

Algorithmic Trading For the Masses

— How Data-Driven & AI-First Finance Change the Landscape

FXCM Algo Summit, London, 15. June 2018

Dr. Yves J. Hilpisch



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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. The products are intended for retail and professional clients. 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. The market commentary has not been prepared in accordance with legal requirements designed to promote the independence of investment research, and it is therefore not subject to any prohibition on dealing ahead of dissemination. FXCM and 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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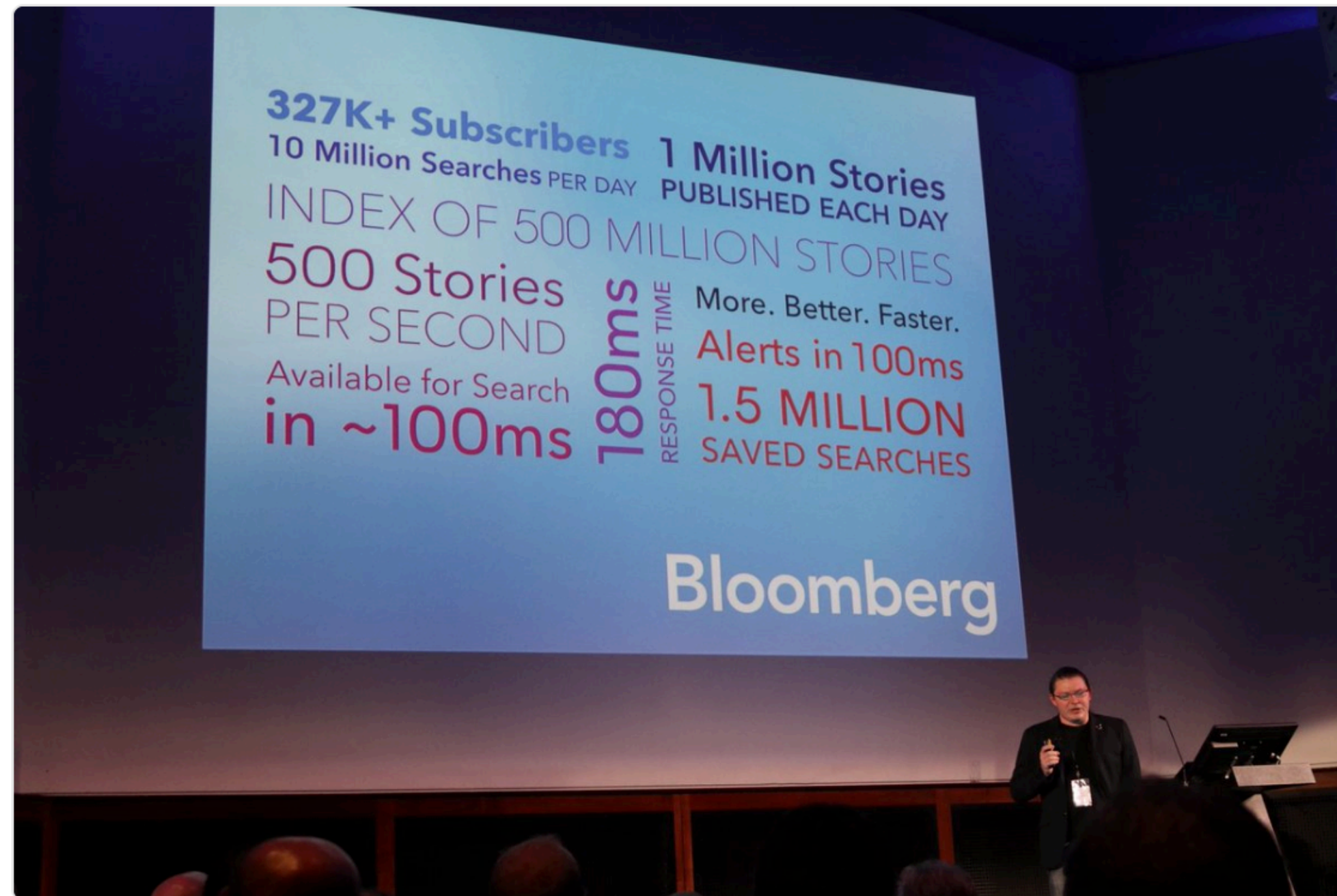
Saeed

@saeedamenfx

Following

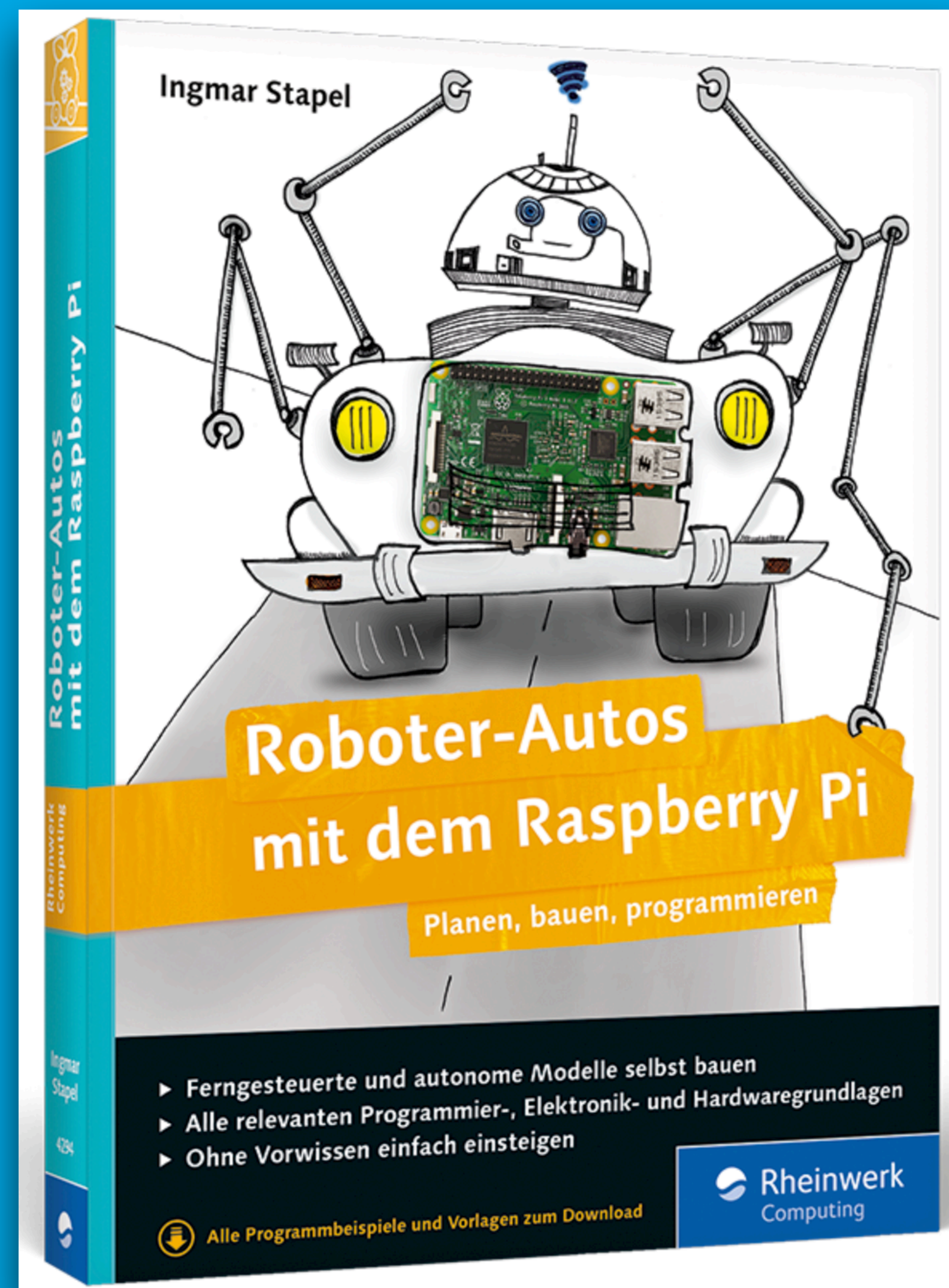
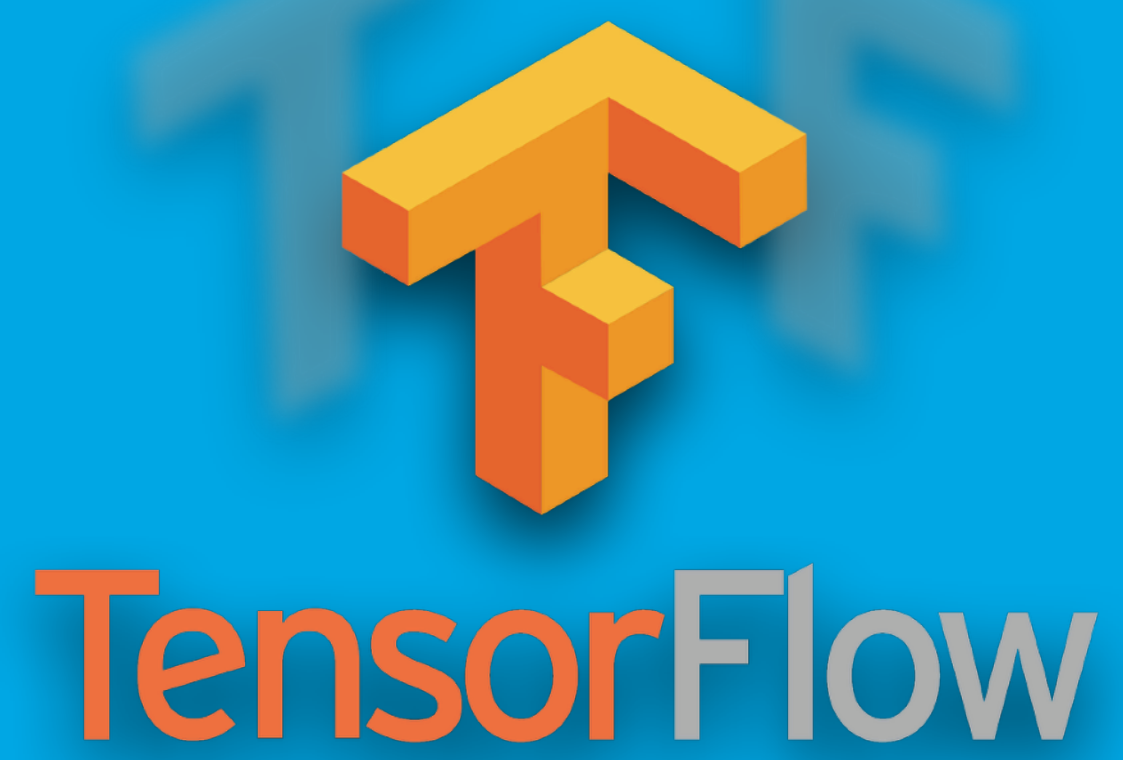


we ingest 1.5m articles a day at @Bloomberg
- Gary Kazantsev talking about machine
readable news #ImperialCollege



9:53 AM - 31 May 2018

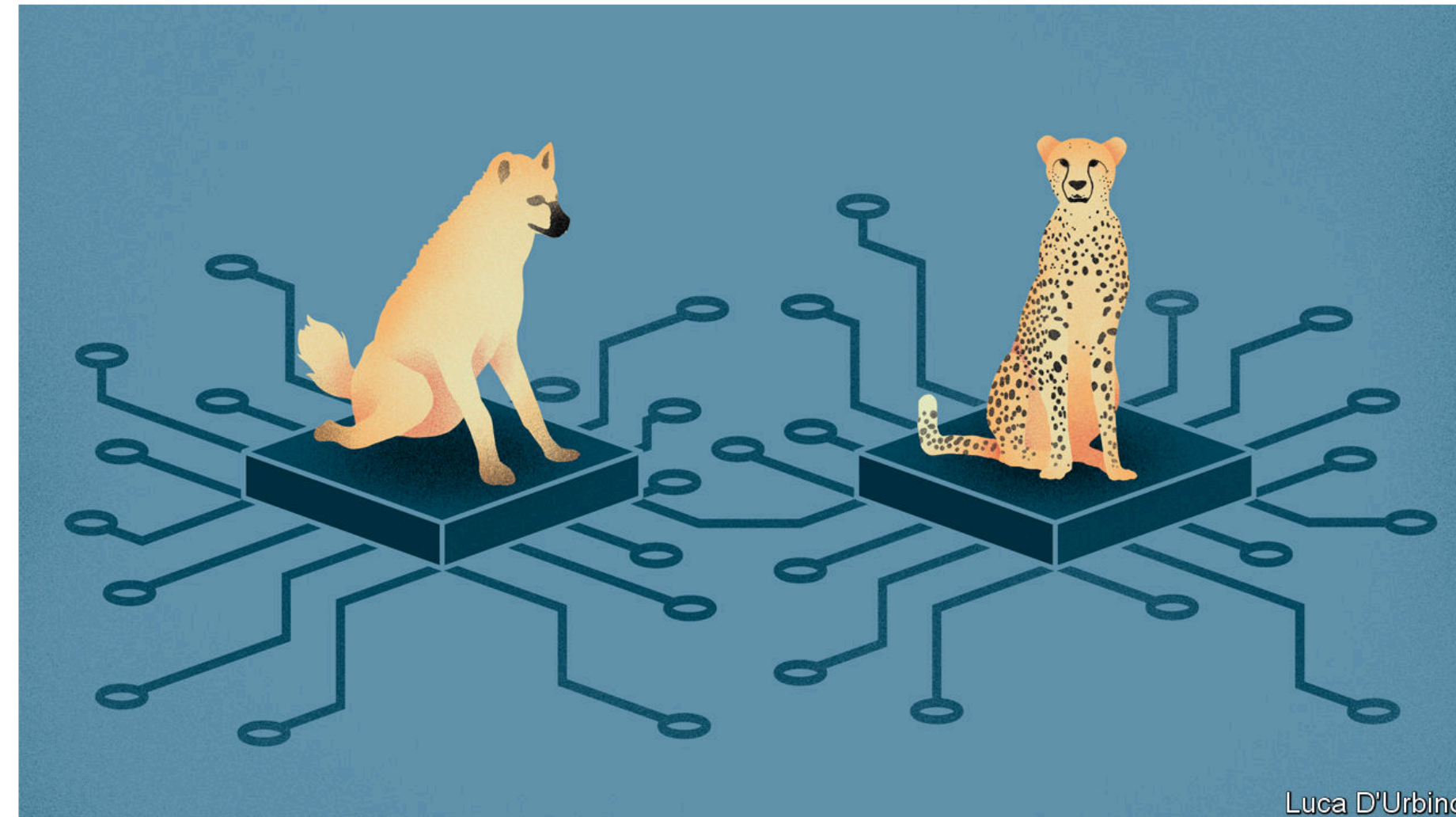
9:53 AM - 31 May 2018



Hyenas and cheetahs

Artificial intelligence is awakening the chip industry's animal spirits

Generalist chips are ceding some of the savannah to new, specialist processors



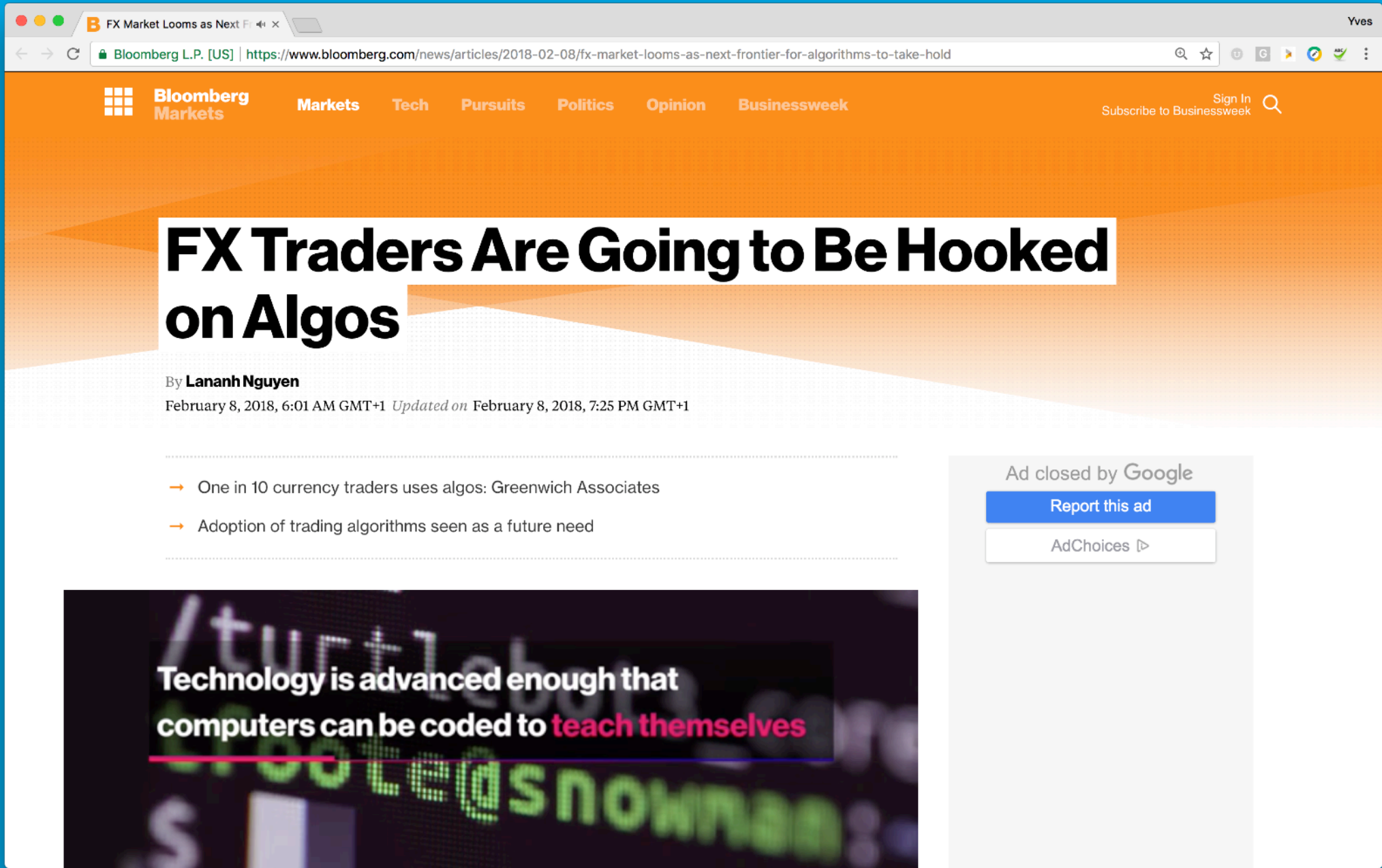
Print edition | Business >

Jun 7th 2018 | BRISTOL



SUPERCOMPUTERS usually fill entire rooms. But the one on the fifth floor of an office building in the centre of Bristol fits in an average-sized drawer. Its 16 processors punch more than 1,600 teraflops, a measure of computer performance. This puts the machine among the world's 100 fastest, at least when solving certain artificial-intelligence (AI) applications, such as recognising speech and images.

The Economist, 7. June 2018



Bloomberg, 8. February 2018

BloombergMarkets

FX Traders Are Going to Be Hooked on Algos

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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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.

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almost 60 percent of respondents said algos had materially cut trading costs, according



Georgetown Students turn \$1 Million into \$383 Billion in University Challenge.

A [Georgetown McDonough](#) team won the “Best Hedge Fund Strategy Award” in the [Peeptrade Challenge](#), a simulated investment competition, the event was hosted by the University of Chicago. The students set up a global record with a 38 million percent return.

with a 38 million percent return.
was hosted by the University of Chicago. The students set up a global record

AGENDA

- **Introduction**
- **Data-Driven Finance**
- **AI-First Finance**
- **Example Strategy**
- **The AI Machine**
- **Outlook**

Introduction

SERVICES
for financial institutions globally



EVENTS
for Python quants &
algorithmic traders



THE PYTHON
QUANTS

TRAINING
about Python for finance
& algorithmic trading



CERTIFICATION
in cooperation with university



BOOKS
about Python and
finance

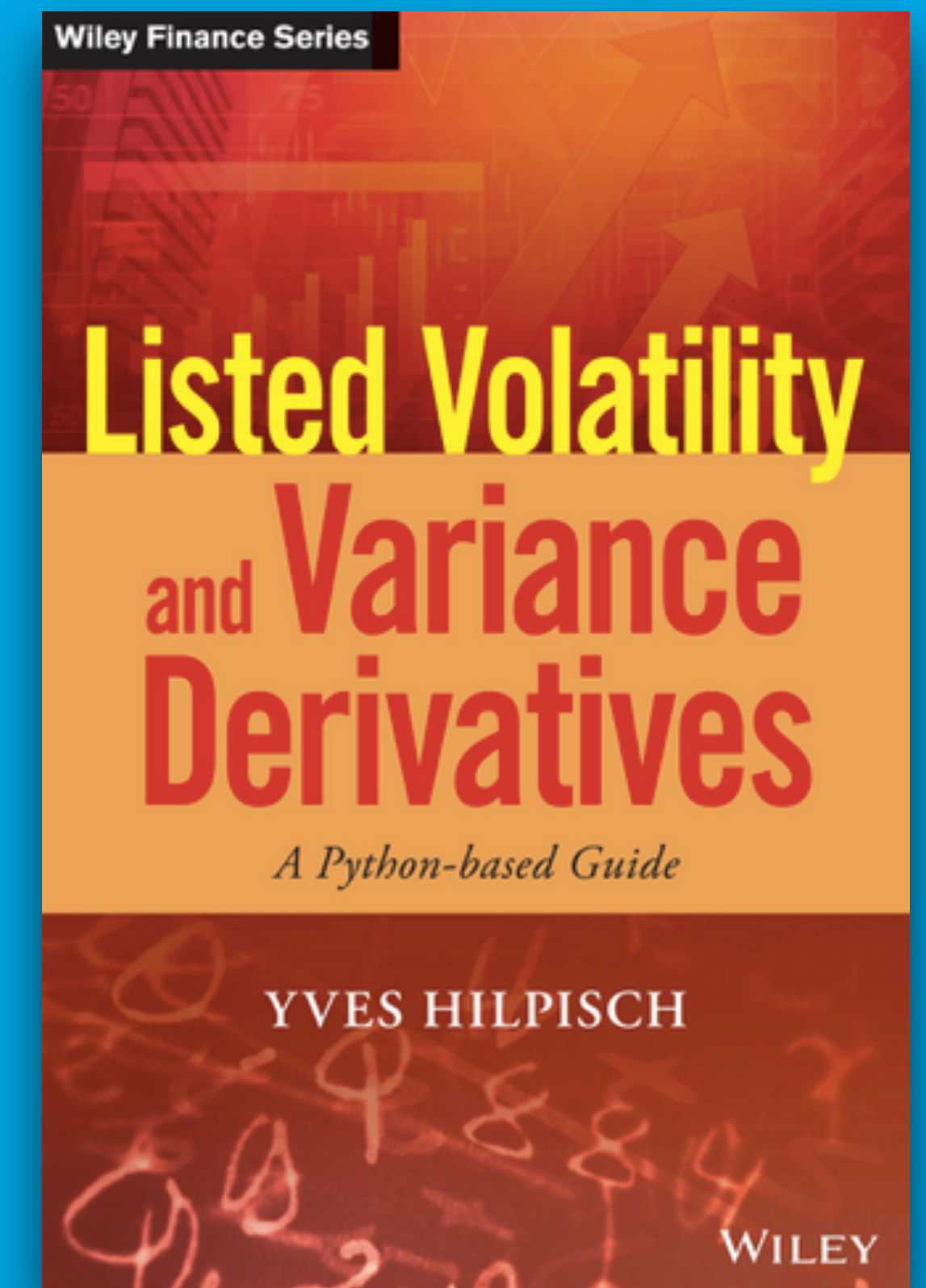
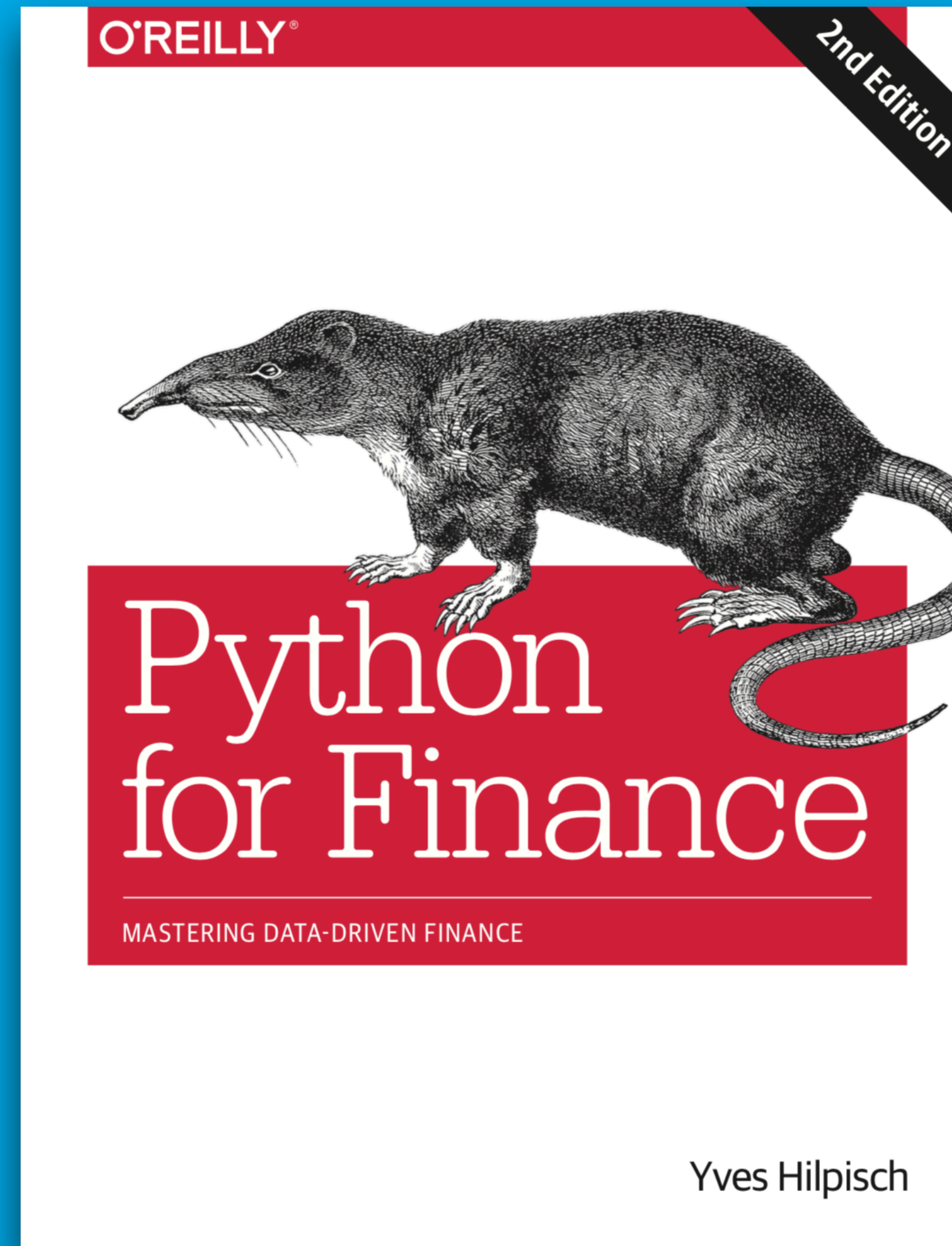
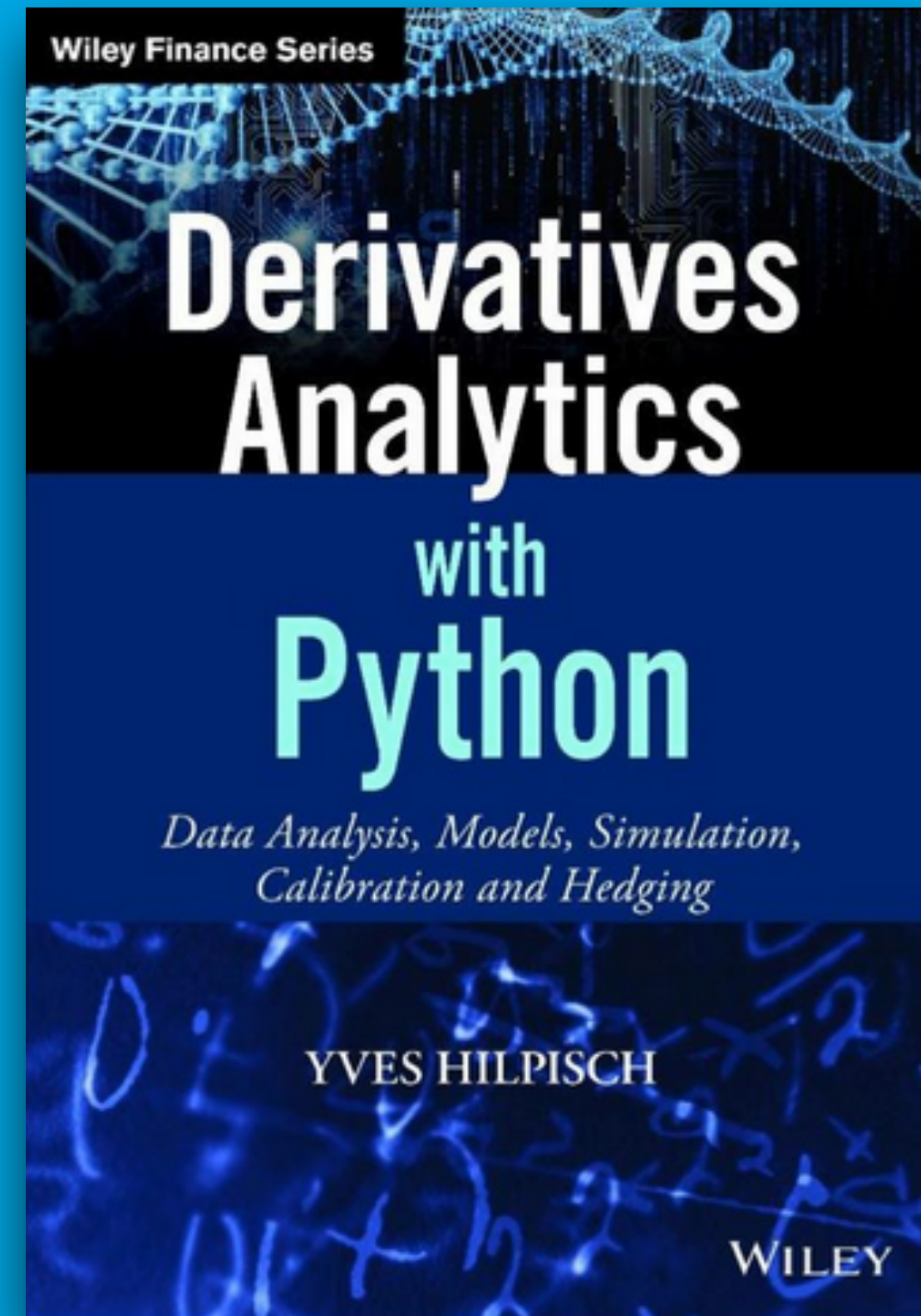
PLATFORM
for browser-based
data analytics



OPEN SOURCE
Python library
for financial analytics







Data-Driven Finance

Yves

← → ↺ <https://emea1.apps.cp.thomsonreuters.com/web/Apps/Corp?s=AAPL.O&st=RIC&app=true#/Overview?s=AAPL.O&template=SOV> 🔍 ☆ U 📱 G ⋮

AAPL.O

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AAPL.O ▼ APPLE INC ▼

United States | NASDAQ Global Select Consolidated | Computer Hardware

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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	📅
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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 📄 AAPL34.SA (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

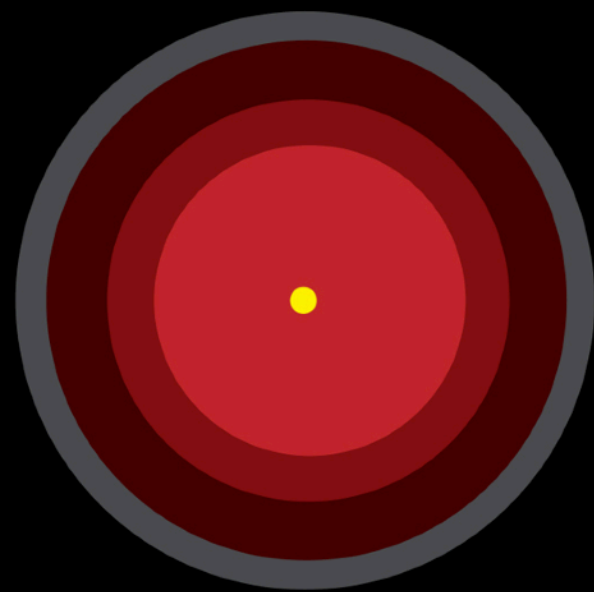
By Sruthi Shankar and Tanya Agrawal

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

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)

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.”

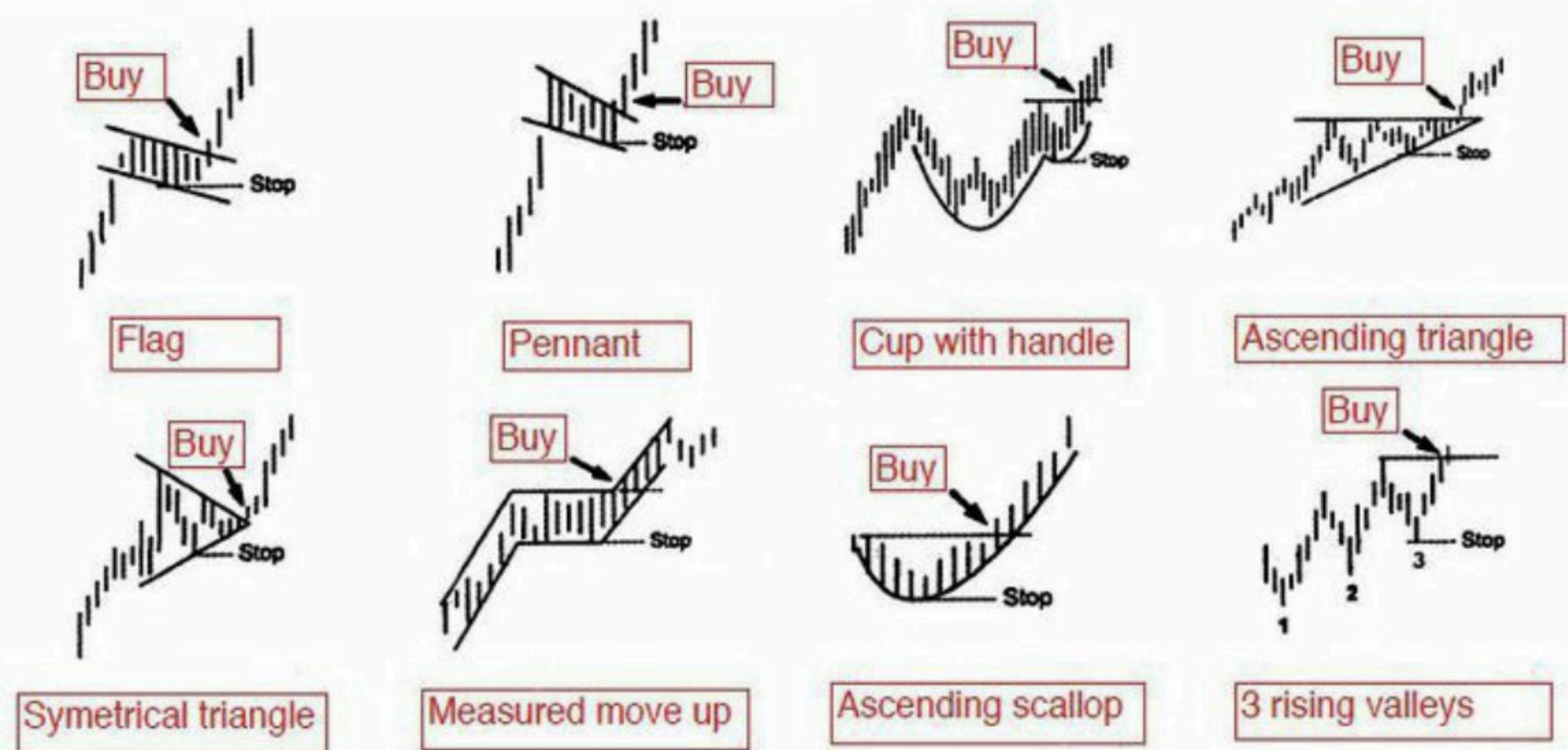
“... what if economists finally started to consider non-linear functions?”

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

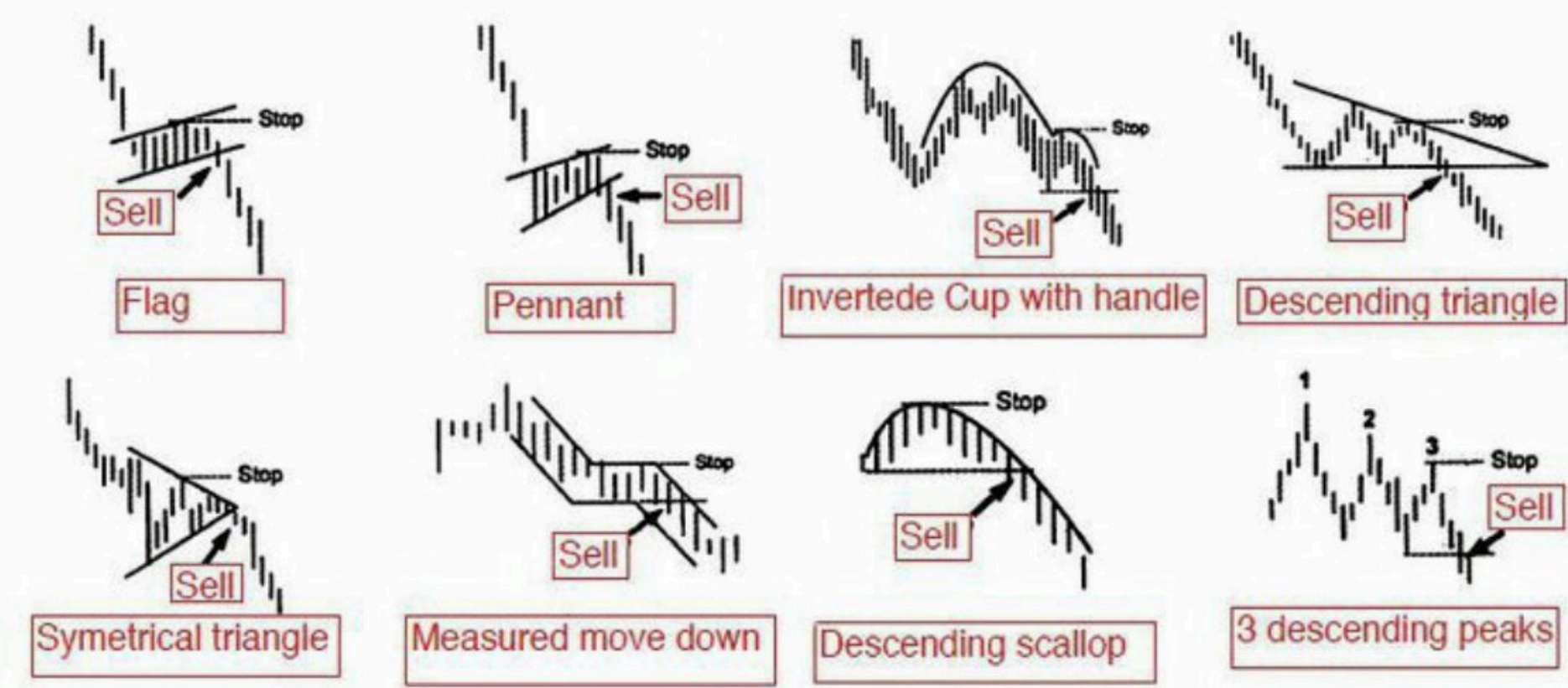
“Econometrics might be good enough to succeed in financial academia (for now), but succeeding in practice requires ML.”

Marcos López de Prado (2018)

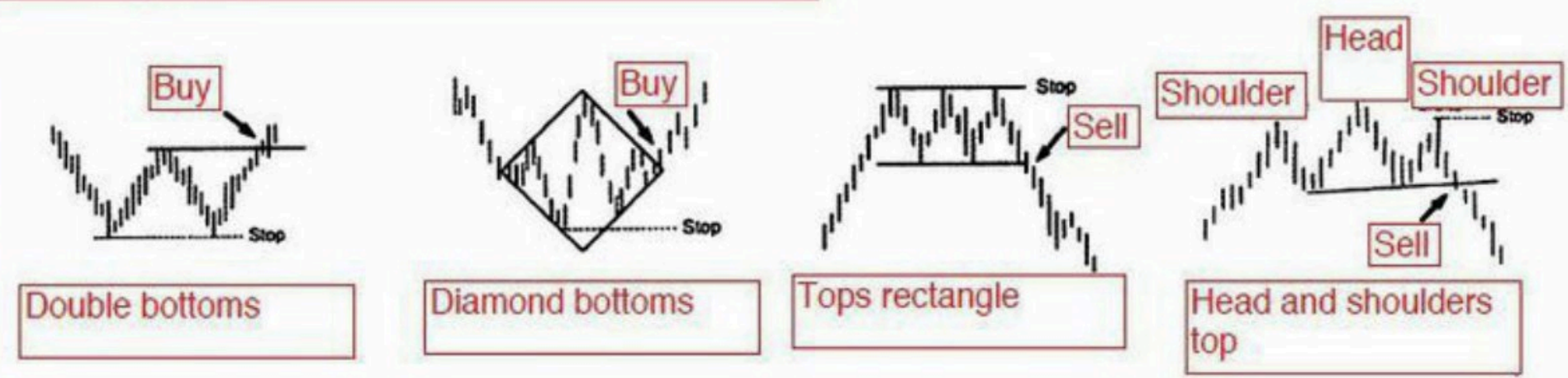
Bullish patterns (going up)



Bearish patterns (going down)



Reversal patterns

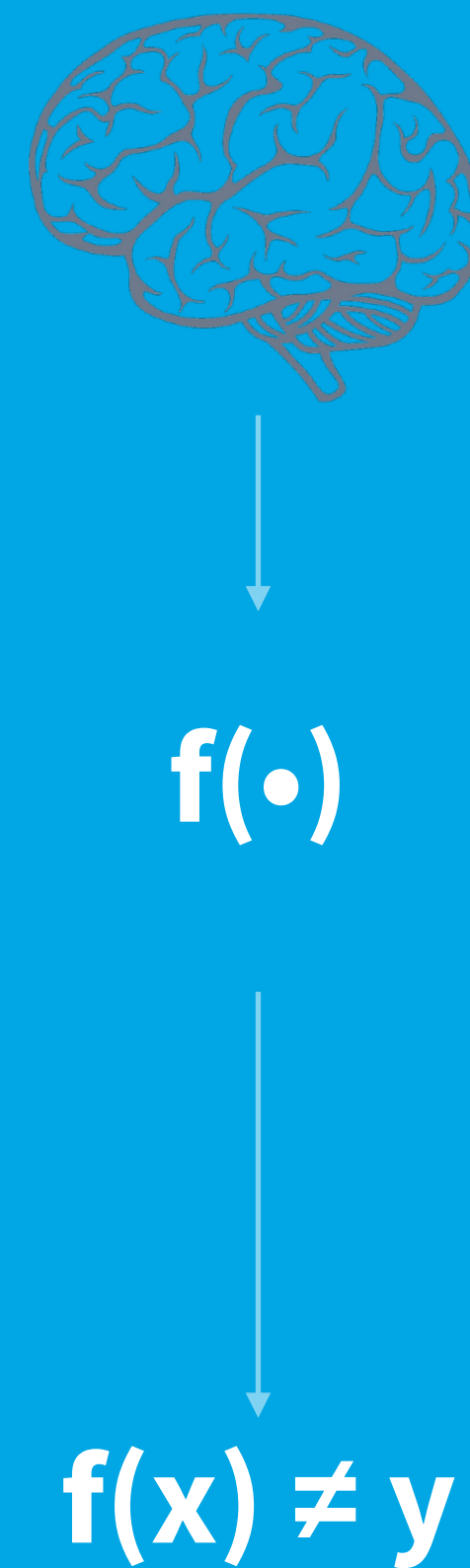


Financial Markets



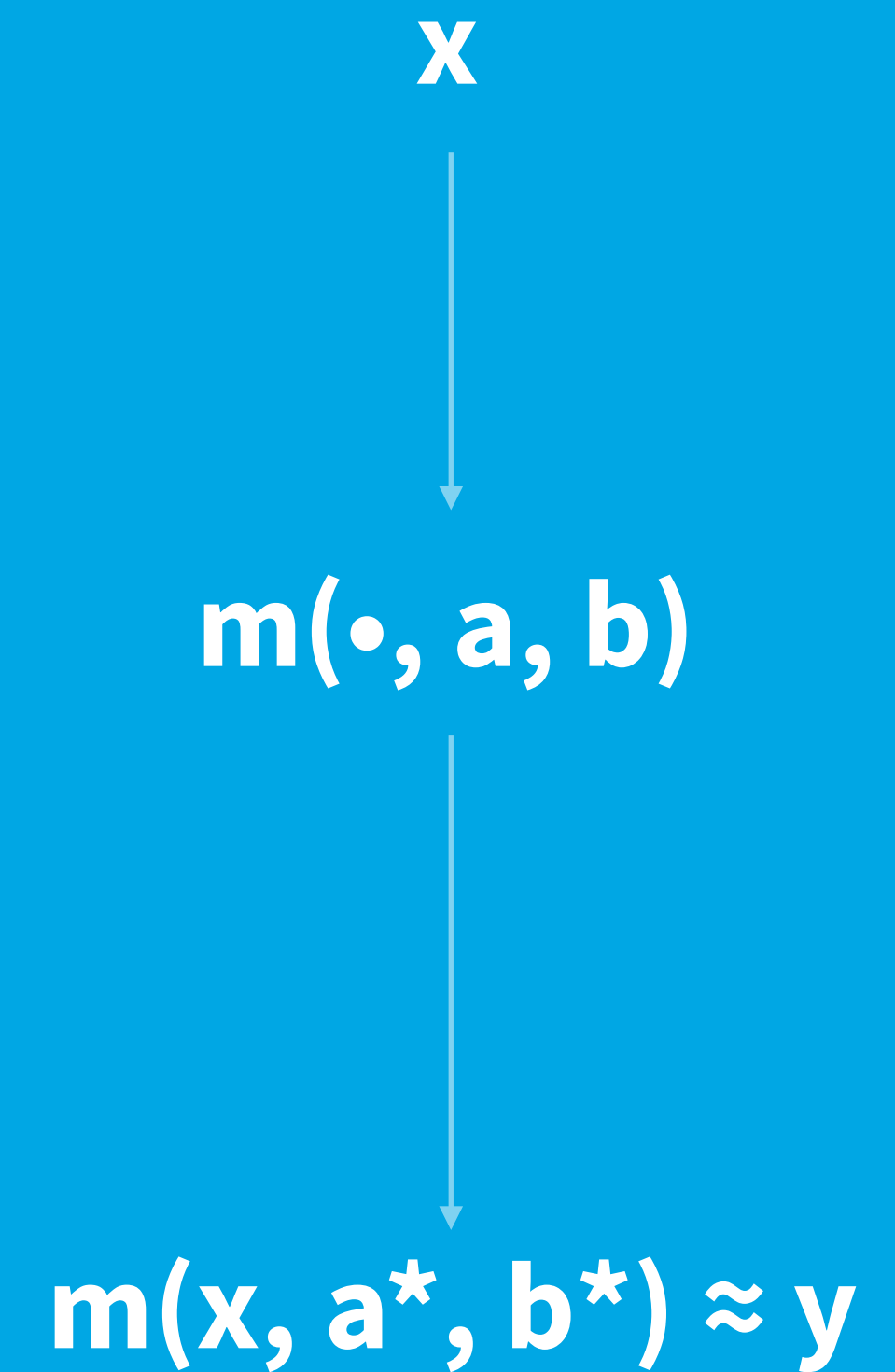
“non-linear, complex,
changing”

Finance History

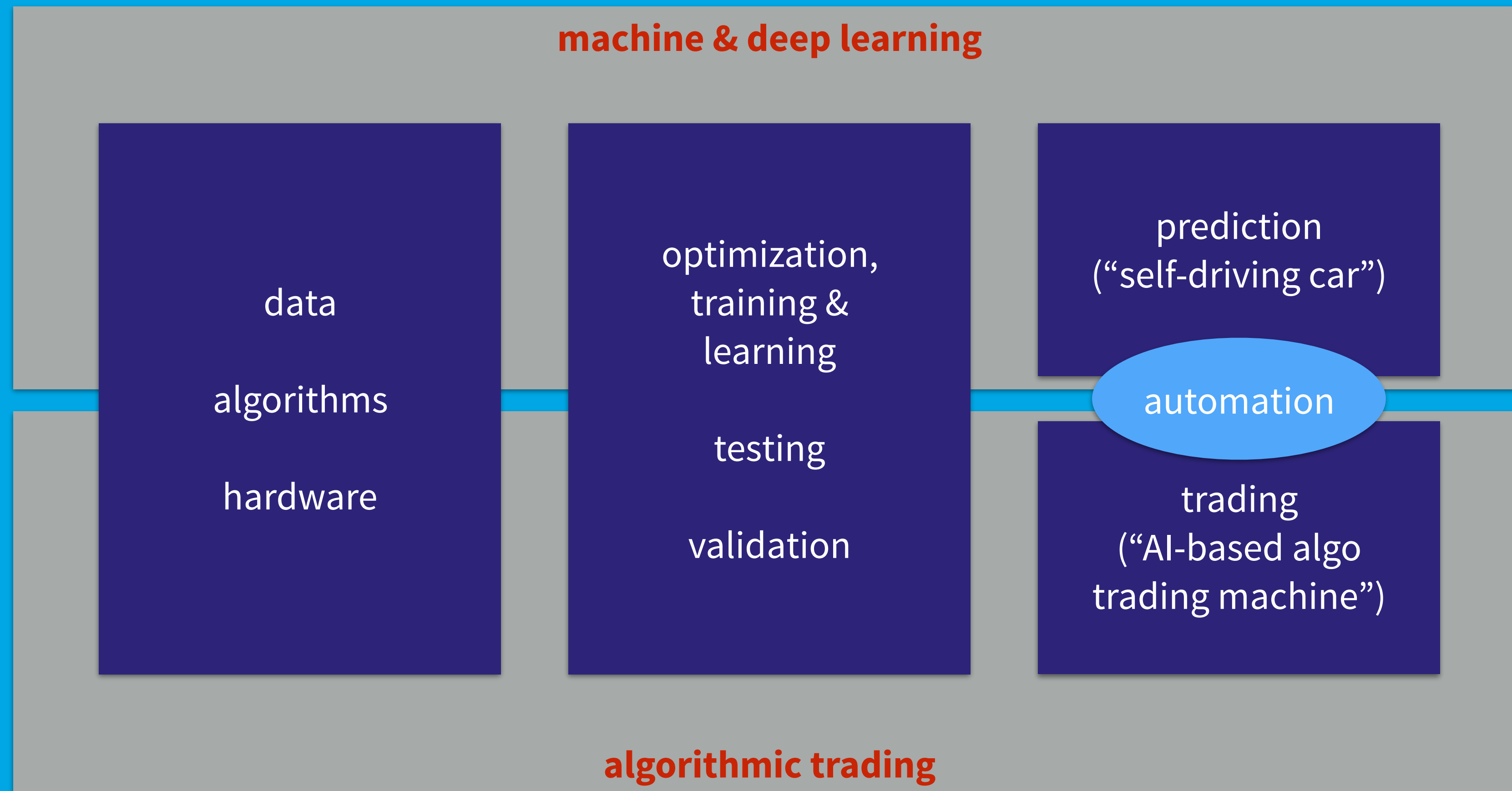


“brain-driven &
beauty myth”

AI in Finance = finaince



“data-driven &
AI-first”



Example Strategy

STRATEGY IDEA

- **instruments:** single instrument (FX), leveraged
- **positions:** long and short
- **financial data:** mid-frequency (5 or 10 mins)
- **algorithm:** classification (Bayes, LR, LR and similar)
- **goal:** alpha = outperformance + positive return + low correlation
- **robustness:** acceptable performance independent of parameters
- **programming:** Python, NumPy, pandas, scikit-learn



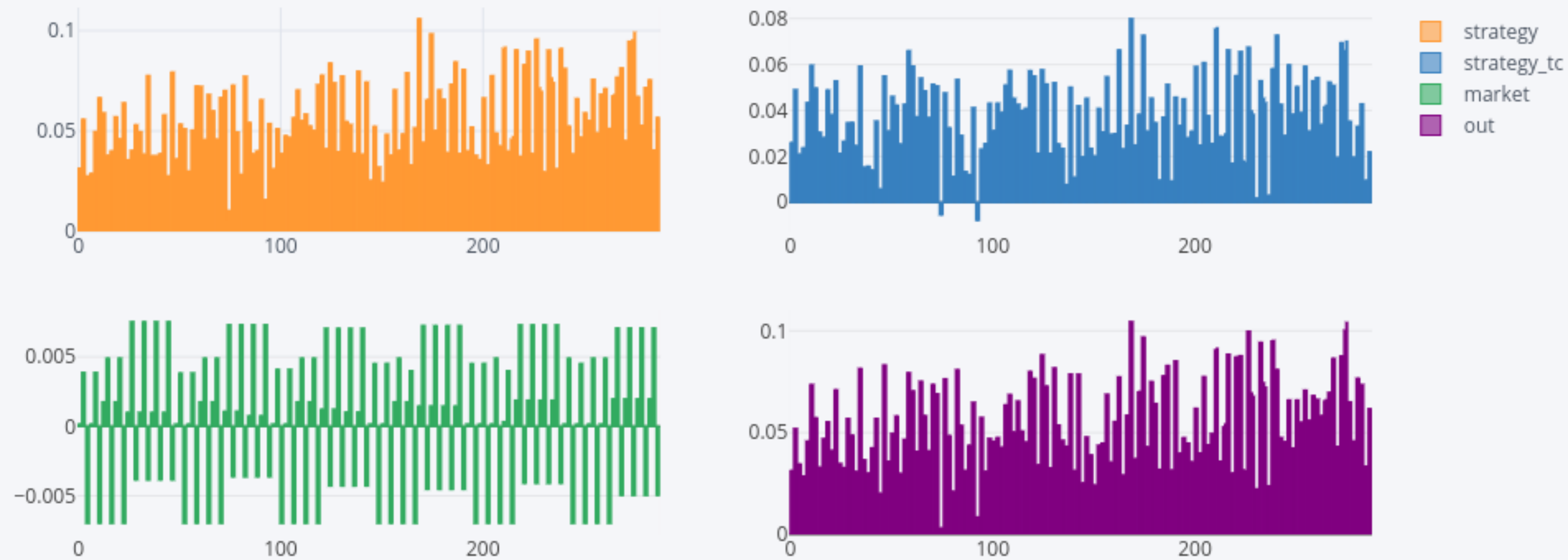
PARAMETERS

- EUR_USD, 5min bars
- sequential training/backtest
- 40% to 60% train-test split



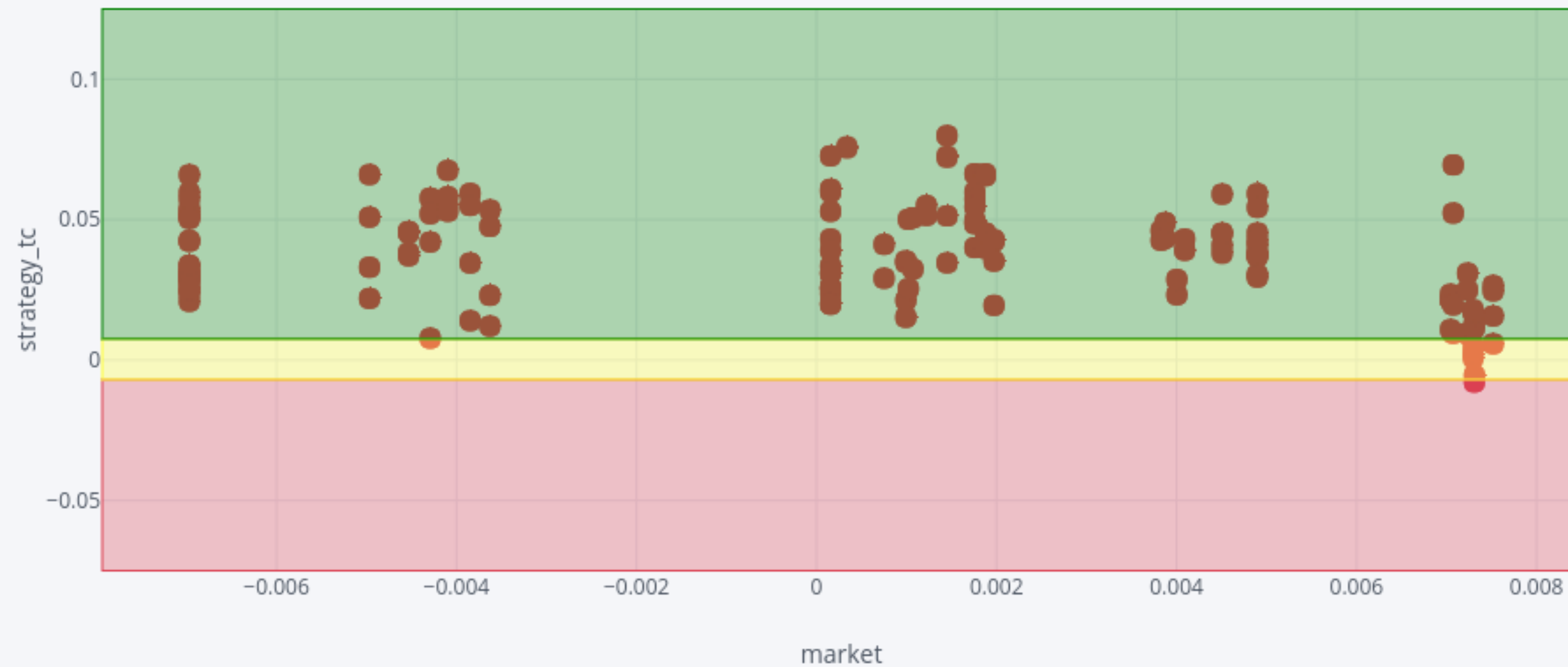
PARAMETERS

- EUR_USD, 5min bars
- randomized training/backtest
- 40% to 60% train-test split



PARAMETERS

- EUR_USD, 10min bars
- randomized training/backtest
- 40% to 60% train-test split
- 288 algorithm configurations



PARAMETERS

- EUR_USD, 10min bars
- randomized training/backtest
- 40% to 60% train-test split
- 288 algorithm configurations

The AI Machine

A bit of background and some general thoughts

- On the way from The Python Quant to The AI Quant ...
- “Do you trade? Do you do algo trading on your own?”
- Many people fail deploying their algo trading ideas
- Walk the talk ... and come up with a proof-of-concept
- Robust, reliable execution as a *conditio sine qua non*
- Fascination for markets and betting — getting direct feedback

16 week program

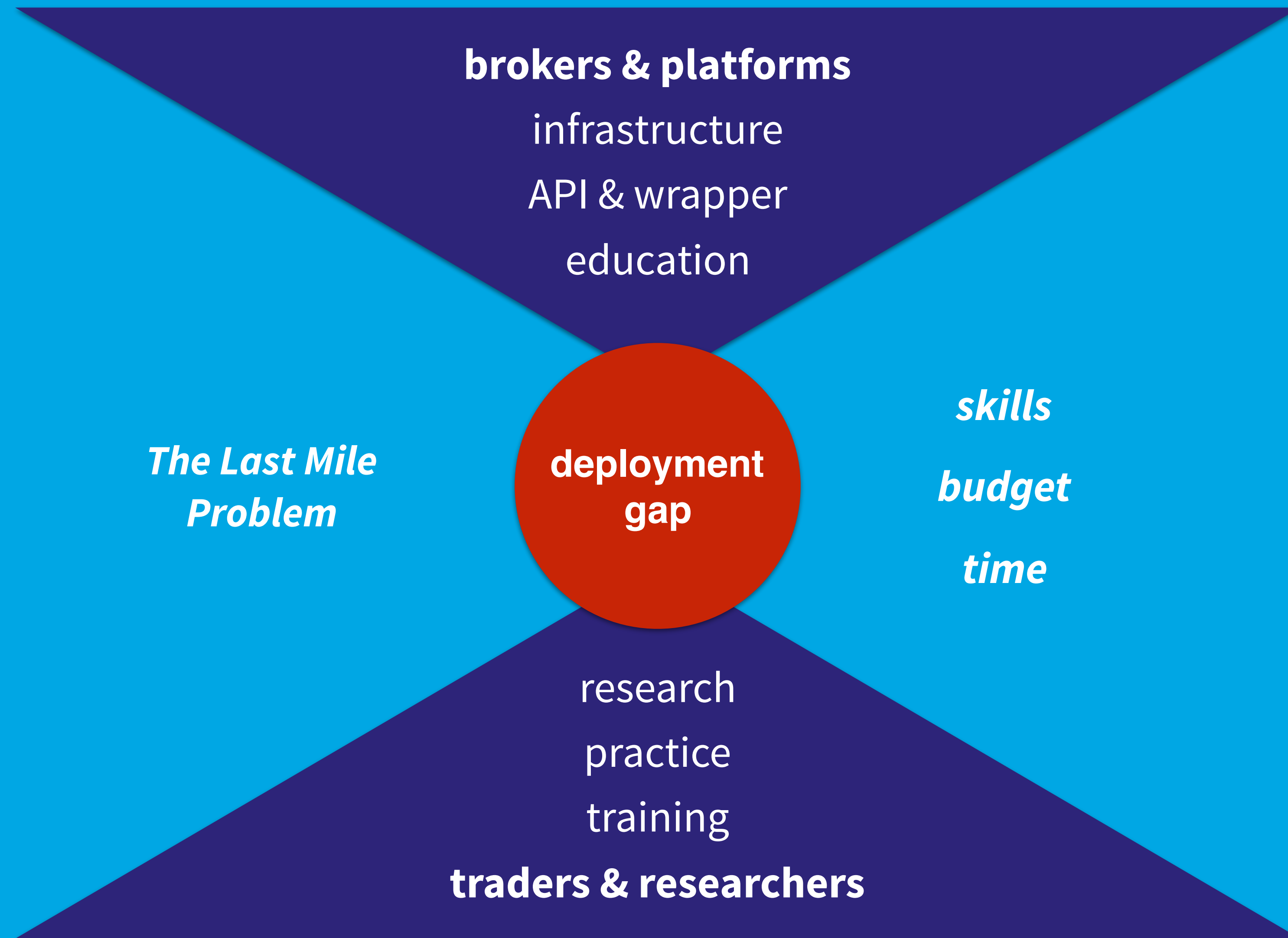
150+ hours
of instruction

5,000+ lines
of code

1,200 pages PDF

<http://certificate.tpq.io>





The AI Machine

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

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

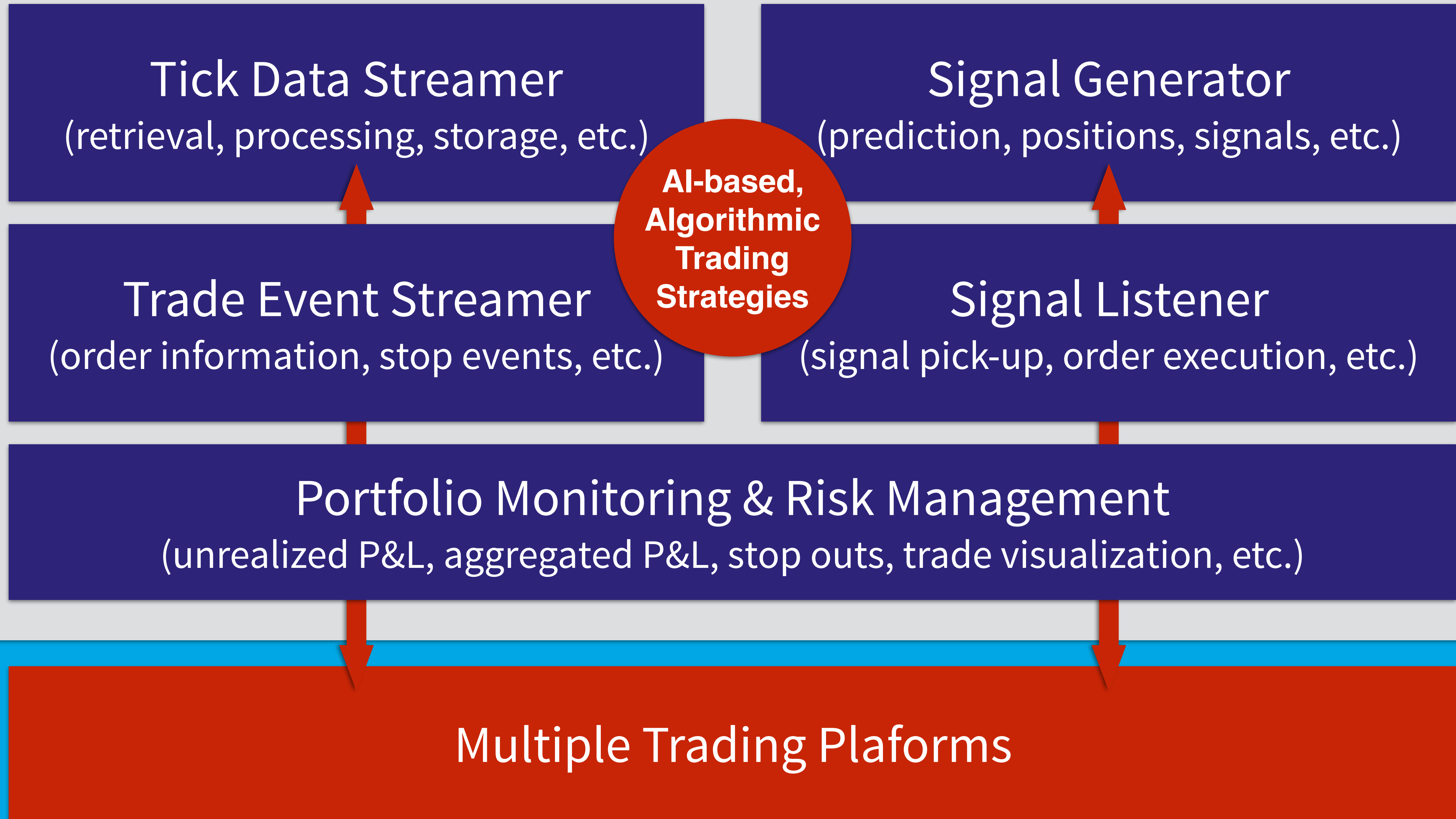
AI-based,
Algorithmic
Trading
Strategies

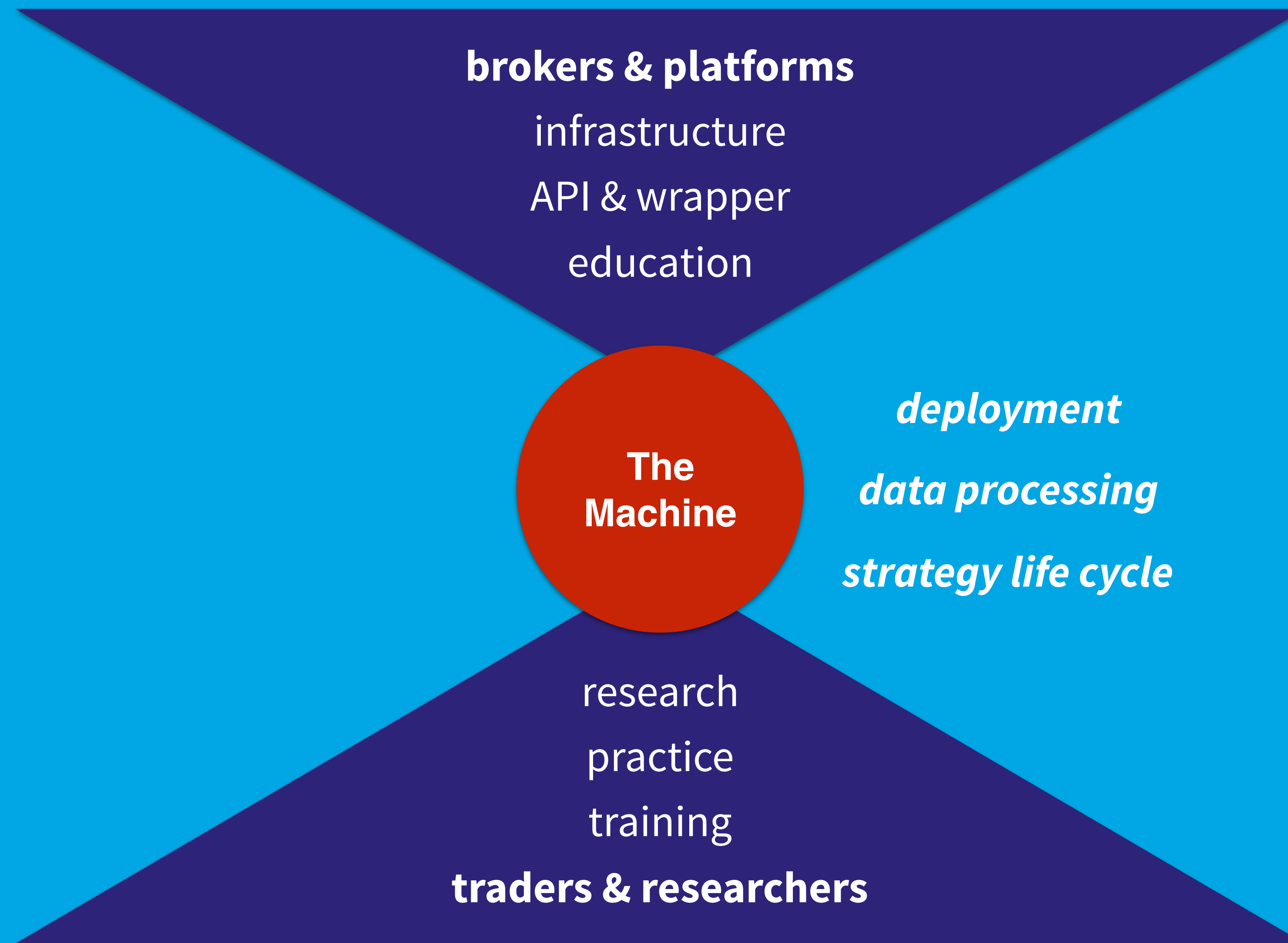
Trade Event Streamer
(order information, stop events, etc.)

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



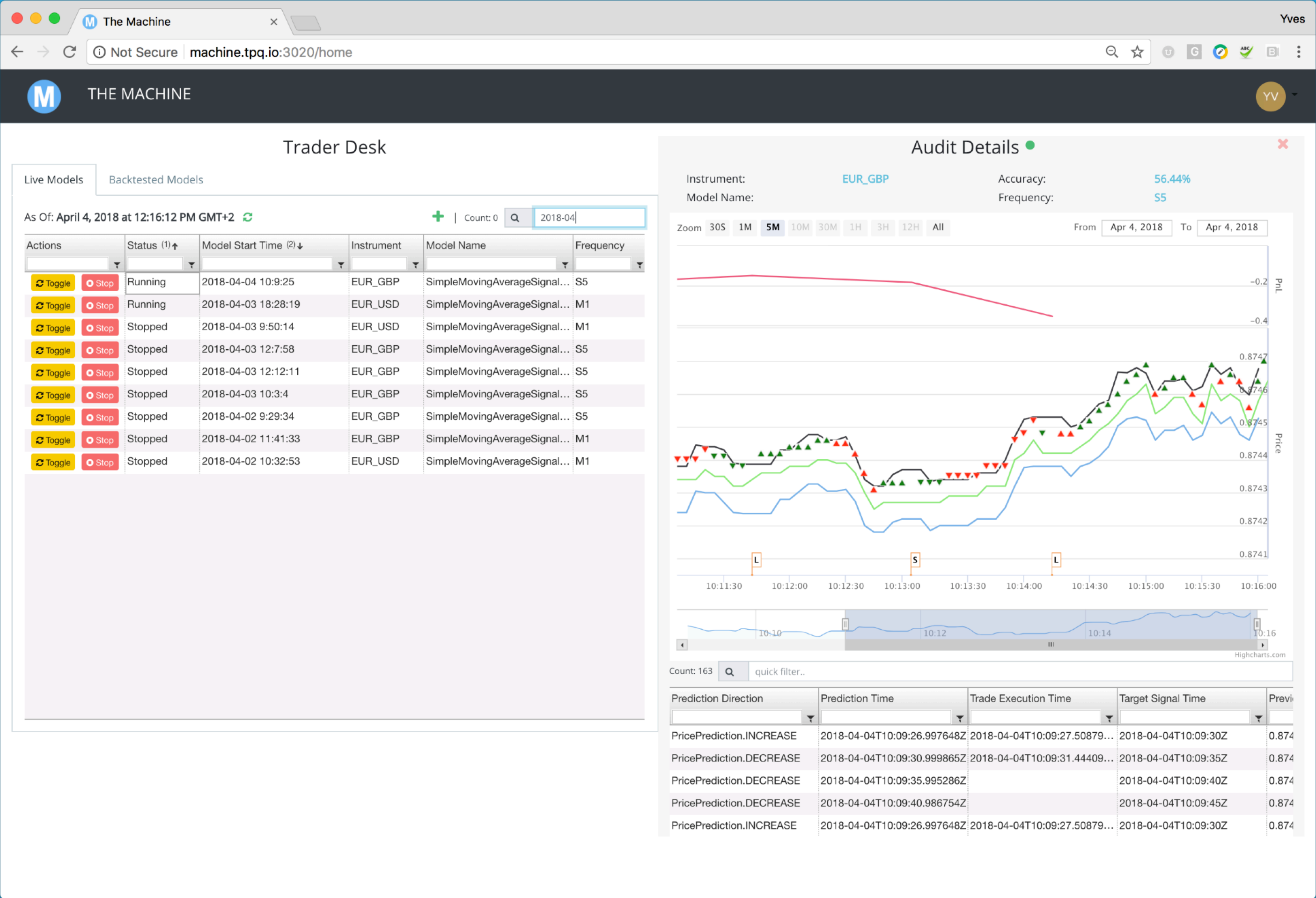




**AI-based,
Algorithmic
Trading
Strategies**

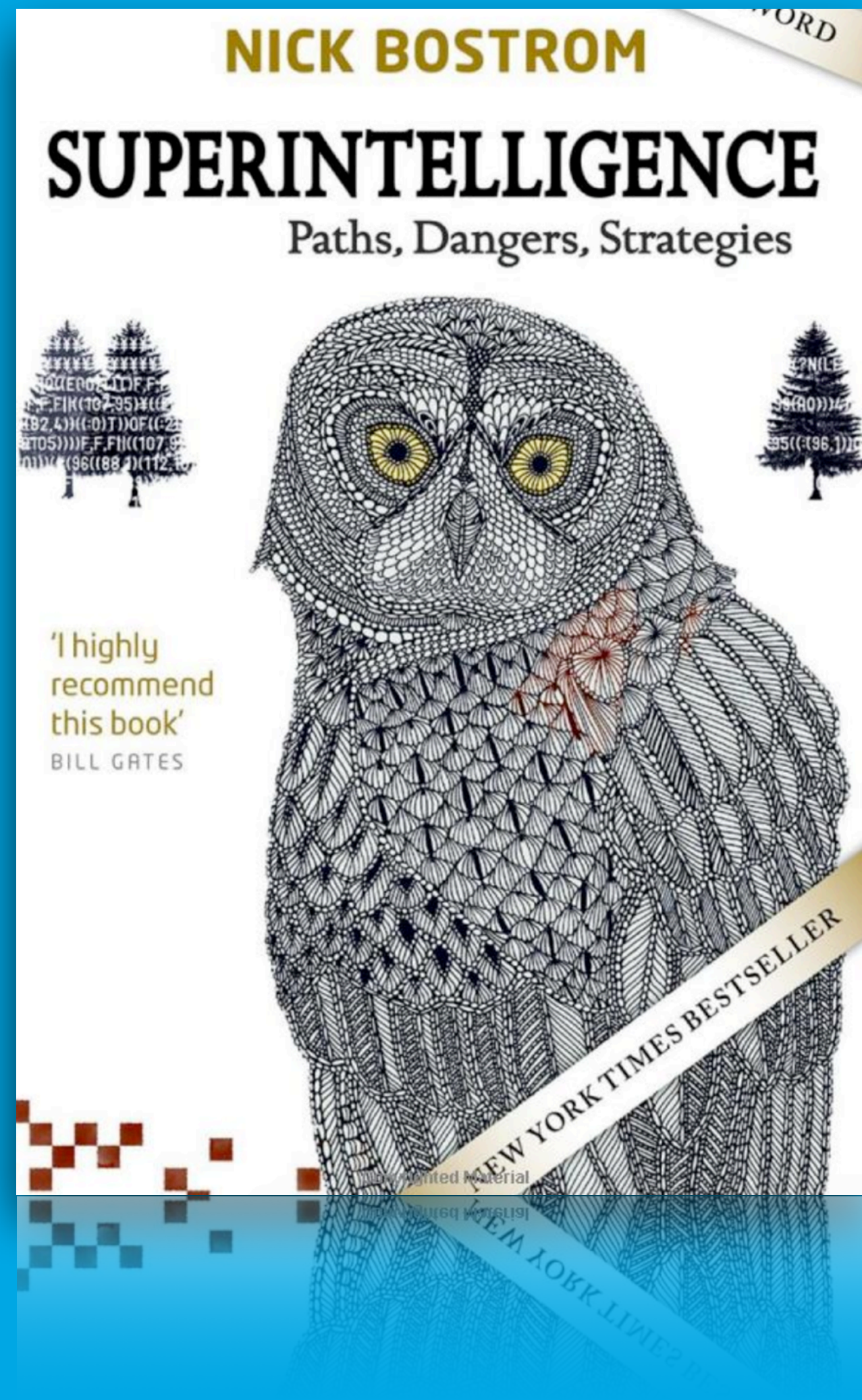
**The AI
Machine**

The AI Machine
standardized deployment
of AI-based algorithmic
trading strategies



**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)



“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.

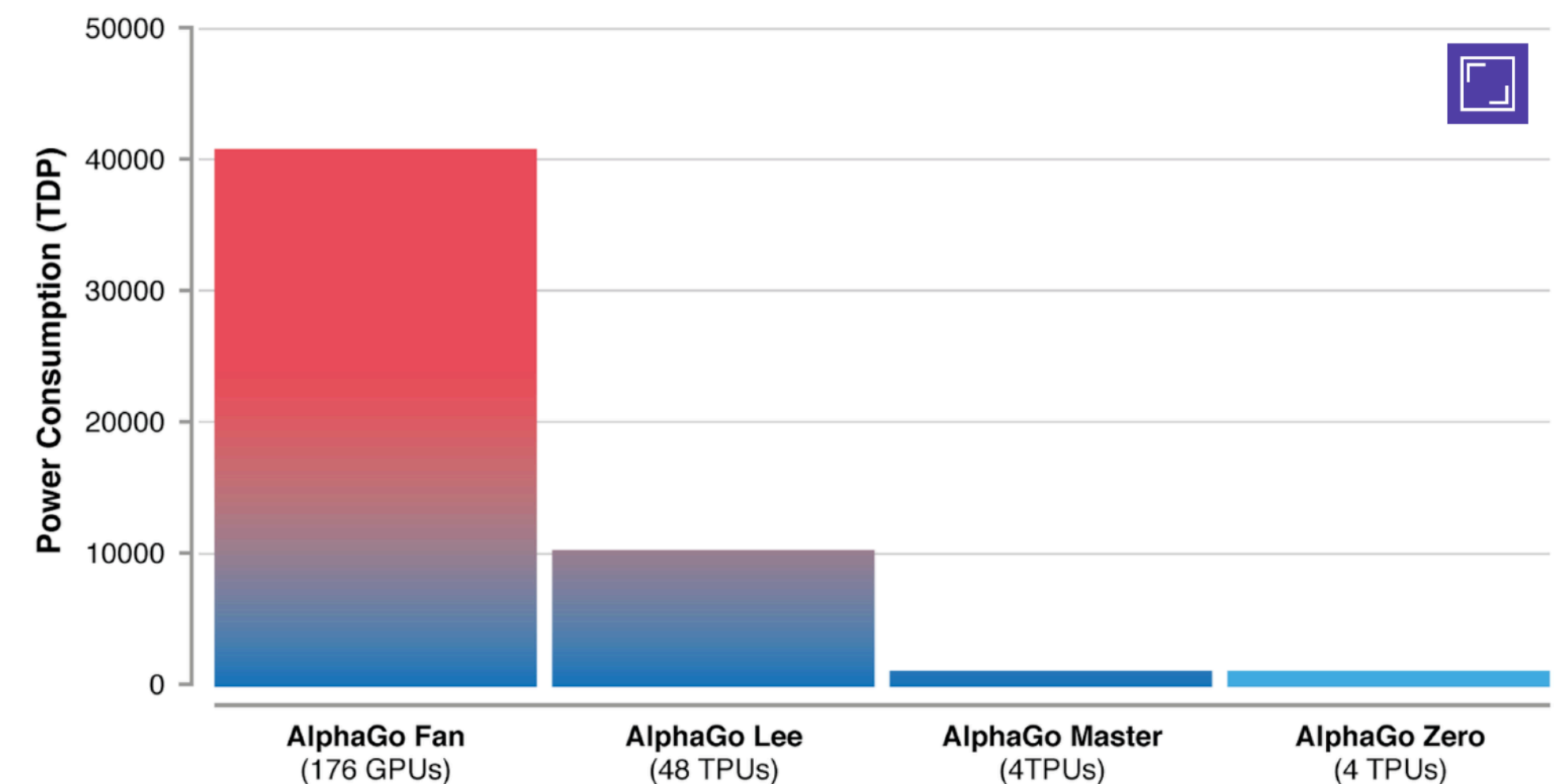
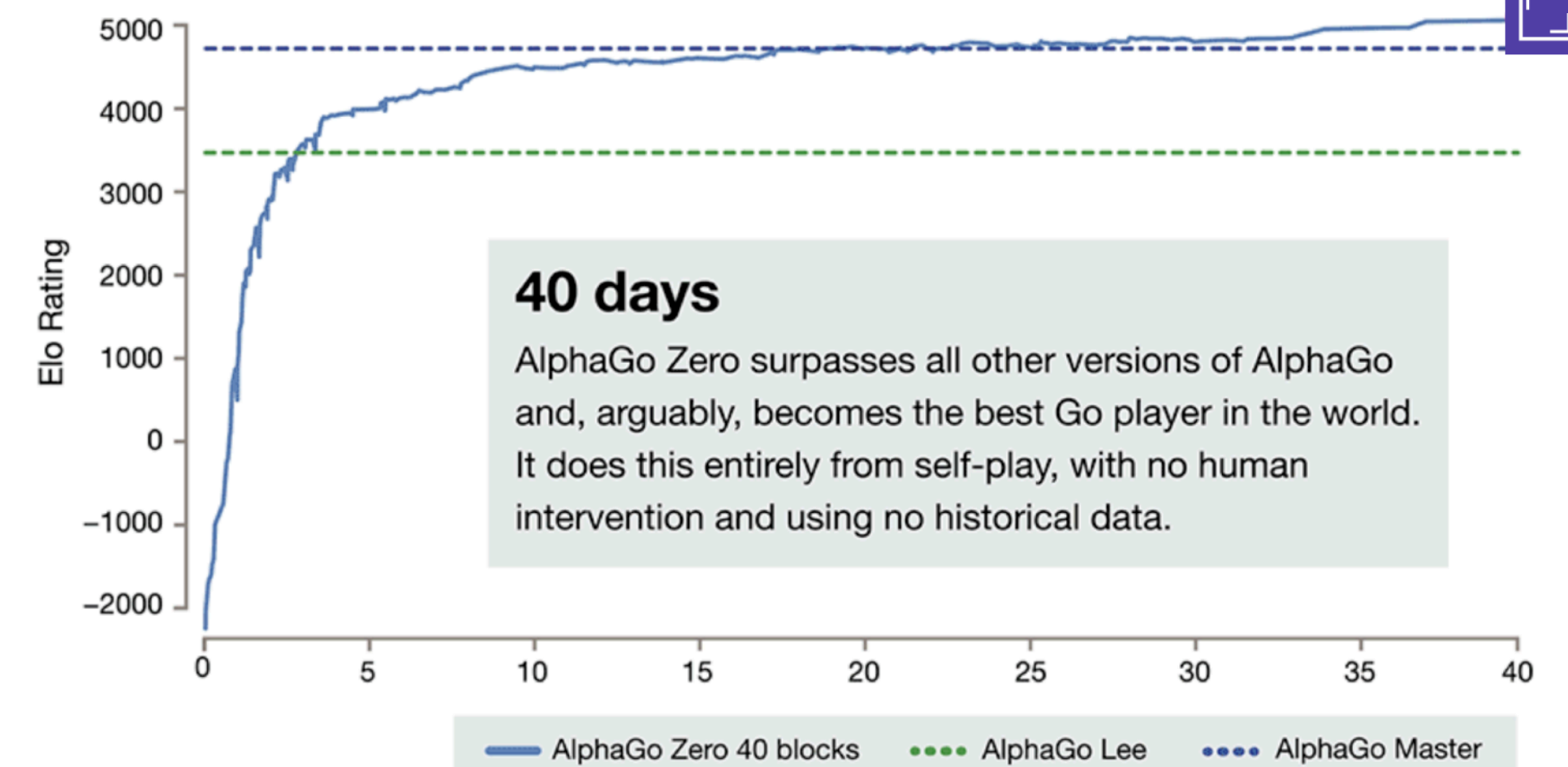
AlphaGo's first formal match was against the reigning 3-times European Champion, Mr Fan Hui, in October 2015. Its 5-0 win was the first ever against a Go professional, and the results were published in full technical detail in the international journal, [Nature](#). AlphaGo then went on to compete against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

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@dyjh

