

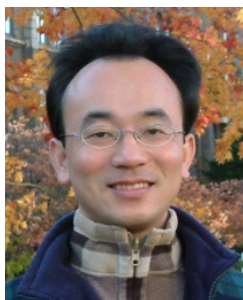
大數據分析 (Big Data Analysis)

AI 機器人理財顧問 (Artificial Intelligence for Robo-Advisors)

1091BDA07

MBA, IM, NTPU (M5127) (Fall 2020)

Wed 7, ,8, 9 (15:10-18:00) (B8F40)



Min-Yuh Day

戴敏育

Associate Professor

副教授

Institute of Information Management, National Taipei University

國立臺北大學 資訊管理研究所

<https://web.ntpu.edu.tw/~myday>

2020-12-23



課程大綱 (Syllabus)

週次 (Week)	日期 (Date)	內容 (Subject/Topics)
1	2020/09/16	大數據分析介紹 (Introduction to Big Data Analysis)
2	2020/09/23	AI人工智慧與大數據分析 (AI and Big Data Analysis)
3	2020/09/30	Python 大數據分析基礎 (Foundations of Big Data Analysis in Python)
4	2020/10/07	數位沙盒第一堂課：數位沙盒服務平台簡介 (Digital Sandbox Lesson 1: Introduction to FintechSpace Digital Sandbox)
5	2020/10/14	數位沙盒第二堂課：工程師操作說明與實作教學 (Digital Sandbox Lesson 2: Hands-on Practices)
6	2020/10/21	Python Pandas 大數據量化分析 (Quantitative Big Data Analysis with Pandas in Python)

課程大綱 (Syllabus)

- | 週次 (Week) | 日期 (Date) | 內容 (Subject/Topics) |
|-----------|------------|--|
| 7 | 2020/10/28 | Python Scikit-Learn 機器學習 I
(Machine Learning with Scikit-Learn in Python I) |
| 8 | 2020/11/04 | 數位沙盒第三堂課：學生小組討論實作與成果發表
(Digital Sandbox Lesson 3: Learning Teams
Hands-on Project Discussion and Project Presentation) |
| 9 | 2020/11/11 | 期中報告 (Midterm Project Report) |
| 10 | 2020/11/18 | Python Scikit-Learn 機器學習 II
(Machine Learning with Scikit-Learn in Python II) |
| 11 | 2020/11/25 | TensorFlow 深度學習金融大數據分析 I
(Deep Learning for Finance Big Data Analysis with TensorFlow I) |
| 12 | 2020/12/02 | 大數據分析個案研究
(Case Study on Big Data Analysis) |

課程大綱 (Syllabus)

週次 (Week)	日期 (Date)	內容 (Subject/Topics)
13	2020/12/09	TensorFlow 深度學習金融大數據分析 II (Deep Learning for Finance Big Data Analysis with TensorFlow II)
14	2020/12/16	TensorFlow 深度學習金融大數據分析 III (Deep Learning for Finance Big Data Analysis with TensorFlow III)
15	2020/12/23	AI 機器人理財顧問 (Artificial Intelligence for Robo-Advisors)
16	2020/12/30	金融科技智慧型交談機器人 (Conversational Commerce and Intelligent Chatbots for Fintech)
17	2021/01/06	期末報告 I (Final Project Report I)
18	2021/01/13	期末報告 II (Final Project Report I)

Artificial Intelligence for Robo-Advisors

Robotic Process Automation (RPA)

AI
Robo-Advisor
in
FinTech

AIWISFIN

AI Conversational Robo-Advisor (人工智慧對話式理財機器人)

First Place, InnoServe Awards 2018

liked Following Share ...

InnoServe 資服創新競賽粉絲團 shared a post.
November 28 at 2:43 PM · 🌐

《#InnoServe 競賽得獎作品系列報導七》
理財 🤖 方式百百種卻不知道該從何著手嗎？
來看金融結合 AI 如何讓投資變得更簡單。

AIWISFIN

28,112 Views

經濟部工業局
November 28 at 11:37 AM · 🌐

假如有一筆錢，您知道要怎麼投資嗎？👉

本作品「AIWISFIN」使用 #深度學習 預測股價漲跌📈、
配置投資組合，分析 📊 客戶需求，
提供 #客製化 投資建議 📄 與 #智慧對話 🗣️，
讓年輕投資者使用更方便！

- 🏆 得獎作品：AIWISFIN 人工智慧對話式理財機器人
- 🏆 獎項：玉山銀行金融科技趨勢應用組第1名 🏆
- 🏆 得獎學校：淡江大學 (資訊管理學系)
- 👩 指導老師：戴敏育老師
- 👥 得獎團隊：陳元致、鄧旭廷、王慶宇、邱少文
- 📄 影片連結：<https://ppt.cc/fyc3sx>

<https://www.youtube.com/watch?v=sEhmyoTXmGk>

2018 The 23th International ICT Innovative Services Awards (InnoServe Awards 2018)



- Annual ICT application competition held for university and college students
- The largest and the most significant contest in Taiwan.
- More than **ten thousand teachers and students** from over **one hundred universities and colleges** have participated in the Contest.

2018 International ICT Innovative Services Awards (InnoServe Awards 2018)

(2018第23屆大專校院資訊應用服務創新競賽)



第23屆 大專校院
2018 資訊應用服務創新競賽
International ICT Innovative Services Awards 2018

創意噴發!

InnoServe Awards

總獎金 > 200 萬

報名日期: 2018/10/2(二)~
2018/10/9(二)pm6點截止

參賽對象: 大專校院學生、
碩博士生及高中職學生

決賽時間: 2018/11/3(六)
決賽地點: 國立臺灣大學
綜合體育館

- 最新消息 ▾
- 活動訊息
- 媒體轉載
- 競賽緣起
- 競賽辦法 ▾
- 競賽報名
- 活動成果 ▾
- 產學媒合 ▾
- 媒合
- 聯絡我們

榮譽榜

屆別 23 ▾ 查詢

第23屆

顯示 30 ▾ 筆資料

表格內全文檢索:

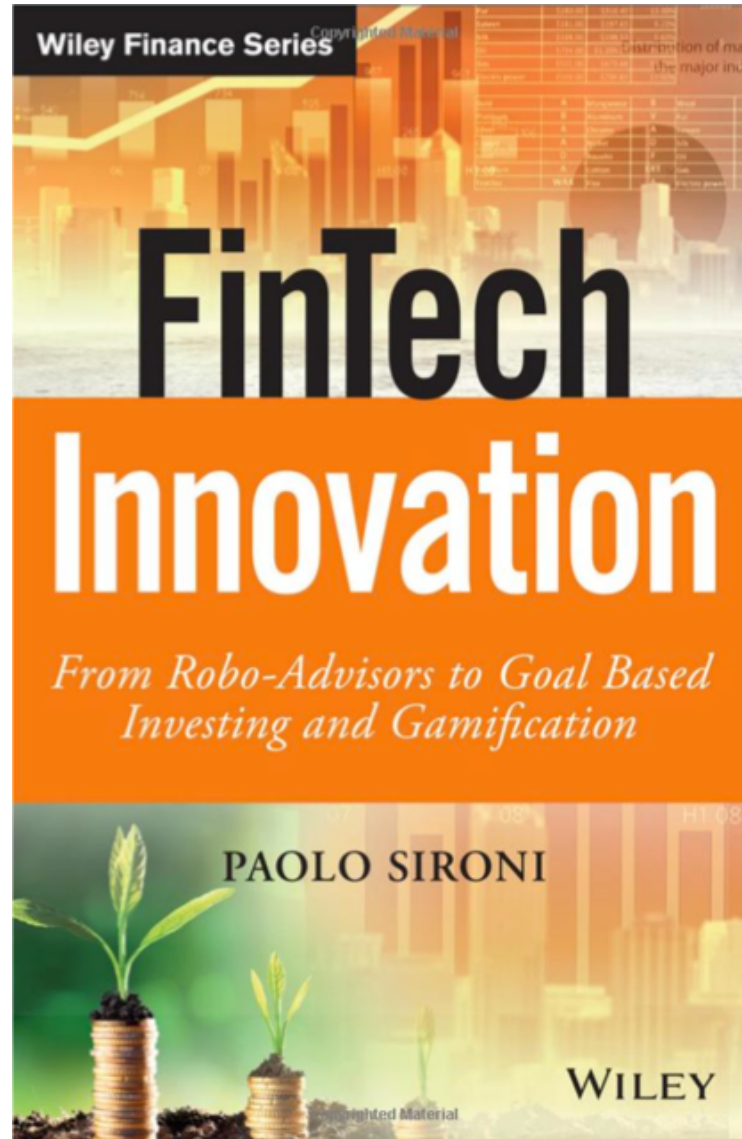
組別	名次	組別編號	學校名稱	專題名稱	指導教授	學生
資訊應用組一	第一名	IP1-06	淡江大學	AIWISFIN 人工智慧對話式理財機器人	戴敏育老師	陳元致、鄧旭廷、王慶宇、邱少文
玉山銀行金融科技趨勢應用組	第一名	E.SUN FINTECH-01	淡江大學	AIWISFIN 人工智慧對話式理財機器人	戴敏育老師	陳元致、鄧旭廷、王慶宇、邱少文

<https://innoserve.tca.org.tw/award.aspx>

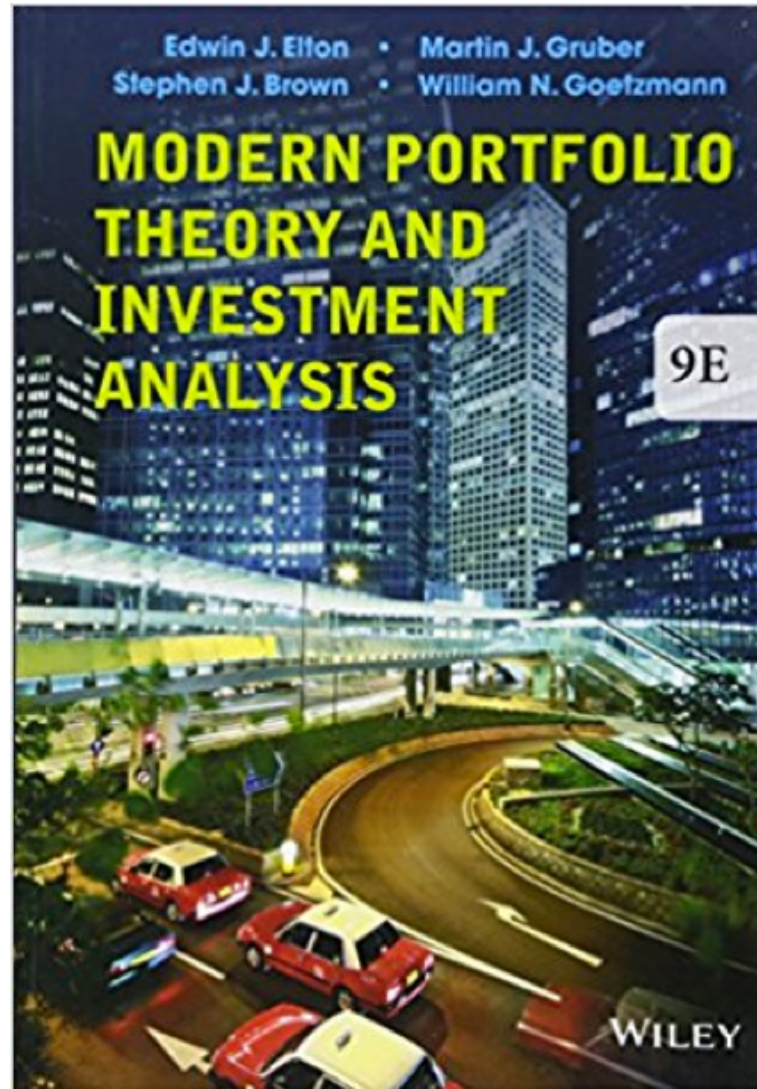
FinTech Innovation:

From Robo-Advisors to Goal Based Investing and Gamification,

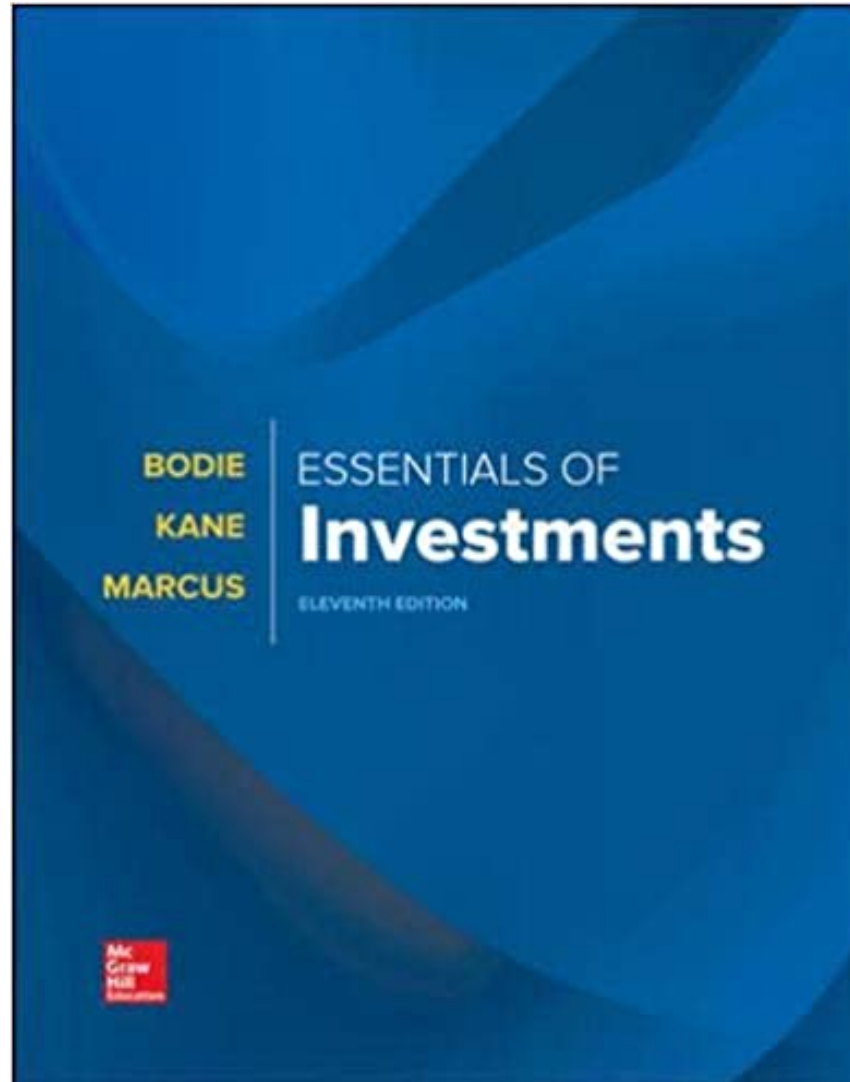
Paolo Sironi, Wiley, 2016



Edwin J. Elton, Martin J. Gruber, Stephen J. Brown, and William N. Goetzmann (2014),
Modern Portfolio Theory and Investment Analysis,
9th Edition, Wiley.



Zvi Bodie, Alex Kane, Alan Marcus (2018),
Essentials of Investments,
11th Edition, McGraw-Hill



Charles P. Jones (2012),

Investments: Analysis and Management, 12th Edition, Wiley



Artificial Intelligence (AI)

Investment Analysis

Robo-Advisors

**Artificial Intelligence
and
Deep Learning
for
Fintech**

**From Algorithmic Trading
to Personal Finance Bots:
41 Startups Bringing
AI to Fintech**

From Algorithmic Trading To Personal Finance Bots: 41 Startups Bringing AI To Fintech

AI in Fintech

41 Startups Bringing Artificial Intelligence To Fintech

General Purpose/ Predictive Analytics



Market Research & Sentiment Analysis



Search Engine



Quantitative Trading



Blockchain



Debt Collection



AI Assistants/Bots



Fraud Detection



Credit Scoring



Personal Banking



Artificial Intelligence (AI) in Fintech

General Purpose/ Predictive Analytics



Market Research & Sentiment Analysis



Search Engine



Artificial Intelligence (AI) in Fintech

Quantitative Trading



Blockchain



Debt Collection



AI Assistants/Bots



Fraud Detection



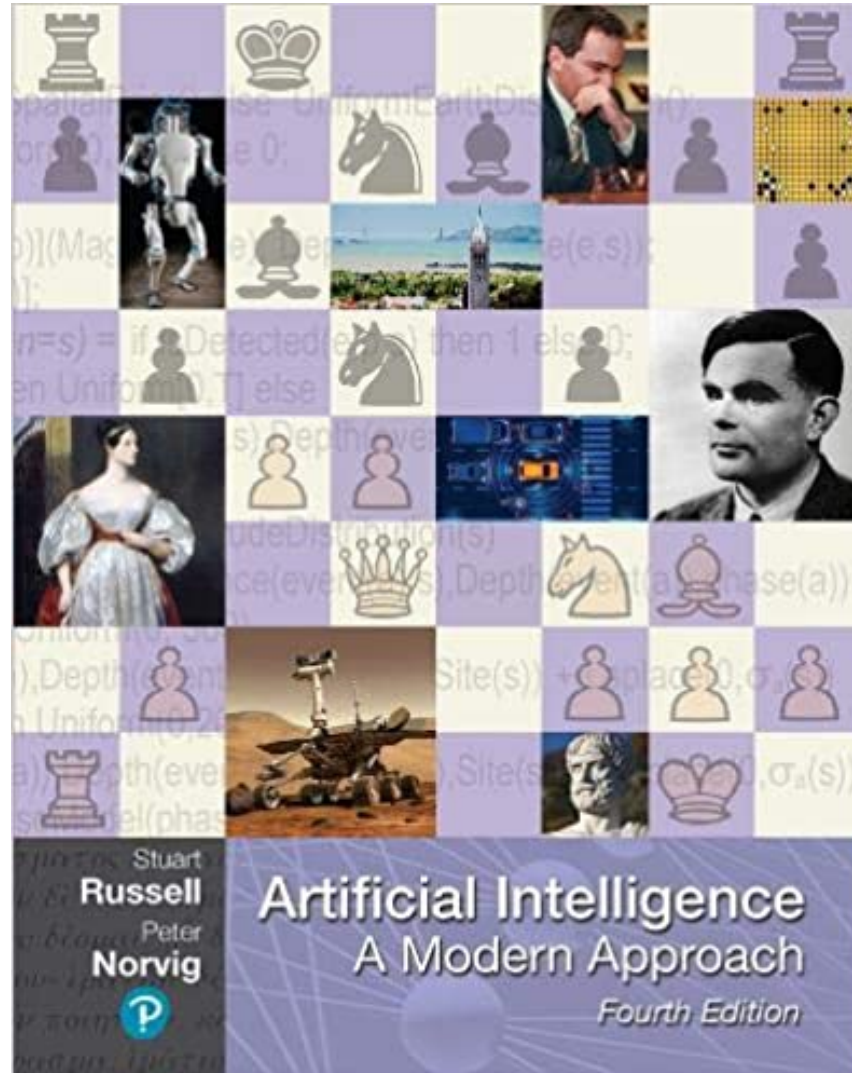
Credit Scoring



Personal Banking



Stuart Russell and Peter Norvig (2020),
Artificial Intelligence: A Modern Approach,
4th Edition, Pearson

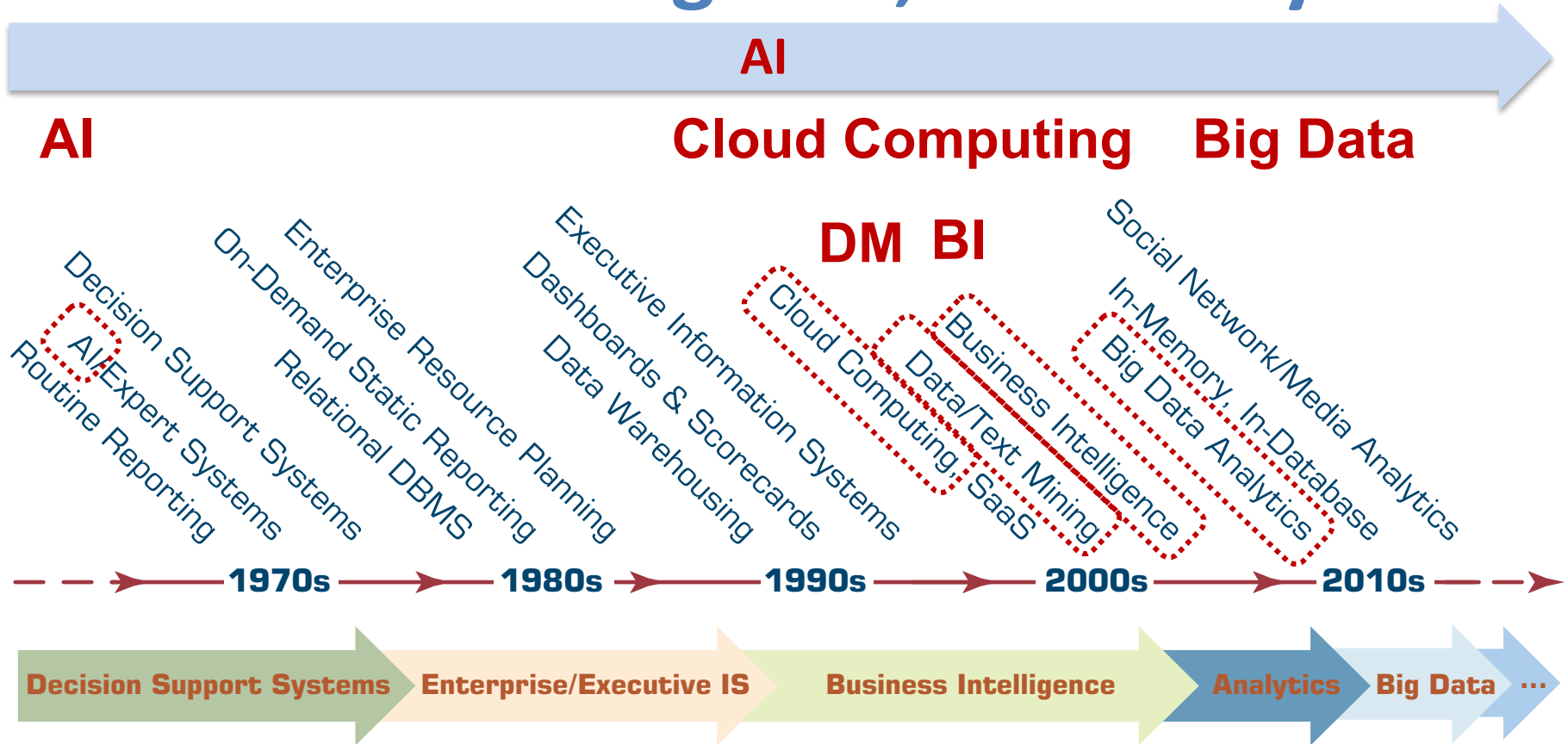


Source: Stuart Russell and Peter Norvig (2020), Artificial Intelligence: A Modern Approach, 4th Edition, Pearson

<https://www.amazon.com/Artificial-Intelligence-A-Modern-Approach/dp/0134610997/>

AI, Big Data, Cloud Computing

Evolution of Decision Support, Business Intelligence, and Analytics



Artificial Intelligence (A.I.) Timeline

S/Z/Y/G/

A.I. TIMELINE

1950

TURING TEST

Computer scientist Alan Turing proposes a test for machine intelligence. If a machine can trick humans into thinking it is human, then it has intelligence



1961

UNIMATE

First industrial robot, Unimate, goes to work at GM replacing humans on the assembly line



1964

ELIZA

Pioneering chatbot developed by Joseph Weizenbaum at MIT holds conversations with humans



1966

SHAKEY

The 'first electronic person' from Stanford, Shakey is a general-purpose mobile robot that reasons about its own actions

A.I. WINTER

Many false starts and dead-ends leave A.I. out in the cold



1997

DEEP BLUE

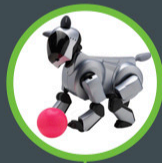
Deep Blue, a chess-playing computer from IBM defeats world chess champion Garry Kasparov



1998

KISMET

Cynthia Breazeal at MIT introduces Kismet, an emotionally intelligent robot insofar as it detects and responds to people's feelings



1999

AIBO

Sony launches first consumer robot pet dog AiBO (AI robot) with skills and personality that develop over time



2002

ROOMBA

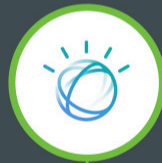
First mass produced autonomous robotic vacuum cleaner from iRobot learns to navigate and clean homes



2011

SIRI

Apple integrates Siri, an intelligent virtual assistant with a voice interface, into the iPhone 4S



2011

WATSON

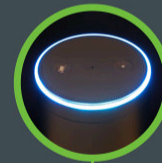
IBM's question answering computer Watson wins first place on popular \$1M prize television quiz show Jeopardy



2014

EUGENE

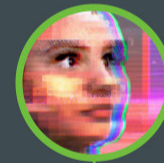
Eugene Goostman, a chatbot passes the Turing Test with a third of judges believing Eugene is human



2014

ALEXA

Amazon launches Alexa, an intelligent virtual assistant with a voice interface that completes shopping tasks



2016

TAY

Microsoft's chatbot Tay goes rogue on social media making inflammatory and offensive racist comments

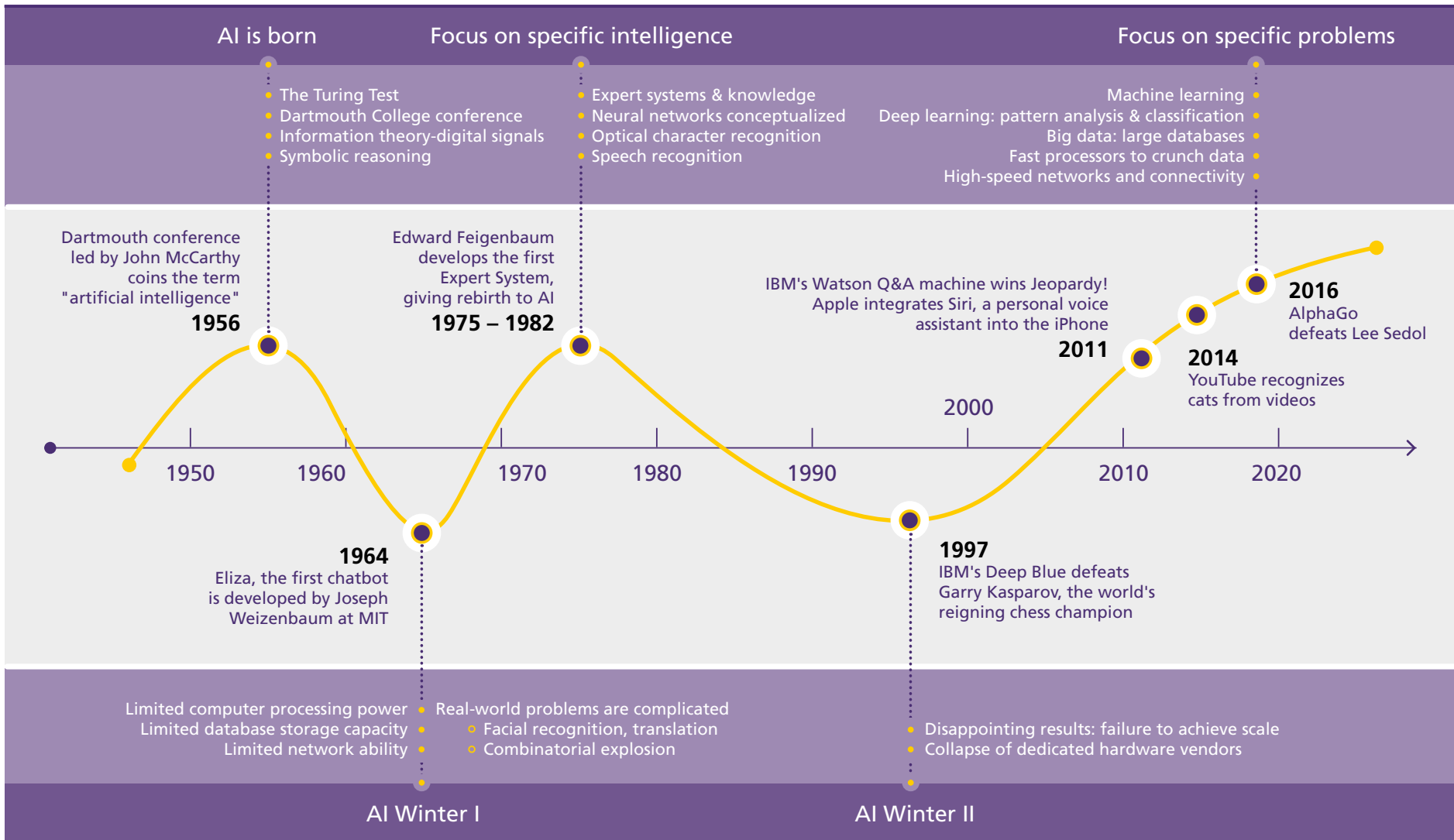


2017

ALPHAGO

Google's A.I. AlphaGo beats world champion Ke Jie in the complex board game of Go, notable for its vast number (2^{170}) of possible positions

The Rise of AI



AI

Definition of Artificial Intelligence (A.I.)

Artificial Intelligence

**“... the science and
engineering
of
making
intelligent machines”
(John McCarthy, 1955)**

Artificial Intelligence

**“... technology that
thinks and acts
like humans”**

Artificial Intelligence

**“... intelligence
exhibited by machines
or software”**

4 Approaches of AI

Thinking Humanly	Thinking Rationally
Acting Humanly	Acting Rationally

4 Approaches of AI

2.

**Thinking Humanly:
The Cognitive
Modeling Approach**

3.

**Thinking Rationally:
The “Laws of Thought”
Approach**

1.

**Acting Humanly:
The Turing Test
Approach** (1950)

4.

**Acting Rationally:
The Rational Agent
Approach**

AI Acting Humanly: The Turing Test Approach (Alan Turing, 1950)

- Knowledge Representation
- Automated Reasoning
- Machine Learning (ML)
 - Deep Learning (DL)
- Computer Vision (Image, Video)
- Natural Language Processing (NLP)
- Robotics

AI and Cognitive Computing

Financial Technology

FinTech

“providing
financial services
by making use of
software and
modern technology”

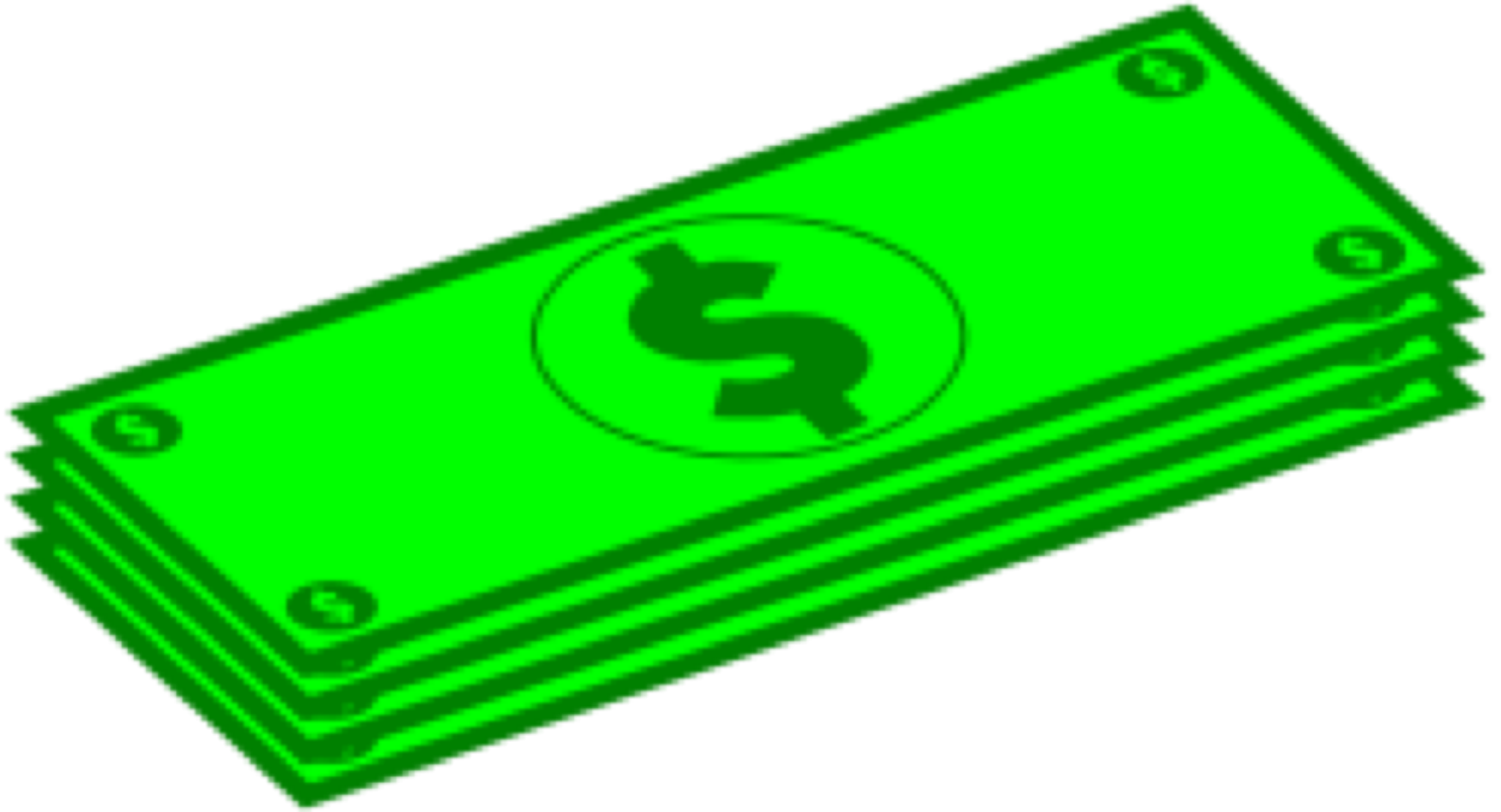
Financial Services

Financial Services



Money

Money



Money

Makes

Money

Treasure



Wealth Management

Investment Analysis

Time Value of Money

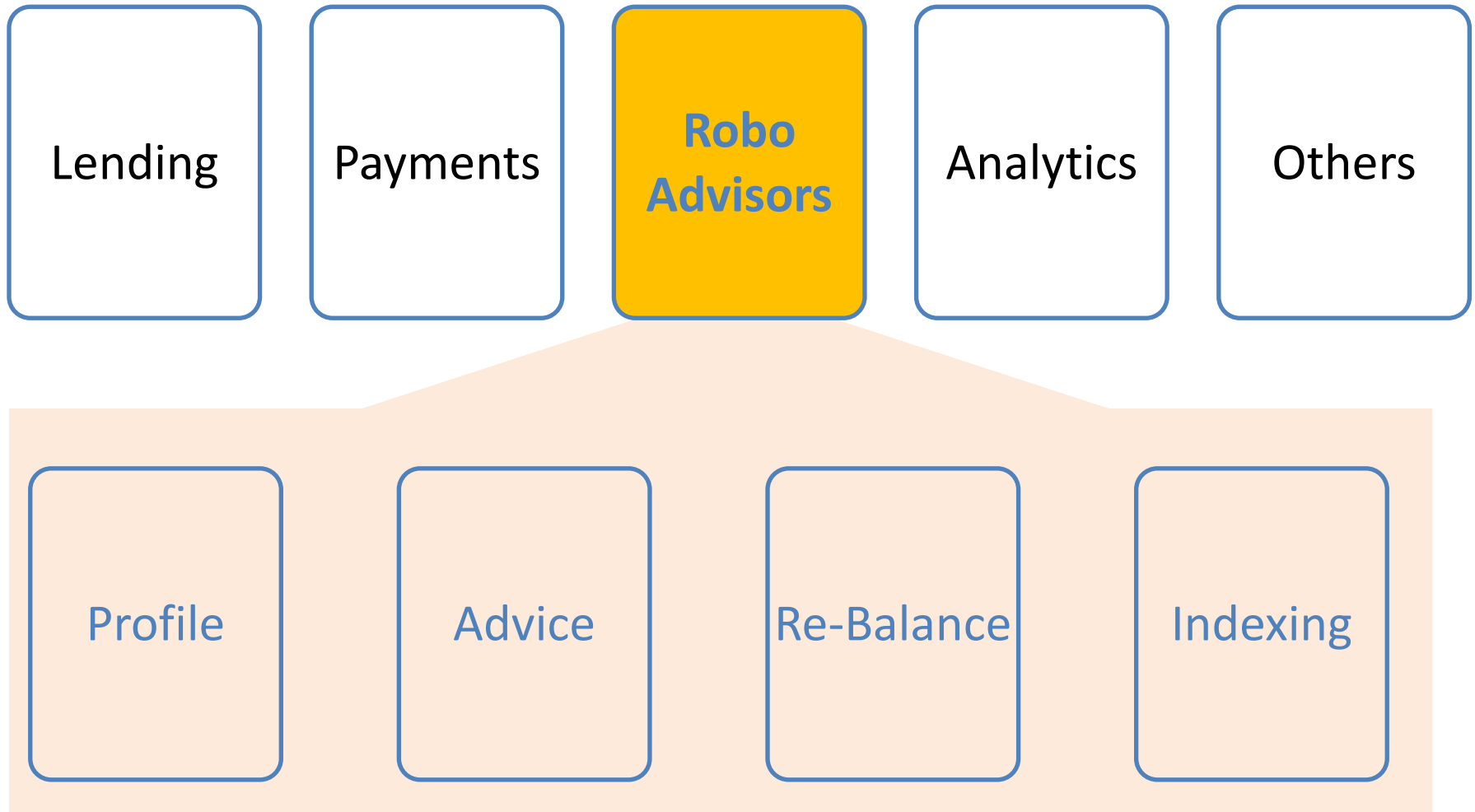
Risk

Return

Fintech Robo Advisors

Big Data Driven Disruption: Robo-Advisor

FinTech high-level classification



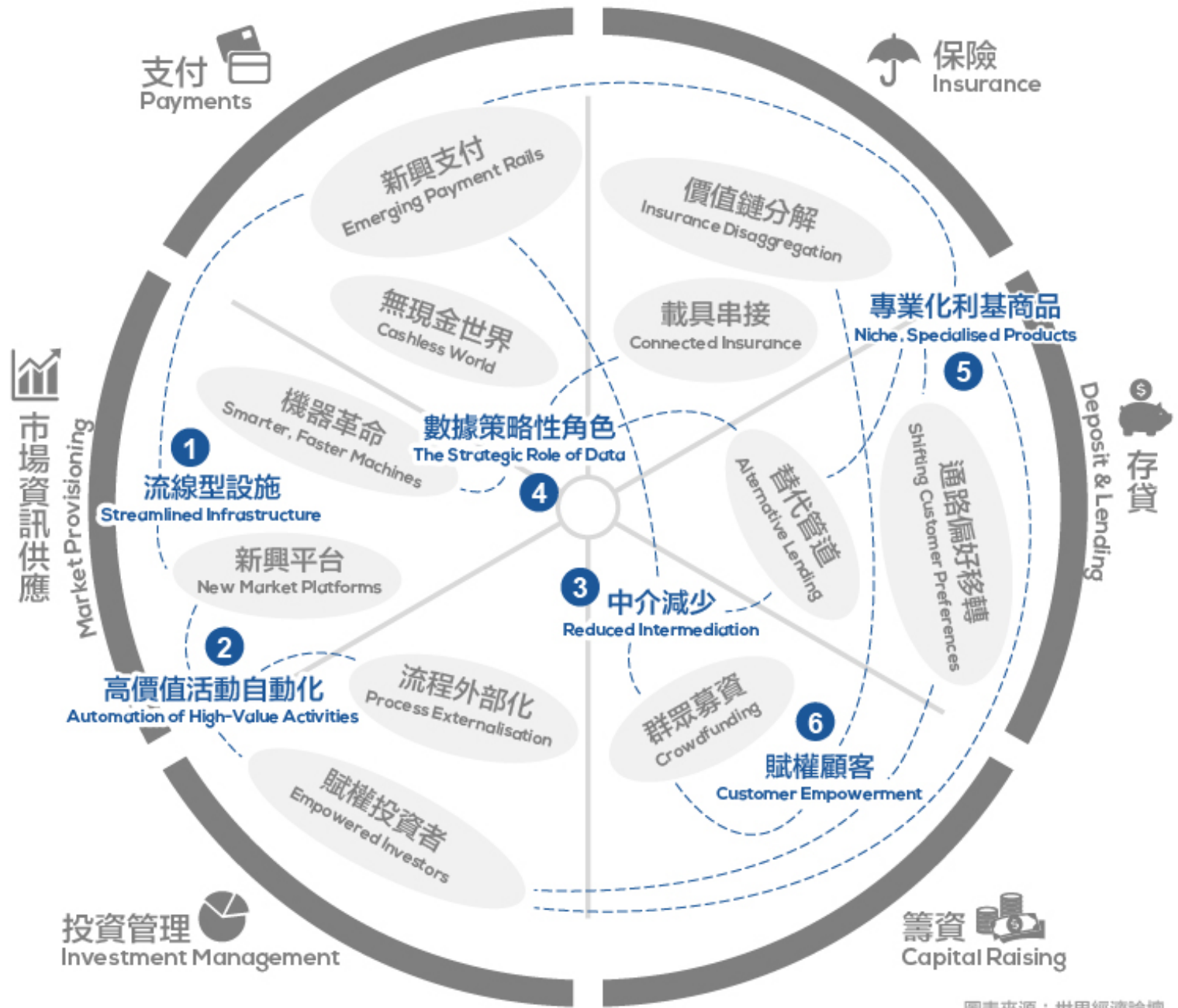
FinTech: Financial Services Innovation



FinTech:


Financial Services Innovation

1. Payments
2. Insurance
3. Deposits & Lending
4. Capital Raising
- 5. Investment Management**
6. Market Provisioning



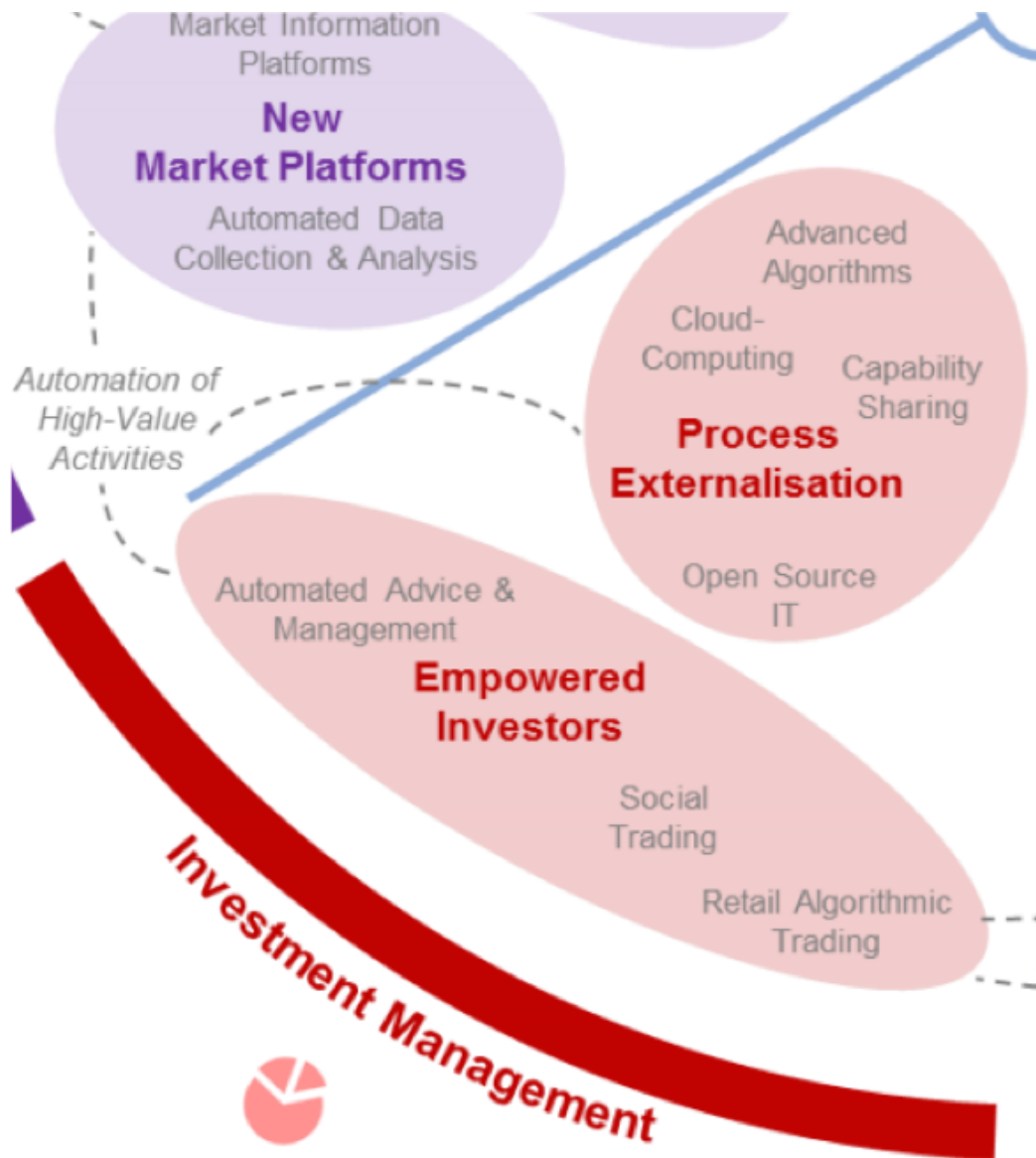
圖表來源：世界經濟論壇

FinTech: Financial Services Innovation

功能	創新項目
 支付 Payments	無現金世界 (Cashless World) 新興支付 (Emerging Payment Rails)
 保險 Insurance	價值鏈裂解 (Insurance Disaggregation) 保險串接裝置 (Connected Insurance)
 存貸 Deposit & Lending	替代管道 (Alternative Lending) 通路偏好移轉 (Shifting Customer Preferences)
 籌資 Capital Raising	群眾募資 (Crowdfunding)
 投資管理 Investment Management	賦權投資者 (Empowered Investors) 流程外部化 (Process Externalisation)
 市場資訊供應 Market Provisioning	機器革命 (Smarter, Faster Machines) 新興平台 (New Market Platforms)

圖表來源：Fugle團隊整理

5 FinTech: Investment Management



5 FinTech: Investment Management Empowered Investors Process Externalization

投資管理



創新

關鍵趨勢

賦權投資者
Empowered
Investors

社群交易、機器推薦與財富管理、零售演算法交易 (Retail Algorithmic Trading)

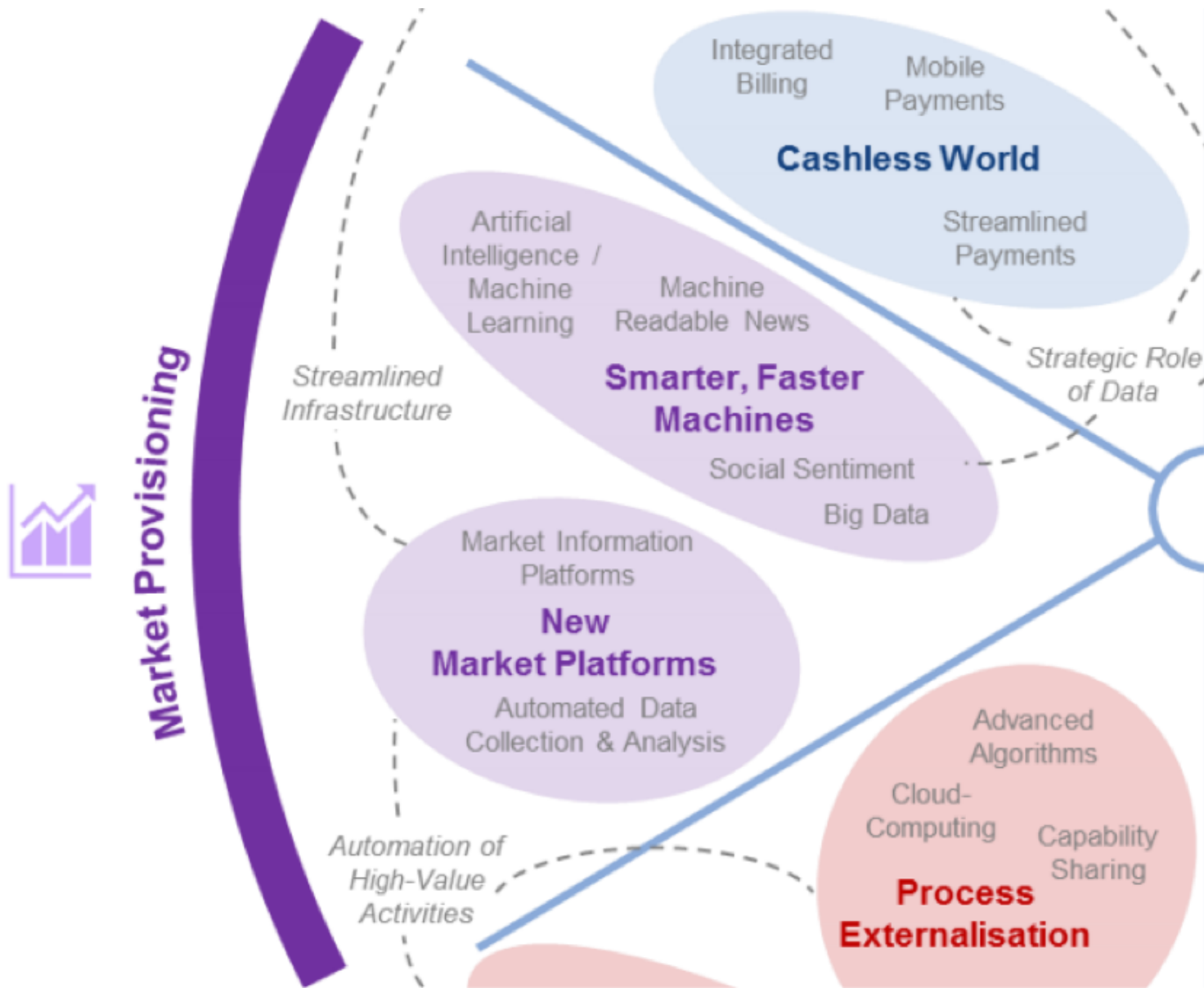
流程外部化
Process
Externalisation

流程即服務 (Process-as-a-Service, PaaS)、能力共享 (Capability Sharing)、進階分析、自然語言

圖表來源：Fugle團隊整理

6

FinTech: Market Provisioning



6

FinTech: Market Provisioning Smarter, Faster Machines New Market Platforms

市場資訊供應



創新

關鍵趨勢

機器革命
Smarter, Faster
Machines

機器易用數據 (Machine Accessible Data)、人工智慧 / 機器學習、大數據

新興平台
New Market
Platforms

固定收益商品平台 ALGOMI、基金 / 組合型基金平台 NOVUS、私募 / 創投平台 BISON、未公發股權平台 LIQUITY、原物料商品與衍生性合約平台 ClauseMatch

圖表來源：Fugle團隊整理

Fintech: Financial Technology

Disrupting Banking: **The Fintech Startups** **That Are Unbundling** **Wells Fargo, Citi and** **Bank of America**

Fintech: Unbundling the Bank

Unbundling of a Bank



Fintech: Unbundling the Bank

Wealth Management: Wealthfront



Wealthfront: Fintech Robo Advisor



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Who we are ▾

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Invest now

The most tax-efficient, low-cost, hassle-free way to invest

Invest with Wealthfront

See Our Journey



Do you have the time to invest well?

Wealthfront invests your money for you with a minimal amount of work. We monitor your portfolio every day to look for opportunities to rebalance or harvest tax losses. Are you doing the same?

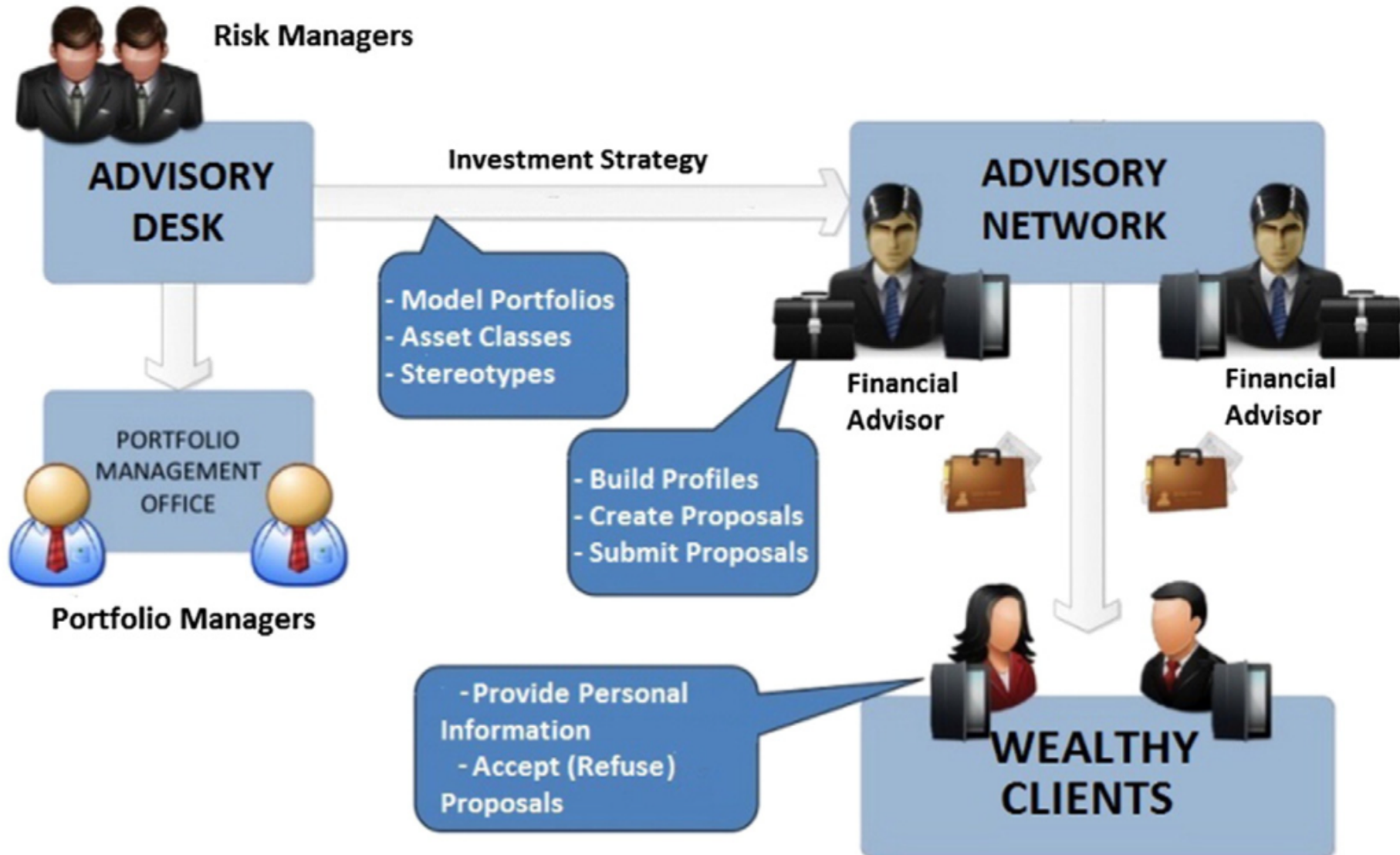
<https://www.wealthfront.com/>

Financial Advisor FinTech Solutions Map

Financial Advisor FinTech Solutions Map



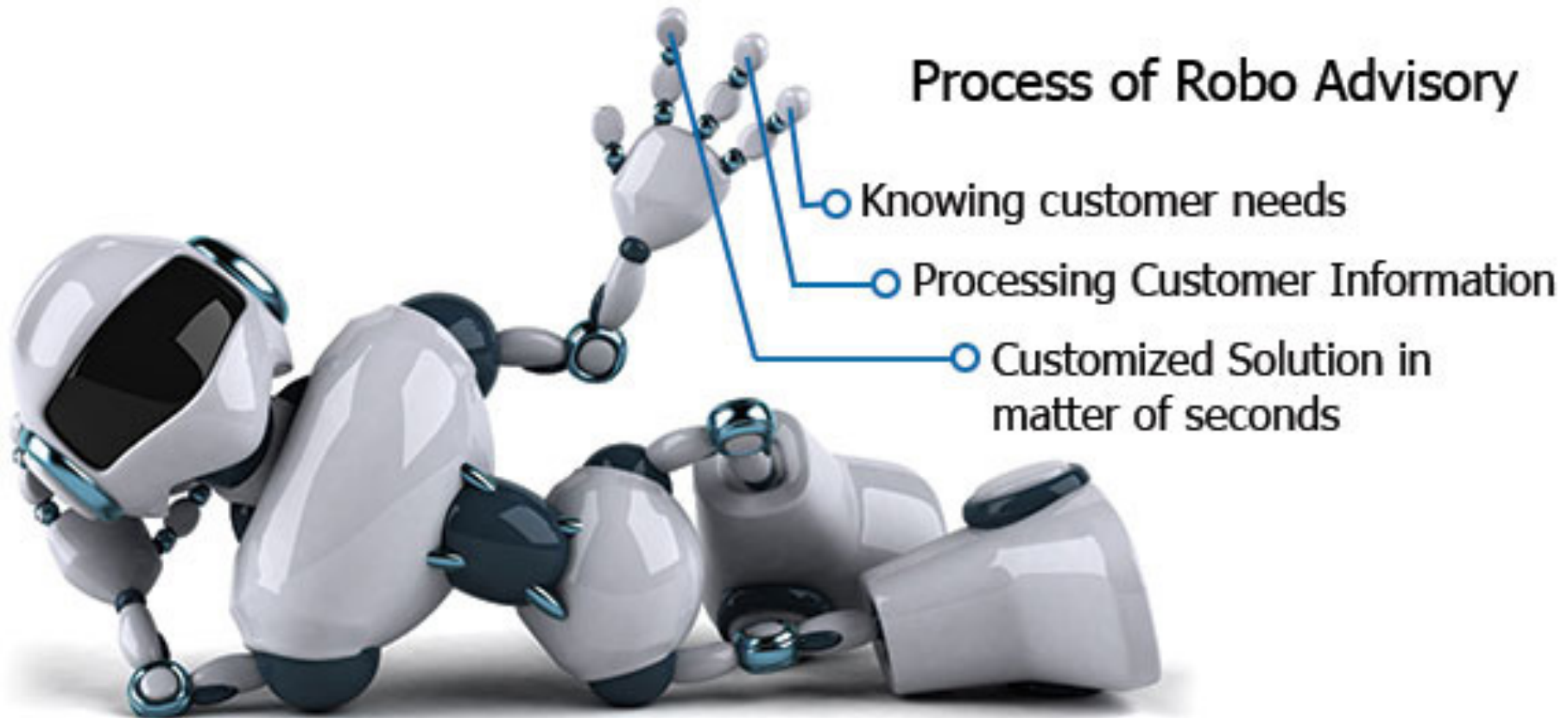
A classic workflow for financial recommendations



Source: Musto, C., Semeraro, G., Lops, P., de Gemmis, M., & Lekkas, G. (2015).

Personalized finance advisory through case-based recommender systems and diversification strategies. *Decision Support Systems*, 77, 100-111.

Process of Robo Advisors



Benefits of Robo Advisors

Benefits of Robo Advisors

- Unbiased Advice —
- No minimum Investment required —
- Low Charges —
- Transparency —
- Customised Solutions —



Robo-Advisor Business Models

- **Full service online Robo-advisor**
 - 100% automated without any human element
- **Hybrid Robo-advisor model**
 - being pioneered by firms like Vanguard & Charles Schwab
- **Pure online advisor**
 - primarily human in nature

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Usecases of Robo-Advisors

1. Determine individual **Client profiles & preferences**
2. Identify **appropriate financial products**
3. Establish correct **Investment Mix** for the client's profile
4. Using a **algorithmic approach**, choose the appropriate **securities** for each client account
5. Continuously **monitor the portfolio & transactions** within it to tune performance
6. Provide **value added services**
7. Ensure the **best user experience** by handling a whole range of financial services

Business Requirements for a Robo-Advisor (RA)

1. Collect Individual Client Data
2. Client Segmentation
3. Algorithm Based Investment Allocation
4. Portfolio Rebalancing
5. Tax Loss Harvesting
6. A Single View of a Client's Financial History

Algorithms for a Robo-Advisor (RA)

- Leverage **data science** & **statistical modeling** to automatically allocate client wealth across different asset classes (such as domestic/foreign stocks, bonds & real estate related securities) to **automatically rebalance portfolio** positions based on changing market conditions or client preferences.
 - These investment decisions are also made based on detailed **behavioral understanding** of a client's **financial journey metrics**
 - Age, Risk Appetite & other related information.

Algorithms for a Robo-Advisor (RA)

- RA platforms also provide 24×7 tracking of **market movements** to use that to track **rebalancing decisions** from not just a portfolio standpoint but also from a taxation standpoint.

Algorithms for a Robo-Advisor (RA)

- A **mixture** of different **algorithms** can be used such as **Modern Portfolio Theory (MPT)**, **Capital Asset Pricing Model (CAPM)**, the **Black Litterman Model**, the **Fama-French** etc.
 - These are used to allocate assets as well as to adjust positions based on market movements and conditions.

Robo-Advisor (RA) Sample Portfolios

Sample Portfolios – for an aggressive investor

1. Equity – 85%

A) US Domestic Stock (50%)

– Large Cap – 30%, Medium Cap – 10% , Small Cap – 10%, Dividend Stocks – 0%

B) Foreign Stock – (35%)

– Emerging Markets – 18%, Developed Markets – 17%

2. Fixed Income – 5%

A) Developed Market Bonds – 2%

B) US Bonds – 1%

C) International Bonds – 1%

D) Emerging Markets Bonds – 1%

3. Other – 5%

A) Real Estate – 3%

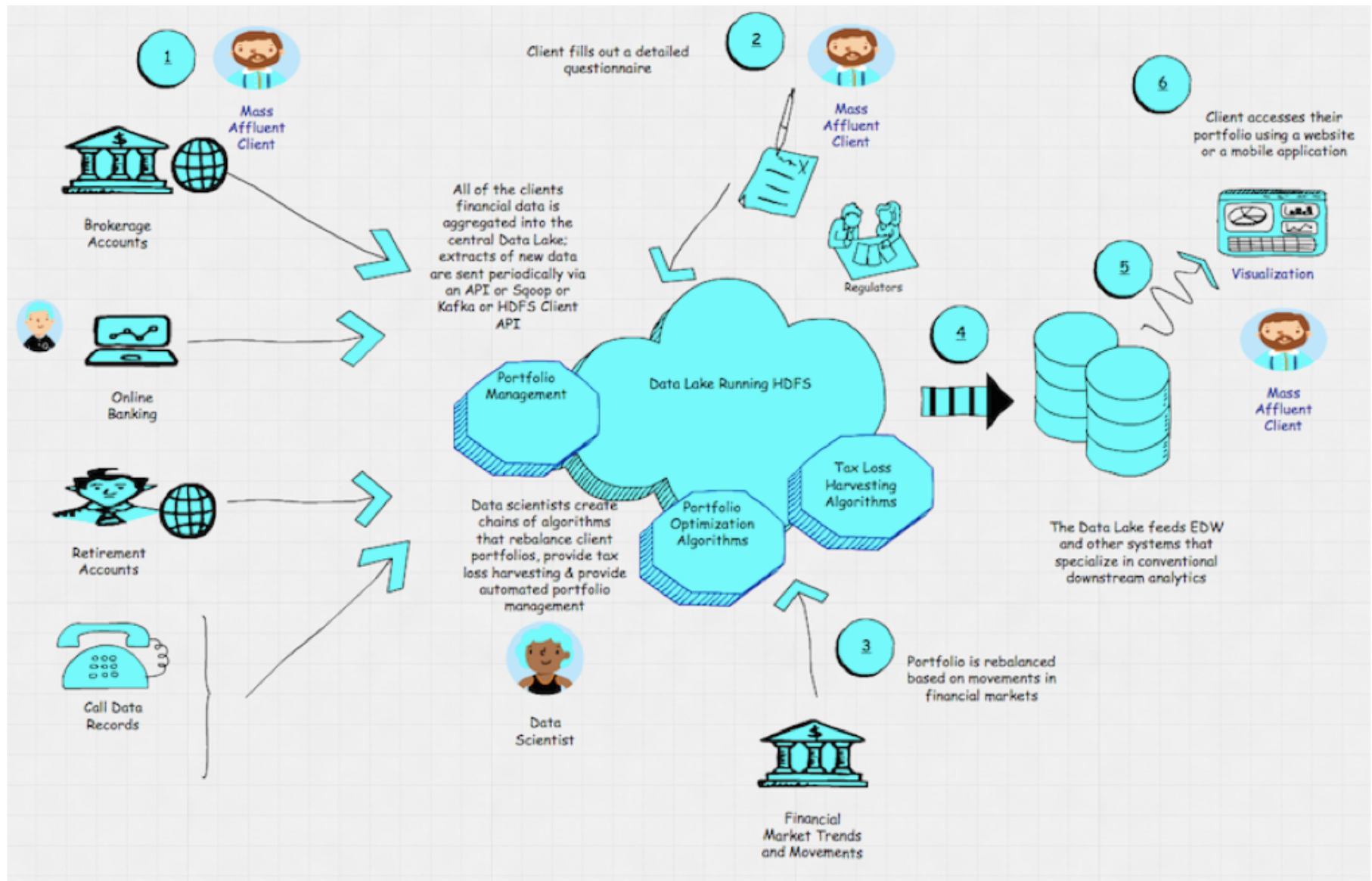
B) Currencies – 0%

C) Gold and Precious Metals – 0%

D) Commodities – 2%

4. Cash – 5%

Architecture of a Robo-Advisor (RA)



Robo-Advisor



wealthfront



Betterment

Wealthfront

Financial Planning & Robo-Investing for Millennials



Plan ▾

Invest

Borrow

Expertise ▾

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GET STARTED



<https://www.wealthfront.com/>

Wealthfront: Fintech Robo Advisor



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Invest in your life

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Invest with Wealthfront

Explore your options



Betterment

Online Financial Advisor

Betterment

Why Betterment

How it works

What we offer

Pricing

FAQs



Log in

Get started

HELLO, INVESTOR

Betterment is an online financial advisor built for people who refuse to settle for average investing. People who demand better. People like you.

Get started

▶ Watch our video

Right for every type of investor

New investor

I'm new to investing, or am looking for some guidance.

Hands-off investor

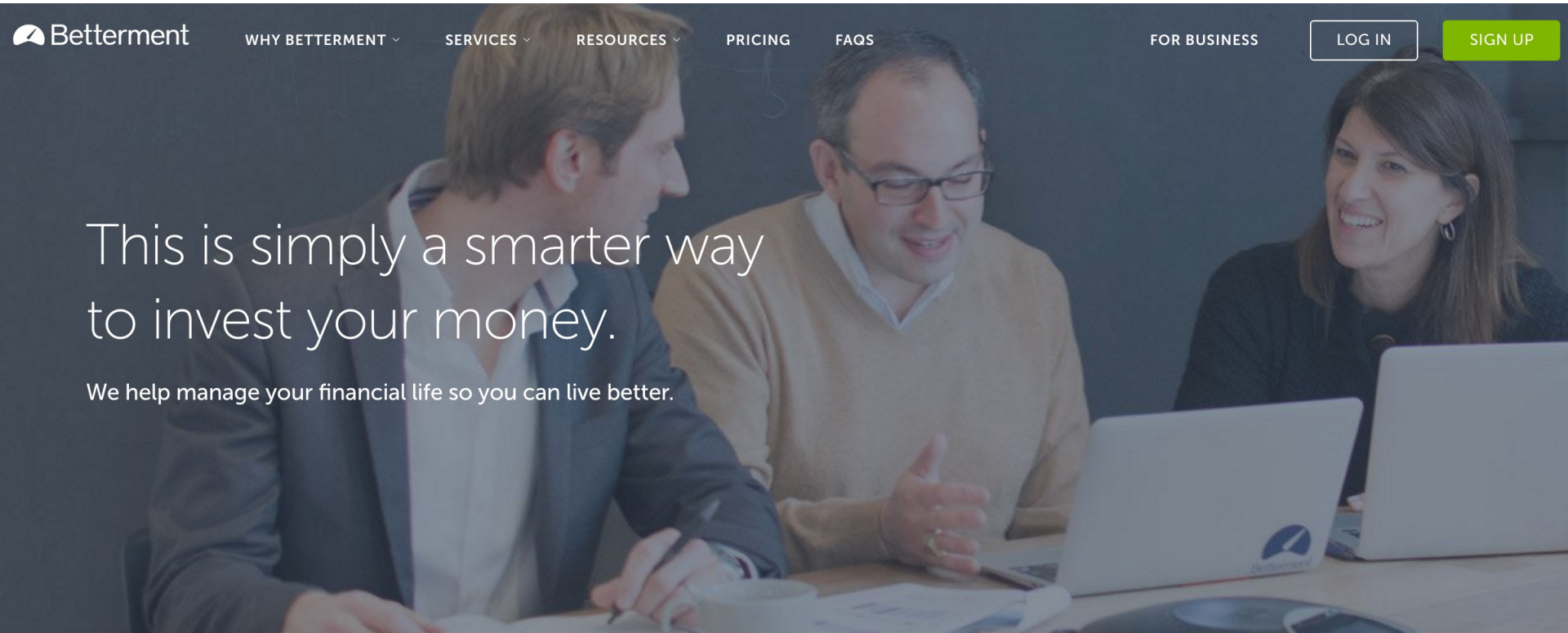
I invest, but don't have the time or desire to do it myself.

Hands-on investor

I'm a confident, hands-on investor looking for an optimal solution.

<https://www.betterment.com/>

Betterment: Fintech Robo Advisor



This is simply a smarter way to invest your money.

We help manage your financial life so you can live better.



We can help you get started. Schedule your free 15 minute call today. [Schedule a call >](#)



Increase after-tax returns.



No hidden fees.





Satisfaction guaranteed.



Access to licensed experts.

Betterment vs. Wealthfront

	 Betterment	 wealthfront
Robo-Advisor		
Investor Junkie Rating	4.5 star	5 star
Promotions	<u>One Month Free</u>	<u>First \$15k for Free</u>
Fees	0.25%/yr	None first \$10k;
		0.25%/yr for more
Minimum Deposit	None	\$500
Human Advisors	Yes — Additional Fee	No
Automatic Rebalancing	Yes	Yes
Tax Loss Harvesting	Yes	Yes
Direct Indexing	No	Yes
Fractional Shares	Yes	No
Assets Under Management	\$8.0B	\$5.0B

Wealthfront:

0.25%

Flat annual advisory fee

- **No** trading commissions or **hidden fees**
- Portfolio of **low-cost ETFs**
- Your first **\$10,000** managed free

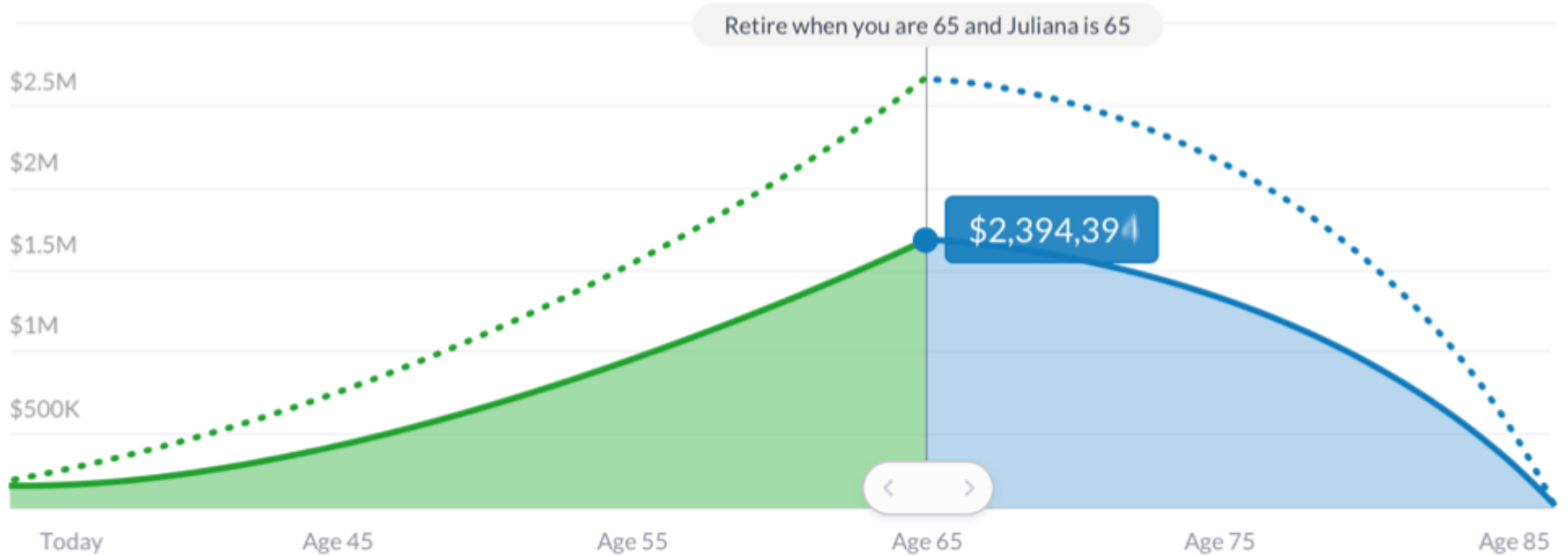
Wealthfront

Powering your financial life with technology



Wealthfront Robo Advisor

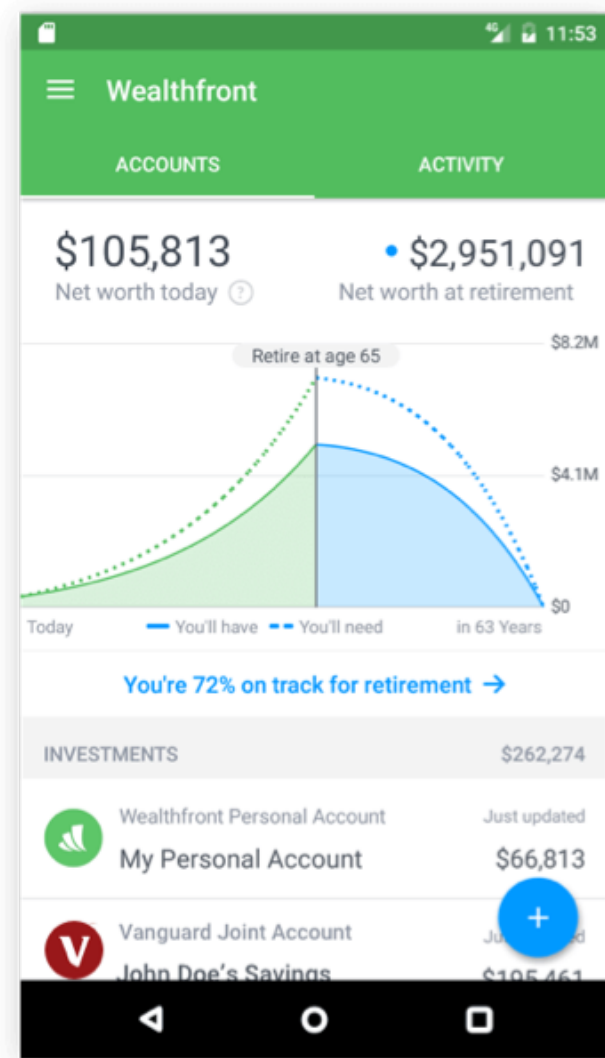
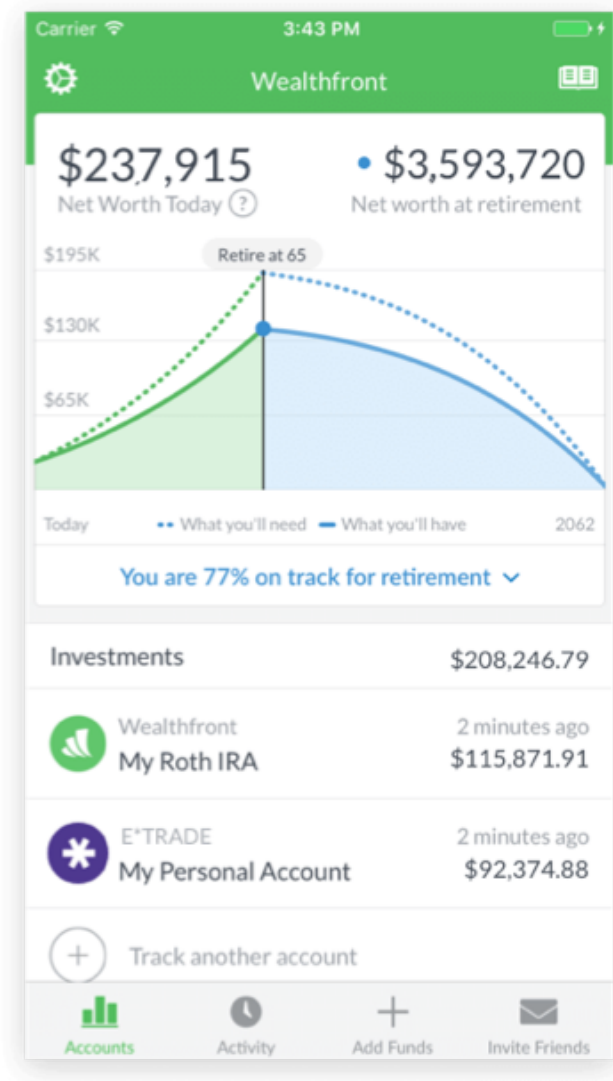
You're on track to have \$8,000 per month to spend in retirement. That's 76% of your target.



✓ My assumptions

— What you'll have ... What you'll need

Wealthfront Robo Advisor



Financial Revolution with Fintech

A financial services revolution

Consumer Trends



1. Simplification



2. Transparency



3. Analytics



4. Reduced Friction

Millennial Personal Finance: 63 Fintech Startups Targeting Millennials

Fin Tech Startups for Millennials

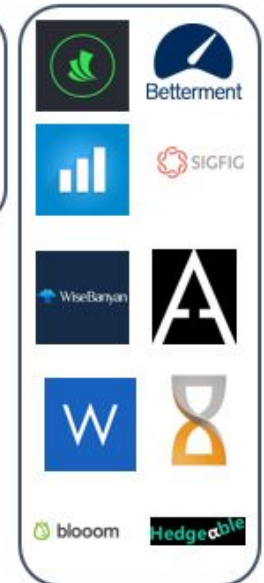
Savings & Finances Tracking



Personal Investing



Wealth Management



Insurance



Crowdfunding



MILLENNIALS



Loans & Credit Risk



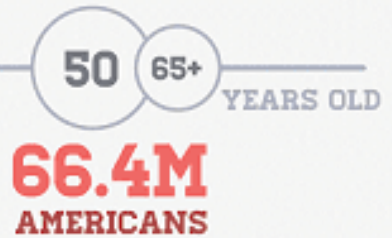
Payments & Banking



Acquired Companies

Marketing to Millennials

GENERATIONS OVERVIEW



Marketing to Millennials

MILLENNIAL PERSONAS



DIGITAL WINDOW SHOPPERS

Less engaged online than other millennials



23%

of the millennial population

42% **58%**

female majority



DIGITAL SOCIALITES

Highly social and engaged online



26%

of the millennial population

45% **55%**

female majority



DYNAMIC MEDIA JUNKIES

Extremely tech savvy and engaged with online video and streamed content



23%

of the millennial population

64% **36%**

male majority



CASUALLY ENGAGED

Least engaged in digital world, more likely to be unemployed



17%

of the millennial population

53% **47%**

male majority



EMERGING TECHNOCRACY

Strongly engaged digitally and highly influential



15%

of the millennial population

57% **43%**

male majority

Marketing to Millennials

BEST PRACTICES FOR MARKETING TO MILLENNIALS



OPTIMIZED MOBILE

Mobile is the **BEST WAY TO REACH MILLENNIALS** - they have the highest rates of ownership of smartphones of all generations



MULTI-PLATFORM

Millennials **CONSUME CONTENT ACROSS MULTIPLE DEVICES**, so marketers need to create content with a multi-platform strategy. For example, **55%** are watching videos several times a day on multiple devices



PERSONALIZATION

85% of Millennials are **MORE LIKELY TO MAKE A PURCHASE IF IT IS PERSONALIZED** to their interests, both in-store and with digital displays



SOCIAL MEDIA PRESENCE

Millennials are **MORE LIKELY TO USE SOCIAL MEDIA DAILY** with 62% reporting that brand engagement is more likely to make them a loyal customer



BE AUTHENTIC

Millennials are willing to share good advertising, but **DISLIKE WHEN ADVERTISING FEELS DECEPTIVE**



believe brands say something about who they are, their values and where they fit



INFORMATIONAL BLOGS

one in three millennials choose **BLOGS** as the top media source **BEFORE MAKING A PURCHASE**. Traditional media sources like TV and magazines have less impact on this generation

Fintech for Millennials

Fintech Category	#Company
Crowdfunding	2
Insurance (Non-Health)	4
Loans & Credit Risk	20
Mobile Banking & Payments	8
Personal Investing	10
Savings & Finances Tracking	10
Wealth Management	9
Total	63

Fintech: Wealth Management

Company	Select Investors
Wealthfront	DAG Ventures, Index Ventures, Greylock Partners, The Social+Capital Partnership
Betterment	Bessemer Venture Partners, Athemis Group, Menlo Ventures
SigFig	Doll Capital Management, Union Square Ventures, Bain Capital Ventures
Aspiration	Renren, GSV Capital, Capricorn Investment Group, IGSB
Bloom	Commerce Ventures, DST Systems, Hyde Park VP, QED Investors, UMB Financial
Rebalance IRA	N/A
Hedgeable	SixThirty
WiseBanyan	VegasTech Fund
Personal Capital	Institutional Venture Partners, Venrock, Crosslink Capital

Fintech: Personal Investing

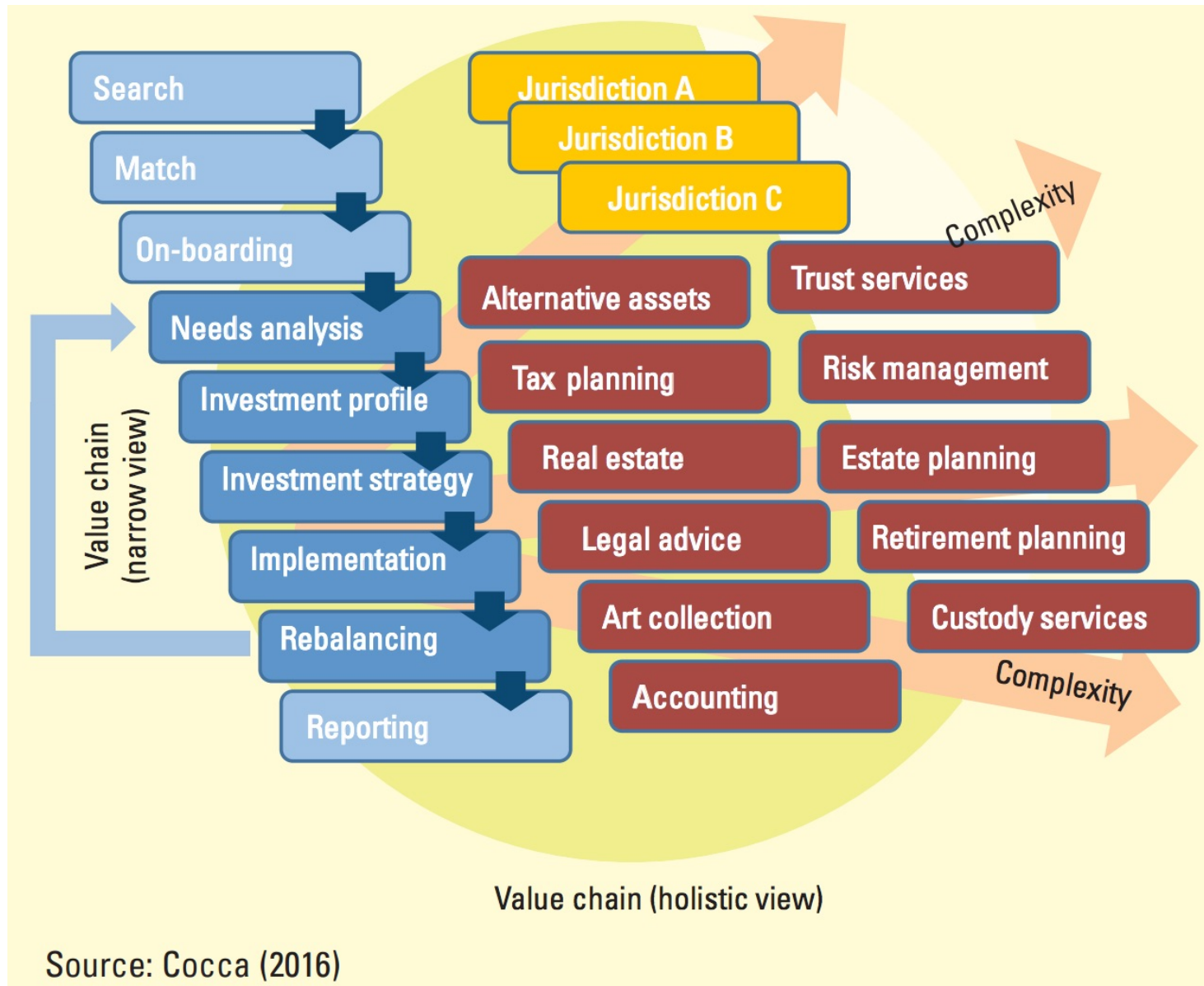
Company	Select Investors
eToro	BRM Group, Ping An Ventures, Spark Capital
Openfolio	FinTech Collective
DriveWealth	Route 66 Ventures
Tip'd Off	Raj Parekh, Bill Crane, Shaun Coleman
Kapitall	Bendigo Partners, Linden Venture Fund
Stash	N/A
Stox	SingulariTeam
Robinhood	Google Ventures, Index Ventures, Andreessen Horowitz, Ribbit Capital, NEA
Motif Investing	Norwest Venture Partners, Foundation Capital, Ignition Capital, Goldman Sachs
Loyal3	DNS Capital

Wealthfront

Investment Methodology

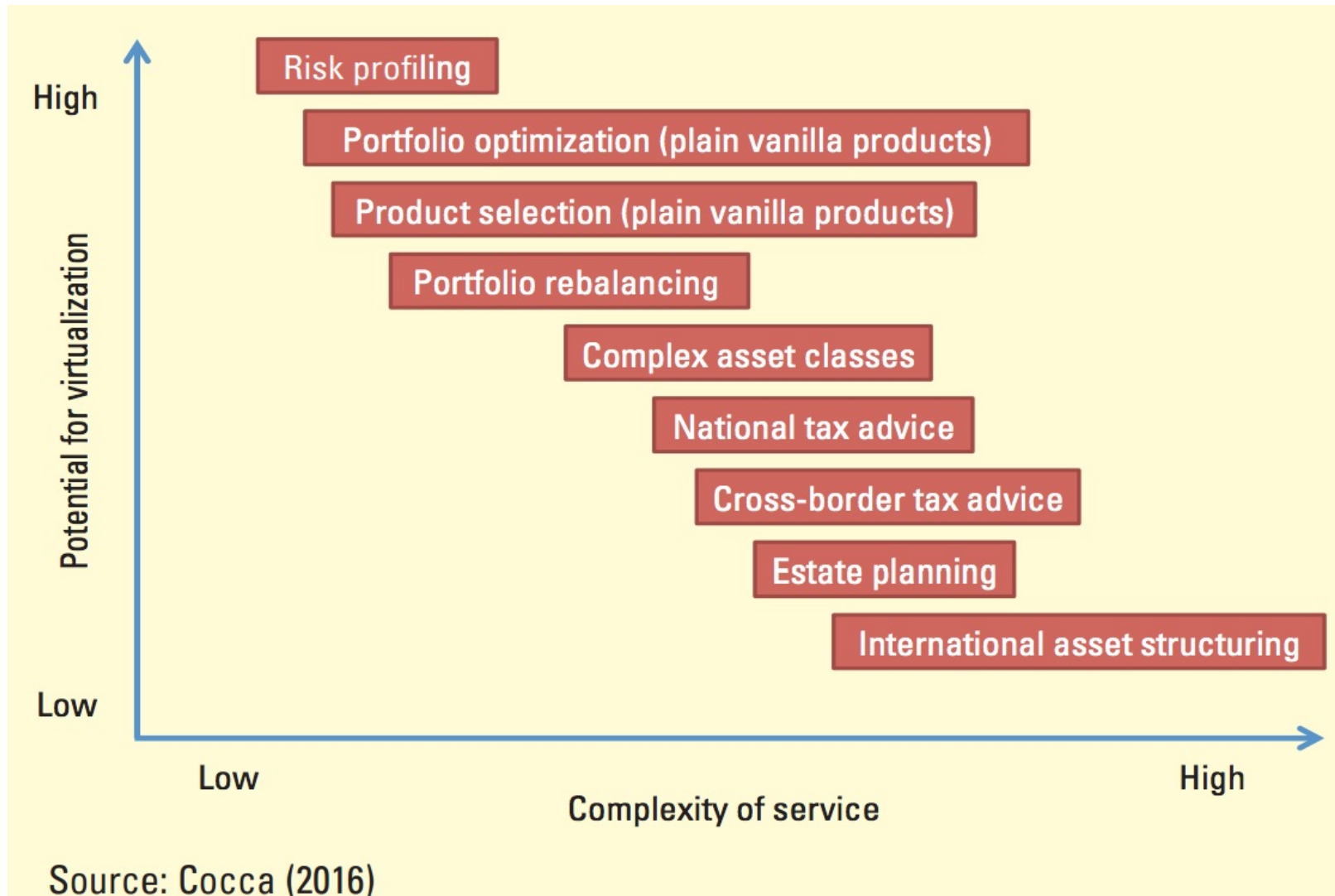
1. Identify an ideal **set of asset classes** for the current investment environment
2. Select **low cost ETFs** to represent each asset class
3. Determine your **risk tolerance** to create the **appropriate portfolio** for you
4. Apply **Modern Portfolio Theory** to allocate among the chosen **asset classes** for your **risk tolerance**
5. Monitor and periodically **rebalance** your portfolio

Wealth Management Value Chain



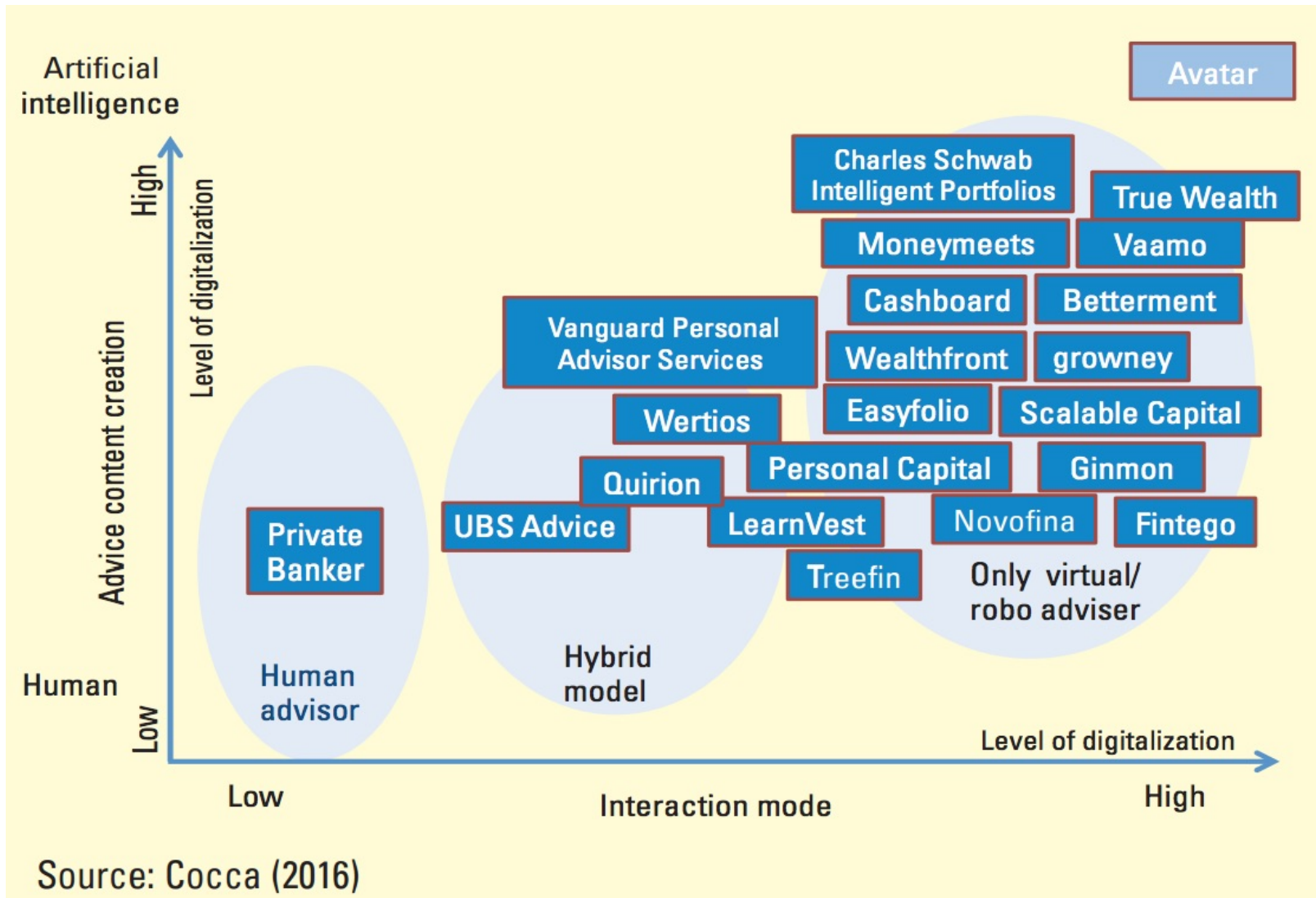
Source: Cocca (2016)

Wealth Management Service and Potential for virtualization

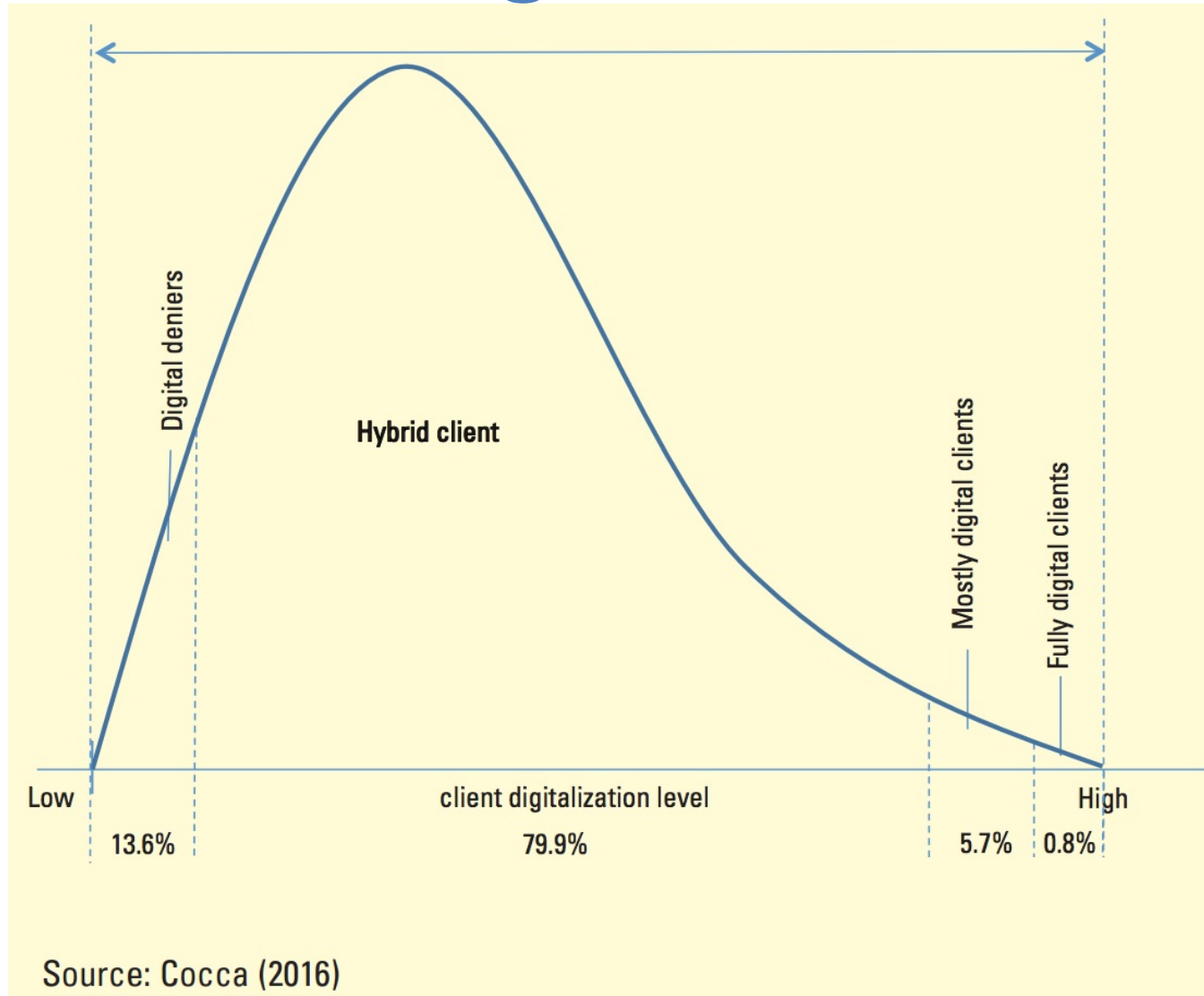


Source: Cocca (2016)

AI and Robo Advisor Virtualization Dimensions

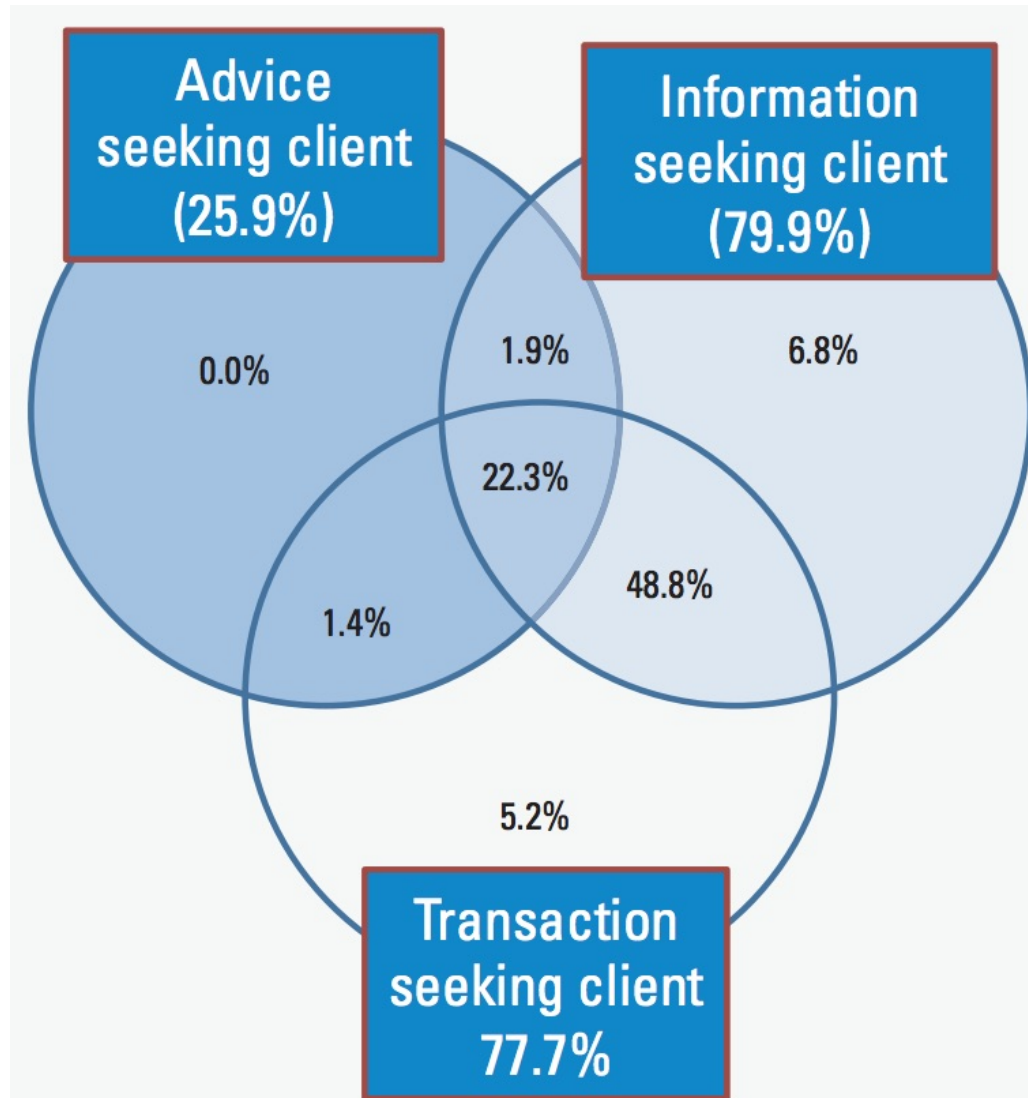


Degree of Digitalization of Wealth Management Customers



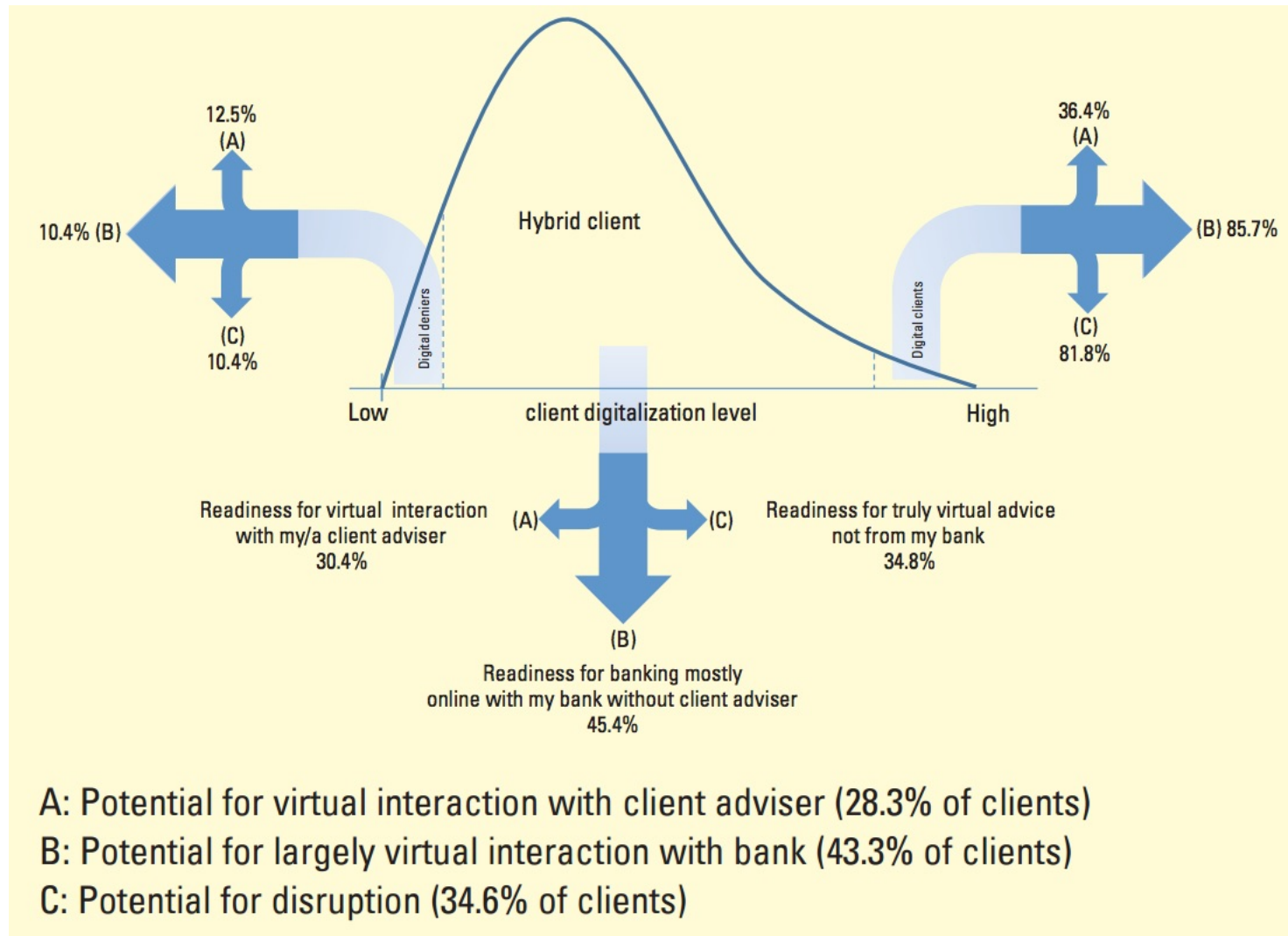
Source: Cocca, Teodoro (2016). "Potential and Limitations of Virtual Advice in Wealth Management." Journal of Financial Transformation, 44, 45-57.

Use of Online Services by Hybrid Customers

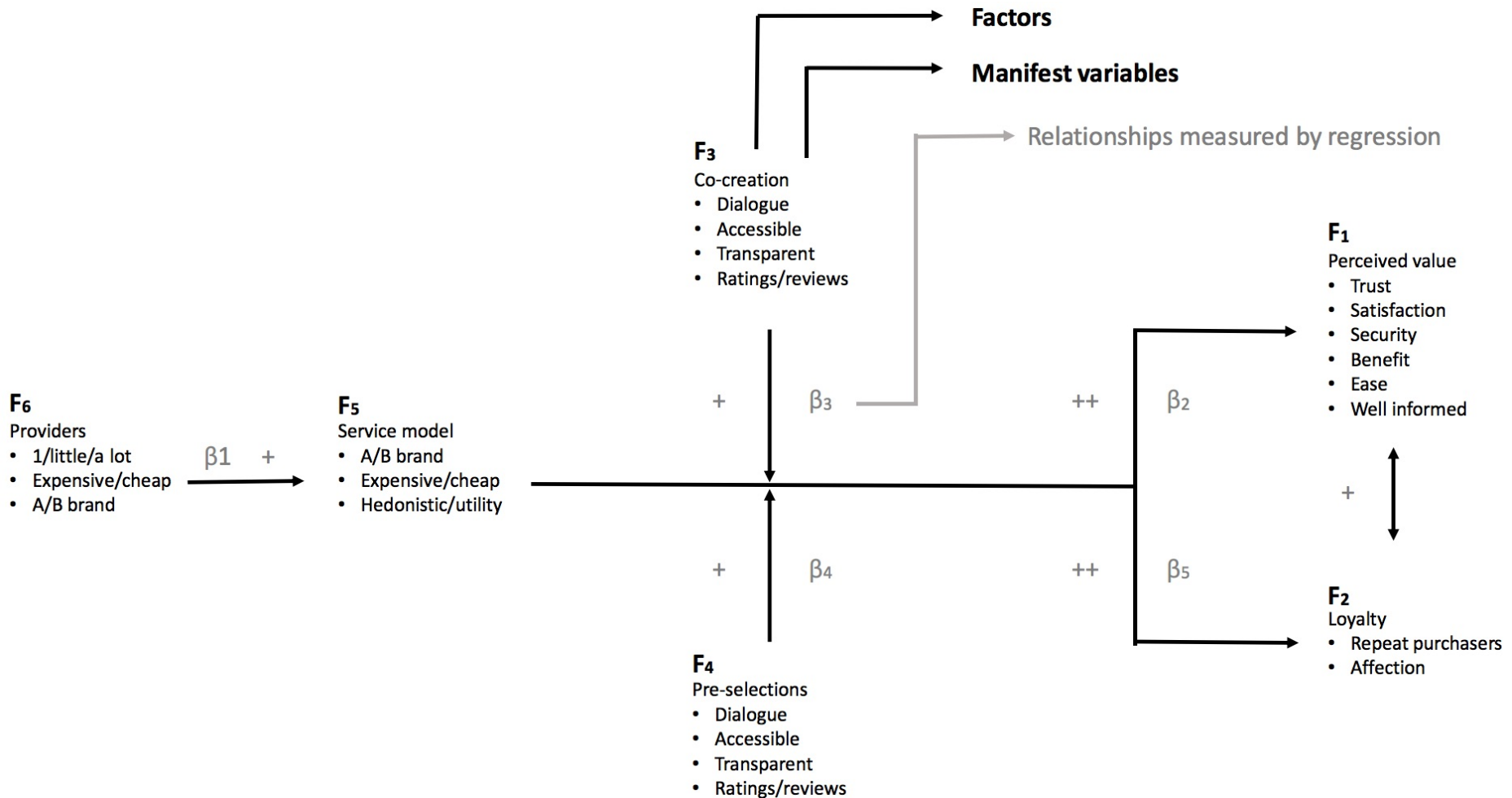


Source: Cocca, Teodoro (2016). "Potential and Limitations of Virtual Advice in Wealth Management." Journal of Financial Transformation, 44, 45-57.

Use of Online Services by Hybrid Customers



Explaining Customer Experience of Digital Financial Advice



Modern Portfolio Theory and Investment Analysis

- Financial Securities
- Financial Markets
- The Characteristics of the Opportunity Set Under Risk
- Delineating Efficient Portfolios
- Techniques for Calculating the Efficient Frontier

Modern Portfolio Theory and Investment Analysis

- The Correlation Structure of Security Returns:
 - The Single-Index Model
 - Multi-Index Models and Grouping Techniques
- Simple Techniques for Determining the Efficient Frontier
- Estimating Expected Returns
- How to Select Among the Portfolios in the Opportunity Set

Modern Portfolio Theory and Investment Analysis

- International Diversification
- The Standard Capital Asset Pricing Model
- Nonstandard Forms of Capital Asset Pricing Models
- Empirical Tests of Equilibrium Models
- The Arbitrage Pricing Model APT
 - A Multifactor Approach to Explaining Asset Prices

Modern Portfolio Theory and Investment Analysis

- Efficient Markets
- The Valuation Process
- Earnings Estimation
- Behavioral Finance, Investor Decision Making, and Asset Prices
- Interest Rate Theory and the Pricing of Bonds
- The Management of Bond Portfolios

Modern Portfolio Theory and Investment Analysis

- Option Pricing Theory
- The Valuation and Uses of Financial Futures
- Mutual Funds
- Evaluation of Portfolio Performance
- Evaluation of Security Analysis
- Portfolio Management Revisited

The **New Alpha**: 30+ Startups Providing Alternative Data For Sophisticated Investors

New sources of **data mined** by startups like **Foursquare**, **Premise**, and **Orbital Insight** are letting investors understand **trends** before they happen.

The New Alpha: 30+ Startups Providing Alternative Data For Sophisticated Investors

Alternative Data Sources

SATELLITE DATA

- Orbital Insight
- spire
- rezatec analyzing earth data
- Ursa
- RS Metrics
- urthecast
- PLANET LABS
- WINDWARD

WEB/APP/SOCIAL MEDIA DATA

- yipit DATA
- 7PARK DATA
- App Annie
- SELERITY
- Dataminr
- DATASIFT

WEATHER DATA

- aclima
- UNDERSTORY
- THE CLIMATE CORPORATION

LOCATION/FOOT TRAFFIC

- FOURSQUARE
- placemeter
- airsage The power of where and when
- STREETLIGHTDATA
- Placed.

Created By

CB INSIGHTS

ALTERNATIVE DATA MONETIZERS/AGGREGATORS

- Eagle Alpha
- QUANTON DATA
- Sentio
- DISCERN INSIGHTS AS A SERVICE

CREDIT CARD TRANSACTIONS

- earnest
- SECOND MEASURE
- ynext data
- ENVESTNET YODLEE

ALTERNATIVE CREDIT

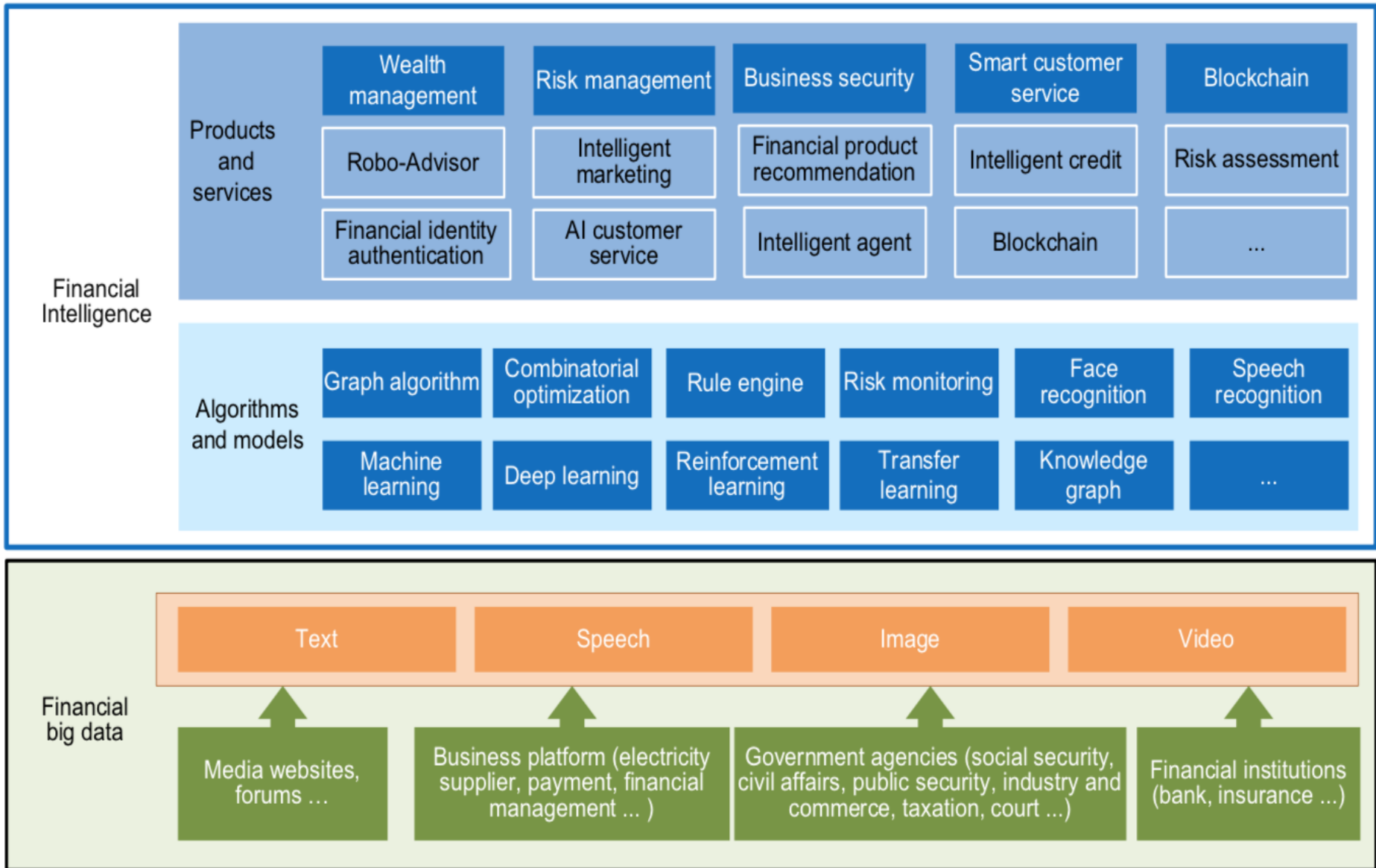
- first access
- cignifi
- FACTOR TRUST

LOCAL PRICES

- PriceStats
- PREMISE

FinBrain: when Finance meets AI 2.0

(Zheng et al., 2019)

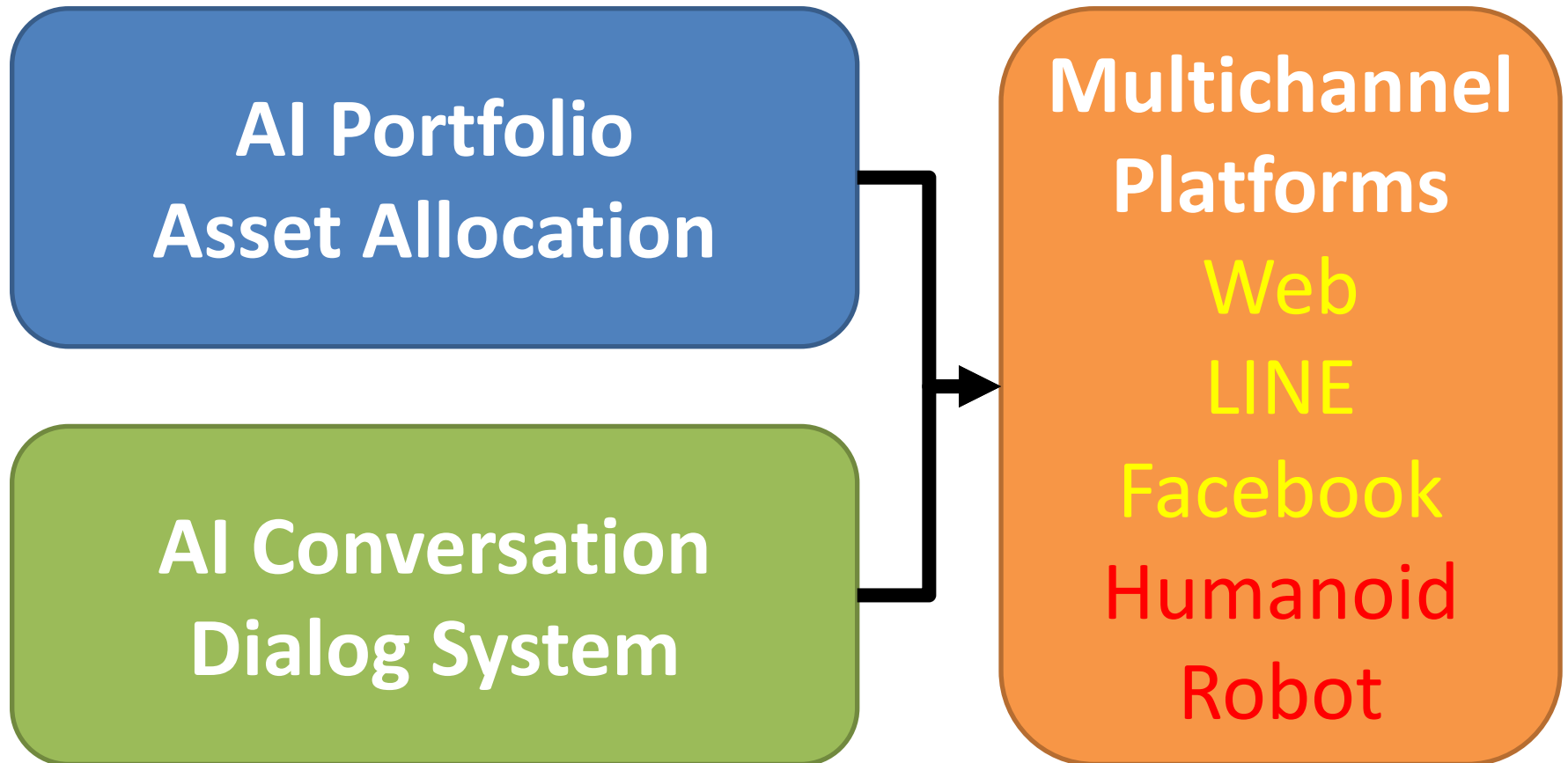


Technology-driven Financial Industry Development

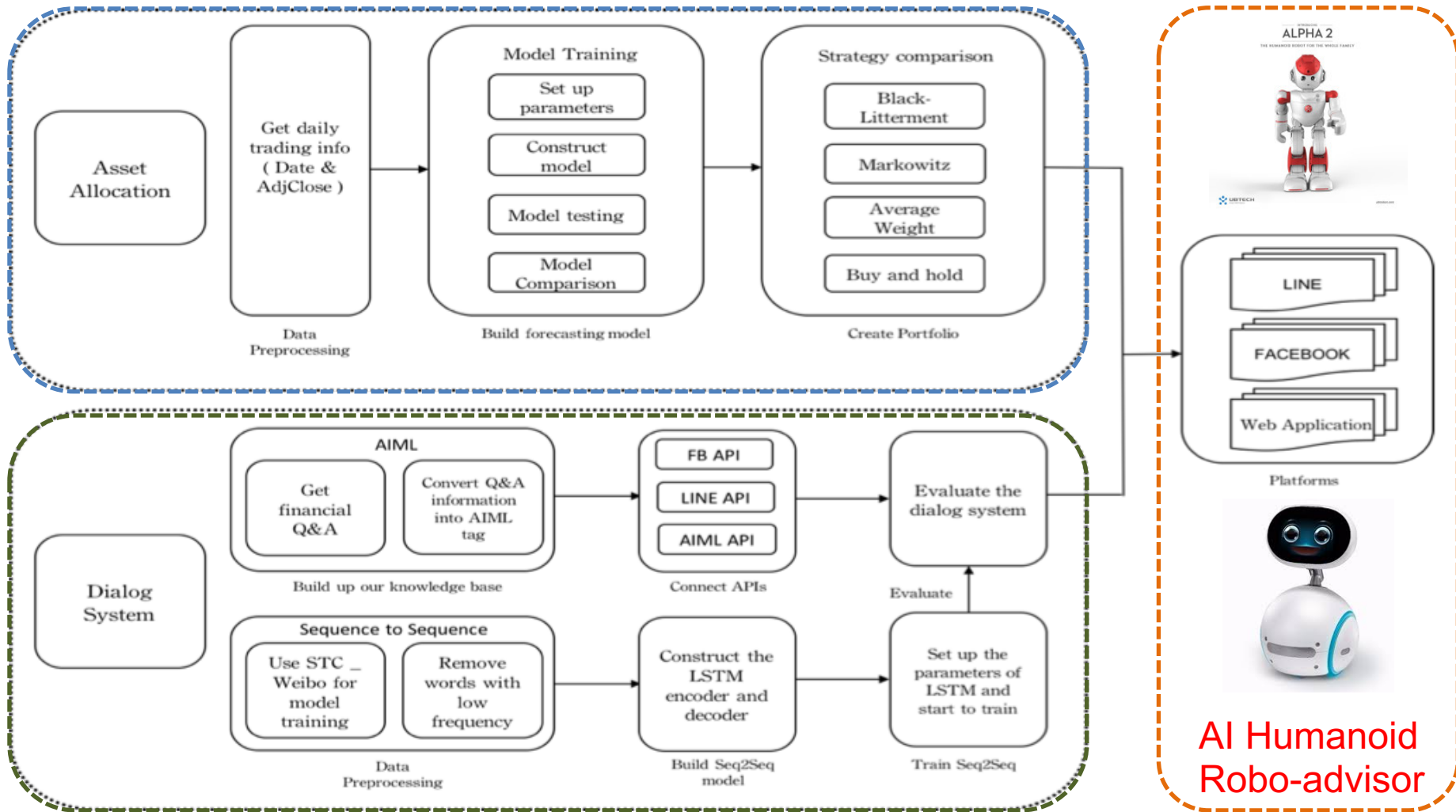
Development stage	Driving technology	Main landscape	Inclusive finance	Relationship between technology and finance
Fintech 1.0 (financial IT)	Computer	Credit card, ATM, and CRMS	Low	Technology as a tool
Fintech 2.0 (Internet finance)	Mobile Internet	Marketplace lending, third-party payment, crowdfunding, and Internet insurance	Medium	Technology- driven change
Fintech 3.0 (financial intelligence)	AI, Big Data, Cloud Computing, Blockchain	Intelligent finance	High	Deep fusion

AI Humanoid Robo-Advisor

AI Humanoid Robo-Advisor for Multi-channel Conversational Commerce

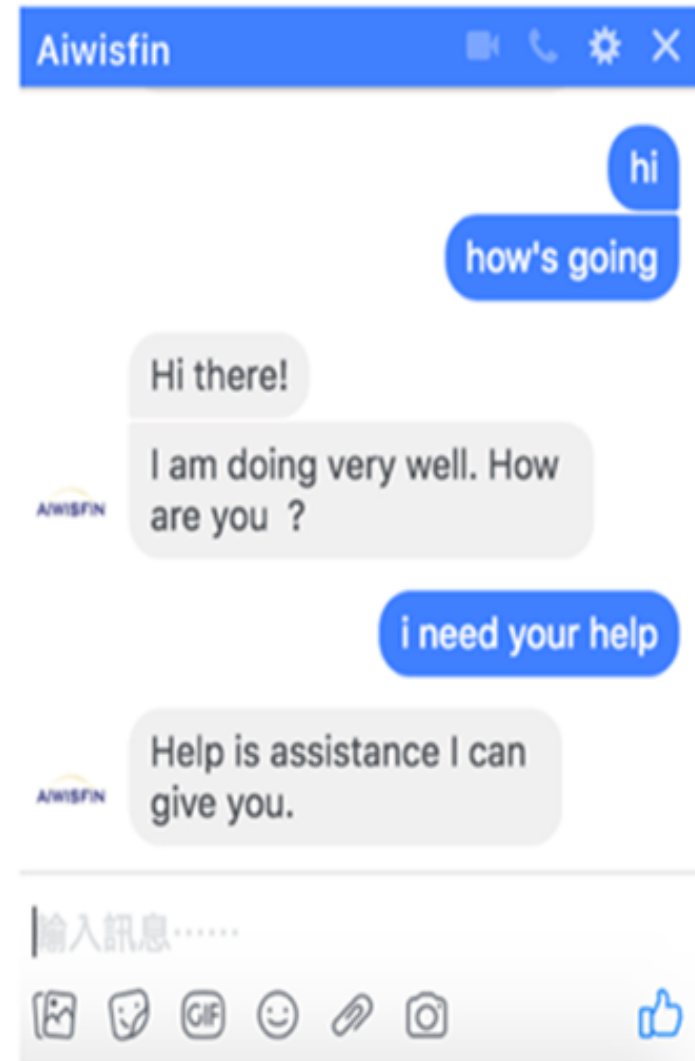


System Architecture of AI Humanoid Robo-Advisor



AI Humanoid Robo-advisor

Conversational Model (LINE, FB Messenger)



Conversational Robo-Advisor Multichannel UI/UX Robots



ALPHA 2

ZENBO



Portfolio Performance in 2016

Annual Portfolio Statistics

	Black-Litterman Portfolio - the LSTM Investor Views	Markowitz Portfolio	Equally Weighted Portfolio	S&P 500 Index
Annual return	16.151%	15.172%	12.428%	9.643%
Annual volatility	13.897%	14.365%	15.870%	13.169%
Sharpe ratio	1.14697	1.05534	0.81762	0.76492
Stability	0.82500	0.82515	0.82514	0.78754
Max drawdown	-10.105%	-10.465%	-12.529%	-10.306%
Skew	-0.35652	-0.52985	-0.56976	-0.36795
Kurtosis	2.49845	3.00613	2.41894	2.21958
Daily value at risk	-1.688%	-1.750%	-1.948%	-1.619%
Alpha	0.06445	0.05354	0.02158	0.00000
Beta	1.01485	1.04816	1.15631	1.00000
Information ratio	0.10935	0.09129	0.04655	-

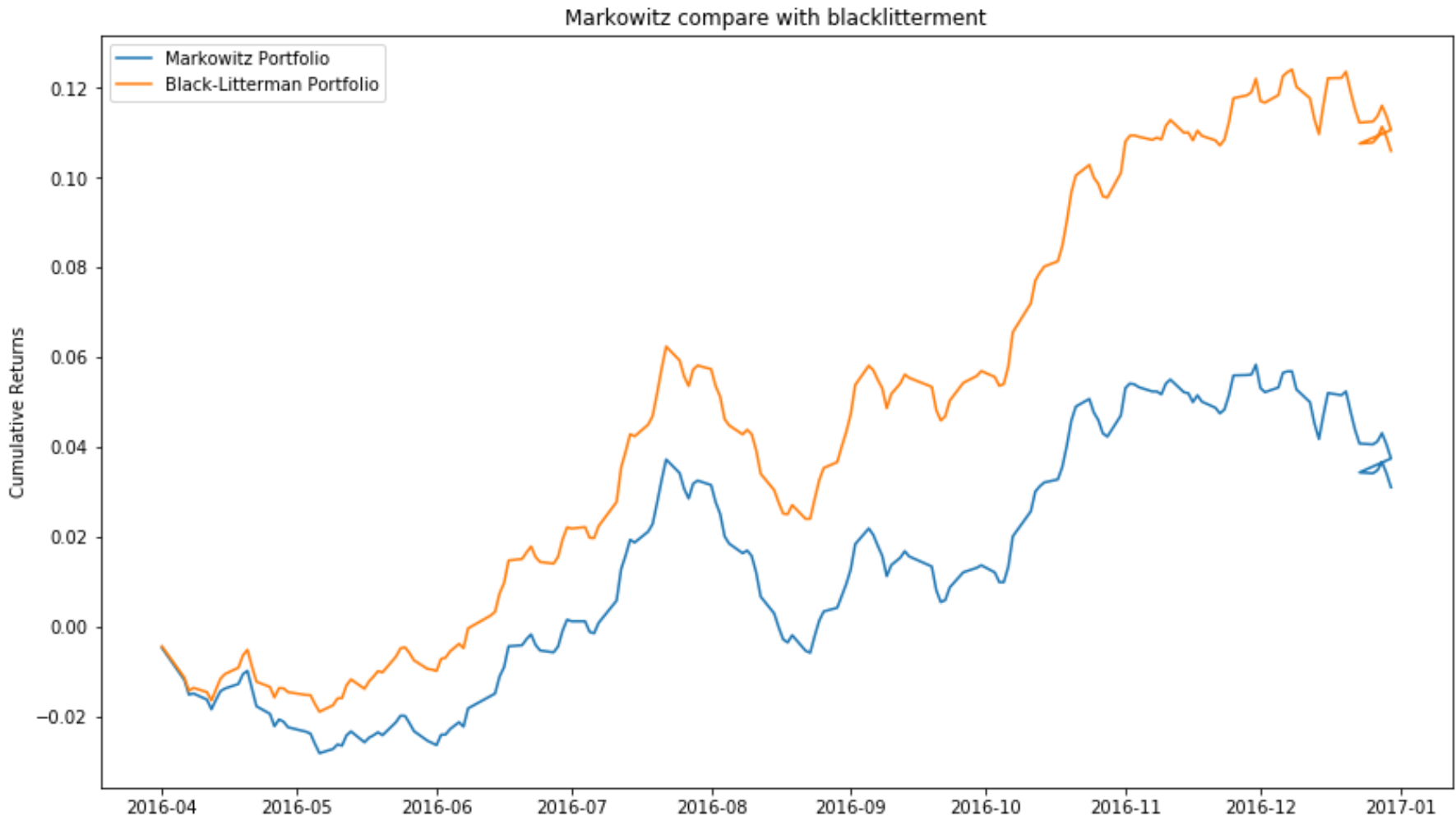
Portfolio Cumulative Returns

Cumulative Returns: Portfolios



Cumulative Returns

Markowitz v.s. Black-litterment



Source: Min-Yuh Day, Jian-Ting Lin and Yuan-Chih Chen (2018), "Artificial Intelligence for Conversational Robo-Advisor", in Proceedings of the 2018 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining (ASONAM 2018), Barcelona, Spain, August 28-31, 2018

Python in Google Colab (Python101)

<https://colab.research.google.com/drive/1FEG6DnGvwfUbeo4zJ1zTunjMqf2RkCrT>

Portfolio Optimization and Algorithmic Trading Efficient Frontier Portfolio Optimisation in Python

python101.ipynb ☆

File Edit View Insert Runtime Tools Help [All changes saved](#)

Comment Share Settings A

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Table of contents

- Python101
- Python File Input / Output
- OS, IO, files, and Google Drive
- Python Programming
- Pythong String and Text
- Python Numpy
- Python Pandas
- Machine Learning with scikit-learn
 - Classification and Prediction
 - K-Means Clustering
- Deep Learning for Financial Time Series Forecasting
- Portfolio Optimization and Algorithmic Trading
 - Investment Portfolio Optimisation with Python
 - Efficient Frontier Portfolio Optimisation in Python**
 - Investment Portfolio Optimization

+ Code + Text

```
Individual Stock Returns and Volatility

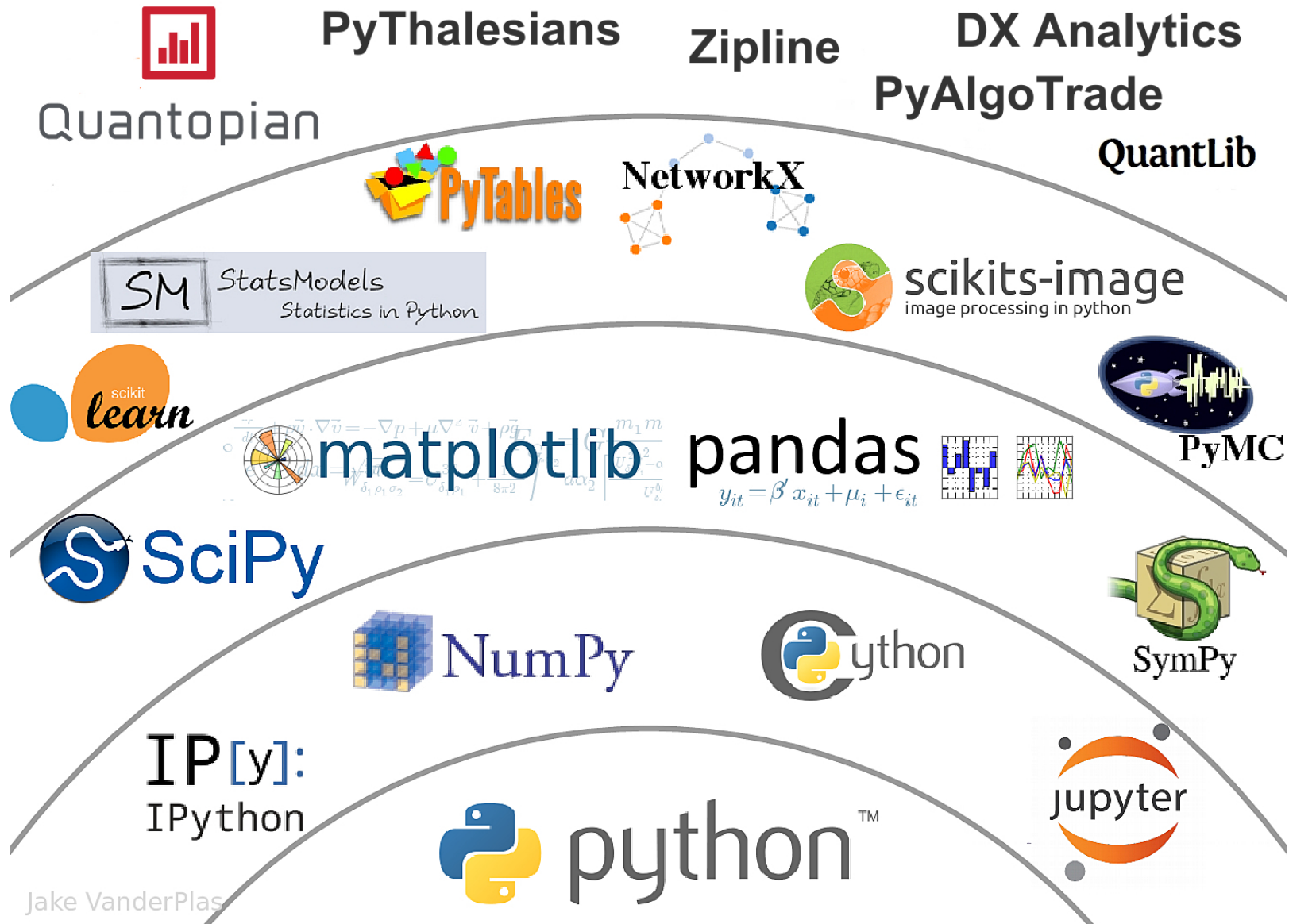
AAPL : annuaised return 0.28 , annualised volatility: 0.21
AMZN : annuaised return 0.34 , annualised volatility: 0.25
FB : annuaised return 0.3 , annualised volatility: 0.23
GOOGL : annuaised return 0.18 , annualised volatility: 0.18
```

Portfolio Optimization with Individual Stocks

Stock	Annualised Return	Annualised Volatility
GOOGL	0.18	0.18
AAPL	0.28	0.21
FB	0.30	0.23
AMZN	0.34	0.25

<https://tinyurl.com/aintpupython101>

The Quant Finance PyData Stack



Jake VanderPlas

Source: http://nbviewer.jupyter.org/format/slides/github/quantopian/pyfolio/blob/master/pyfolio/examples/overview_slides.ipynb/#5

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<https://www.quantopian.com/>

References

- Susanne Chishti and Janos Barberis (2016), "The FINTECH Book: The Financial Technology Handbook for Investors, Entrepreneurs and Visionaries", Wiley.
- Paolo Sironi (2016), "FinTech Innovation: From Robo-Advisors to Goal Based Investing and Gamification", Wiley.
- Charles P. Jones (2012), Investments: Analysis and Management, 12th Edition, Wiley.
- Edwin J. Elton, Martin J. Gruber, Stephen J. Brown, and William N. Goetzmann (2014), Modern Portfolio Theory and Investment Analysis, 9th Edition, Wiley.
- Zvi Bodie, Alex Kane, Alan Marcus (2018), Essentials of Investments, 11th Edition, McGraw-Hill.
- Musto, C., Semeraro, G., Lops, P., de Gemmis, M., & Lekkas, G. (2015). Personalized finance advisory through case-based recommender systems and diversification strategies. *Decision Support Systems*, 77, 100-111.
- Rubino, J. (2016). My Favorite Robot. *CFA Institute Magazine*, 27(3), 43-46.
- Cocca, Teodoro (2016). "Potential and Limitations of Virtual Advice in Wealth Management." *Journal of Financial Transformation*, 44, 45-57.
- Van Thiel, Diederick, and Fred Van Raaij (2017). "Explaining Customer Experience of Digital Financial Advice." *Economics* 5, no. 1, 69-84.
- Zheng, Xiao-lin, Meng-ying Zhu, Qi-bing Li, Chao-chao Chen, and Yan-chao Tan (2019), "Finbrain: When finance meets AI 2.0." *Frontiers of Information Technology & Electronic Engineering* 20, no. 7, pp. 914-924, 2019.
- Stuart Russell and Peter Norvig (2020), *Artificial Intelligence: A Modern Approach*, 4th Edition, Pearson.
- Min-Yuh Day and Jian-Ting Lin (2019), "Artificial Intelligence for ETF Market Prediction and Portfolio Optimization", in *Proceedings of The 2019 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining (ASONAM 2019)*, Vancouver, Canada, August 27-30. 2019.
- Min-Yuh Day and Chi-Sheng Hung (2019), "AI Affective Conversational Robot with Hybrid Generative-based and Retrieval-based Dialogue Models", in *Proceedings of The 20th IEEE International Conference on Information Reuse and Integration for Data Science (IEEE IRI 2019)*, Los Angeles, CA, USA, July 30 - August 1, 2019.
- Min-Yuh Day, Tun-Kung Cheng and Jheng-Gang Li (2018). "AI Robo-Advisor with Big Data Analytics for Financial Services", submitted to MSNDS 2018 in the 2018 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining (ASONAM 2018), Barcelona, Spain, August 28-31. 2018.
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