News from TPQ: Python for Finance 2nd, Certificates, AI in Finance & The AI Machine

Dr. Yves J. Hilpisch Python for Quant Finance Meetup London, 21. March 2019







Overview

- 1. Background
- 2. Python for Finance
- 3. Certificates
- 4. Al in Finance
- 5. The Al Machine

nd r Finance es nce



Background —Data-Driven Finance

FINANCIAL TIMES

ohamed El-Erian

Torturing Theresa Boris Johnson's bid to dictate May's Brexit strateav



Las Vegas reels from worst US mass shooting

A casualty is carried from the sce fter a gunman opened fire on concer goers in Las Vegas on Sunday night. More than 58 people were killed and over 515 wounded, making it the deadli Las Vegas police said the suspe

the US president, called the shooti



Catalan president urges Brussels to mediate in independence clash

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



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 : • Uber's UK head quits as chief flies in

Jo Bertran, Uber's UK boss, has quit the company a day before a visit to London by Dara to meet regulators over a threat prevoke the ride-hailing app's

▶ Koike faces Japan election dilemma okyo governor Yuriko Koike is under pressure 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 ahea of a hearing at the US Congress later today that disclosing that it had been hacked would have ncouraged "copycat" cyber attacks.- PAGE 13 ▶ Western envoys warn on Kenya re-run

Western ambassadors have condemned President Uhuru Kenyatta and Raila Odinga, opposition eader, for undermining the electoral commission pility to restage its election this month.- PAGE 4

▶ Huawei beats Apple as top China choice uawei has for the first time beaten Apple to top spot for intended smartphone purchases in China





Smith & Wesson said profi 6, as gun sales slow from eir recent torrid pace. **B2** Pacific trade talks adjourned vithout a deal amid discord be ween the U.S. and Japan. A17 Italy pulled out of a two ear contraction in the thir uarter, posting flat GDP. A Three Swiss banks agreed to participate in a U.S. tax-eva sion-disclosure program. C5

■ LightSquared can proceed with a suit against Dish over a debt purchase, a judge ruled. B3 Monsanto is teaming up with a Danish firm to develop * * *

World-Wide

Congressional negotiat struck a budget deal that v allow more domestic and r ary spending and include def it-cutting measures. A1, A8 Ukrainian forces storn protesters' encampment in Kiev, hours after Western dip-omats called for a nonviolent end to the political crisis. **A13** ■ Obama's disapproval rate hit 54%, the high for his presi-dency, amid the flawed health law rollout, a Wall Street Journal/NBC poll found. A4

World leaders gathered to nor Mandela. In a rare en th Cuba's Raúl Castro. A12 Senate Democrats con-

rmed an Obama appeal ourt pick and the head o A key Senate Democrat lelay new Iran sanctions. A17

Bank Rule Supreme Court justi Challenges proach to air polluti crosses state lines. A Wall Street An AIDS group called for a

probe to see if HIV-infected pa ients were discouraged from enrolling in health plans. A6 By Justin Baer And Julie Steinberg ■ Uruguay's Senate voted to legalize marijuana. The presi-dent plans to sign the bill. A15 A broad new government rule

France's leader flew to the ral African Republic afte o French troops died. A13 Singapore police charged



China Spins New Lesson From Soviet Fall

REST IN PEACE: 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

PARTY DISCIPLINE

 BY JEEDING
 The Community Party boss in castern China's Jiangsu province summond local officials recently to a compulsory study advantary on the Soviet Union's collarge.
 fall apart because of the communist system trayed it, especially Mikhail Gorbache.
 The office in charge of Mr. Xi's campaig didth' respond to questions about the fill reaged it, especially Mikhail Gorbache.

 The fill begins with images of the Soviet Union in is heyday, but quickly cut to and punctuated by Russian communists is menting their nation's fate.
 The office in charge of Mr. Xi's campaig didth' respond to questions about the fill respondence of the soviet point is heyday, but quickly cut to shown at dozens of political meetings since shown at dozens of political acent what is poly tory including some within the party. The sping to an effort to combat what is poly to are of an effort to combat what is poly to are of an effort to combat what is poly to are dore and meeting the Sincer what he meeting and the dozens' mistake was to over the spread of Western ideas vari medial dore finding the Staling the Sincer who are produced to are dore and poly and the section and analysis, is maintal media to definding the Staling the Sincer who are produced to are dore and poly the section and analysis, is maintal media academia and popular culture.

Here's Your Holiday Bonus, Now Start Running * * *

At a time of year when n

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

BY RACHEL FEINTZEIG A broad new government rule to limit risk-taking by Wall Street mill force banks to rethink virtur ally every aspect of their trading activities, setting the targe for more tumult at the largest U.S. financial institutions. The so-called Volker rule, ap proved by five financial regula, but his employer, coupon website for a company to the setting to the set of the set of the set of the set or a called volker rule, ap proved by five financial regula, but his employer, coupon website for a company to the set of th

24 Indian citizens in connection with a night of rioting Ar3. **Died:** Jim Hall, 83, according to see the second s

iShares Core ETFs US Stocks US Bonds Every investor is unique That's why there's iShares Core. Find out why 9 out of 10 large profe choose iShares for their ETFs.¹ 🚺 iShares by BLACKROCK

DETROIT—General Motors Co. tapped product chief Mary Barra as its next chief executive, smash-ing a century-old gender barrier while choosing a longtime insider who grew up steeped in Detroit's car culture. Ms. Barra will succeed Dan Ak-seren oc CC0 next weath and he

Ms. Barra will succeed Dan Ak-erson as CEO next month and be-come the first woman to run a major global auto maker. The 51-year-old joined GM 33 years ago as a college intern, eventually be-coming an engineering manager before running one of its big U.S. assembly plants. She got global experience managing human re-sources and, more recently, the company's world-wide product development group. evelopment group. She will become the 22nd nan currently running a Fo Please turn to page Al

Milestone is hailed, but worr continue to face obstacles.....
 Heard on the Street.......



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← → C https://emea1.apps.cp.thomsonreuters.com/web/Apps/Corp?s=AAPL.O&st=RIC&app=true#/Overview?s=AAPL.O&template=SOV							
AAPL.O AAPL.O 117.26						≡ 1	💼 🗩 🖊 📰 😰 🗢
NEW Welcome to the new faster, more powerful Company Overview. See what's changed					Rever	rt to previous versio	on 🛛 🗭 Send feedback
AAPL.O ~ APPLE INC ~ CAM 79 United States NASDAQ Global Select Consolidated Computer Hardware	CCR 90					SUMMARY SOV	
Overview News & Research Price & Charts Estimates Financials Events Ownership Debt & Credit Peers & Valuation Derivatives Filings 360 Menu							
BUSINESS SUMMARY >		PRICE PERFORMANCE >					
Apple Inc. designs, manufactures and markets mobile communication and media devices, personal computers digital music players. The Company sells a range of related software, services, accessories, networking solutior party digital content and applications. The Company's segments include the Americas, Europe, Greater China, .	and portable ns, and third- Japan and Rest	Open Prev. Close			AAPL.O 115.190000	Price USD 117.260000	
of Asia Pacific. The Americas segment includes both North and South America. The Europe segment includes E countries, India, the Middle East and Africa. The Greater China segment includes China, Hong Kong and Taiwar Asia Pacific segment includes Australia and the Asian countries not included in the Company's other operating	European n. The Rest of segments. Its	Bid / Ask VWAP Turnover			M	m	115.00
products and services include iPhone, iPad, Mac, iPod, Apple Watch, Apple TV, a portfolio of consumer and pro software applications, iPhone OS (iOS), OS X and watchOS operating systems, iCloud, Apple Pay and a range of service and support offerings.	fessional of accessory,	Volume Short Interest		0.90%	Mm M Mu	1	105.00
NEWS >		YTD			We we		90.00
28-Dec-2016		Beta (5Y Monthly)		1.29			85.00
10:24:36 Apple dominerade julhandeln mätt i antalet aktiverade enheter	FNW	Mkt Cap	USD	625.27B	Dec-31 Mar-31 Jun-3	30 Sep- 14-I	Dec-2016
10:15:18 UPDATE 3-S.Korea fines Qualcomm \$854 mln for violating competition laws	RTRS	PE (LTM)		14.12	Today 5D 3M 6M 1	Y 5Y	No Benchmark 🗸
09:42:52 Corea del Sur multa a Qualcomm con 854 mlns dlr por violar leyes de competencia	RTRS	Div Yield		1.94%			
06:00:10 RPT-Wall Street cale une fois de plus au seuil des 20.000 points	RTRS	DR BRL - AAPL34.SA (1:0		A (1:0.1)	1) 52Wk: 89.47		118.69
03:30:18 Aumento del gasto de último minuto impulsa a temporada de ventas de fin de año	RTRS	DR Type			12-May	11-Oct	
01:50:14 Last-minute spending surge lifts U.S. holiday shopping season	RTRS	DR Bank				<u>III</u> Next Ear	n Report: 24-Jan-2017
27-Dec-2016		Free Float	5.32B	Asset Typ	e Ordinary Share	5 yr CDS	26.980 bps
23:33:16 Reuters Insider - Tech stocks could take the Dow to 20k	CNBC	Outstanding	5.33B	Share Cla	SS	∆ Today	-0.07%
23:32:28 Reuters Insider - History suggests Dow could hit 20k by Friday: Technician	CNBC	IPO Date	12-Dec-1980	Lot Size		∆ 1 Week	-0.074
22:55:29 LEAD 2-Wall Street cale une fois de plus au seuil des 20.000 points	RIRS	First Irade Da	12-Dec-1980	Voting Rig	jnts 1	_	
22:09:59 Apple, Cisco Lead DJIA Higher Tuesday	WALLST	FUNDAMENTALS >					
EVENTS > Upcoming 24-Jan-2017 > 30-Jan-2017	Past				AAPL (Sep-2016)	Growth	Industry
NTS Q1 2017 Apple Inc Earnings Release	ĪĪ	Gross Margin			38.02%	(4.71%) 4Q	38.91%
24-Feb-2017 » 28-Feb-2017	Operating Margin			25.10%	(11.59%) 4Q	5.75%	

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NEW Welcome to the new faster, more powerful Company Overview. See what's changed						Reve	ert to previous version	n 🛛 🎔 Send feedback	
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Overview News & Research Price & Charts Estimates Financials Events Ownership Debt & Credit Peers & Valuation Derivatives Filings 360 Menu								A 🗘	
BUSINESS SUMMARY >									
Apple inc. designs, manufactures and markets mabile communication and madia devices, nervenal computers	and nestable	Open						Drive	
digital music players. The Company sells a range of related software, services, accessories, networking solution	ns, and third-	Prev. Close				AAPL.O 115.190000		USD	
party digital content and applications. The Company's segments include the Americas, Europe, Greater China, J of Asia Pacific. The Americas segment includes both North and South America. The Europe segment includes E	Japan and Rest	Bid / Ask				117.260000 115.00 110.00 105.00			
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Asia Pacific segment includes Australia and the Asian countries not included in the Company's other operating s products and services include iPhone, iPad, Mac, iPod, Apple Watch, Apple TV, a portfolio of consumer and prof	segments. Its fessional	Turnover							
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service and support offerings.		Short Interes	st		0.90%	Mymm h Mym	95.00		
NEWS >						90			
28-Dec-2016		Beta (5Y Mo	nthly)		1.29			85.00	
10:24:36 Apple dominerade julhandeln mätt i antalet aktiverade enheter	FNW	Mkt Cap USD 625.27B			SD 625.27B	Dec-31 Mar-31 Jun-3	Mar-31 Jun-30 Sep- 14-Dec-2016		
10:15:18 UPDATE 3-S.Korea fines Qualcomm \$854 mln for violating competition laws	RTRS	PE (LTM) 14.12		Today 5D 3M 6M 1	IY 5Y	No Benchmark 🗸 🗸			
09:42:52 Corea del Sur multa a Qualcomm con 854 mlns dlr por violar leyes de competencia	RTRS	Div Yield			1.94%	,%			
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23:33:16 Reuters Insider - Tech stocks could take the Dow to 20k	CNBC	Outstanding	4	5.33	Share Cl	ass		-0.07%	
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22:09:39 Apple Cisco Lead D IIA Higher Tuesday	WALLST		·a I	12-Dec-1980	voung R				
EVENTS	Deet	FUNDAMENTA	ALS >						
24-Jan-2017 » 30-Jan-2017	Fasi					AAPL (Sep-2016)	Growth	Industry	
NTS Q1 2017 Apple Inc Earnings Release		Gross Margir	n			38.02%	(4.71%) 4Q	38.91%	
24-Feb-2017 » 28-Feb-2017	Operating M	argin			25.10%	(11.59%) 4Q	5.75%		

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News

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	 Gary Cohn resignation rumors know Wal-Mart drops after reporting ma Indexes down: Dow 0.81 pct, S&P 	ocked down argin fall 1.03 pct, Nasdaq 1.39 pct		
	Updates to early afternoon			
	By Sruthi Shankar and Tanya Agrawal			
	Aug 17 (Reuters) - U.S stocks hit sessio	n lows in early afternoon trading on Thursday as	investors worried about President Donald Tru	ump's ability to







IPython



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Background —AI Success Stories



"We present the first deep learning model to successfully learn control policies directly from high-dimensional sensory input using reinforcement learning. The model is a convolutional neural network, trained with a variant of Q-learning, whose input is raw pixels and whose output is a value function estimating future rewards. We apply our method to seven Atari 2600 games from the Arcade Learning Environment, with no adjustment of the architecture or learning algorithm. We find that it outperforms all previous approaches on six of the games and surpasses a human expert on three of them."

Mnih, V. (2013): "Playing Atari with Deep Reinforcement Learning". https://arxiv.org/pdf/1312.5602v1.pdf arXiv:1312.5602v1 [cs.LG] 19 Dec 2013

Playing Atari with Deep Reinforcement Learning

Volodymyr Mnih Koray Kavukcuoglu David Silver Alex Graves Ioannis Antonoglou

Daan Wierstra Martin Riedmiller

DeepMind Technologies

{vlad,koray,david,alex.graves,ioannis,daan,martin.riedmiller} @ deepmind.com

Abstract

We present the first deep learning model to successfully learn control policies directly from high-dimensional sensory input using reinforcement learning. The model is a convolutional neural network, trained with a variant of Q-learning, whose input is raw pixels and whose output is a value function estimating future rewards. We apply our method to seven Atari 2600 games from the Arcade Learning Environment, with no adjustment of the architecture or learning algorithm. We find that it outperforms all previous approaches on six of the games and surpasses a human expert on three of them.

1 Introduction

Learning to control agents directly from high-dimensional sensory inputs like vision and speech is one of the long-standing challenges of reinforcement learning (RL). Most successful RL applications that operate on these domains have relied on hand-crafted features combined with linear value functions or policy representations. Clearly, the performance of such systems heavily relies on the quality of the feature representation.

Recent advances in deep learning have made it possible to extract high-level features from raw sensory data, leading to breakthroughs in computer vision [11, 22, 16] and speech recognition [6, 7]. These methods utilise a range of neural network architectures, including convolutional networks, multilayer perceptrons, restricted Boltzmann machines and recurrent neural networks, and have exploited both supervised and unsupervised learning. It seems natural to ask whether similar techniques could also be beneficial for RL with sensory data.

However reinforcement learning presents several challenges from a deep learning perspective. Firstly, most successful deep learning applications to date have required large amounts of handlabelled training data. RL algorithms, on the other hand, must be able to learn from a scalar reward signal that is frequently sparse, noisy and delayed. The delay between actions and resulting rewards, which can be thousands of timesteps long, seems particularly daunting when compared to the direct association between inputs and targets found in supervised learning. Another issue is that most deep learning algorithms assume the data samples to be independent, while in reinforcement learning one typically encounters sequences of highly correlated states. Furthermore, in RL the data distribution changes as the algorithm learns new behaviours, which can be problematic for deep learning methods that assume a fixed underlying distribution.

This paper demonstrates that a convolutional neural network can overcome these challenges to learn successful control policies from raw video data in complex RL environments. The network is trained with a variant of the Q-learning [26] algorithm, with stochastic gradient descent to update the weights. To alleviate the problems of correlated data and non-stationary distributions, we use



"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, <u>Nature</u>. 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 <u>highly inventive winning moves</u>, 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





algorithmic advances



Background —AI-First Finance

Financial Markets

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"normative economics = assumptions, axioms, etc."

(too) "simple and elegant theories"



"hardly any supporting empirical evidence"

"non-linear, complex, changing"









Markets & Agents



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Algorithms

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Data-Driven

Al-First

Finance

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Online Training Class based on the 2nd edition of Python for Finance



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Ŧ		Default Kernel	Python 2.7	Python 3.6
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Tools File Manager Task Manager New Editor New Shell User Forum Edit Trainings Edit Course User Settings My Account Administration My Trainings	Regular NumPy Arrays The Basics In []: import numpy as np # <1> In []: a = np.array([0, 0.5, 1.0, 1.5, 2.0]) # <2> a			
Finance with Python	In []: type(a) # <2>			
Python for Algorithmic Trading Python for Finance Update Finance with Python Videos Tools and Skills Dethen for Databases	<pre>In []: a = np.array(['a', 'b', 'c']) # <3> a</pre>			
Python & Linux Environment Certificate Program Certificate Live Sessions	<pre>In []: a = np.arange(2, 20, 2) # <4> a</pre>			
Webinars, Talks & Special Topics Online Summer Bootcamp Financial Data Science Flagship Algorithmic Trading Computational Finance	<pre>In []: a = np.arange(8, dtype=np.float) # <5> a </pre>			
Python Best Practices	in []: a[5:] # <6>			
Python for Excel TPQ Lab Help	In []: a[:2] # <6>			
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Python for Finance 2nd ed. Github repository with all Jupyter notebooks & codes

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Code Issues 0 Pull requests 0 Projects 0 Wiki In Insights Settings Jupyter Notebooks and codes for Python for Finance (2nd ed., O'Reilly) by Yves Hilpisch. Kanage topics Settings Issues 0 I branch 0 releases I or releases In or releas	
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Python for Finance 2nd ed. Many updates and upgrades, lots of new content.

I. Python and Finance 1. Why Python for Finance 2. Python Infrastructure

II. Mastering the Basics 3. Data Types & Structures 4. Numerical Computing with Numpy 5. Data Analysis with pandas 6. Object-Oriented Programming

III. Financial Data Science 7. Data Visualization 8. Financial Time Series 9. Input/Output Operations **10. Performance Python** 11. Mathematical Tools 12. Stochastics 13. Statistics (Machine Learning)

Python for Finance 2nd ed. Many updates and upgrades, lots of new content.

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- B. BSM Option Class

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ython 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

Dr. Yves Hilpisch

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 Pythonbased 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

100s of pages of Finance with Python, Python for Finance, and more

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- Finance with Python (7 hrs, 170 pages) gentle introduction to Finance and Python
- Tools & Skills (20+ hrs) helpful tools and skills for Python financial analytics and development
- Financial Data Science (16+ hrs, 400+ pages) based on my O'Reilly book "Python for Finance", 2nd ed
- Artificial Intelligence in Finance (16+hrs)
- Python for Excel (6 hrs) how to combine Python with Excel efficiently and effectively
- Python for Databases (9 hrs) how to use Python to work with SQL & NoSQL databases
- Natural Language Processing (3 hrs, 50 pages) basics of NLP with Python
- Python for Algorithmic Trading (40+ hrs, 470 pages) using Python for prediction, backtesting, automated trading, etc.
- Python for Computational Finance (25+ hrs, 350 pages) based on my Wiley book "Derivatives Analytics with Python"

machine & deep learning for finance, based on my upcoming book "AI in Finance"

Artificial Intelligence in Finance —A Python-Based Guide

ARTIFICIAL INTELLIGENCE IN FINANCE A Python-based Guide

I. BACKGROUND

- Artificial Intelligence
- Technological Singularity

II. FINANCE

- The Beauty Myth
- Data-Driven Finance
- Al-First Finance

III. ALGORITHMS

- Machine Learning
- Deep Learning
- Reinforcement Learning



IV. APPLICATIONS

- Financial Data Science
- Capital Management
- Computational Finance
- Algorithmic Trading
- The Al Machine

V. OUTLOOK

- Skills & Education
- Governance & Ethics
- Al-based Competition
- Financial Singularity

The AI Machine

Algorithmic Trading							
Data	Features and Labels	Machine & Deep Learning Backtesting		Deployment			
EUR/USD exchange rate	time series features	support vector machine & DNN classifier	vectorized backtesting	online algorithm			
1 minute bars	economic indicators	training & testing	event-based backtesting	cloud deploymen			
August & September 2018	directional movement	validation	visualization	monitoring & risk management			





Algorithmic Trading Machine & Backtesting Deployment **Deep Learning FXCM**

Al Machin

The Python Quants GmbH

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