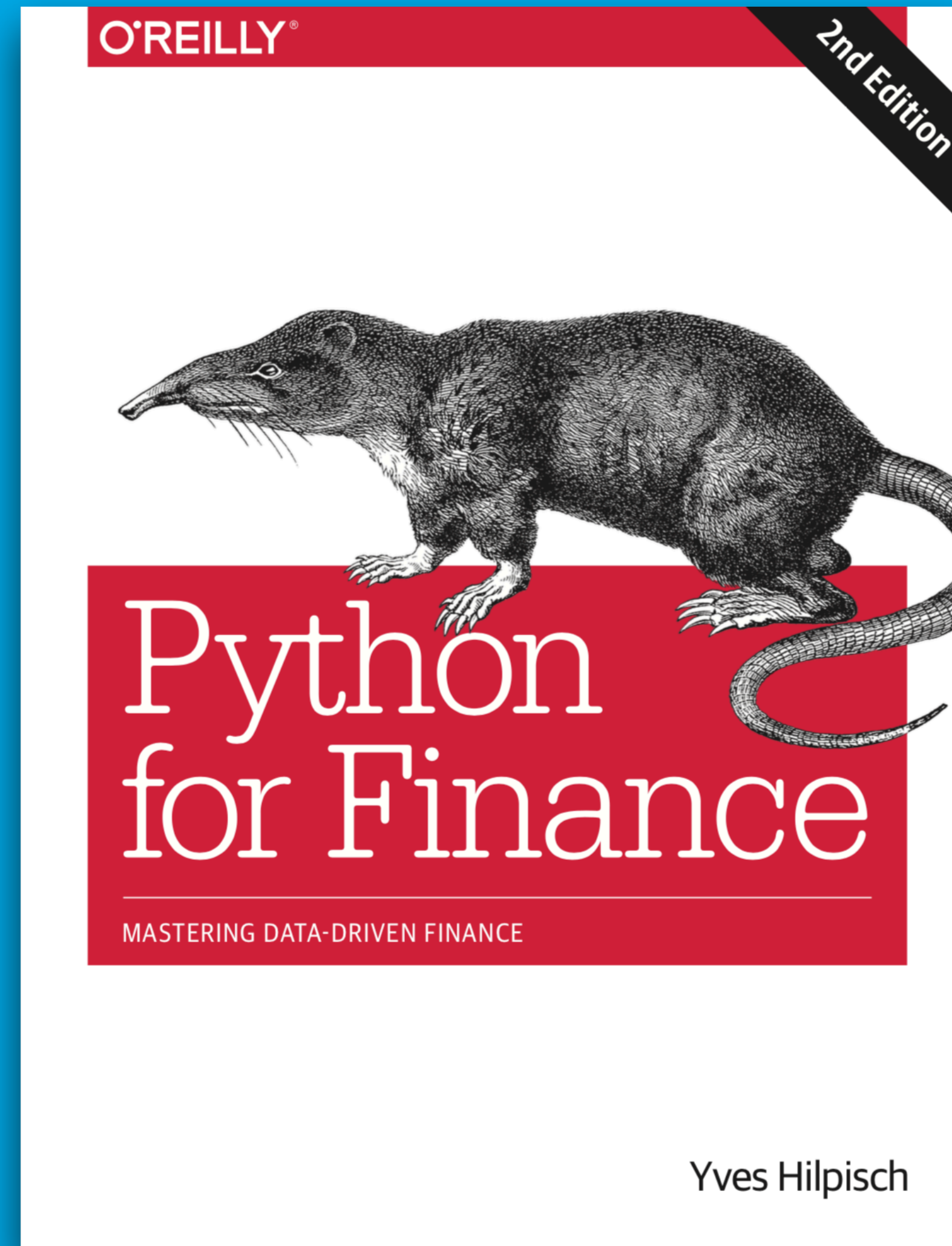
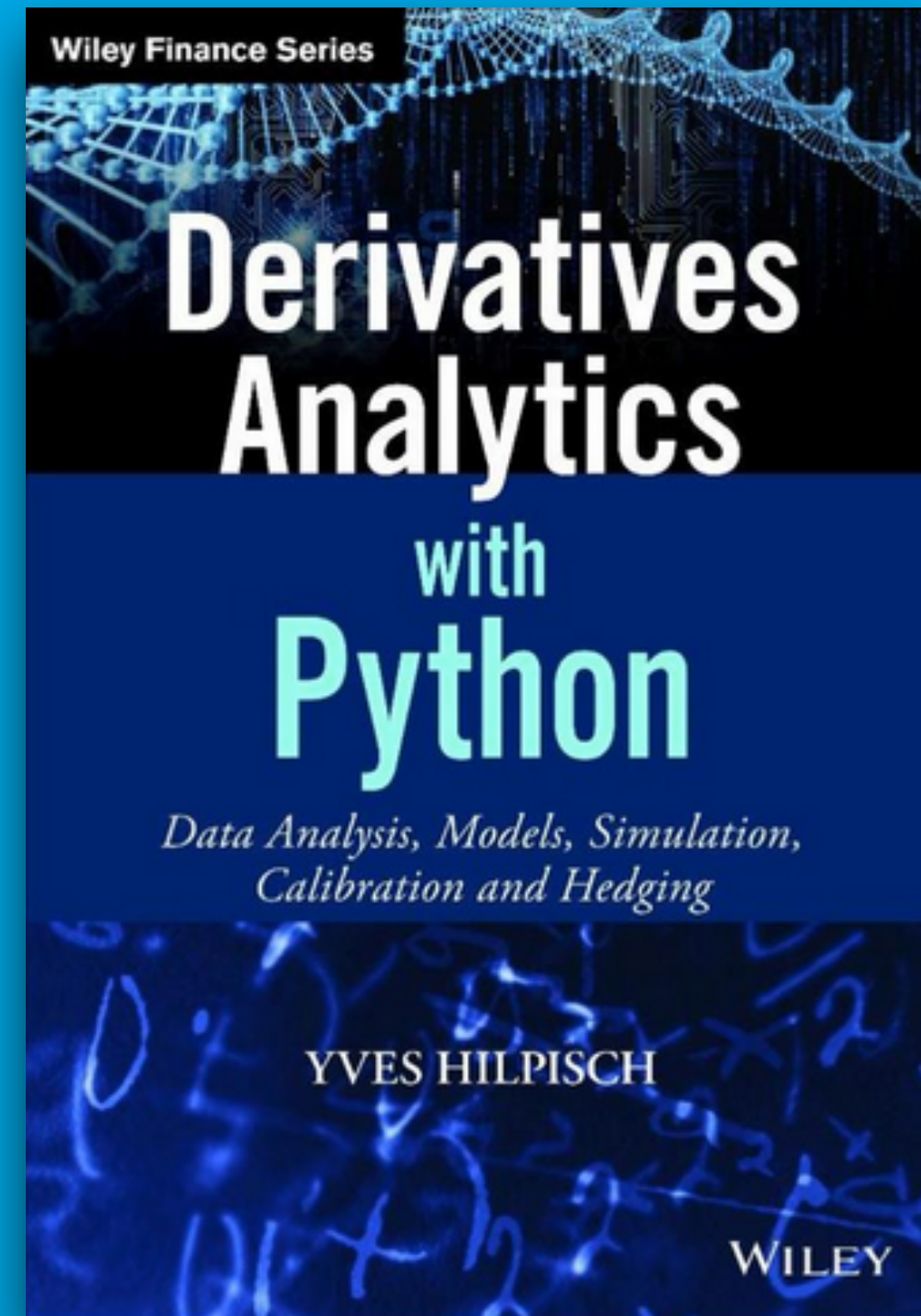


OPEN SOURCE

Python library
for financial analytics







<http://books.tpq.io>

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 515 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



David Becker/Reuters

Catalan president urges Brussels to mediate in independence clash

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

MICHAEL TOTHARD — BARCELONA

IAN MOUNT — GIRONA

The Catalan government said it wanted to avoid a "traumatic split" from Spain and appealed to the EU to mediate with Madrid in signals it was holding back from an early declaration of independence after Sunday's secession referendum.

Catalan President Carles Puigdemont, the Catalan president, said that after Sunday's vote, when 90 per cent of the 3.5m ballots cast were in favour of independence, Catalonia now had the right to be free from Spain. But he hinted that this would not happen immediately.

"There is no button to push for independence, it does not exist," said Mr Puigdemont at a press conference. He called on the EU to help broker negotiations. "It's obvious we need mediation."

He added: "We don't want a traumatic break... We want a new understanding with the Spanish state."

Breaking with its previous reticence to speak out on Catalonia, the European Commission condemned the violent clashes between police seeking to block the poll and voters. It urged both sides to reach an agreement.

"We call on all relevant players to now move very swiftly from confrontation to dialogue," it said, but it stopped short of offering to broker talks, repeating the issue was an "internal matter".

Financial markets have been rattled by the vote, which raised fears of an immediate break with Spain. Madrid's main equities benchmark, the Ibex 35, closed down 1.2 per cent and yields on 10-year Spanish bonds were up 7 basis

points. Sunday's referendum, while illegal and invalid under Spanish law, was also a historic challenge to the authority of the Spanish state that threatens to plunge the country into a political and constitutional crisis.

As Mariano Rajoy, Spain's prime minister, met other party leaders, his government gave little sign it was open to talks as long as the separatist Catalan government pushes for full independence from Spain.

Fernando Martínez Sallat, a senior member of the governing Popular party, said the election had been a "grand farce" and the Catalan regional government has been "delegitimised".

Rafael Catalá, the justice minister, said the government would use all the tools at its disposal — including if

necessary the suspension of Catalonia's autonomy — to enforce the rule of law.

There were also hawkish calls by Albert Rivera, the head of the liberal Ciudadanos party which supports the poll, for the full imposition of the unilateral declaration of independence unless talks with Madrid can start.

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Carles Puigdemont, the Catalan president, is leaving the door open to a unilateral declaration of independence unless talks with Madrid can start.

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Briefing

► **Puerto Rico calls for billions in aid**
Raul Maldonado Gasset, 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 a threat to revoke the ride-hailing app's licence in the capital. — PAGE 13

► **Kolke faces Japan election dilemma**
Tokyo governor Yuriko 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 Ruto's coalition 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 16

Datawatch

US manufacturing purchasing managers' index
Above 50 = growth



Sources: Thomson Reuters Datastream, ISM

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

CLIVE COOKSON — SCIENCE EDITOR

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 behaviour, hormone release, blood pressure and other physiological functions.

Their research was carried out mainly during the 1990s and 1990s, working with fruit flies as a "model organism" at Brandeis University in Boston and Rockefeller University in New York. The body clock works in essentially the same way across the animal kingdom.

According to the citation for the Nobel (S3 line) prize, the researchers "were able to peek inside our biological clock and elucidate its inner workings. Their discoveries explain how plants, animals and humans adapt their biological rhythm so that it is synchronised with the Earth's revolution."

Johann Zierath of the Nobel Assembly said the research "helped to raise awareness of the proper importance of sleep hygiene and the importance of really making certain we allow ourselves to go to bed at an hour that's suitable."

From insects to mammals. Plants too have similar timekeeping systems.

Thomas Perlmann, secretary of the Nobel Assembly, said he reached Professor Rosbash by phone shortly before the announcement was made public in Stockholm. "He was silent and then he said, 'You are kidding me.'"

The fundamental discovery of the three laureates was that a pair of genes called "period" and "timeless" set up a feedback loop, in which their activity is inhibited as their protein products build up. The result is a biochemical oscillation over a 24-hour cycle — a body clock that is then regulated by external cues such as light and darkness.

Carlson Haizer of the Karolinska Institute said: "Since the seminal discoveries... circadian biology has developed into a vast and highly dynamic research field, with important implications for our health and well-being."

When we travel across several time zones there is a misalignment between our internal clock and external environment, which produces jet lag. While some people take the hormone melatonin to reset the body clock, scientists are working on a more effective remedy.

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DOW JONES

WEDNESDAY, DECEMBER 11, 2013 - VOL. CCLXII NO. 138

WSJ.com

★★★★★ \$2.00

DJIA 15973.13 ▲ \$2.40 0.3% NASDAQ 4060.49 ▼ 0.2% NIKKEI 15613.31 ▼ 0.2% STOXX600 3145.91 ▼ 0.7% 10-YR TREAS. ▲ 16/32, yield 2.797% OIL \$98.51 ▲ \$1.17 GOLD \$1,262.40 ▲ \$27.10 EURO \$1.3761 YEN 102.84

What's News

Business & Finance

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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.

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Deal Brings Stability to U.S. Budget

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

By JANEY HOOK

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NEWS >

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

EVENTS > Upcoming Past

NTS Q1 2017 Apple Inc Earnings Release

Open	AAPL.O 115.190000				Price USD
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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		

	AAPL (Sep. 2016)	Growth	Industry
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Tick Data

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```

```
<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

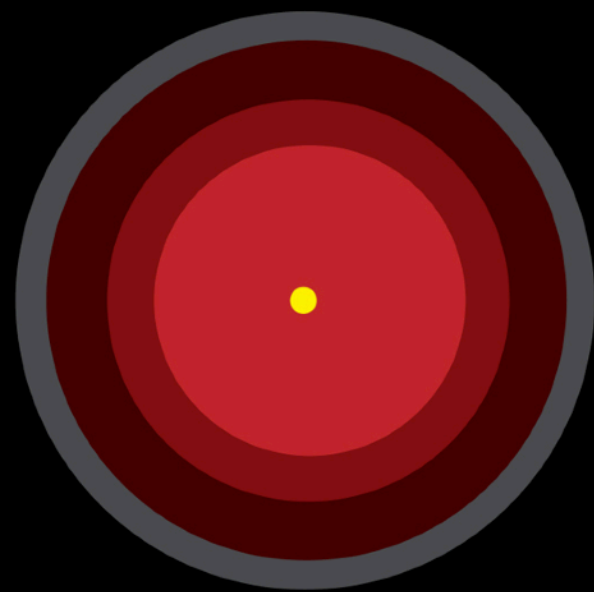
By Sruthi Shankar and Tanya Agrawal

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

THE TECHNOLOGICAL SINGULARITY

MURRAY SHANAHAN



THE MIT PRESS ESSENTIAL KNOWLEDGE SERIES

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“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)



Flag



Pennant



Cup with handle



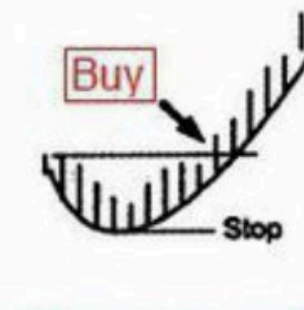
Ascending triangle



Symetrical triangle



Measured move up



Ascending scallop



3 rising valleys

Bearish patterns (going down)



Flag



Pennant



Invertede Cup with handle



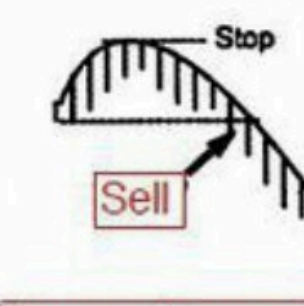
Descending triangle



Symetrical triangle



Measured move down



Descending scallop

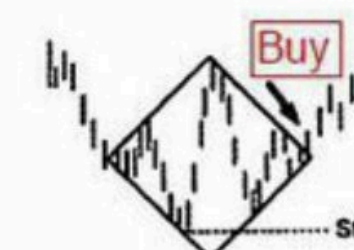


3 descending peaks

Reversal patterns



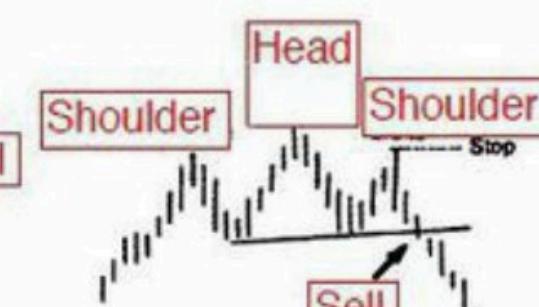
Double bottoms



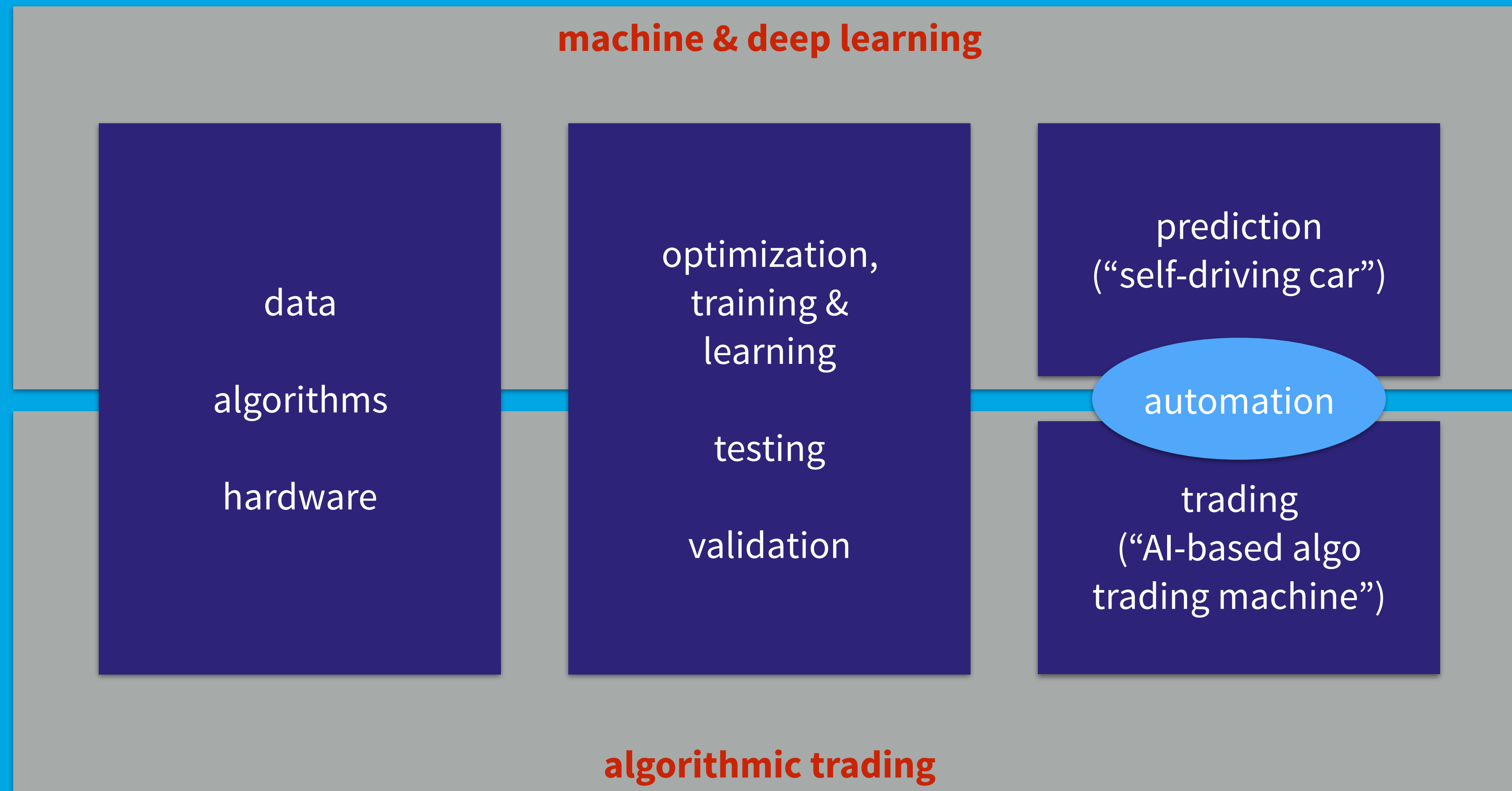
Diamond bottoms



Tops rectangle



Head and shoulders top

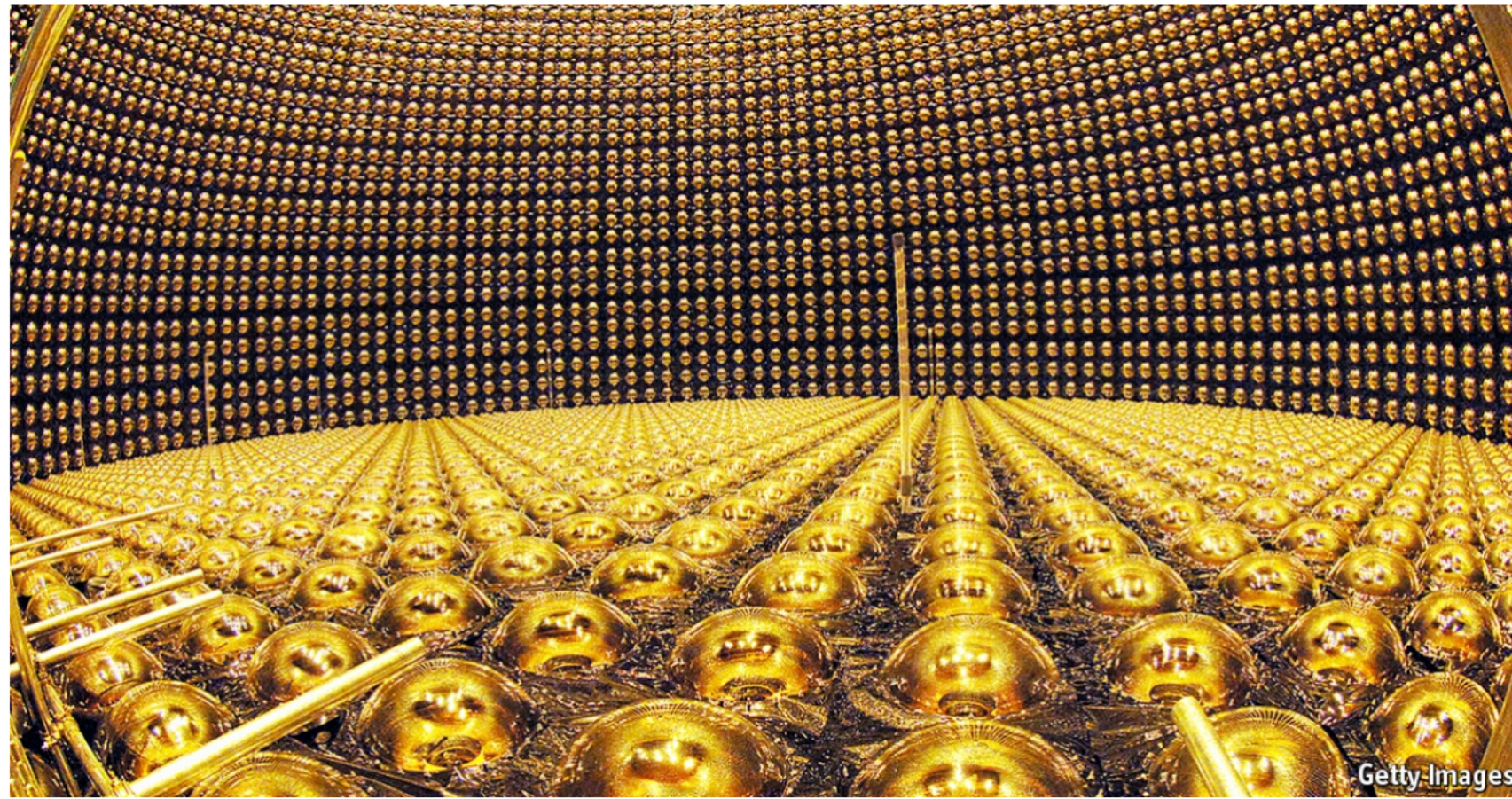


Particle physics

Fundamental physics is frustrating physicists

The Economist

No GUTs, no glory



Print edition | Science and technology >

Jan 13th 2018



DEEP in a disused zinc mine in Japan, 50,000 tonnes of purified water held in a vast cylindrical stainless-steel tank are quietly killing theories long cherished by physicists. Since 1996, the photomultiplier-tube detectors (pictured above) at Super-Kamiokande, an experiment under way a

The beauty myth

One such is Sabine Hossenfelder of the Frankfurt Institute for Advanced Studies, in Germany. She argues that the appeal of GUTs, supersymmetry and the like rests on their ability to explain “numerological coincidences” that do not need to be explained. Perhaps, to take one example, the universe simply started out with more matter than antimatter in it, rather than this being a consequence of its subsequent evolution. As she points out, no theory precludes this possibility—it is just that it is not very elegant. Similarly, she says, “It’s not like anybody actually needs supersymmetry to explain anything. It’s an idea widely praised for its aesthetic appeal. Well, that’s nice, but it’s not science.”

aesthetic appeal. Well, that's nice, but it's not science.”

supersymmetry to explain anything. It's an idea widely praised for its

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.”

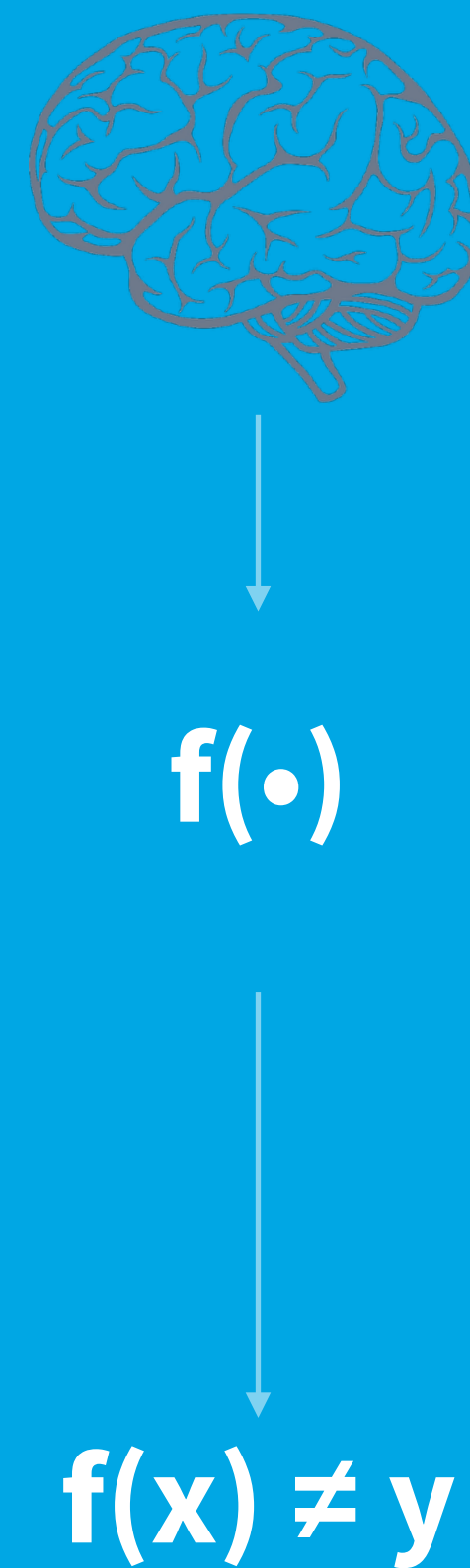
Marcos López de Prado (2018)

Financial Markets



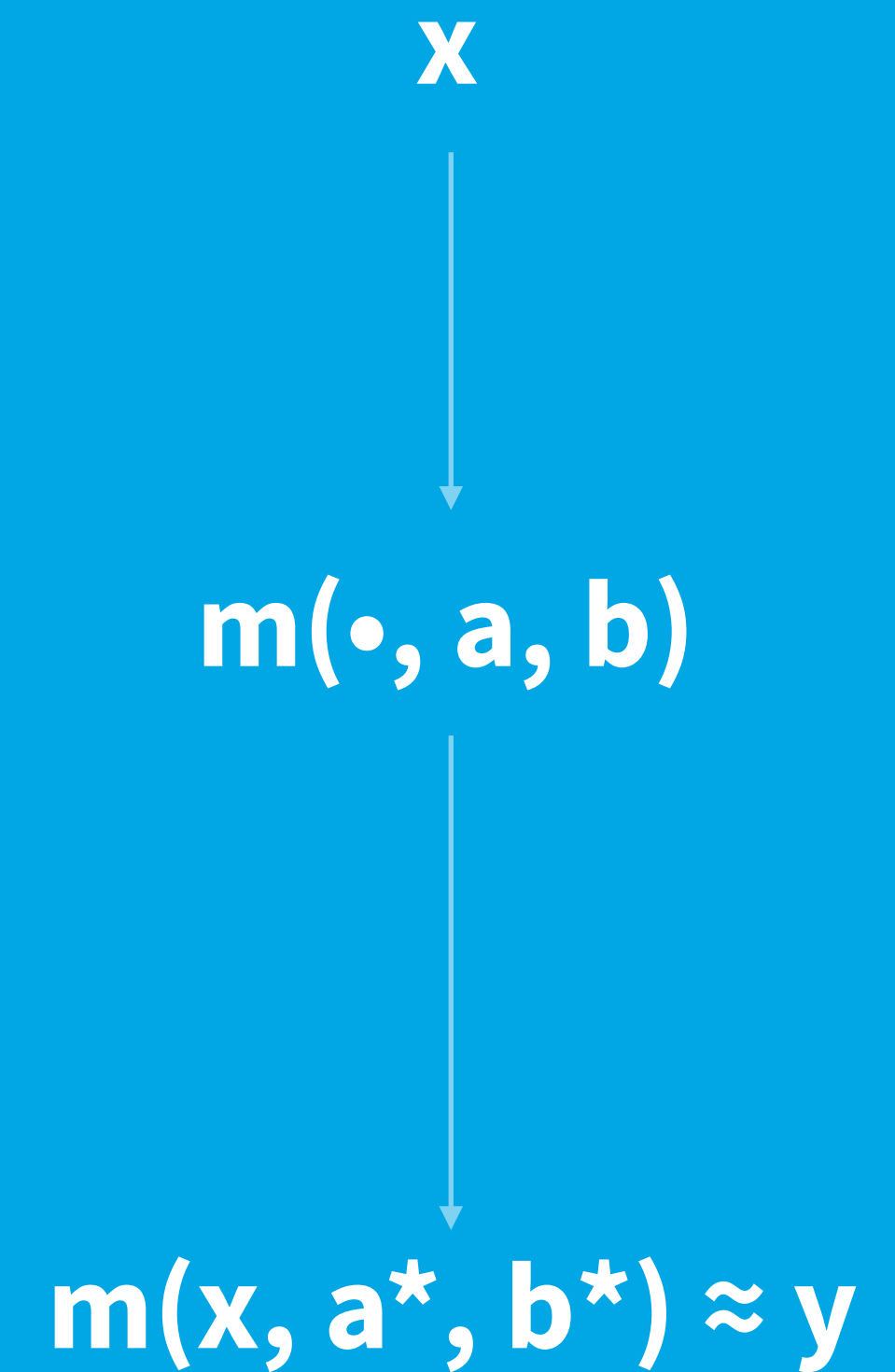
“non-linear, complex,
changing”

Finance History

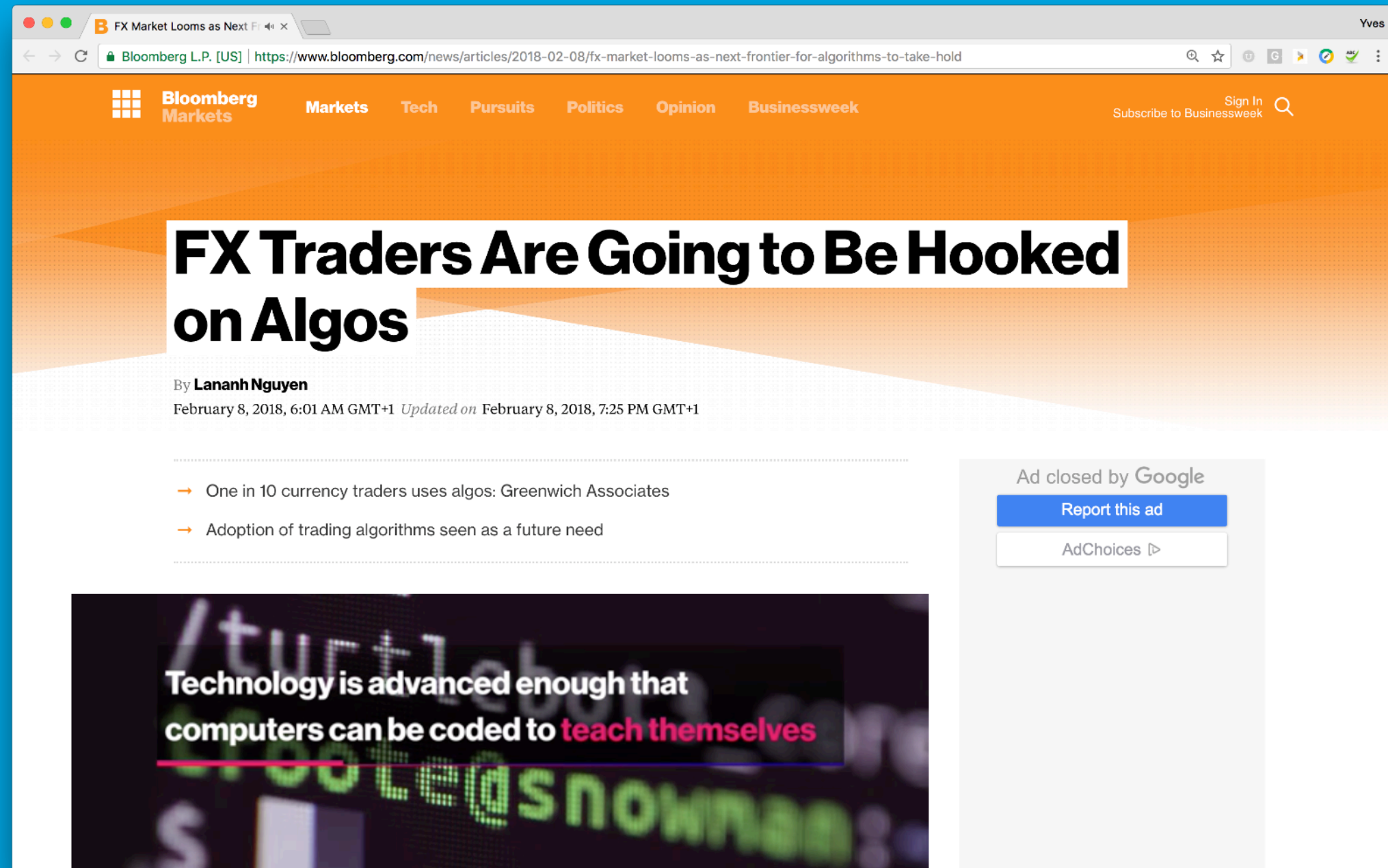


“brain-driven &
beauty myth”

AI in Finance = finaince



“data-driven &
AI-first”



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.

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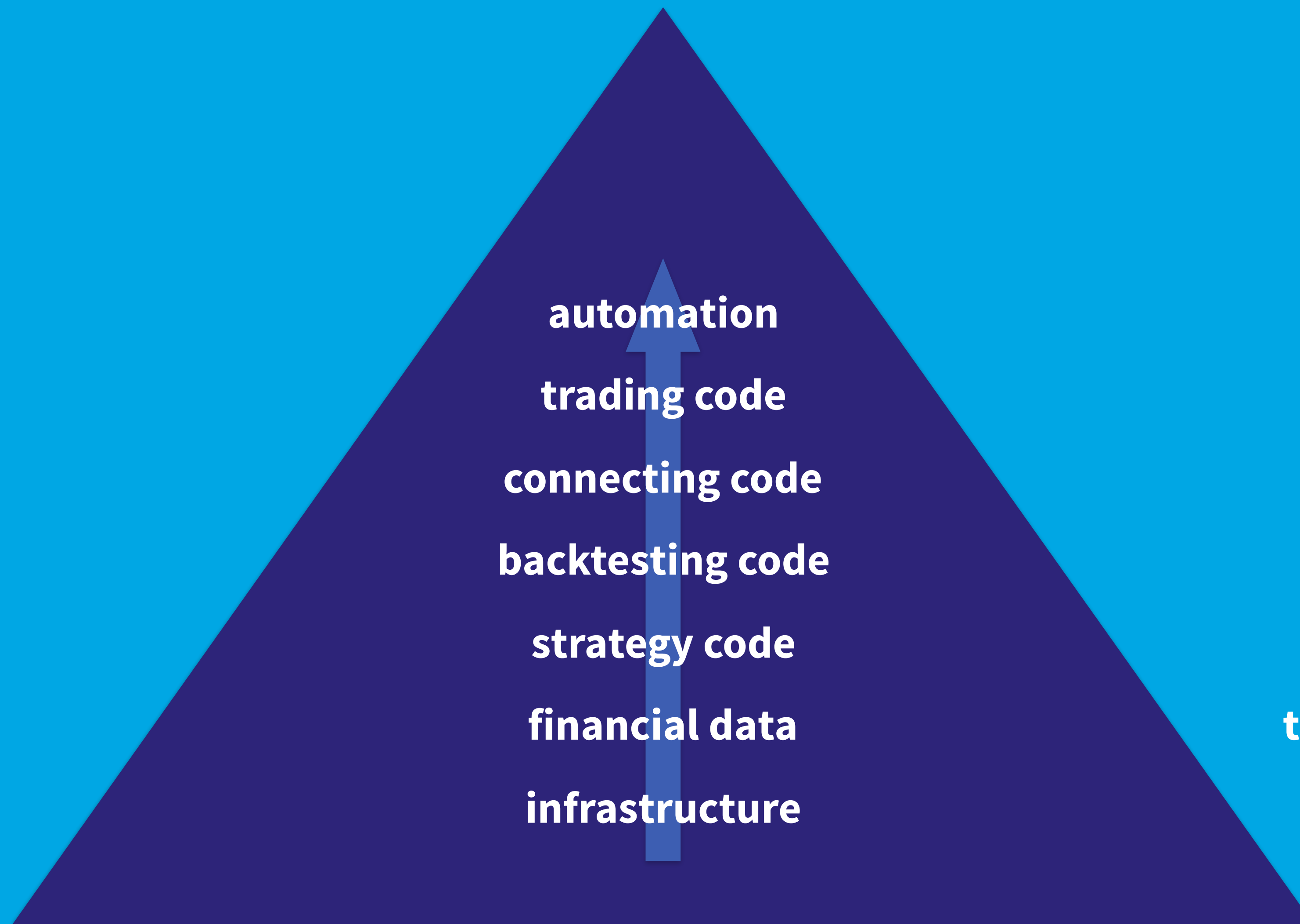
Sign Up

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.

FXCM REST API Demo



FXCM

simple algorithm

order placement

streaming

vectorized backtesting

SVM classifier

tick, historical, real-time

Python, Jupyter

16 week program

150+ hours
of instruction

5,000+ lines
of code

1,200 pages PDF

<http://certificate.tpq.io>



The Machine

The Machine

Tick Data Streamer
(retrieval, processing, storage, etc.)

Signal Generator
(prediction, positions, signals, etc.)

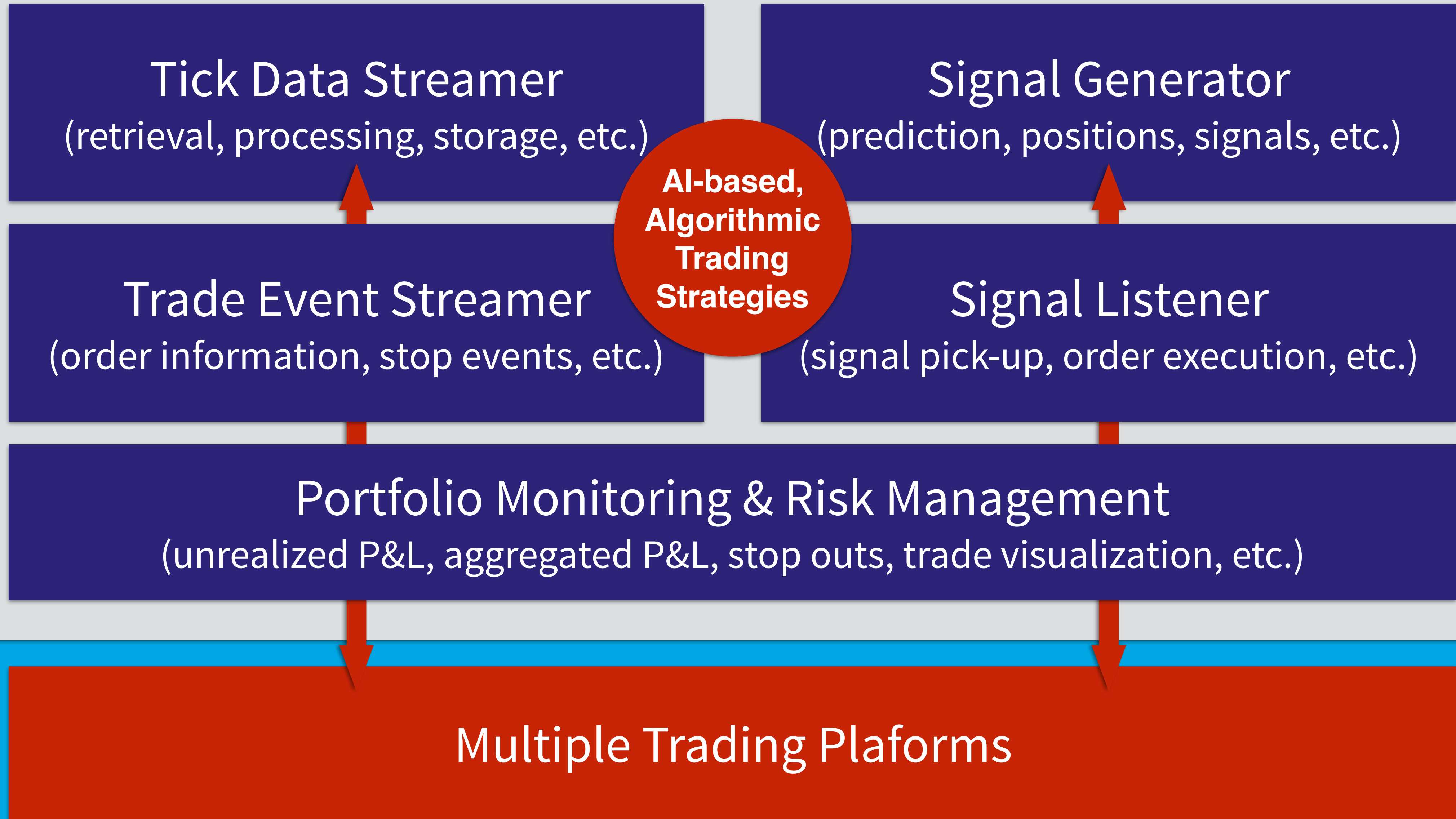
AI-based,
Algorithmic
Trading
Strategies

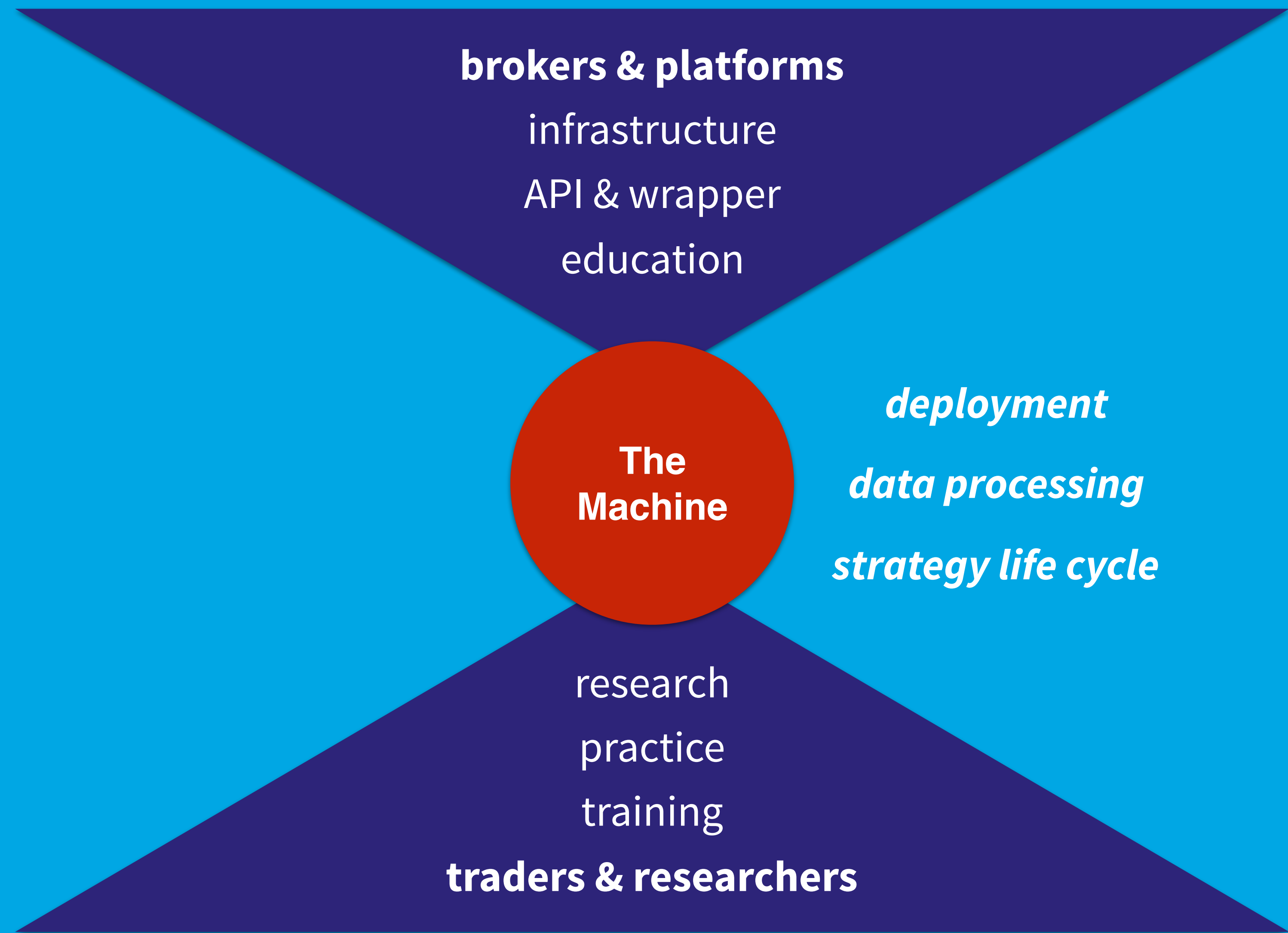
Trade Event Streamer
(order information, stop events, etc.)

Signal Listener
(signal pick-up, order execution, etc.)

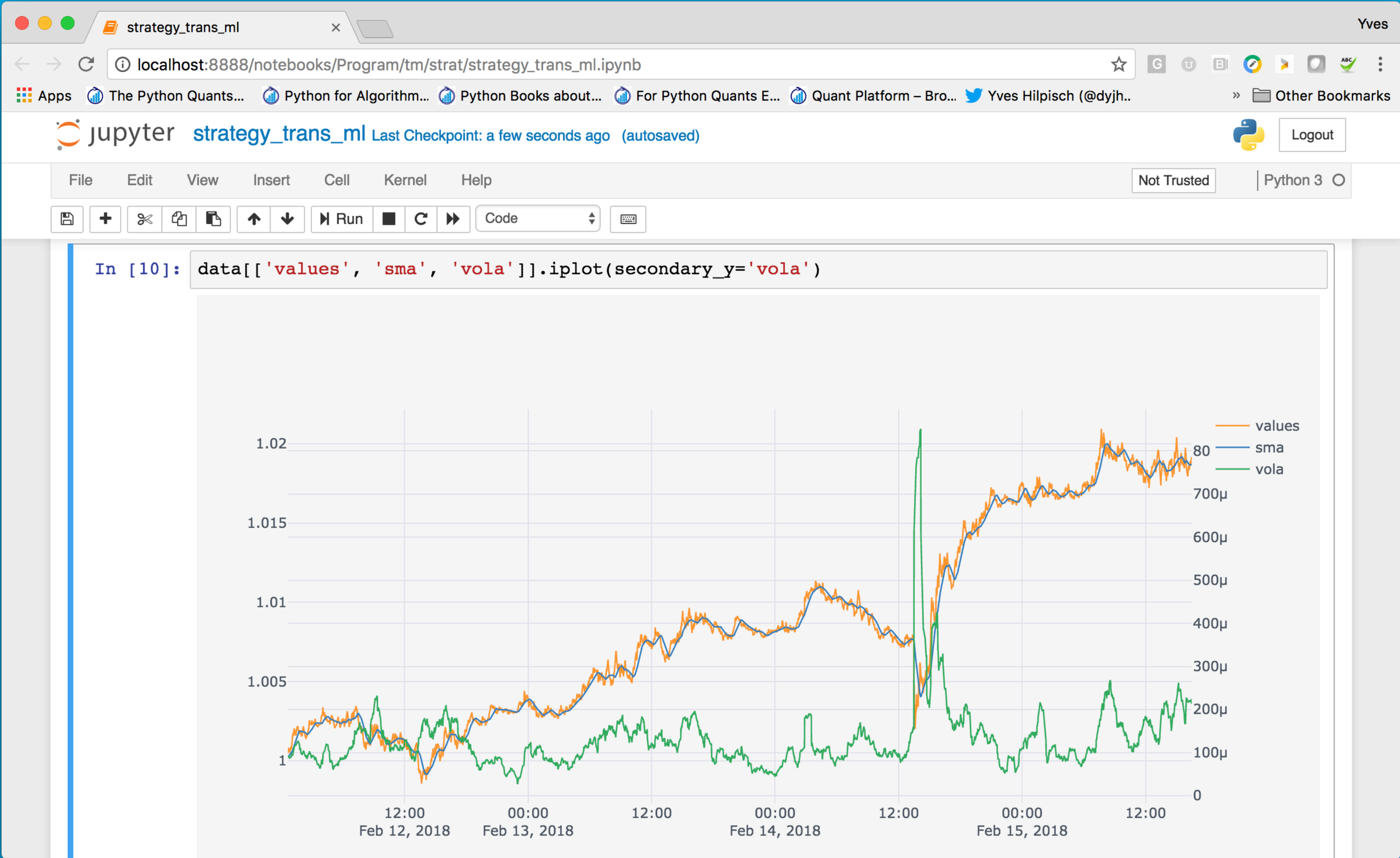
Portfolio Monitoring & Risk Management
(unrealized P&L, aggregated P&L, stop outs, trade visualization, etc.)

Multiple Trading Platforms





1. RESEARCH



2. BACKTESTING

Back Test Model

Instrument

EUR_GBP

Model

SimpleMovingAverageSignalGenerator

Frequency

Every 5 Seconds

SMA Short Interval

5

SMA Long Interval

20

Test Start

21.02.2018

Test End

22.02.2018

Backtest Model

Close

3. BACKTESTING RESULTS

Test Output Details

Training Start Date: 2018-02-21T00:00:0Z
Training End Date: 2018-02-23T23:59:5Z
Testing Start Date: 2018-02-21T00:00:0Z
Testing End Date: 2018-02-23T23:59:5Z
Frequency : S5

In Sample Testing

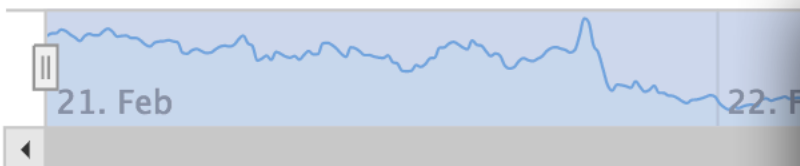
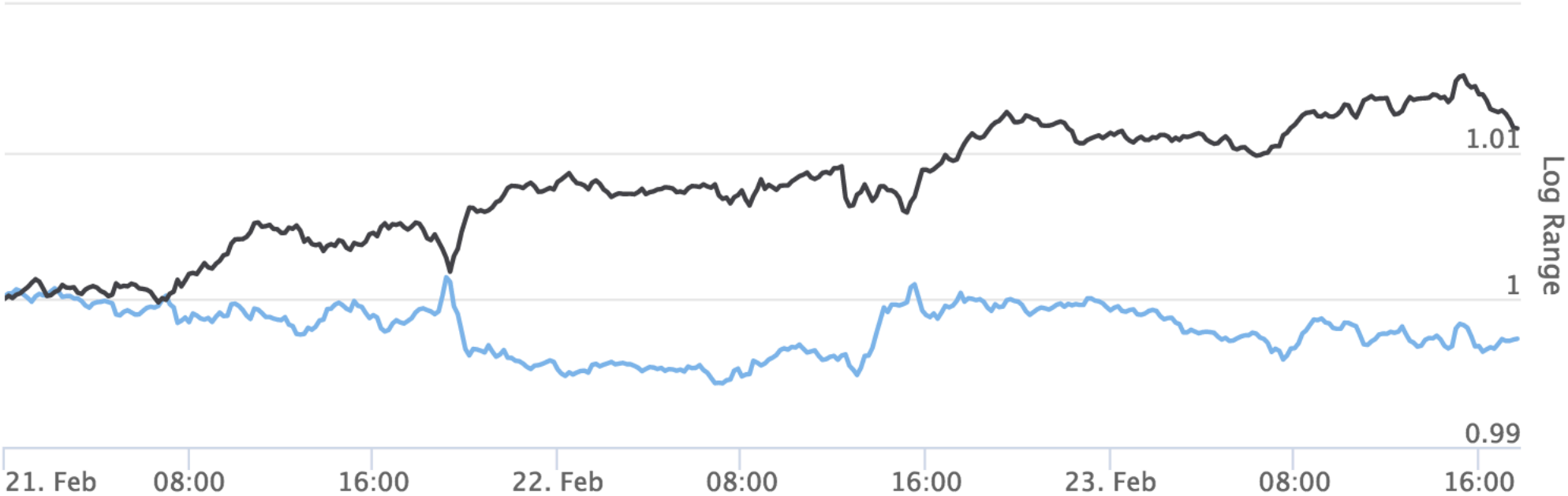
Model:SimpleMovingAverage; Instrument:EUR_USD
2018-02-21T00:00:0Z-2018-02-23T23:59:5Z

Zoom 1m 3m 6m YTD 1y All From Feb 21, 2018 To Feb 23, 2018

In Sample Testing

Model:SimpleMovingAverage; Instrument:EUR_USD
2018-02-21T00:00:0Z-2018-02-23T23:59:5Z

Zoom 1m 3m 6m YTD 1y All From Feb 21, 2018 To Feb 23, 2018



Date	Market Returns	Model Returns
2018-02-21T00:07:30.00000...	1.0000891850914957	1.0000891850914957
2018-02-21T00:07:35.00000...	1.0000243232067716	1.0000243232067716
2018-02-21T00:07:40.00000...	1.0000405386779527	1.0000405386779527
2018-02-21T00:07:55.00000...	0.9999918922644093	1.0000891874579887
2018-02-21T00:08:00.00000...	0.9999918922644093	1.0000891874579887
2018-02-21T00:08:05.00000...	1.000032430942362	1.0000486464792764
2018-02-21T00:08:10.00000...	1.0001702624474011	0.9999108317338958
2018-02-21T00:08:15.00000...	1.00015404697622	0.9998946204687897
2018-02-21T00:08:20.00000...	1.0001378315050389	0.9998784092036839
2018-02-21T00:08:25.00000...	1.0001278215050389	0.9998784092036839

4. GOING LIVE WITH MODEL

Add Live Model

Input Name	Value
Instrument	EUR_GBP
Model Name	SimpleMovingAverageSignalGenerator
Frequency	S5
sma_short_interval	5
sma_long_interval	15

Quantity to Trade

SL Distance (%age)

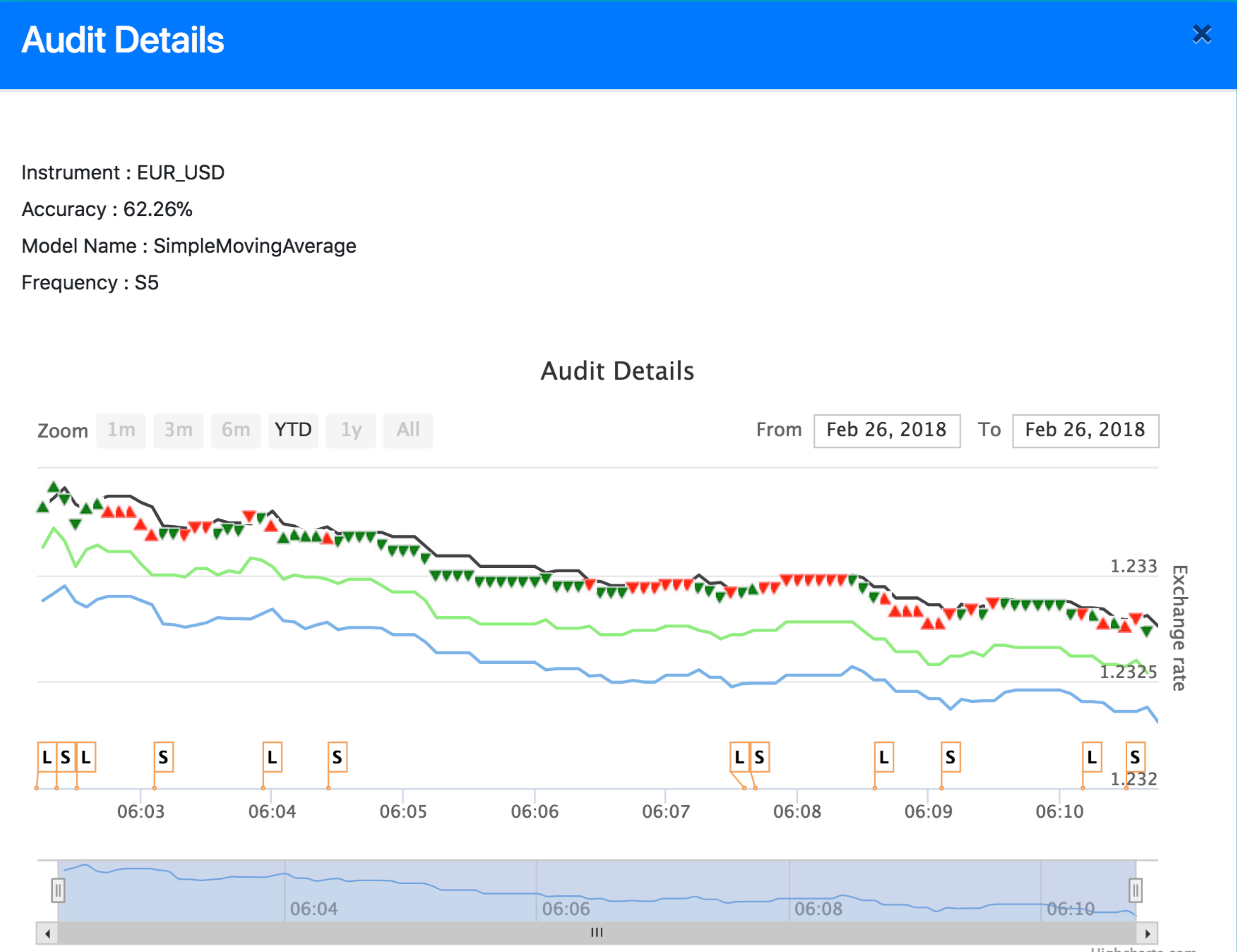
100000

1

Add Model

Close

5. LIVE AUDIT



**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)

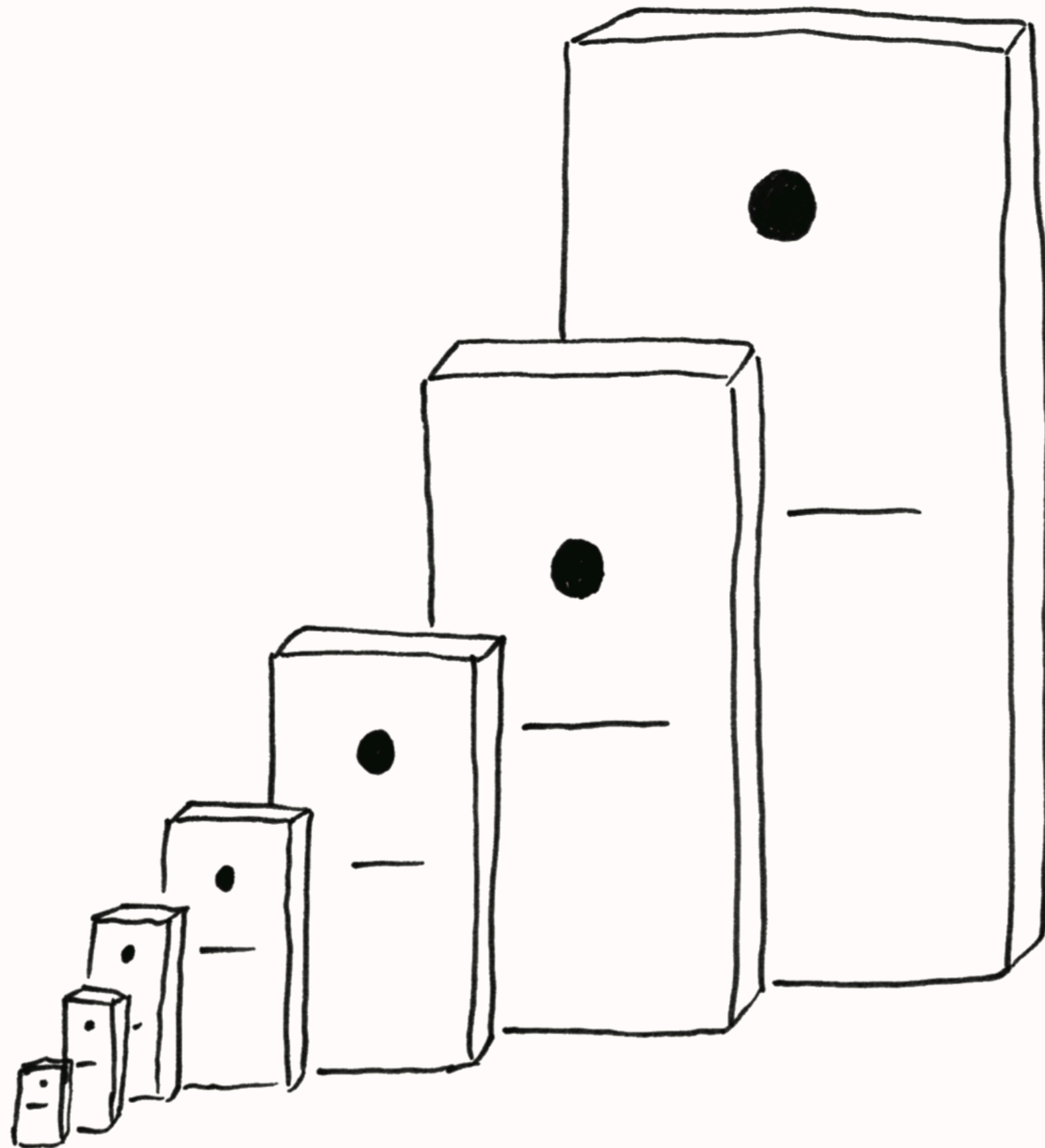
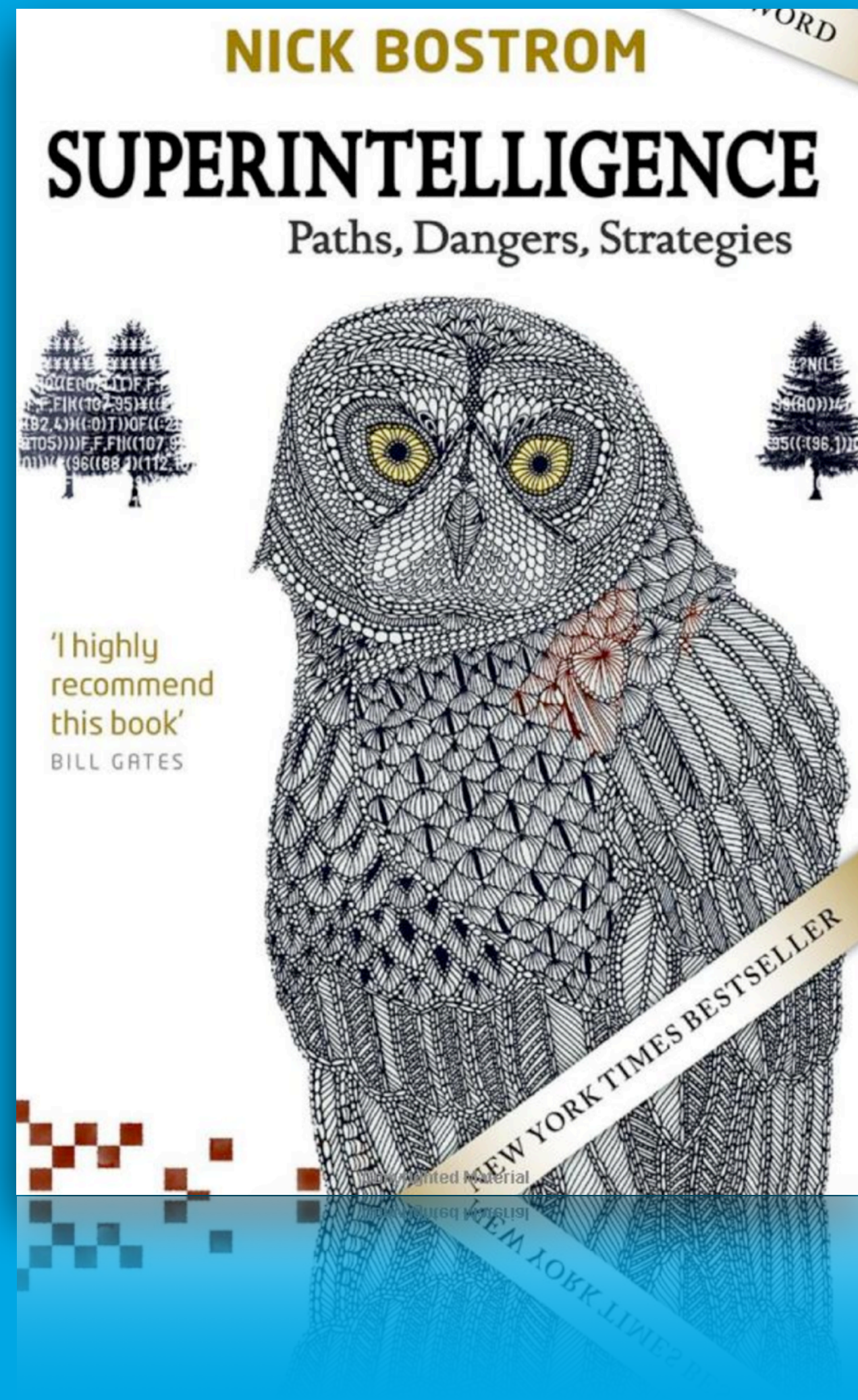


FIG 1 A geometric domino progression.

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.

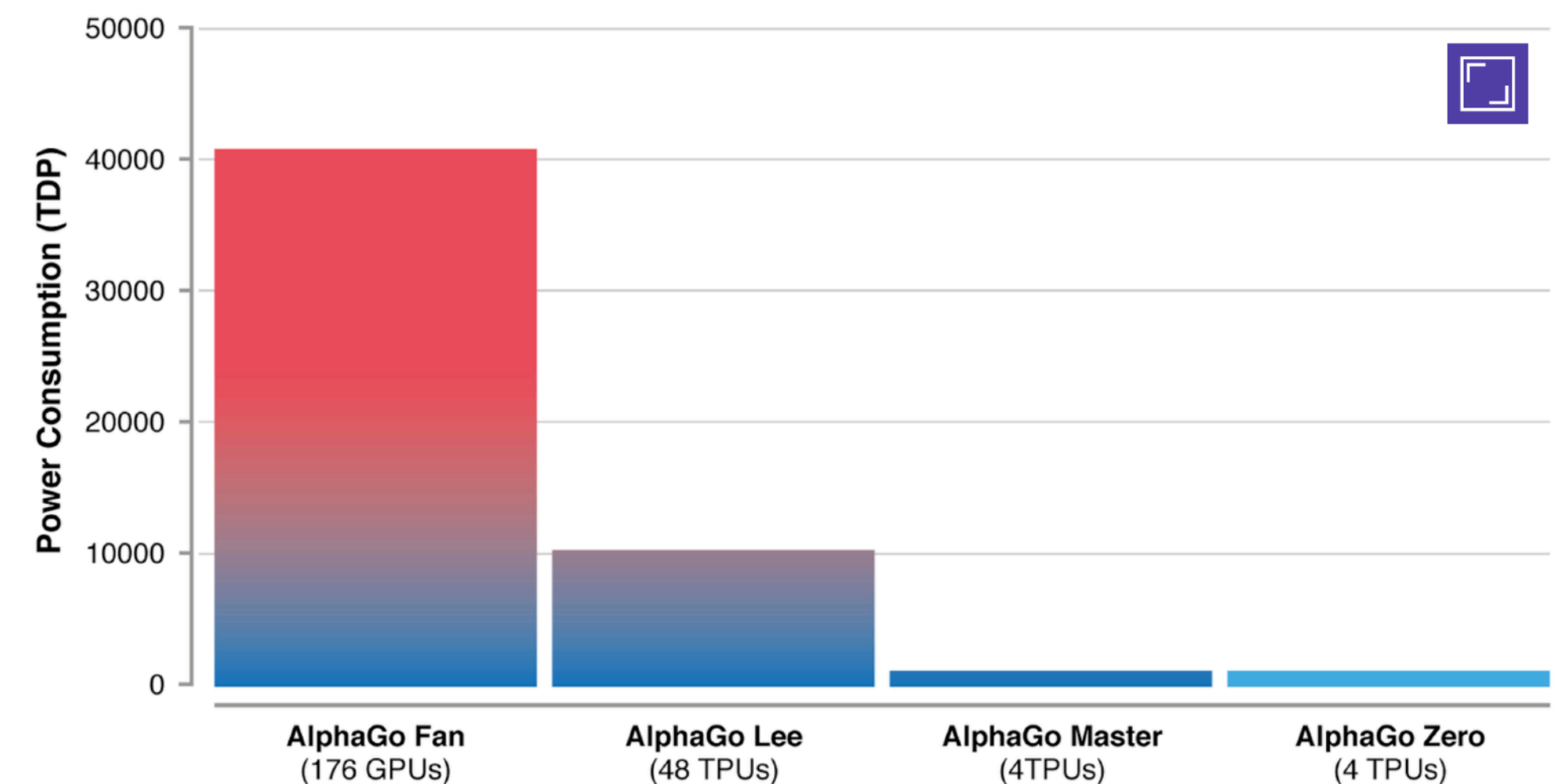
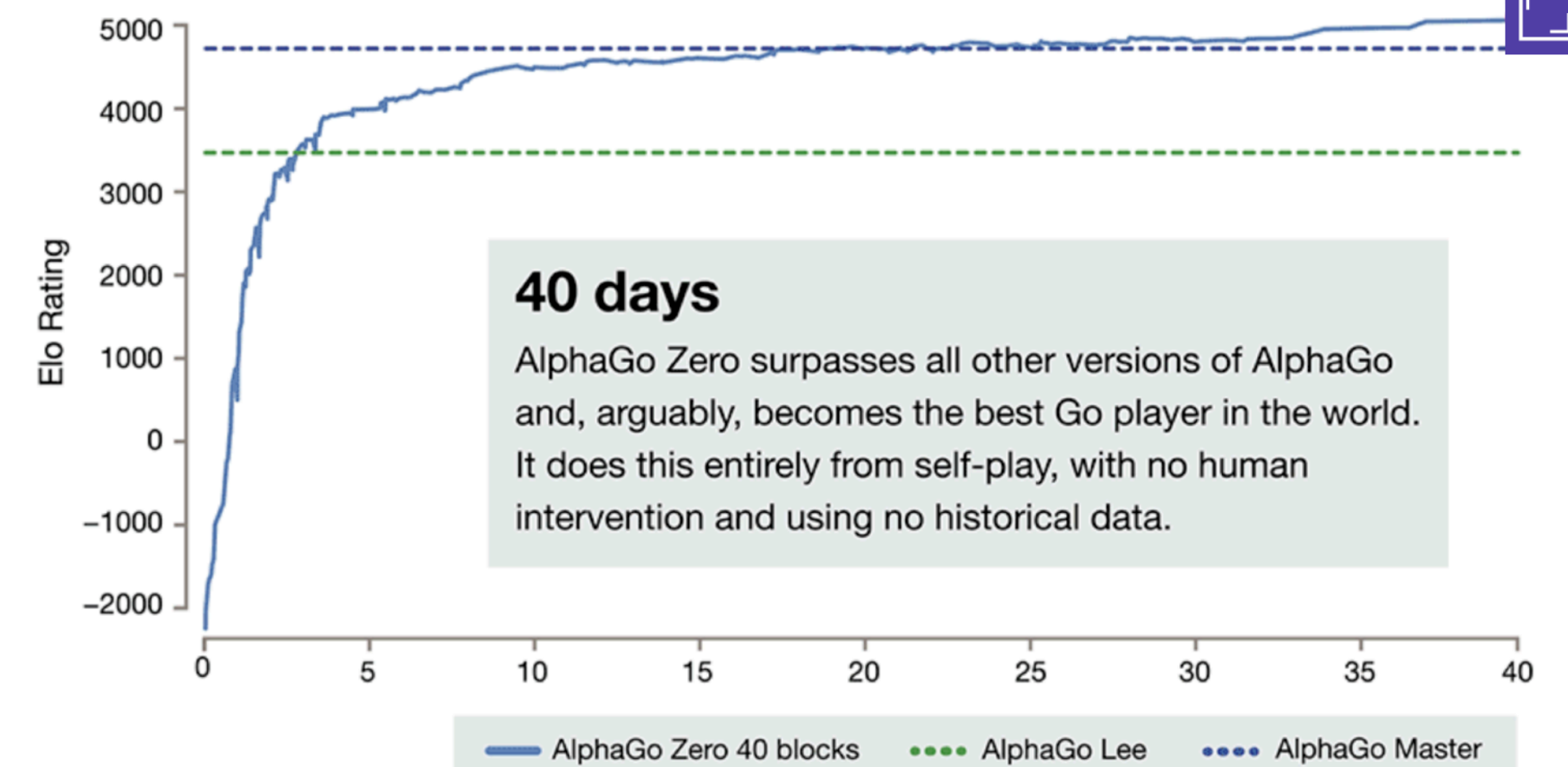
AlphaGo's first formal match was against the reigning 3-times European Champion, Mr Fan Hui, in October 2015. Its 5-0 win was the first ever against a Go professional, and the results were published in full technical detail in the international journal, [Nature](#). AlphaGo then went on to compete against 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 games of all levels in the course of winning



AlphaGo has become progressively more efficient thanks to hardware gains and more recently algorithmic advances

The Python Quants GmbH

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