

智慧金融量化分析

(Artificial Intelligence in Finance and Quantitative Analysis)

智慧金融量化分析概論

(Introduction to Artificial Intelligence
in Finance and Quantitative Analysis)

1101AIFQA01

MBA, IM, NTPU (M6132) (Fall 2021)

Tue 2, 3, 4 (9:10-12:00) (8F40)

戴敏育 副教授

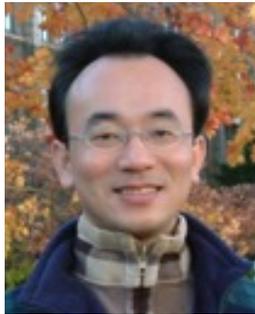
Min-Yuh Day, Ph.D, Associate Professor

國立臺北大學 資訊管理研究所

Institute of Information Management, National Taipei University

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

2021-09-28





戴敏育 博士 (Min-Yuh Day, Ph.D.)



2020 Cohort



2020 Cohort



國立臺北大學 資訊管理研究所 副教授
中央研究院 資訊科學研究所 訪問學人
國立臺灣大學 資訊管理 博士
智慧金融創新科技實驗室

Intelligent Financial Innovation Technology, IFIT Lab, IM, NTPU

- 人工智慧 (Artificial Intelligence)
- 金融科技 (Financial Technology)
- 大數據分析 (Big Data Analytics)
- 資料與文字探勘 (Data Mining and Text Mining)
- 電子商務 (Electronic Commerce)



國立臺北大學 110 學年度 第1學期

課程大綱

Fall 2021 (2021.09 - 2022.02)

- 課程名稱：**智慧金融量化分析**
(Artificial Intelligence in Finance and Quantitative Analysis)
- 授課教師：戴敏育 (Min-Yuh Day)
- 開課系所：資管所碩士班 (資訊管理研究所2)
- 開課資料：選修 半學年 3 學分 (3 Credits, Elective) (M6132)
- 上課時間：週二 2, 3, 4 (9:10-12:00)
- 上課教室：商8F40 (台北大學三峽校區)

Google Meet: <http://meet.google.com/uaq-vmjj-vff>



教學目標

1. 瞭解智慧金融量化分析基本概念與研究議題。
2. 具備智慧金融量化分析實務操作能力。
3. 進行智慧金融量化分析相關之資訊管理研究。

Course Objectives

1. Understand the **fundamental concepts and research issues of Artificial Intelligence in Finance and Quantitative Analysis.**
2. Equip with Hands-on practices of **Artificial Intelligence in Finance and Quantitative Analysis.**
3. Conduct information systems research in the context of **Artificial Intelligence in Finance and Quantitative Analysis.**

內容綱要

- 本課程介紹**智慧金融量化分析**
基本概念、研究議題、與實務操作。
- 課程內容包括：
 1. 智慧金融量化分析概論、
 2. AI 金融科技: 金融服務創新應用、
 3. 投資心理學與行為財務學、
 4. 財務金融事件研究法、
 5. 財務金融理論、
 6. 數據驅動財務金融、
 7. 金融計量經濟學、
 8. 人工智慧優先金融、
 9. 財務金融深度學習、財務金融強化學習、
 10. 演算法交易、風險管理、交易機器人與基於事件的回測、
 11. 與智慧金融量化分析分析個案研究。

Course Outline

- This course introduces the **fundamental concepts, research issues, and hands-on practices of AI in Finance and Quantitative Analysis.**
- Topics include:
 1. Introduction to Artificial Intelligence in Finance and Quantitative Analysis,
 2. AI in FinTech: Financial Services Innovation and Application,
 3. Investing Psychology and Behavioral Finance,
 4. Event Studies in Finance,
 5. Finance Theory,
 6. Data-Driven Finance,
 7. Financial Econometrics,
 8. AI-First Finance,
 9. Deep Learning in Finance, Reinforcement Learning in Finance,
 10. Algorithmic Trading, Risk Management, Trading Bot and Event-Based Backtesting,
 11. Case Study on AI in Finance and Quantitative Analysis.

資訊管理研究所 系核心能力 (Core Competence)

- 資訊科技新知探索與系統開發應用 80 %
- 網路行銷企劃能力 10 %
- 論文寫作與獨立研究能力新知 10 %

校四大基本素養

Four Fundamental Qualities

- **專業 (Professionalism)**
 - **創意思考與問題解決 (Creative thinking and Problem-solving) 40 %**
 - **綜合統整 (Comprehensive Integration) 40 %**
- **人際 (Interpersonal Relationship)**
 - **溝通協調 (Communication and Coordination) 10 %**
 - **團隊合作 (Teamwork) 5 %**
- **倫理 (Ethics)**
 - **誠信正直 (Honesty and Integrity) 0 %**
 - **尊重自省 (Self-Esteem and Self-reflection) 0 %**
- **國際觀 (International Vision)**
 - **多元關懷 (Caring for Diversity) 0 %**
 - **跨界宏觀 (Interdisciplinary Vision) 5 %**

商學院學習目標

(College Learning Goals)

- **Ethics/Corporate Social Responsibility**
- **Global Knowledge/Awareness**
- **Communication**
- **Analytical and Critical Thinking**

系所學習目標

(Department Learning Goals)

- **Information Technologies and System Development Capabilities**
- **Internet Marketing Management Capabilities**
- **Research capabilities**

課程大綱 (Syllabus)

| 週次 (Week) | 日期 (Date) | 內容 (Subject/Topics) |
|-----------|------------|---|
| 1 | 2021/09/28 | 智慧金融量化分析概論 (Introduction to Artificial Intelligence in Finance and Quantitative Analysis) |
| 2 | 2021/10/05 | AI 金融科技: 金融服務創新應用 (AI in FinTech: Financial Services Innovation and Application) |
| 3 | 2021/10/12 | 投資心理學與行為財務學 (Investing Psychology and Behavioral Finance) |
| 4 | 2021/10/19 | 財務金融事件研究法 (Event Studies in Finance) |
| 5 | 2021/10/26 | 智慧金融量化分析個案研究 I (Case Study on AI in Finance and Quantitative Analysis I) |
| 6 | 2021/11/02 | 財務金融理論 (Finance Theory) |

課程大綱 (Syllabus)

| 週次 (Week) | 日期 (Date) | 內容 (Subject/Topics) |
|-----------|------------|--|
| 7 | 2021/11/09 | 數據驅動財務金融 (Data-Driven Finance) |
| 8 | 2021/11/16 | 期中報告 (Midterm Project Report) |
| 9 | 2021/11/23 | 金融計量經濟學 (Financial Econometrics) |
| 10 | 2021/11/30 | 人工智慧優先金融 (AI-First Finance) |
| 11 | 2021/12/07 | 智慧金融量化分析產業實務 (Industry Practices of AI in Finance and Quantitative Analysis) |
| 12 | 2021/12/14 | 智慧金融量化分析個案研究 II (Case Study on AI in Finance and Quantitative Analysis II) |

課程大綱 (Syllabus)

| 週次 (Week) | 日期 (Date) | 內容 (Subject/Topics) |
|-----------|------------|---|
| 13 | 2021/12/21 | 財務金融深度學習 (Deep Learning in Finance); 財務金融強化學習 (Reinforcement Learning in Finance) |
| 14 | 2021/12/28 | 演算法交易 (Algorithmic Trading); 風險管理 (Risk Management); 交易機器人與基於事件的回測 (Trading Bot and Event-Based Backtesting) |
| 15 | 2022/01/04 | 期末報告 I (Final Project Report I) |
| 16 | 2022/01/11 | 期末報告 II (Final Project Report II) |
| 17 | 2022/01/18 | 學生自主學習 (Self-learning) |
| 18 | 2022/01/25 | 學生自主學習 (Self-learning) |

教學方法與教學活動

(Teaching methods and activities)

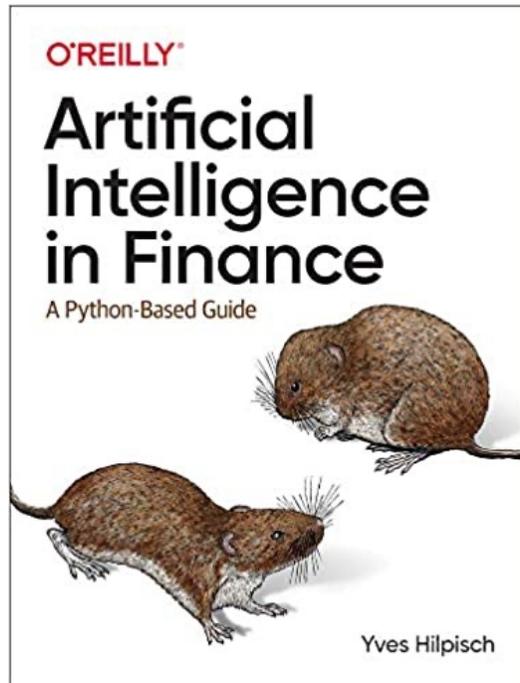
- **講授 (Lecture)**
- **討論 (Discussion)**
- **實習 (Practicum)**

評量方式 (Evaluation Methods)

- **個人報告 (Individual Presentation) 60 %**
- **個案分析報告 (Case Report) 10 %**
- **課堂參與 (Class Participation) 10 %**
- **團體報告 (Group Presentation) 10 %**
- **作業 (Assignment) 10 %**

指定用書 (Required Texts)

- **Yves Hilpisch (2020),
Artificial Intelligence in Finance: A Python-Based Guide,
O'Reilly Media.**



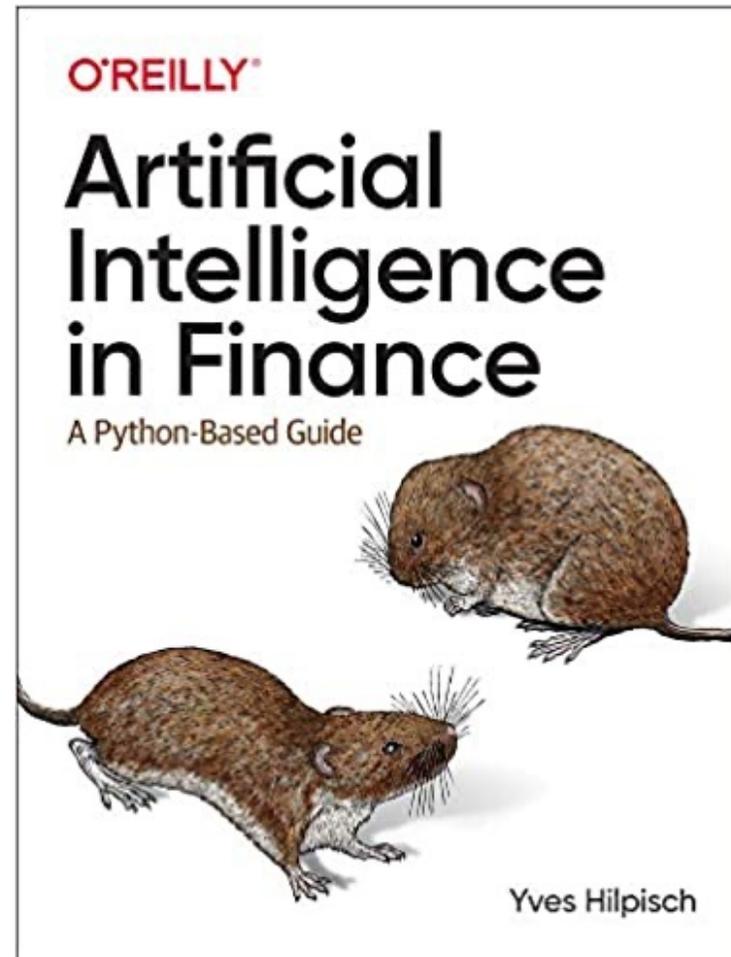
指定用書 (Required Texts)

- **Aurélien Géron (2019),
Hands-On Machine Learning with Scikit-Learn, Keras,
and TensorFlow: Concepts, Tools, and Techniques to
Build Intelligent Systems,
2nd Edition, O'Reilly Media.**
- **Yves Hilpisch (2018),
Python for Finance: Mastering Data-Driven Finance,
2nd Edition, O'Reilly Media.**

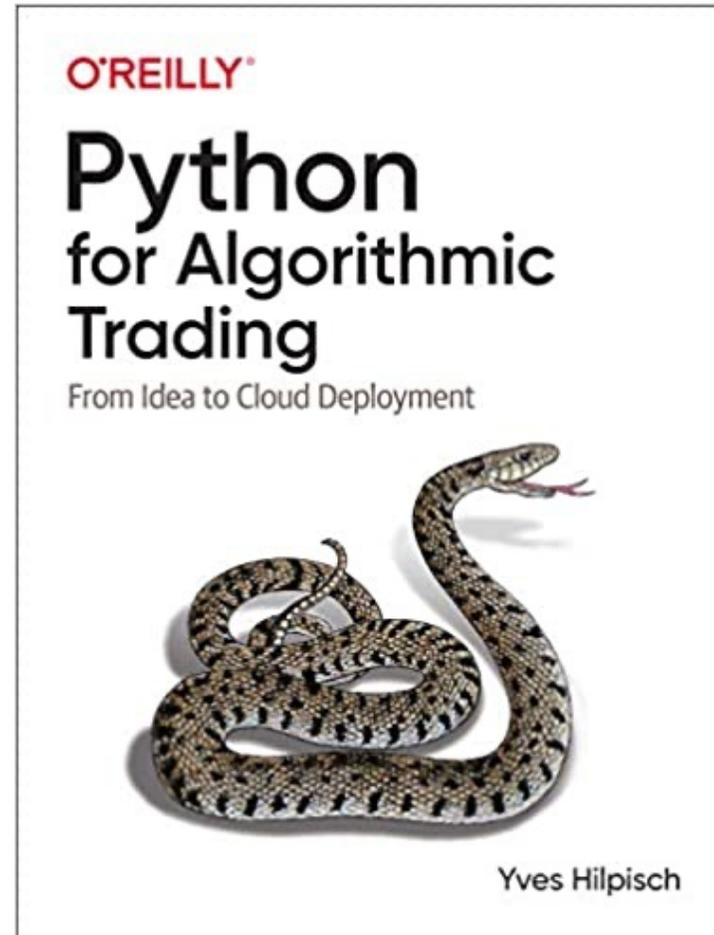
其他參考資料 (Other References)

- **Paolo Sironi (2016),
FinTech Innovation: From Robo-Advisors to Goal Based Investing and Gamification,
Wiley.**
- **Yuxing Yan (2017),
Python for Finance: Apply powerful finance models and quantitative analysis with Python,
Second Edition, Packt Publishing**

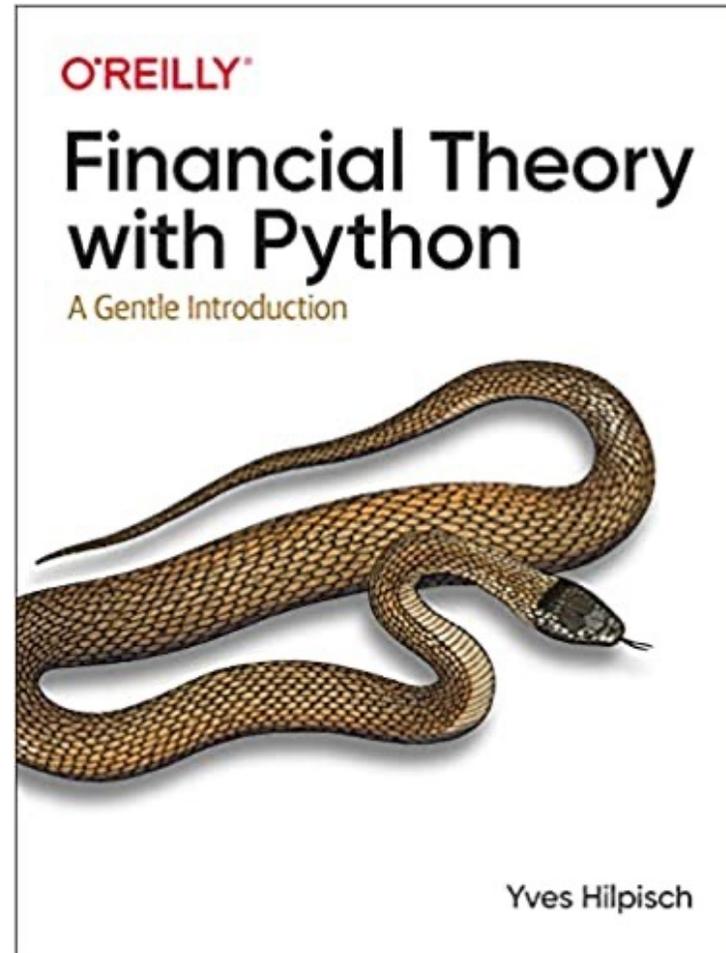
Yves Hilpisch (2020),
Artificial Intelligence in Finance:
A Python-Based Guide,
O'Reilly



Yves Hilpisch (2020),
Python for Algorithmic Trading:
From Idea to Cloud Deployment,
O'Reilly



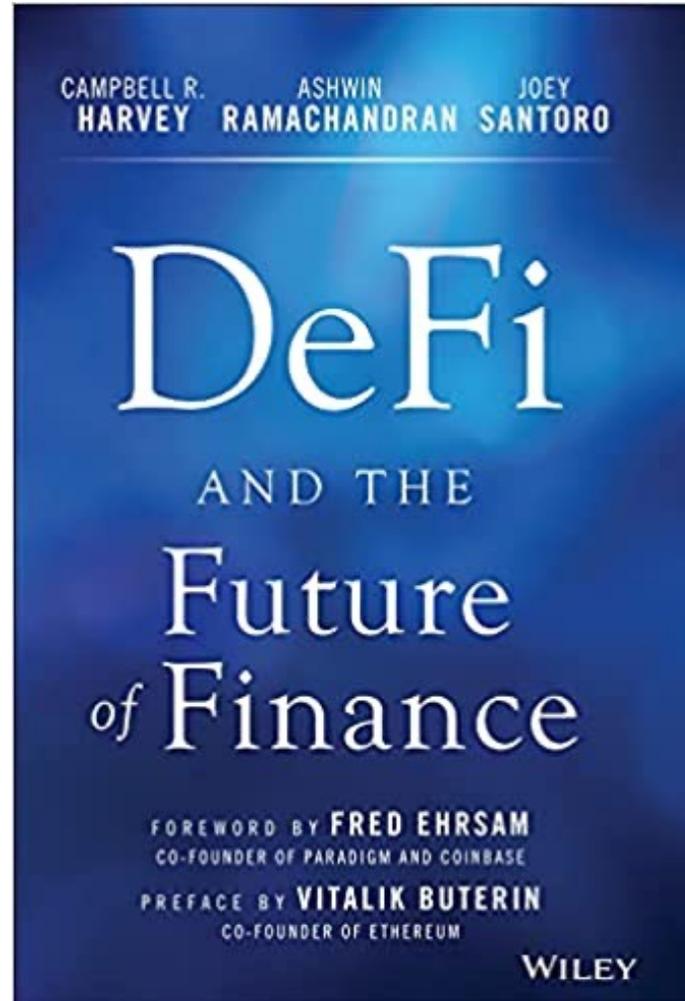
Yves Hilpisch (2021),
Financial Theory with Python:
A Gentle Introduction,
O'Reilly



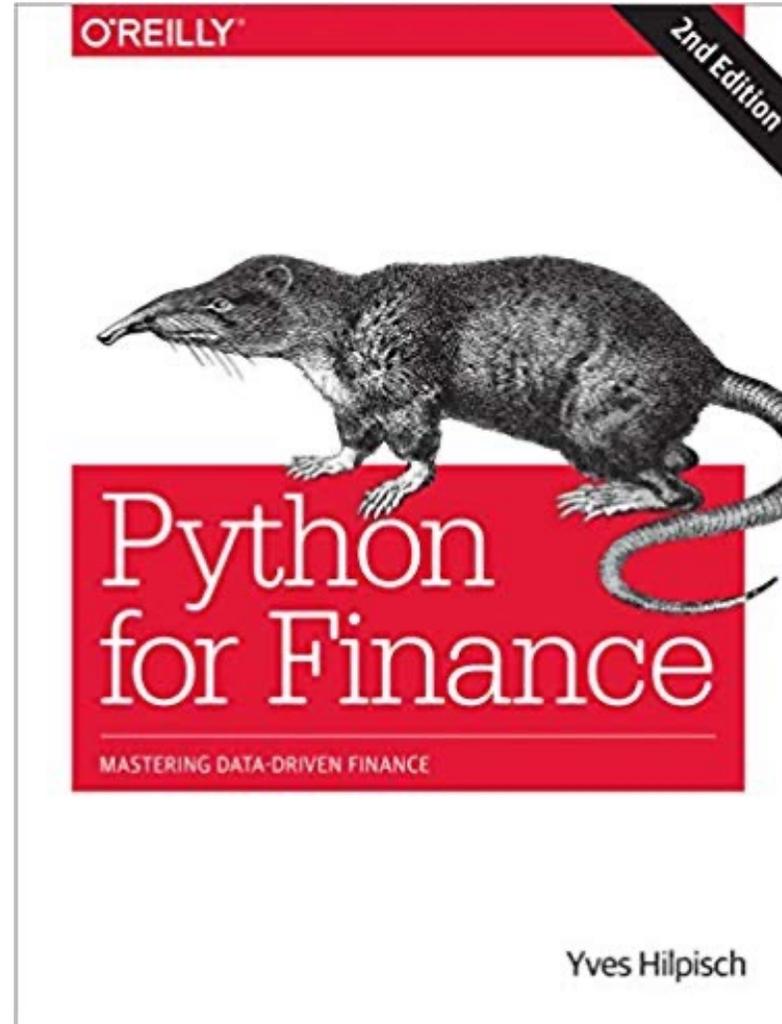
Campbell R. Harvey, Ashwin Ramachandran, Joey Santoro, Fred Ehrsam (2021),

DeFi and the Future of Finance,

Wiley



Yves Hilpisch (2018),
Python for Finance: Mastering Data-Driven Finance,
O'Reilly

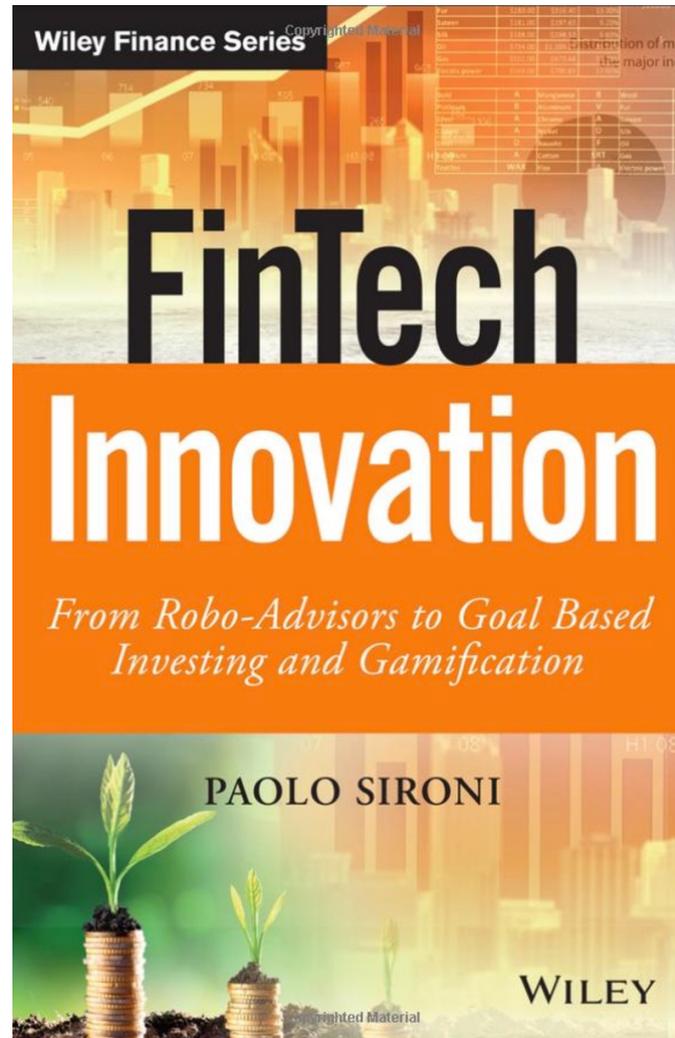


Paolo Sironi (2016)

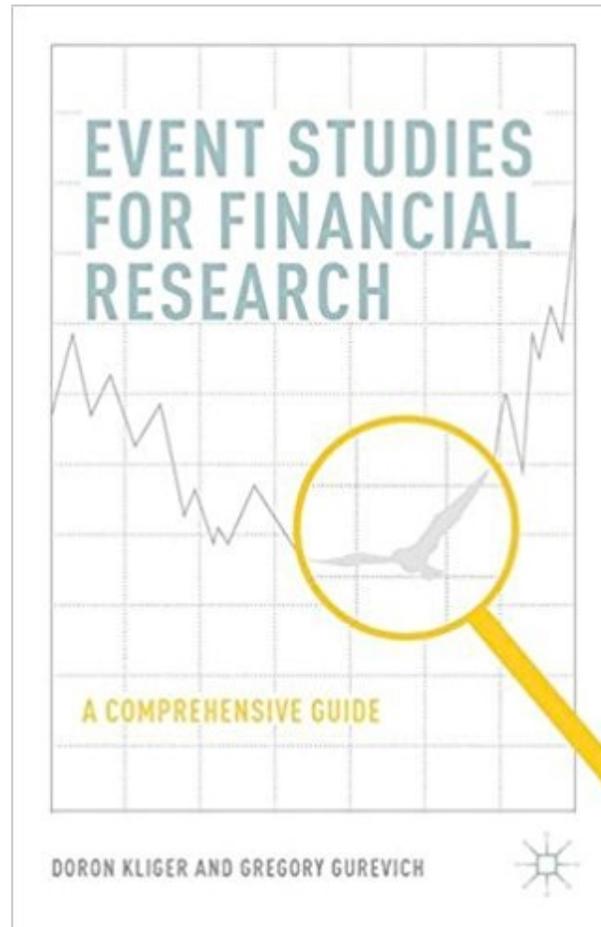
FinTech Innovation:

From Robo-Advisors to Goal Based Investing and Gamification,

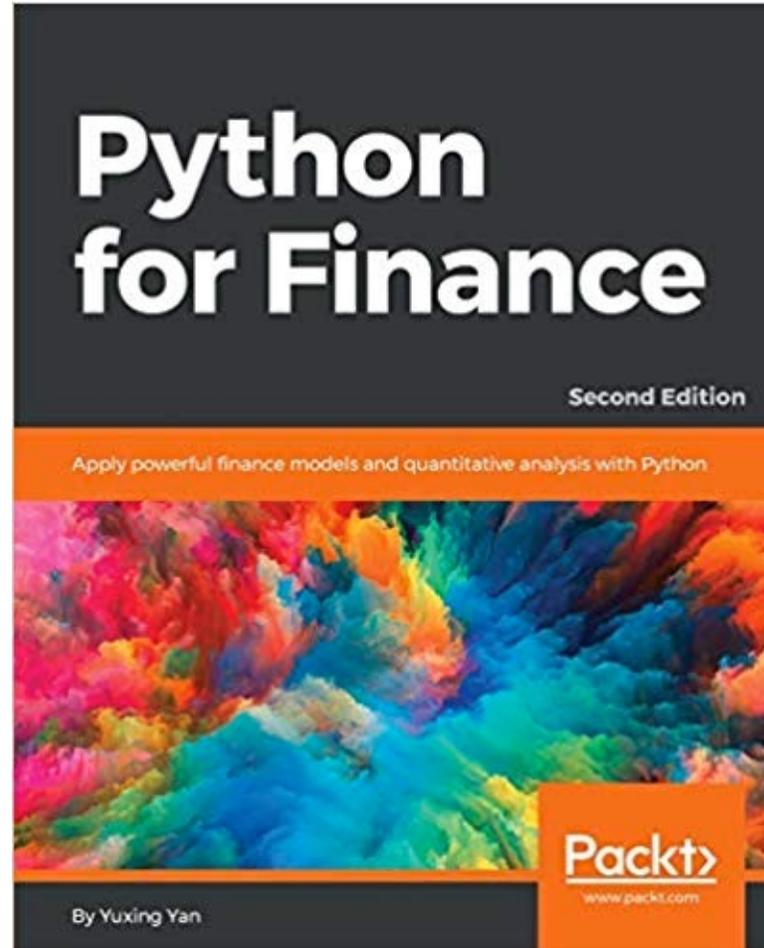
Wiley



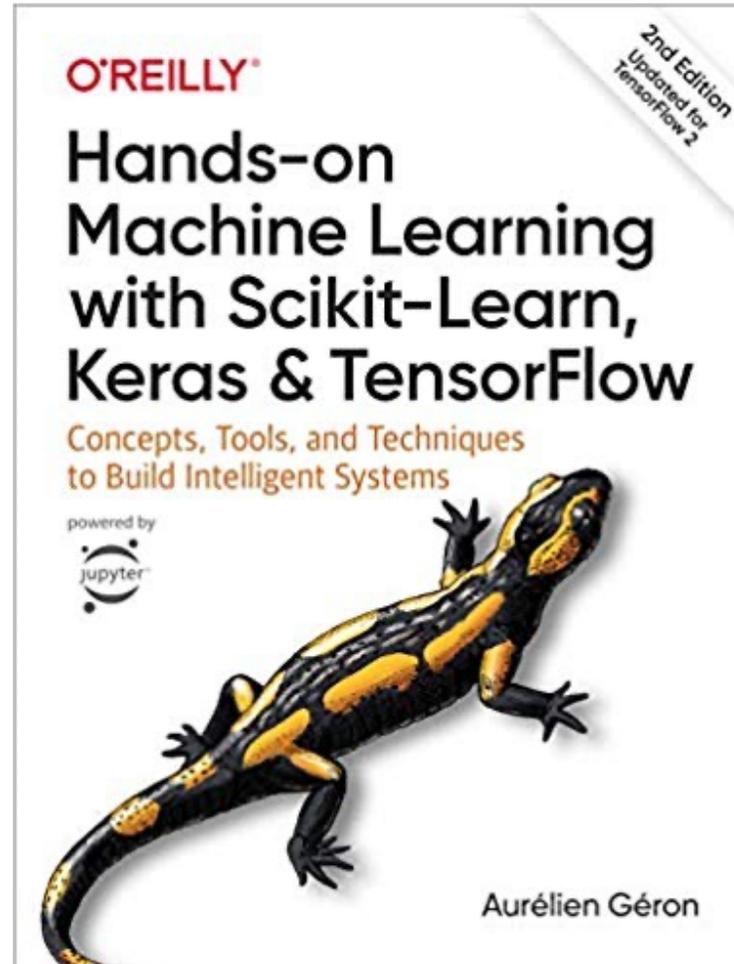
Doron Kliger and Gregory Gurevich (2014),
Event Studies for Financial Research:
A Comprehensive Guide,
Palgrave Macmillan



Yuxing Yan (2017),
**Python for Finance: Apply powerful finance models
and quantitative analysis with Python**, Second Edition,
Packt Publishing



**Aurélien Géron (2019),
Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow:
Concepts, Tools, and Techniques to Build Intelligent Systems, 2nd Edition
O'Reilly Media, 2019**

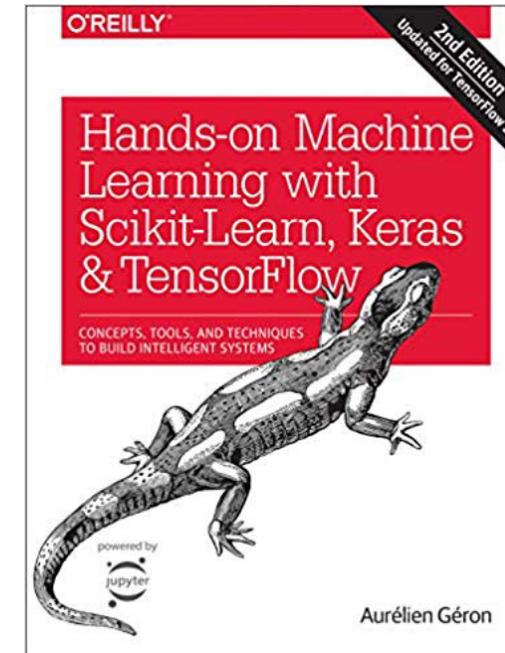


<https://github.com/ageron/handson-ml2>

Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow

Notebooks

- [1. The Machine Learning landscape](#)
- [2. End-to-end Machine Learning project](#)
- [3. Classification](#)
- [4. Training Models](#)
- [5. Support Vector Machines](#)
- [6. Decision Trees](#)
- [7. Ensemble Learning and Random Forests](#)
- [8. Dimensionality Reduction](#)
- [9. Unsupervised Learning Techniques](#)
- [10. Artificial Neural Nets with Keras](#)
- [11. Training Deep Neural Networks](#)
- [12. Custom Models and Training with TensorFlow](#)
- [13. Loading and Preprocessing Data](#)
- [14. Deep Computer Vision Using Convolutional Neural Networks](#)
- [15. Processing Sequences Using RNNs and CNNs](#)
- [16. Natural Language Processing with RNNs and Attention](#)
- [17. Representation Learning Using Autoencoders](#)
- [18. Reinforcement Learning](#)
- [19. Training and Deploying TensorFlow Models at Scale](#)



Sequences using RNNs and CNNs



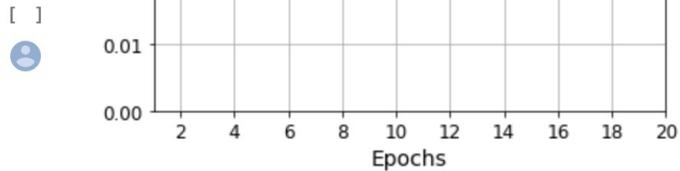
15_processing_sequences_using_rnn_and_cnns.ipynb

File Edit View Insert Runtime Tools Help Last edited on November 6 by ageron

Share Settings

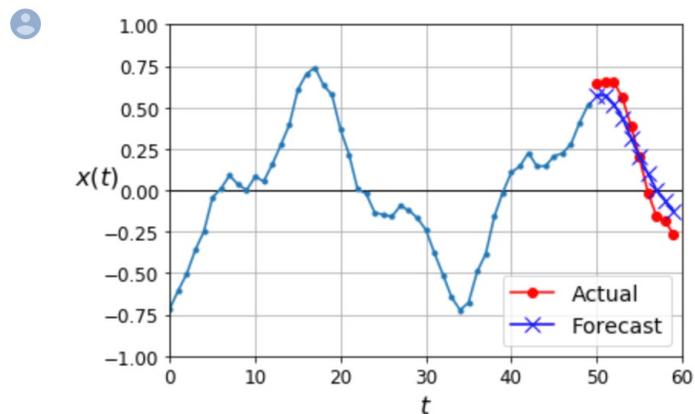
+ Code + Text Copy to Drive

Connect Editing



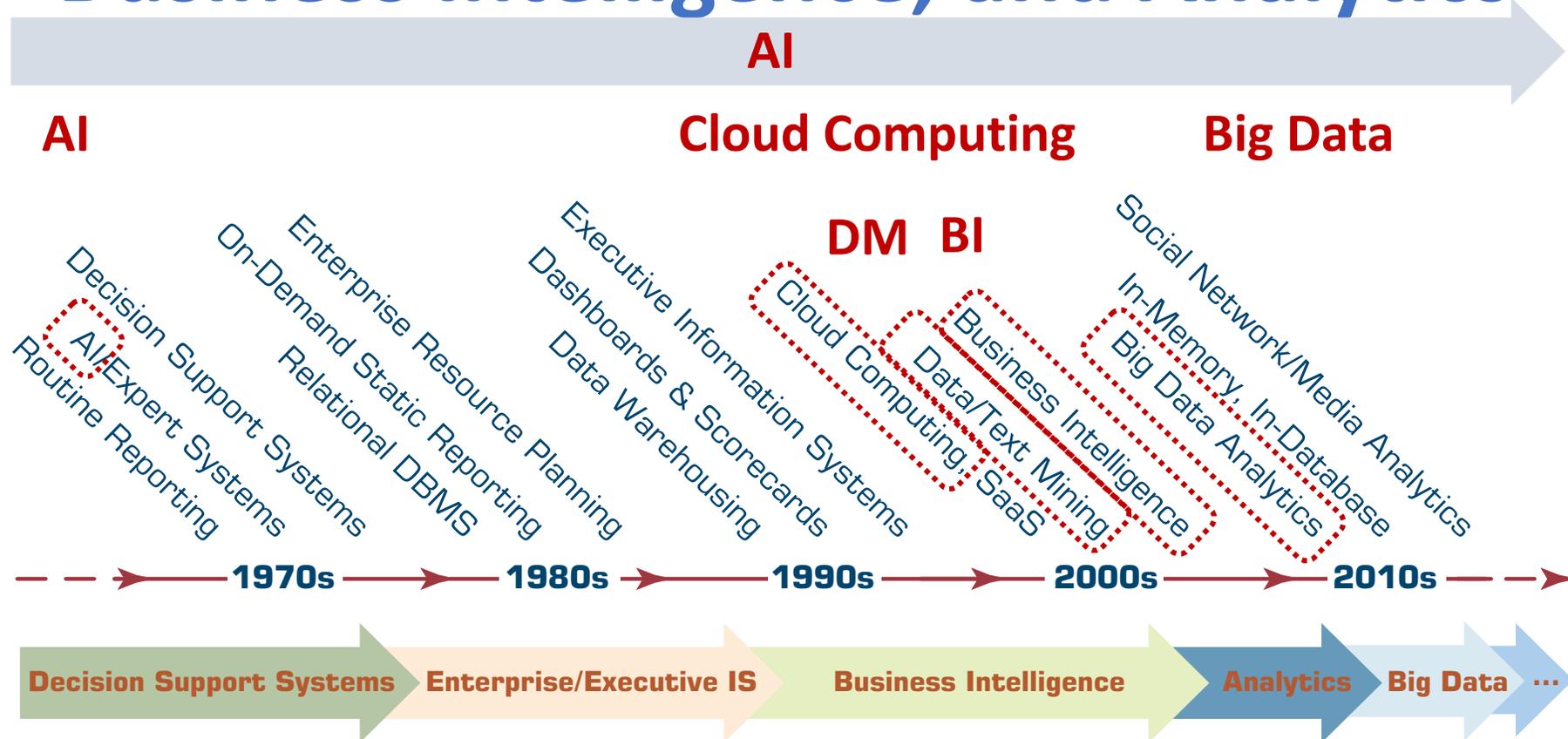
```
[ ] 1 np.random.seed(43)
2
3 series = generate_time_series(1, 50 + 10)
4 X_new, Y_new = series[:, :50, :], series[:, 50:, :]
5 Y_pred = model.predict(X_new)[:, -1][..., np.newaxis]
```

```
[ ] 1 plot_multiple_forecasts(X_new, Y_new, Y_pred)
2 plt.show()
```

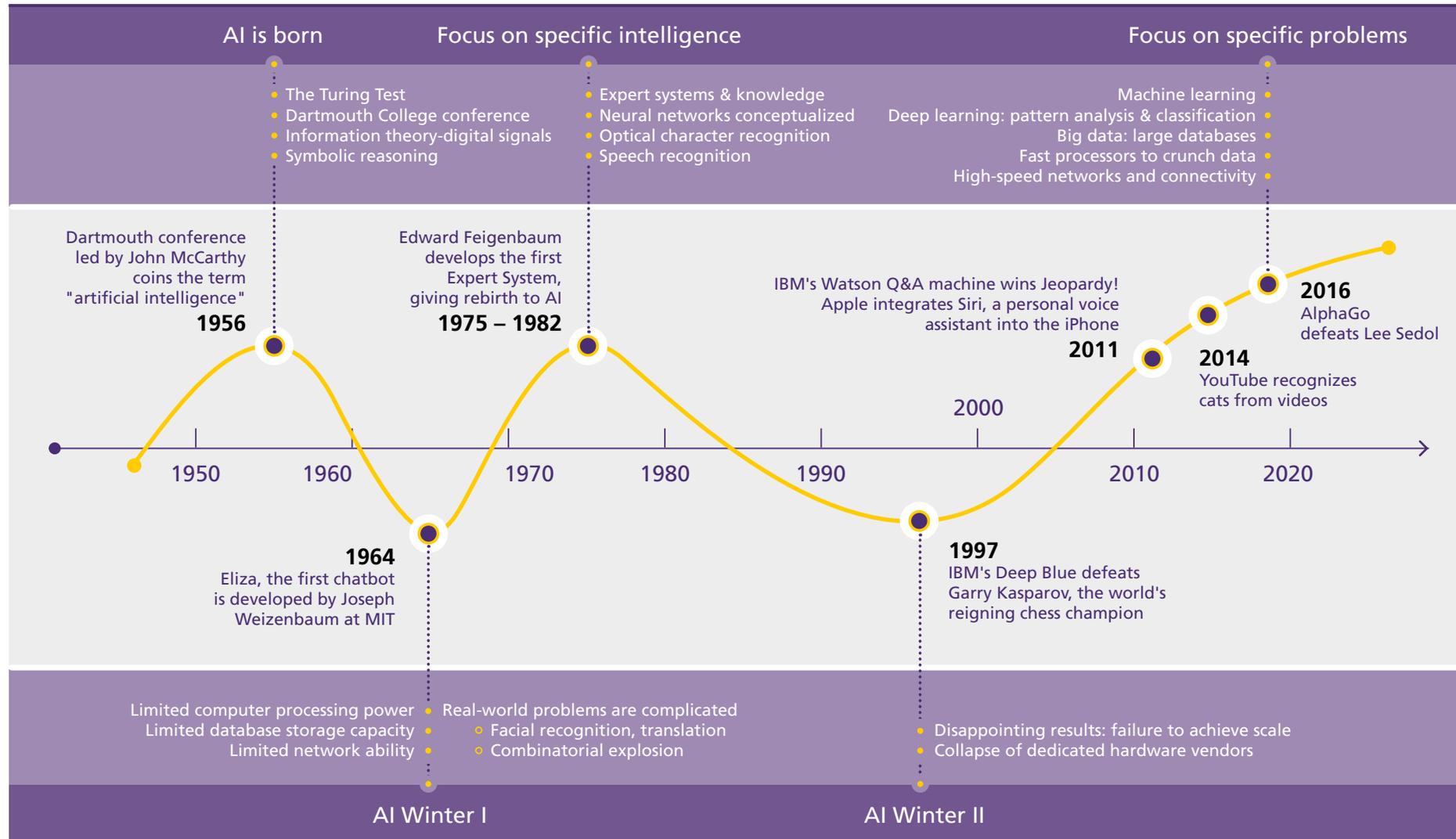


AI, Big Data, Cloud Computing

Evolution of Decision Support, Business Intelligence, and Analytics



The Rise of AI



FinTech

Financial Technology

FinTech



Financial Technology

FinTech

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

Financial Services

Financial Services



Financial Revolution with Fintech

A financial services revolution

Consumer Trends



1. Simplification



2. Transparency



3. Analytics



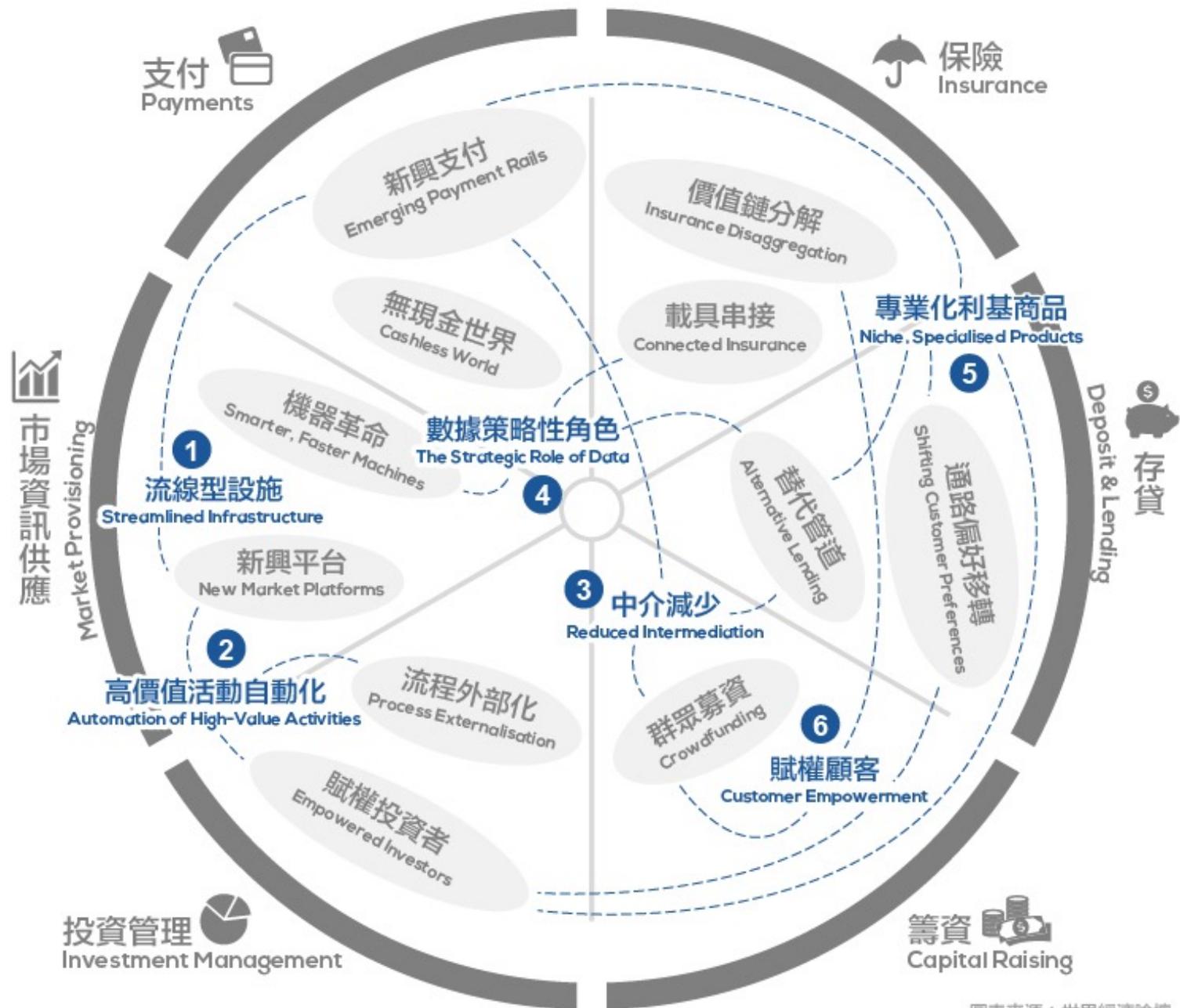
4. Reduced Friction

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

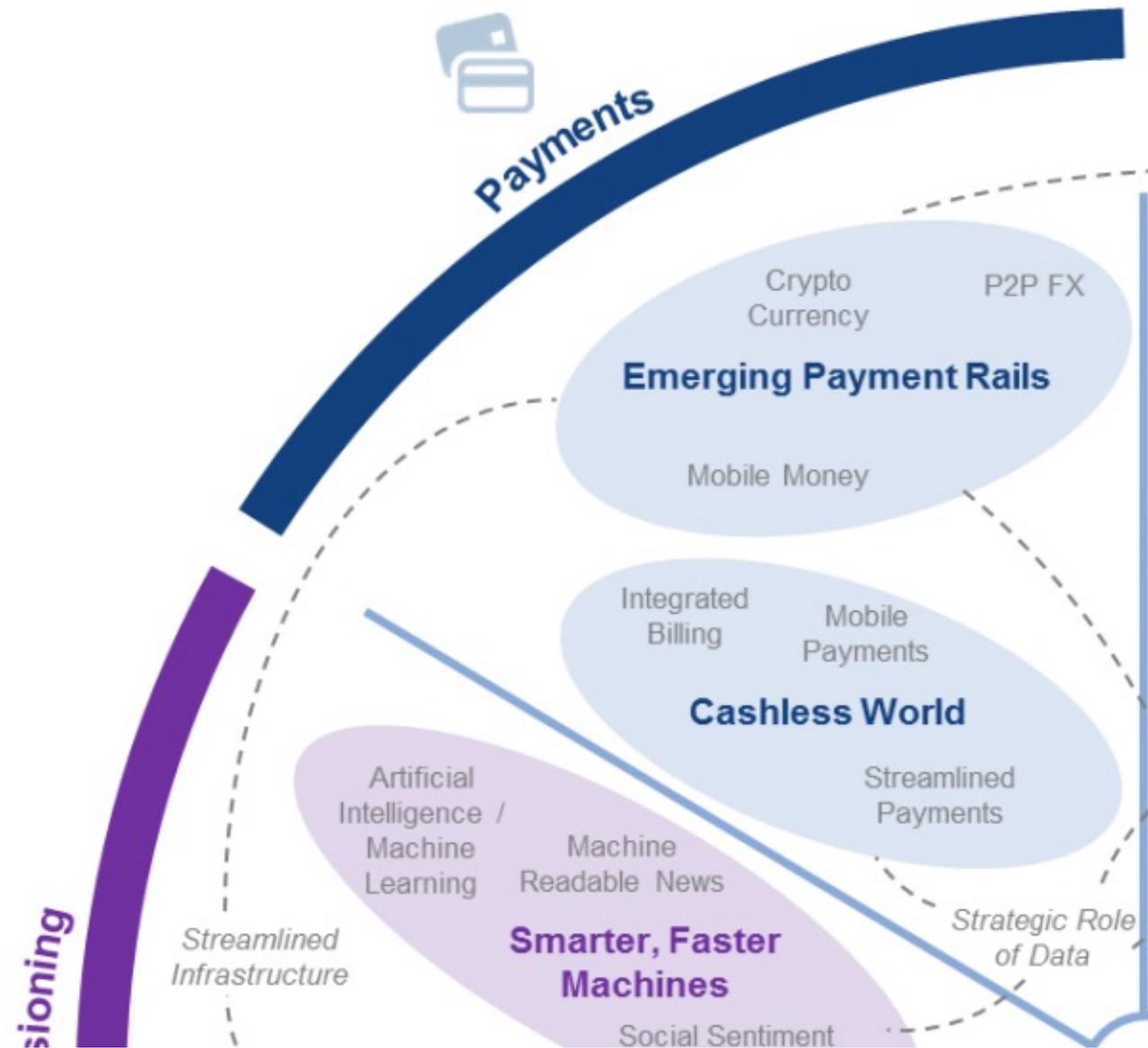
FinTech: Financial Services Innovation

| 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

1

FinTech: Payment



1

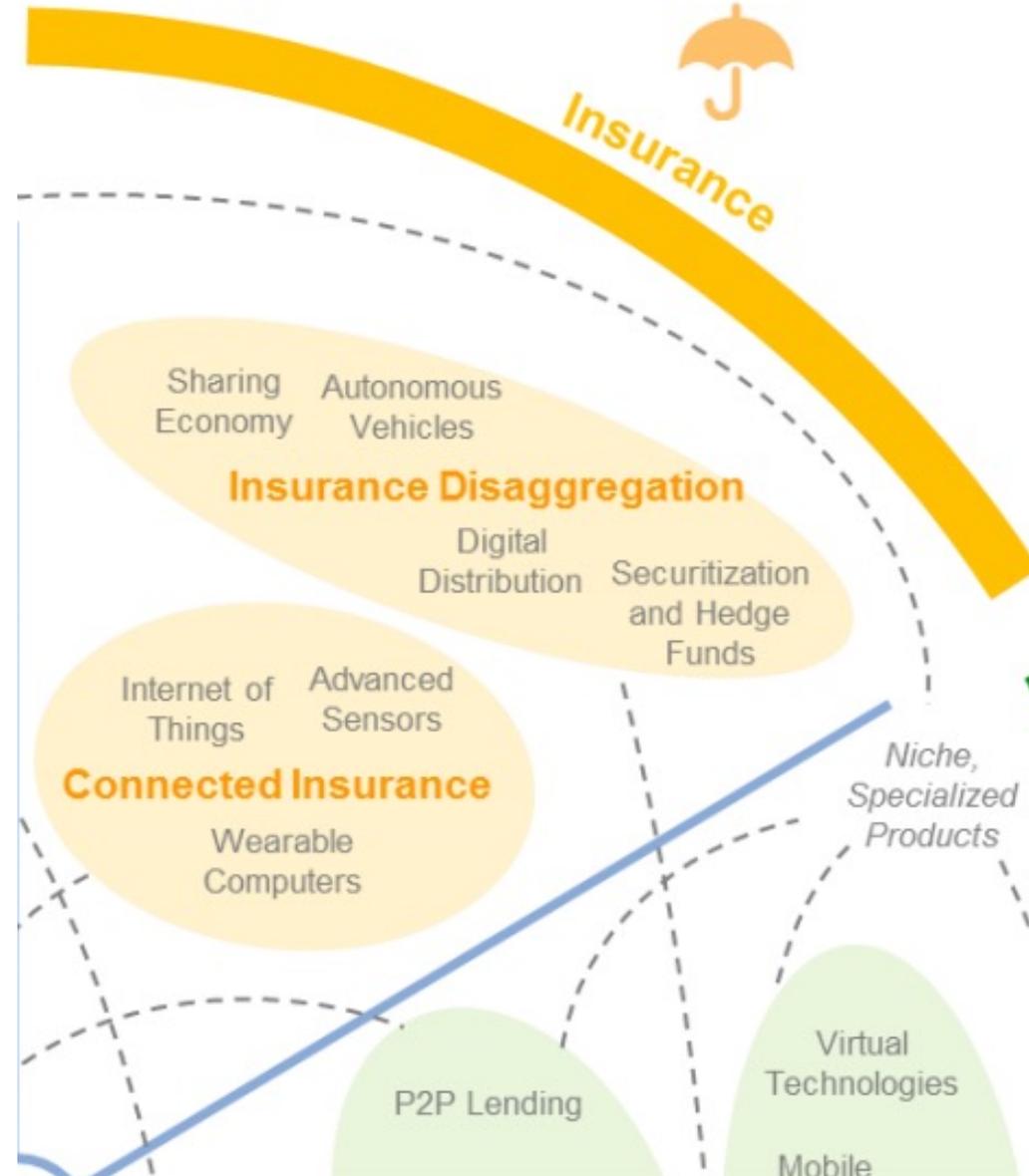
FinTech: Payment Cashless World Emerging Payment Rails



圖表來源：Fugle團隊整理

2

FinTech: Insurance



2

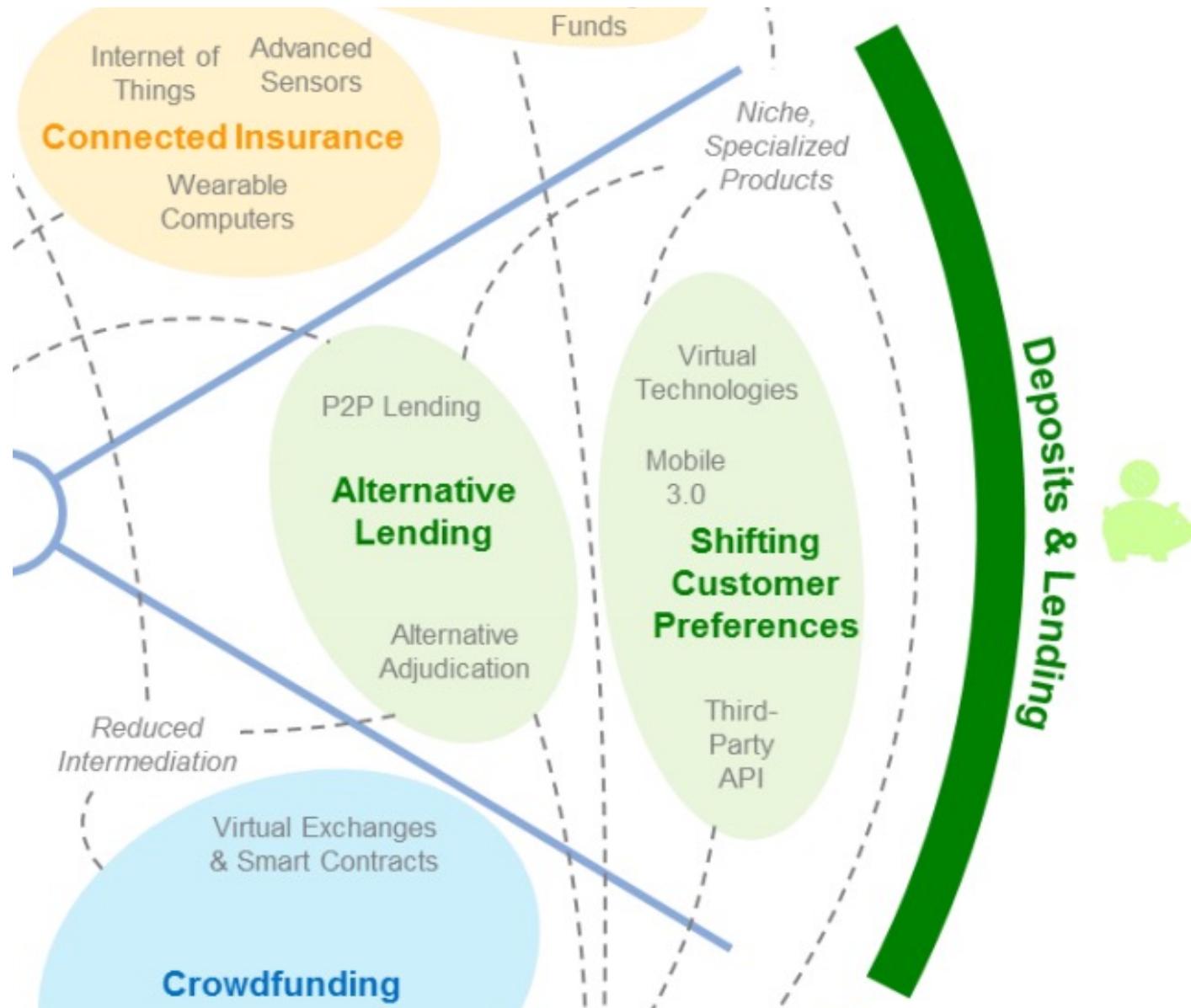
FinTech: Insurance Insurance Disaggregation Connected Insurance



圖表來源：Fugle團隊整理

3

FinTech: Deposits & Lending



3

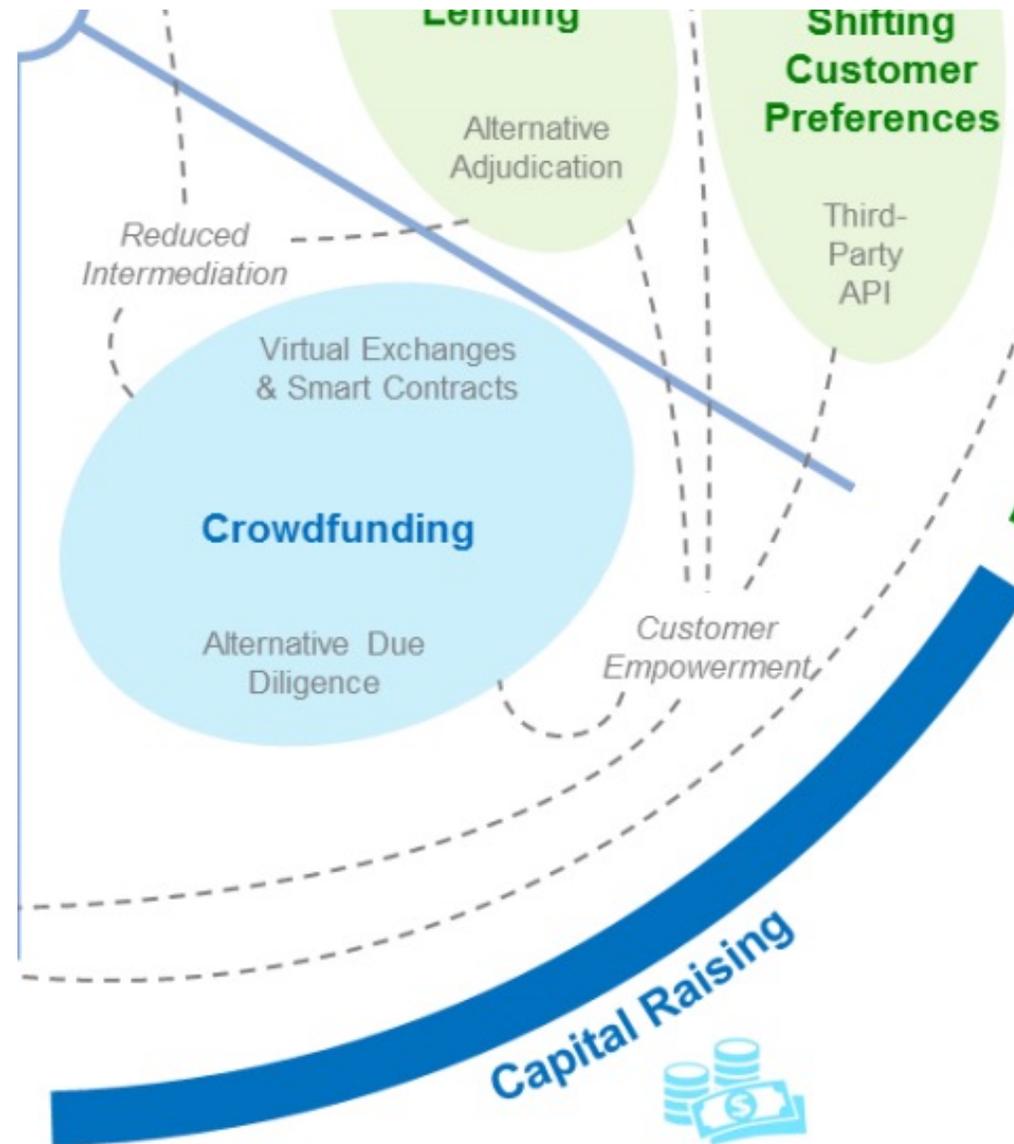
FinTech: Deposits & Lending Alternative Lending Shifting Customer Preferences



圖表來源：Fugle團隊整理

4

FinTech: Capital Raising



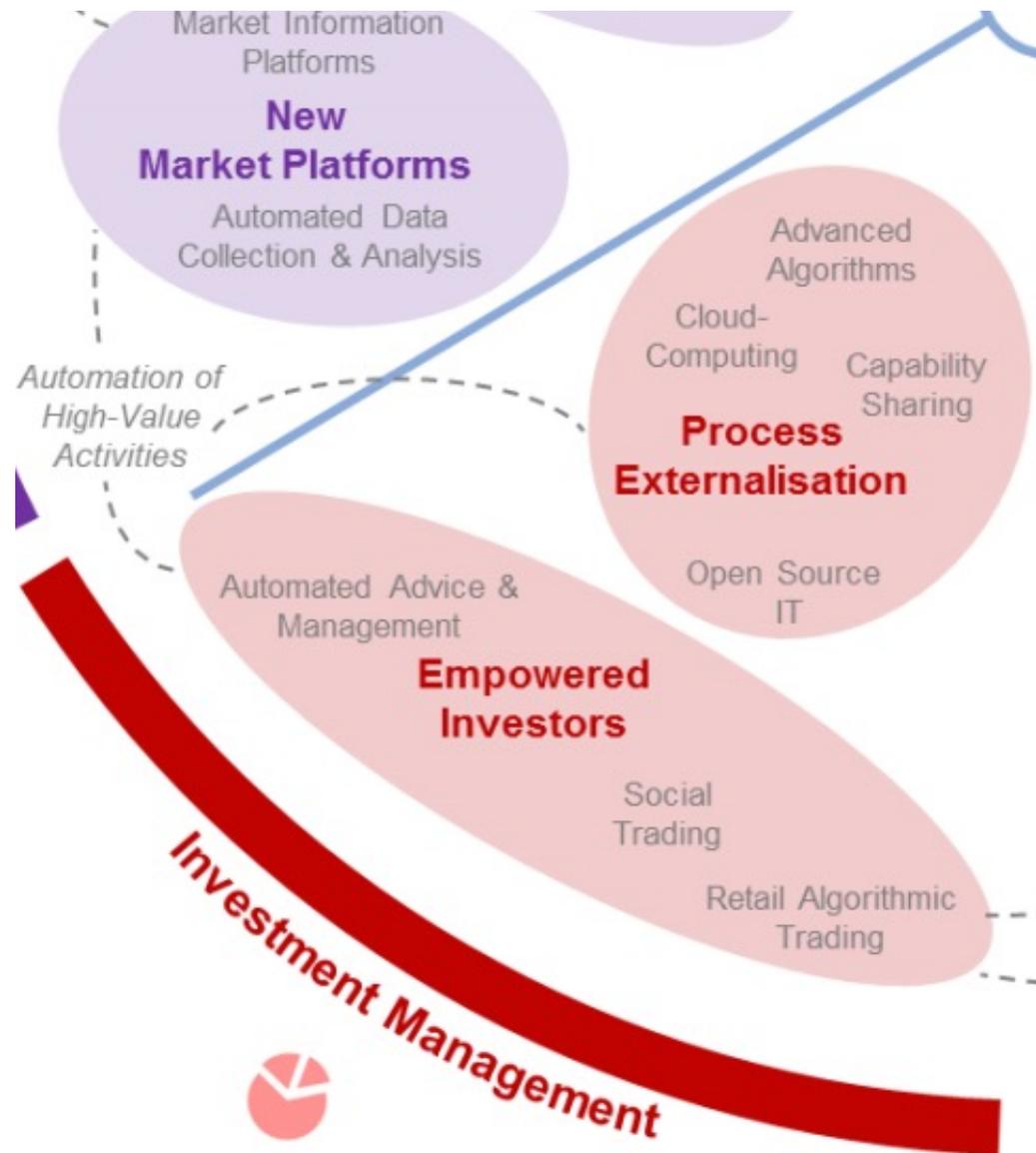
4

FinTech: Capital Raising Crowdfunding



圖表來源：Fugle團隊整理

5 FinTech: Investment Management



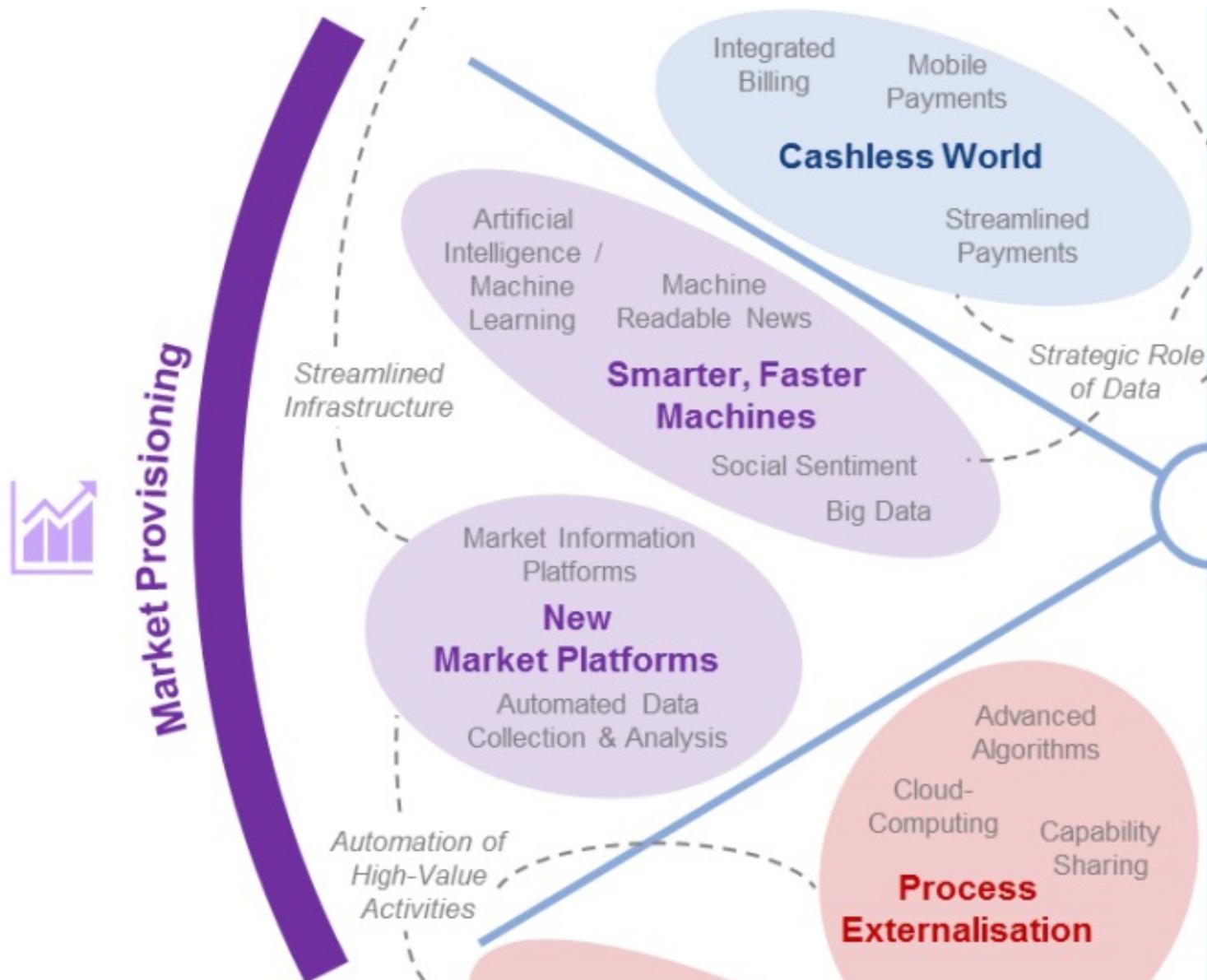
5 FinTech: Investment Management Empowered Investors Process Externalization



圖表來源：Fugle團隊整理

6

FinTech: Market Provisioning



6

FinTech: Market Provisioning Smarter, Faster Machines New Market Platforms



圖表來源：Fugle團隊整理

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

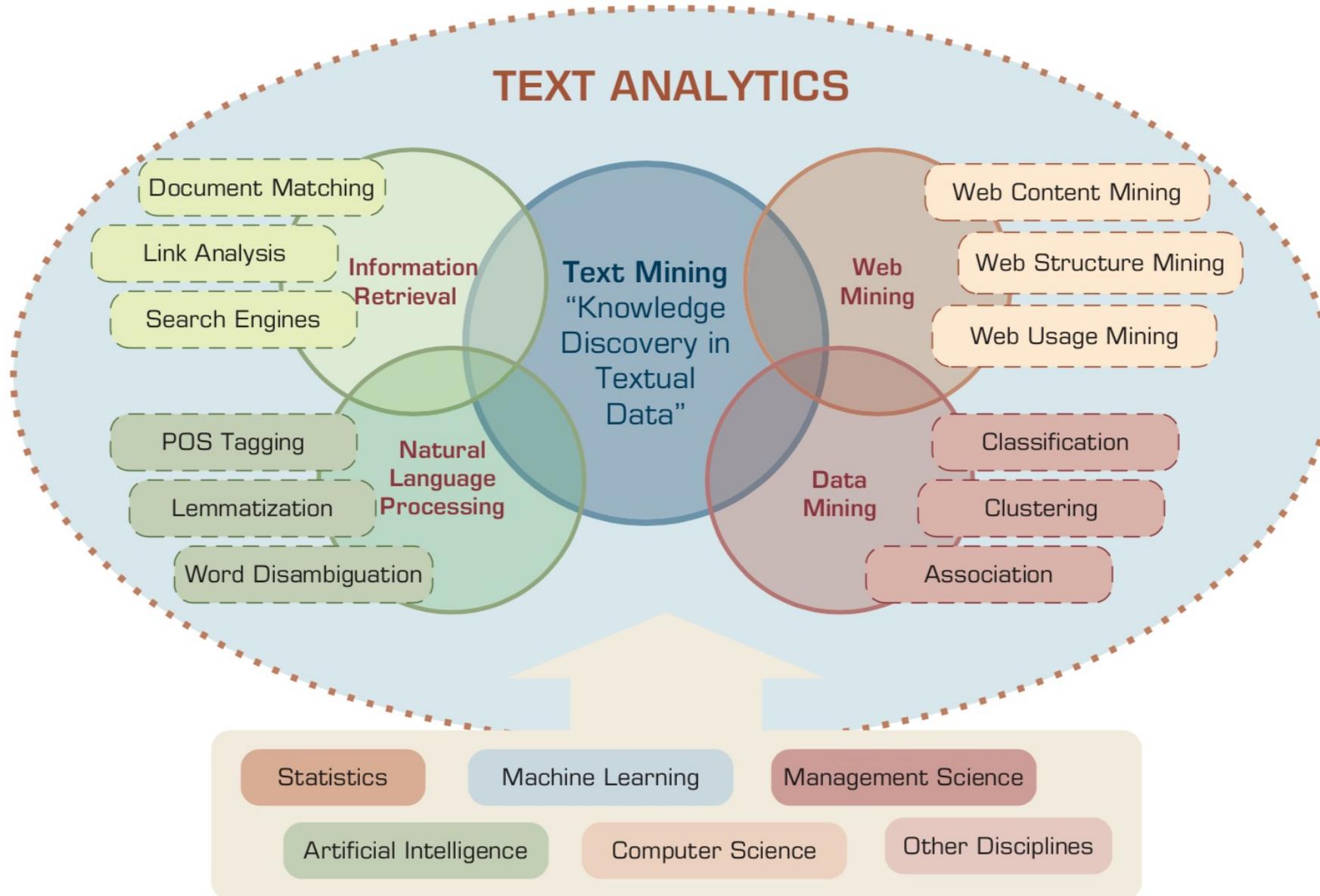
| | |
|---|---|
| <p>2. Thinking Humanly: The Cognitive Modeling Approach</p> | <p>3. Thinking Rationally: The “Laws of Thought” Approach</p> |
| <p>1. Acting Humanly: The Turing Test Approach (1950)</p> | <p>4. Acting Rationally: The Rational Agent Approach</p> |

AI Acting Humanly: The Turing Test Approach

(Alan Turing, 1950)

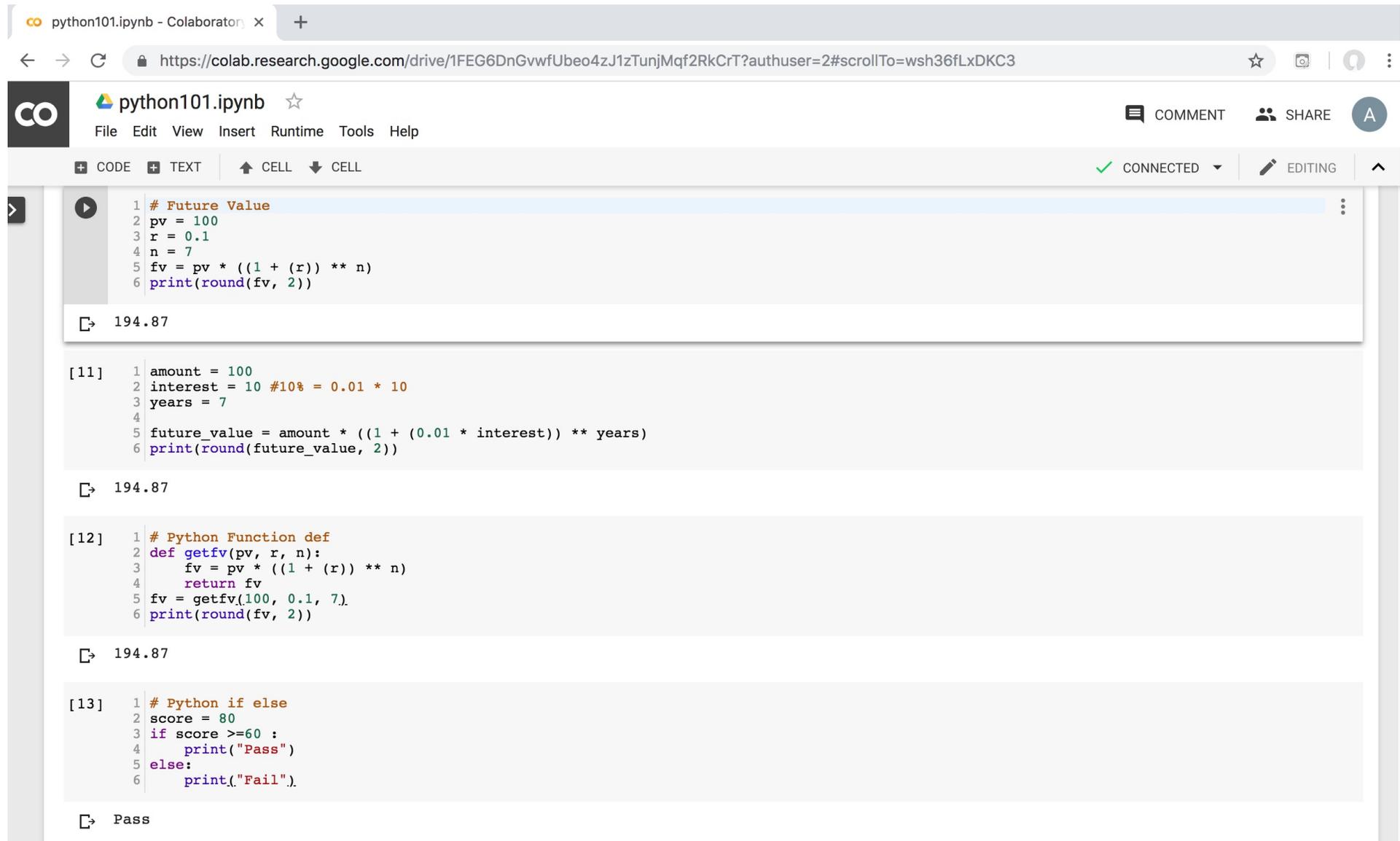
- Knowledge Representation
- Automated Reasoning
- Machine Learning (ML)
 - Deep Learning (DL)
- Computer Vision (Image, Video)
- Natural Language Processing (NLP)
- Robotics

Text Analytics and Text Mining



Python in Google Colab (Python101)

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



The screenshot shows a Google Colab notebook interface. The browser address bar displays the URL: <https://colab.research.google.com/drive/1FEG6DnGvwfUbeo4zJ1zTunjMqf2RkCrT?authuser=2#scrollTo=wsh36fLxDKC3>. The notebook title is "python101.ipynb". The interface includes a menu bar (File, Edit, View, Insert, Runtime, Tools, Help) and a toolbar with options for CODE, TEXT, CELL, and a status indicator showing "CONNECTED" and "EDITING".

The notebook contains four code cells, each followed by its output:

```
1 # Future Value
2 pv = 100
3 r = 0.1
4 n = 7
5 fv = pv * ((1 + (r)) ** n)
6 print(round(fv, 2))
```

194.87

```
[11] 1 amount = 100
     2 interest = 10 #10% = 0.01 * 10
     3 years = 7
     4
     5 future_value = amount * ((1 + (0.01 * interest)) ** years)
     6 print(round(future_value, 2))
```

194.87

```
[12] 1 # Python Function def
     2 def getfv(pv, r, n):
     3     fv = pv * ((1 + (r)) ** n)
     4     return fv
     5 fv = getfv(100, 0.1, 7).
     6 print(round(fv, 2))
```

194.87

```
[13] 1 # Python if else
     2 score = 80
     3 if score >=60 :
     4     print("Pass")
     5 else:
     6     print("Fail").
```

Pass

<https://tinyurl.com/aintpupython101>

教學 (Teaching)



- **智慧金融量化分析 (Artificial Intelligence in Finance and Quantitative)**
 - 國立臺北大學資管所碩士班 (Fall 2021)
- **人工智慧文本分析 (Artificial Intelligence for Text Analytics)**
 - 國立臺北大學資管所碩士班 (Spring 2022)
- **軟體工程 (Software Engineering)**
 - 國立臺北大學資管所碩士班 (電子商務碩士學分學程) (Fall 2020, Fall, 2021, Spring 2022)
- **人工智慧 (Artificial Intelligence)**
 - 國立臺北大學資管所碩士班 (Spring 2021)
- **資料探勘 (Data Mining)**
 - 國立臺北大學資管所碩士班 (電子商務碩士學分學程) (Spring 2021)
- **大數據分析 (Big Data Analytics)**
 - 國立臺北大學資管所碩士班 (Fall 2020)
- **企業雲端運算入門 (Foundation of Business Cloud Computing)**
 - 國立臺北大學企管系 (Spring 2021)

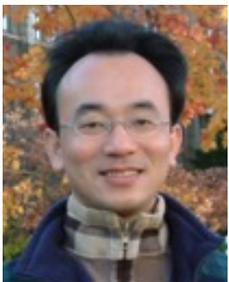
研究計畫 (Research Project)



- **應用 AI 技術建構加密貨幣反洗錢知識圖譜：少樣本學習模型**
(Applying AI technology to construct knowledge graphs of cryptocurrency anti-money laundering: a few-shot learning model)
 - 科技部 (人文司 - 商事財經法) ， 110-2410-H-305-013-MY2 ， 2021/08/01~2023/07/31
[核定經費(新台幣)：1,022,000]
- **企業永續動機、價值攸關性與人工智慧於企業永續績效評比之應用**
(Corporate Sustainability: Motivations, Value Relevance, and the Application of AI in the Assessment)：
 - **子計畫二：人工智慧 AI 於企業永續評比之應用**
(An application of artificial intelligence (AI) in the corporate sustainability assessment)
 - 國立臺北大學 ， 110-NTPU_ORDA-F-001 ， 2021/01/01~2021/12/31

Summary

- This course introduces the **fundamental concepts, research issues, and hands-on practices of AI in Finance and Quantitative Analysis.**
- Topics include:
 1. Introduction to Artificial Intelligence in Finance and Quantitative Analysis,
 2. AI in FinTech: Financial Services Innovation and Application,
 3. Investing Psychology and Behavioral Finance,
 4. Event Studies in Finance,
 5. Finance Theory,
 6. Data-Driven Finance,
 7. Financial Econometrics,
 8. AI-First Finance,
 9. Deep Learning in Finance, Reinforcement Learning in Finance,
 10. Algorithmic Trading, Risk Management, Trading Bot and Event-Based Backtesting,
 11. Case Study on AI in Finance and Quantitative Analysis.



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智慧金融量化分析

(Artificial Intelligence in Finance and Quantitative Analysis)



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