



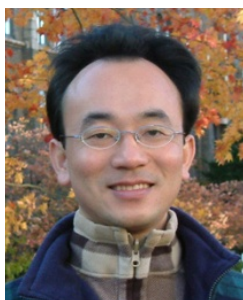
Tamkang
University
淡江大學

AI 人工智慧理財機器人 (AI Robo-Advisors)

主持人：汪志堅 教授、楊運秀 教授
電子商務

時間：2017/11/20 19:00-21:00

地點：國立台北大學電子商務碩士學程
民生東路教學大樓719教室



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2017-11-20





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國立台灣大學資訊管理博士

Publications Co-Chairs, IEEE/ACM International Conference on
Advances in Social Networks Analysis and Mining (ASONAM 2013-)

Program Co-Chair, IEEE International Workshop on
Empirical Methods for Recognizing Inference in Text (IEEE EM-RITE 2012-)

Workshop Chair, The IEEE International Conference on
Information Reuse and Integration (IEEE IRI)



Outline

- Introduction to Artificial Intelligence (AI)
- AI in FinTech
- Conversational Commerce
- Robo-Advisors

Artificial Intelligence (AI)

Robo-Advisors

Investment Analysis

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

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Credit Scoring



Blockchain



Debt Collection



Fraud Detection



Personal Banking



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>Thinking Humanly</p> <p>“The exciting new effort to make computers think . . . <i>machines with minds</i>, in the full and literal sense.” (Haugeland, 1985)</p> <p>“[The automation of] activities that we associate with human thinking, activities such as decision-making, problem solving, learning . . .” (Bellman, 1978)</p>	<p>Thinking Rationally</p> <p>“The study of mental faculties through the use of computational models.” (Charniak and McDermott, 1985)</p> <p>“The study of the computations that make it possible to perceive, reason, and act.” (Winston, 1992)</p>
<p>Acting Humanly</p> <p>“The art of creating machines that perform functions that require intelligence when performed by people.” (Kurzweil, 1990)</p> <p>“The study of how to make computers do things at which, at the moment, people are better.” (Rich and Knight, 1991)</p>	<p>Acting Rationally</p> <p>“Computational Intelligence is the study of the design of intelligent agents.” (Poole <i>et al.</i>, 1998)</p> <p>“AI . . . is concerned with intelligent behavior in artifacts.” (Nilsson, 1998)</p>

4 Approaches of AI

1.

**Thinking Humanly:
The Turing Test
Approach**

3.

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

2.

**Acting Humanly:
The Cognitive Modeling
Approach**

4.

**Acting Rationally:
The Rational Agent
Approach**

AI Thinking Humanly: The Turing Test Approach

(Alan Turing, 1950)

- **Natural Language Processing (NLP)**
- **Knowledge Representation**
- **Automated Reasoning**
- **Machine Learning (ML)**
- **Computer Vision**
- **Robotics**

Boston Dynamics: Atlas



#13 ON TRENDING

What's new, Atlas?

<https://www.youtube.com/watch?v=fRj34o4hN4I>

Humanoid Robot: Sophia



<https://www.youtube.com/watch?v=S5t6K9iwcdw>

Artificial Intelligence (A.I.) Timeline

A.I. TIMELINE

SYZYG

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

1955

A.I. BORN

Term 'artificial intelligence' is coined by computer scientist, John McCarthy to describe "the science and engineering of making intelligent machines"

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

SHAKY

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

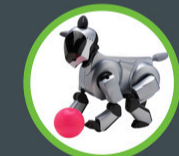
DEEP BLUE

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

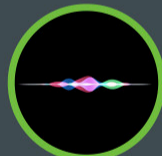
Sony launches first consumer robot pet dog AiBO (AI robot) with skills and personality that develop over time



2002

ROOMBA

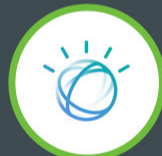
First mass produced autonomous robotic vacuum cleaner from iRobot learns to navigate and clean homes



2011

SIRI

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



2011

WATSON

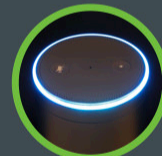
IBM's question answering computer Watson wins first place on popular \$1M prize television quiz show Jeopardy



2014

EUGENE

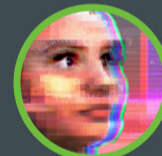
Eugene Goostman, a chatbot passes the Turing Test with a third of judges believing Eugene is human



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

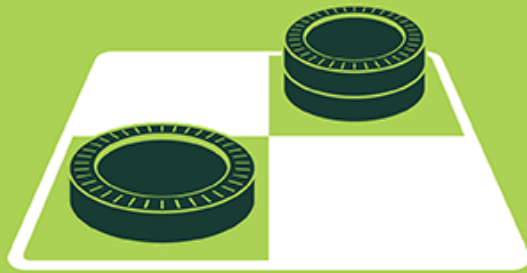
Google's A.I. AlphaGo beats world champion Ke Jie in the complex board game of Go, notable for its vast number (2^{170}) of possible positions

Artificial Intelligence

Machine Learning & Deep Learning

ARTIFICIAL INTELLIGENCE

Early artificial intelligence stirs excitement.



MACHINE LEARNING

Machine learning begins to flourish.



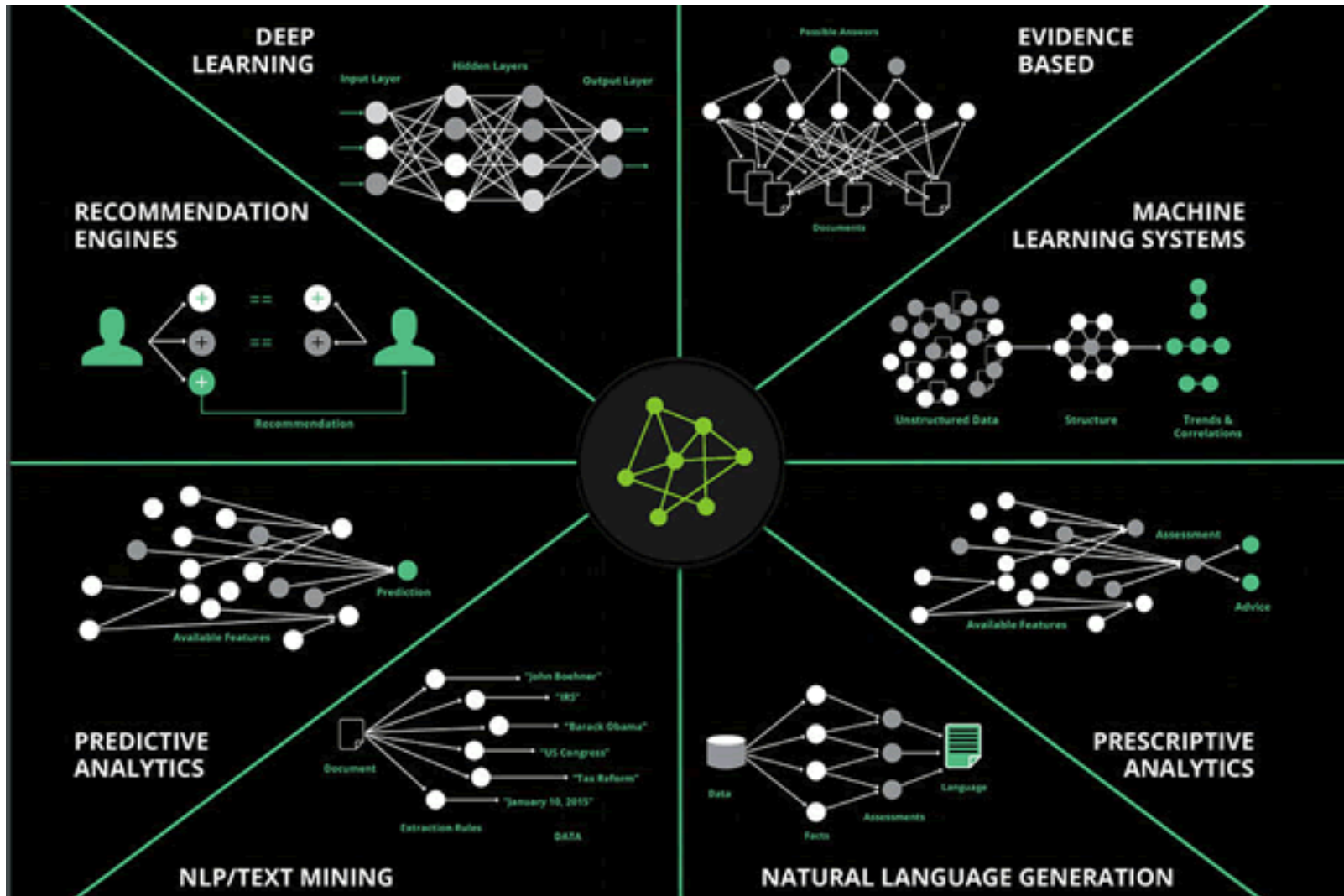
DEEP LEARNING

Deep learning breakthroughs drive AI boom.



Since an early flush of optimism in the 1950s, smaller subsets of artificial intelligence – first machine learning, then deep learning, a subset of machine learning – have created ever larger disruptions.

Artificial Intelligence (AI) is many things

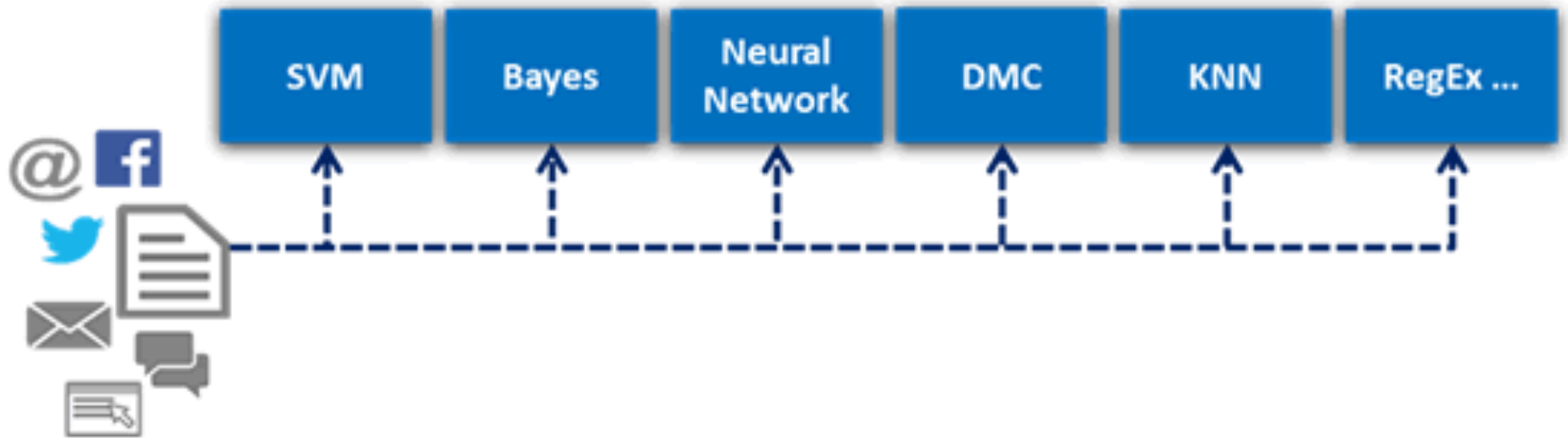


Ecosystem of AI

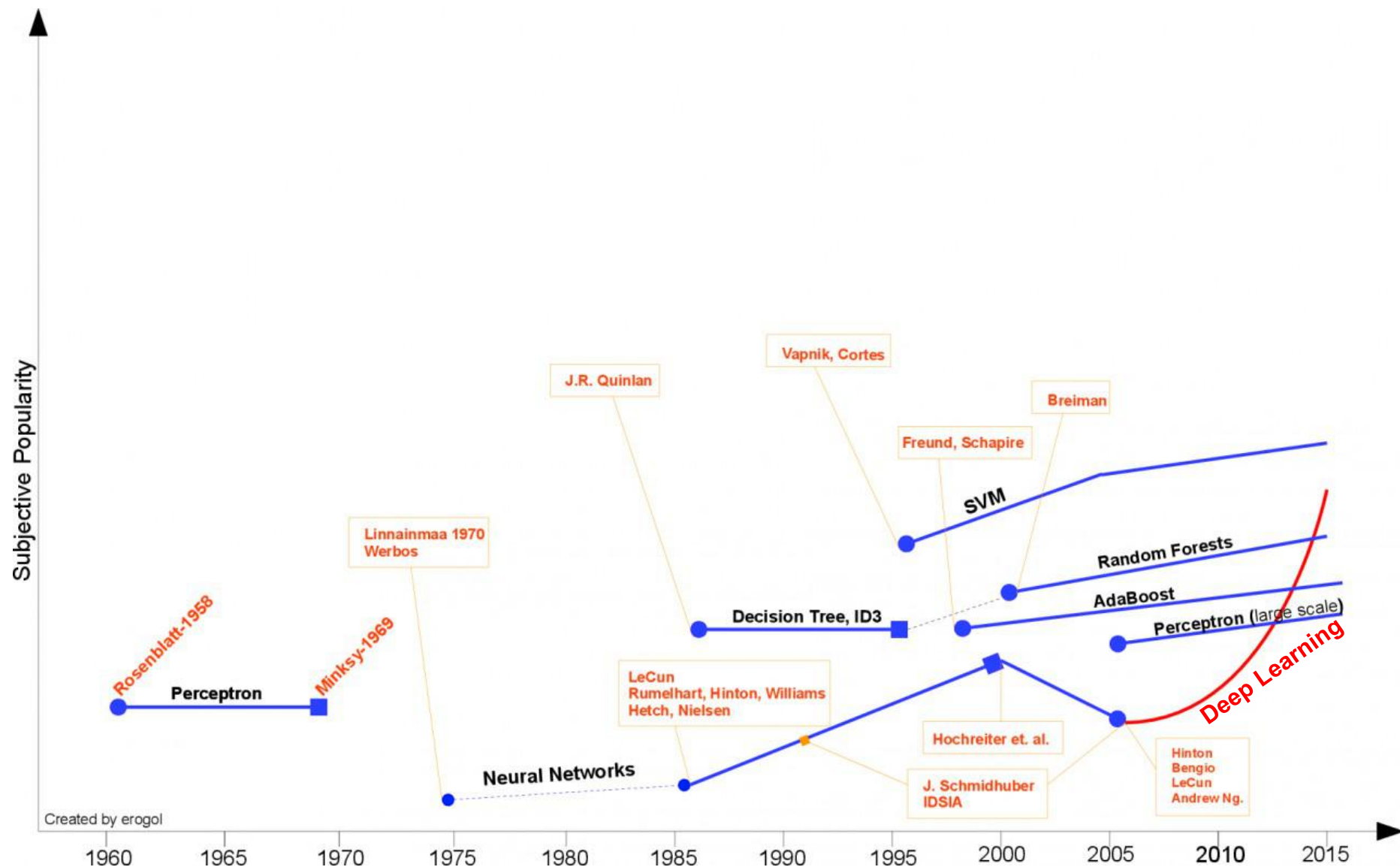
Source: <https://www.i-scoop.eu/artificial-intelligence-cognitive-computing/>

Artificial Intelligence (AI)

Intelligent Document Recognition algorithms



Deep Learning Evolution



AI and Cognitive Computing

AI in FinTech

AI and Big Data Analytics in Finance

- 財務金融大數據分析
 - Big Data Analytics in Finance
- 投資大數據分析
 - Big Data Analytics in Investment
- 人工智慧與財務應用
 - Artificial Intelligence and Financial Application
- 人工智慧與投資分析
 - Artificial Intelligence and Investment Analysis

FinTech

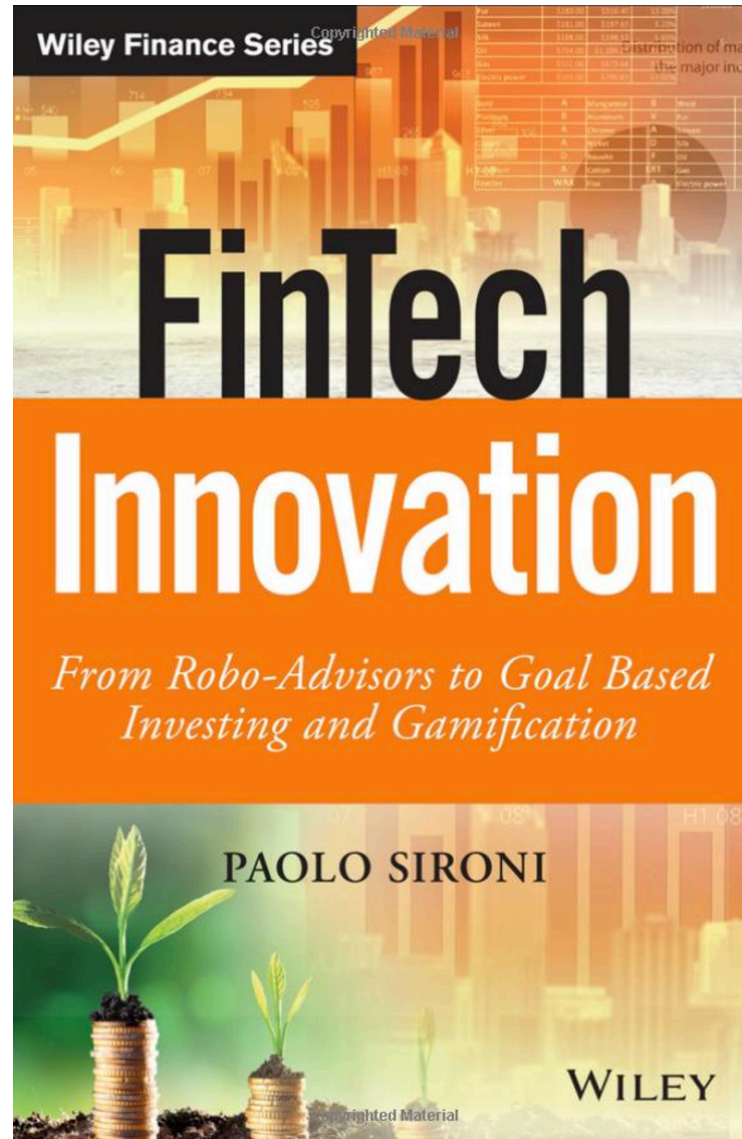
Financial Technology

The FINTECH Book: The Financial Technology Handbook for Investors, Entrepreneurs and Visionaries,

Susanne Chishti and Janos Barberis, Wiley, 2016.



FinTech Innovation:
From Robo-Advisors to Goal Based Investing and Gamification,
Paolo Sironi, Wiley, 2016



FinTech



Financial Technology

FinTech

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

Financial Services

Money

Market

Financial Services



Financial Revolution with Fintech

A financial services revolution

Consumer Trends



1. Simplification



2. Transparency



3. Analytics



4. Reduced Friction

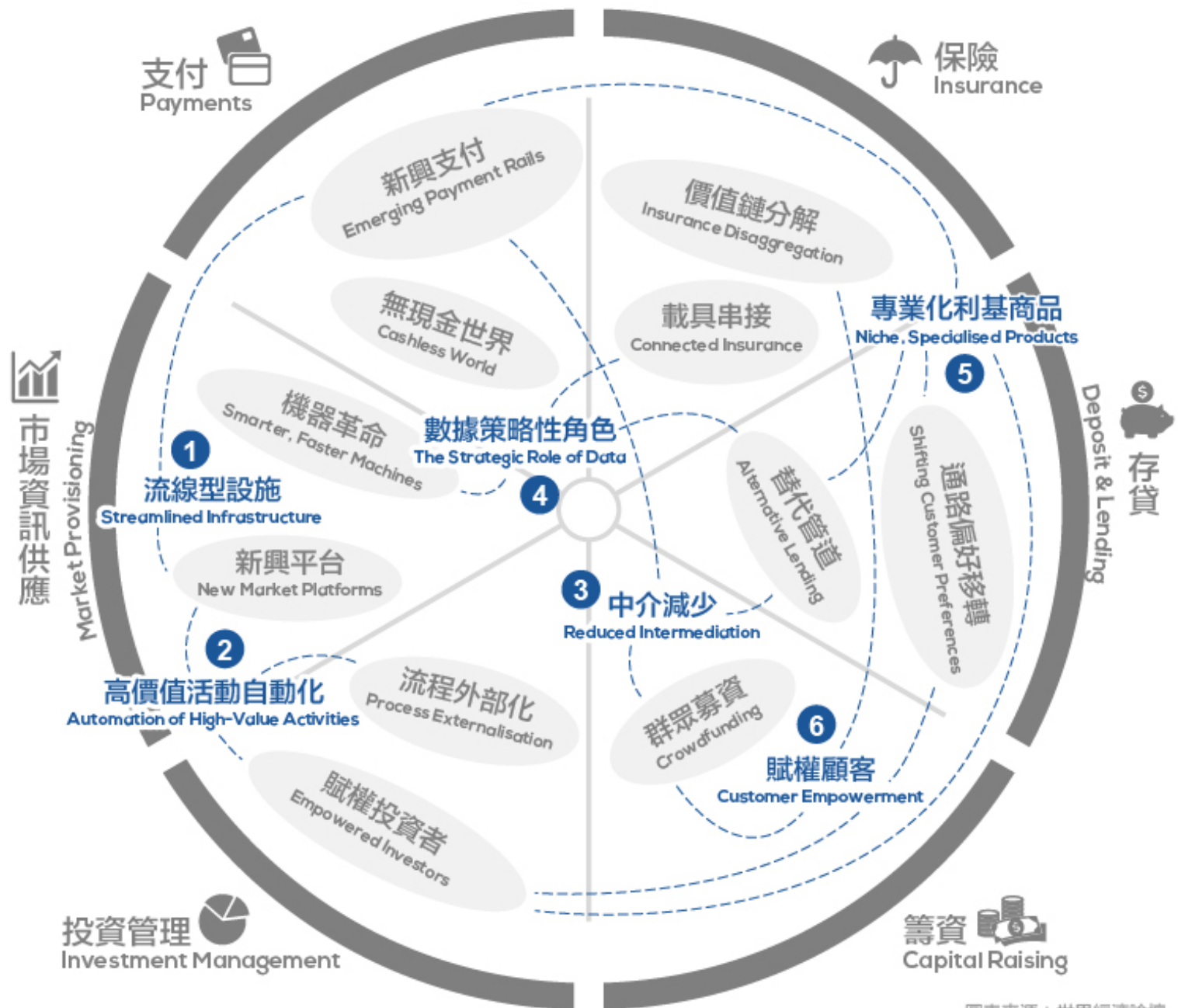
FinTech: Financial Services Innovation



FinTech:



Financial Services Innovation

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



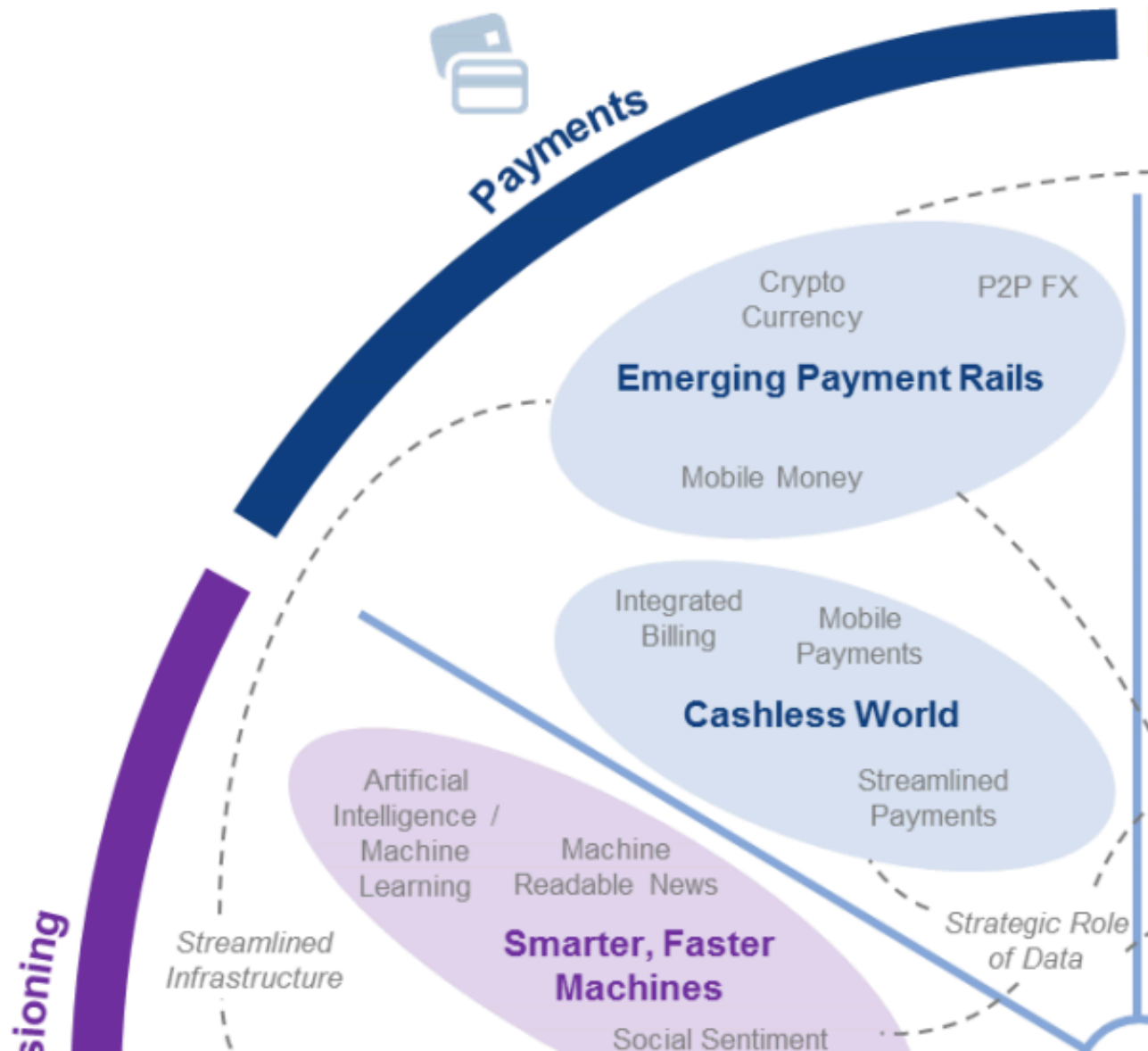
圖表來源：世界經濟論壇

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

FinTech: Payment

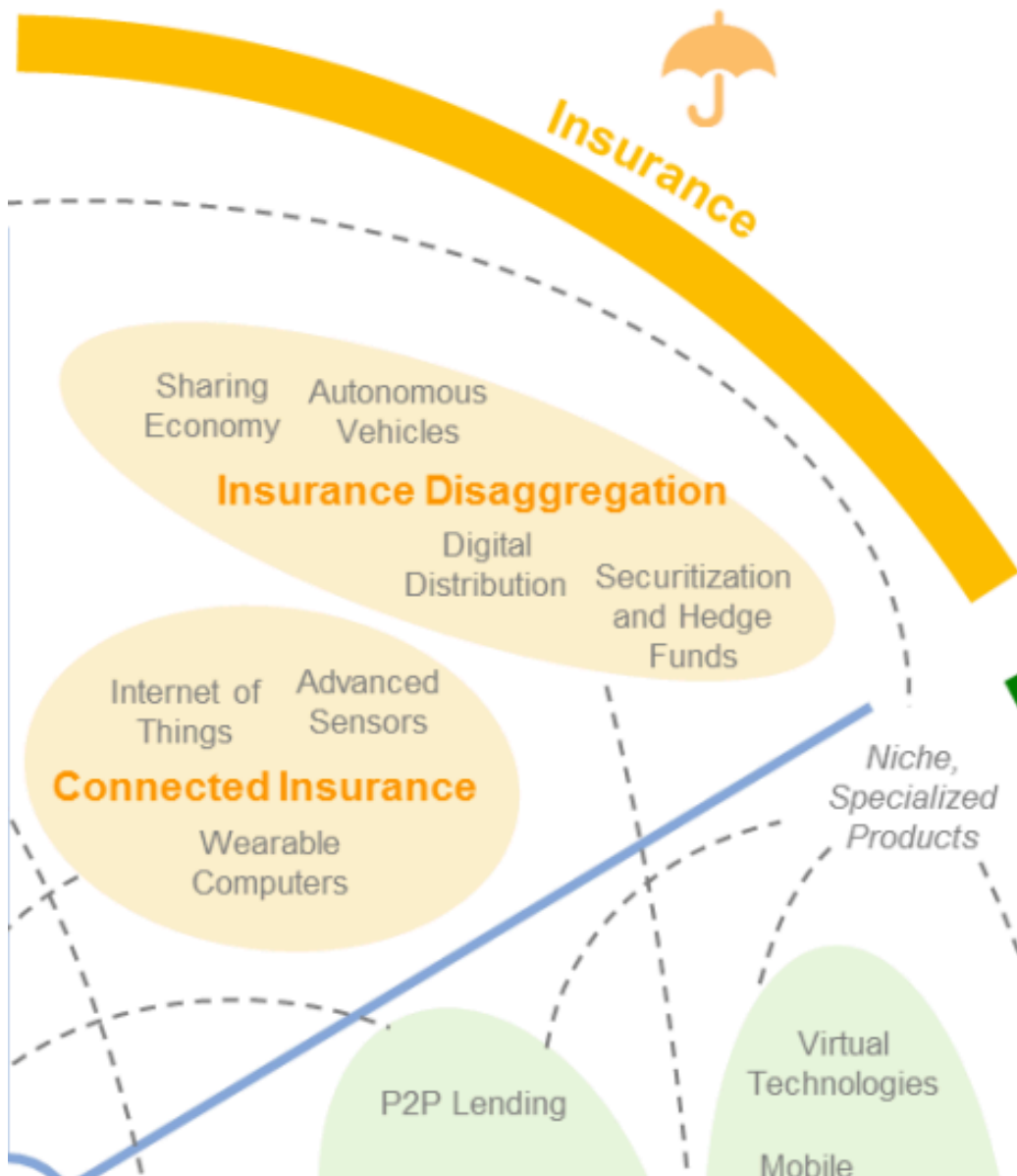


FinTech: Payment Cashless World Emerging Payment Rails



圖表來源：Fugle團隊整理

FinTech: Insurance



FinTech: Insurance

Insurance Disaggregation

Connected Insurance

保險



創新

關鍵趨勢

價值鏈裂解
Insurance
Disaggregation

裂解分佈 (Disaggregated Distribution)、共享
經濟、第三方資本、自動駕駛車

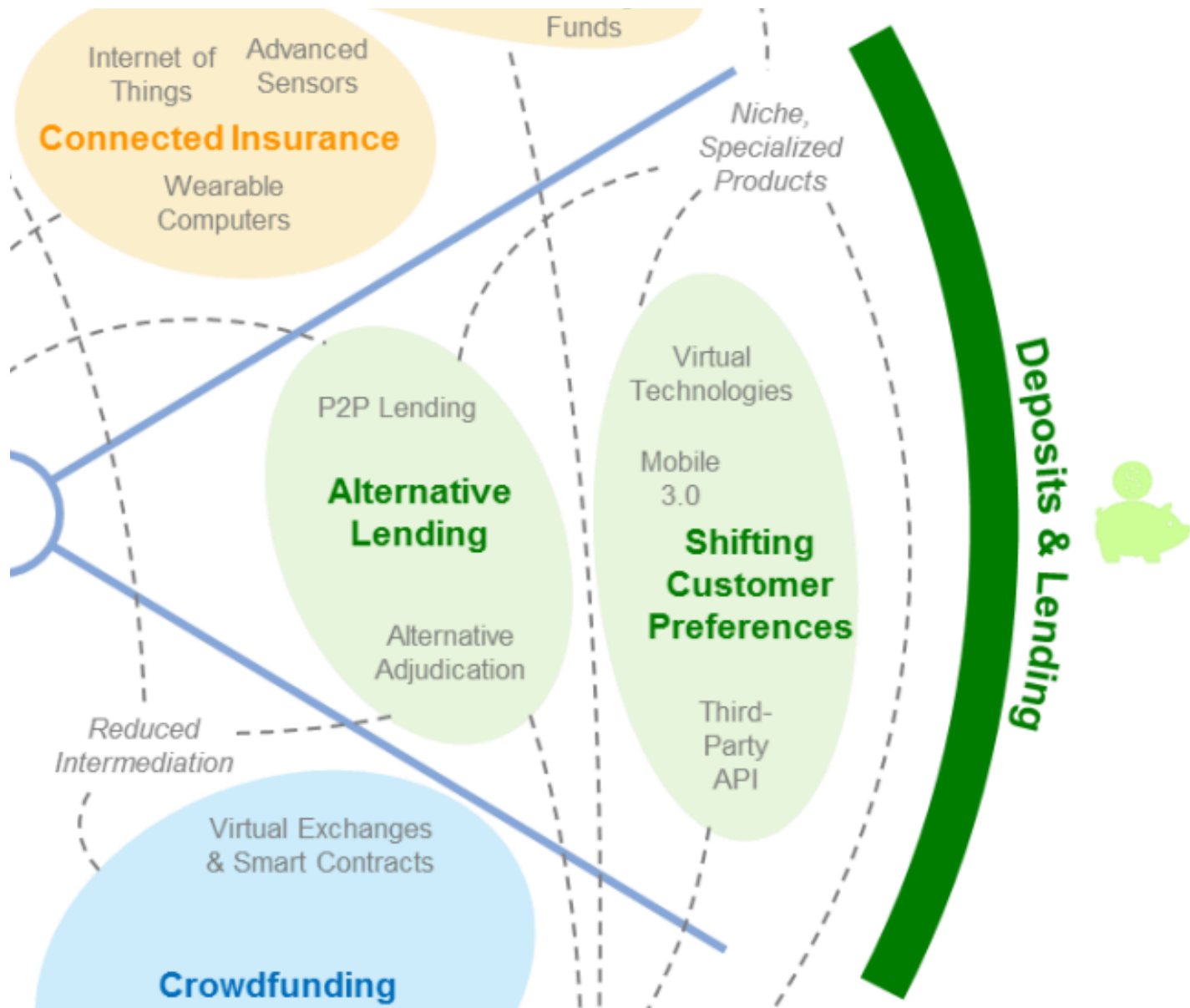
保險串接裝置
Connected
Insurance

高性價比感測器、穿戴式裝置、物聯網、標
準化平台

圖表來源：Fugle團隊整理

3

FinTech: Deposits & Lending



3

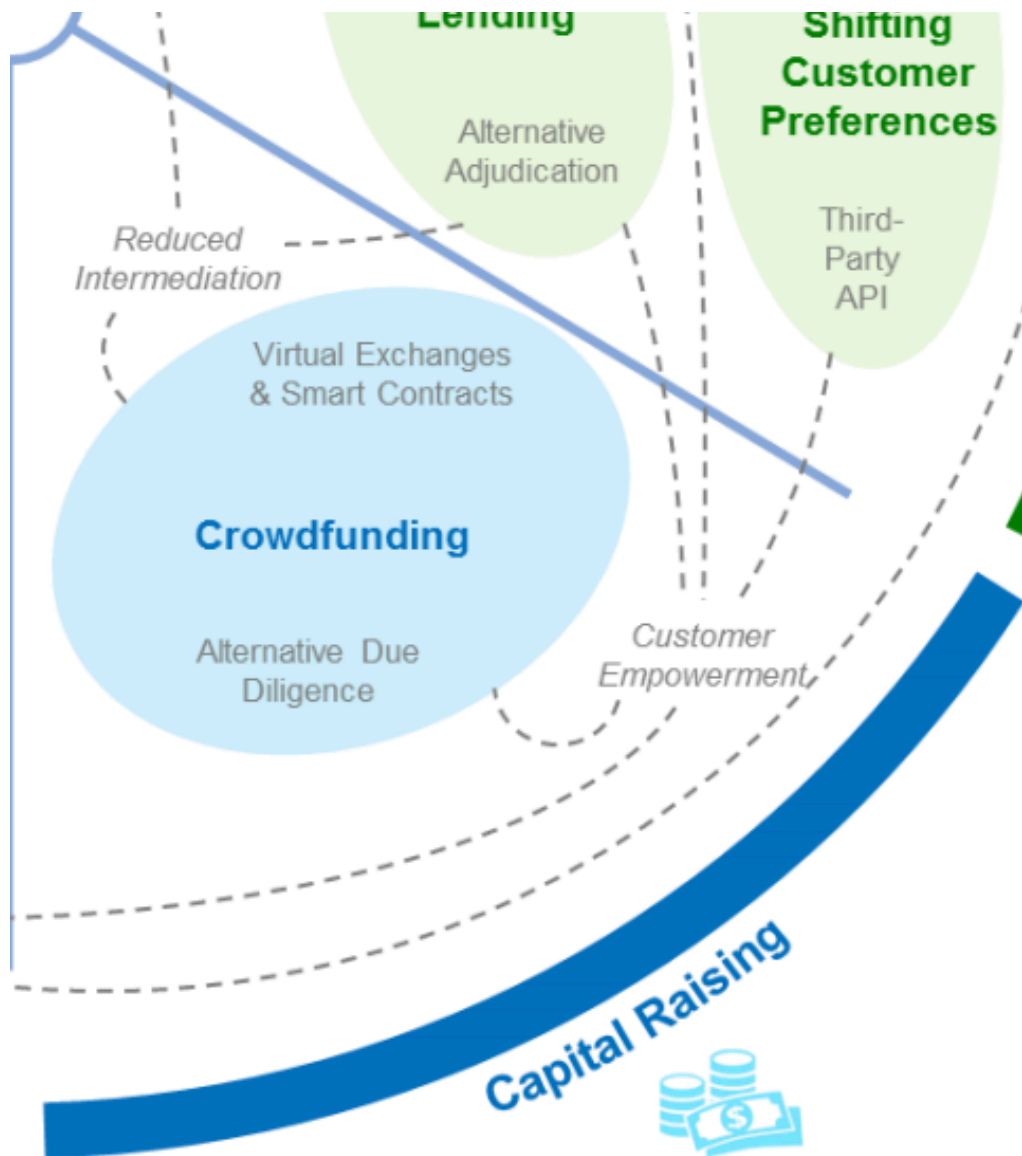
FinTech: Deposits & Lending Alternative Lending Shifting Customer Preferences



圖表來源：Fugle團隊整理

4

FinTech: Capital Raising



4

FinTech: Capital Raising Crowdfunding

籌資



創新

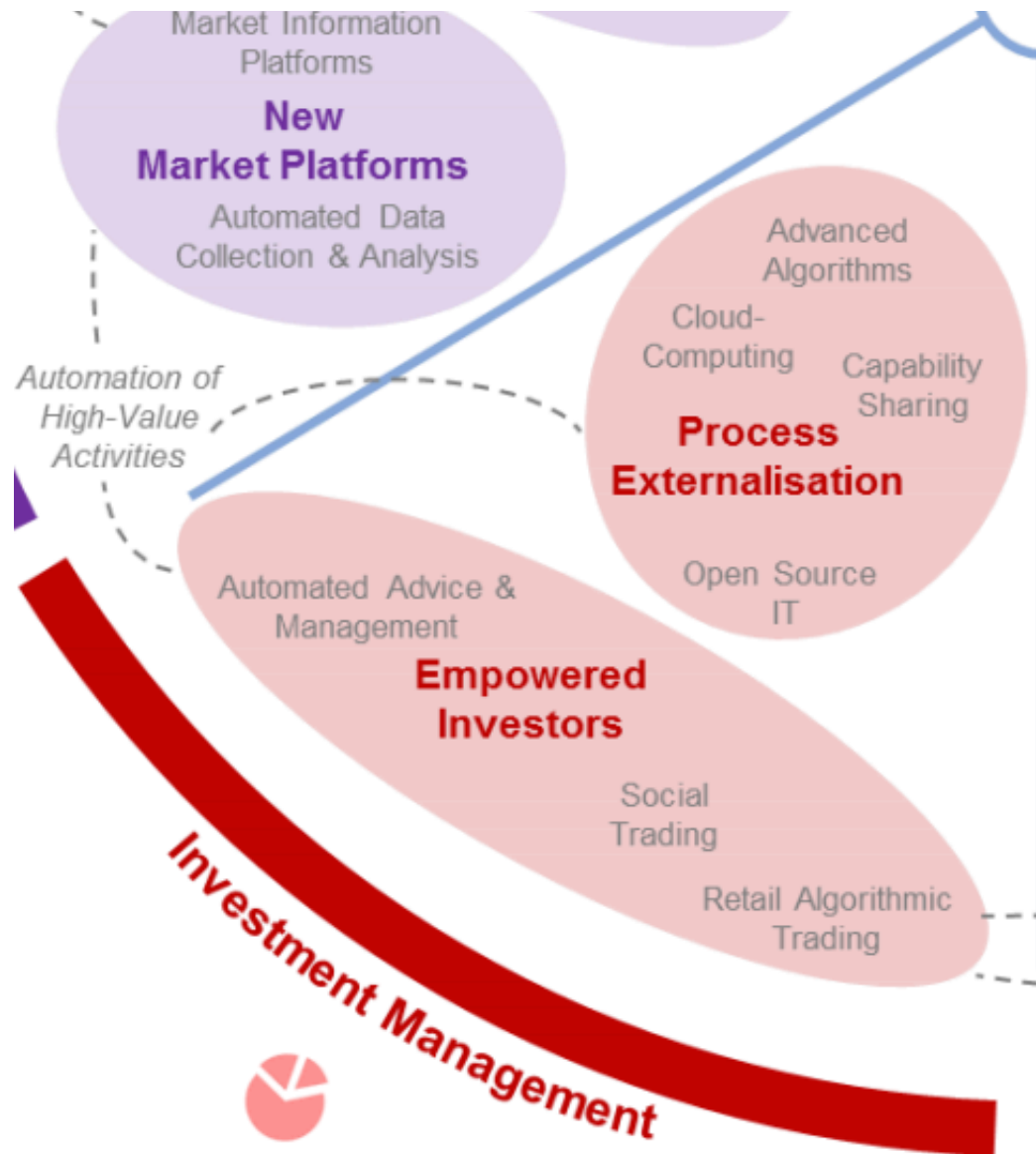
關鍵趨勢

群眾募資
Crowdfunding

另類仲裁 (Alternative Adjudication)、賦權天
使投資者 (Empowered Angel Investors)

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)

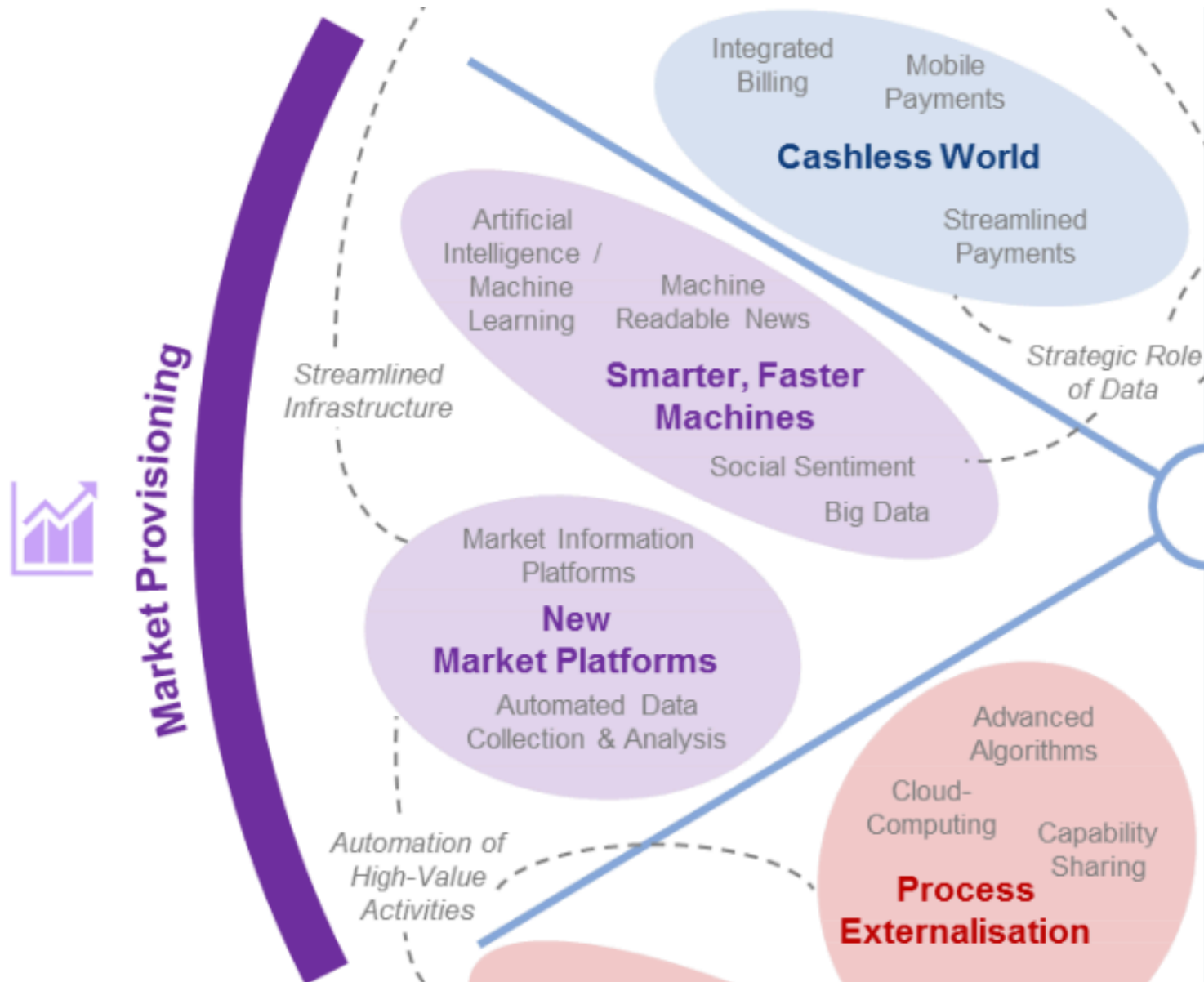
流程外部化
Process
Externalisation

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

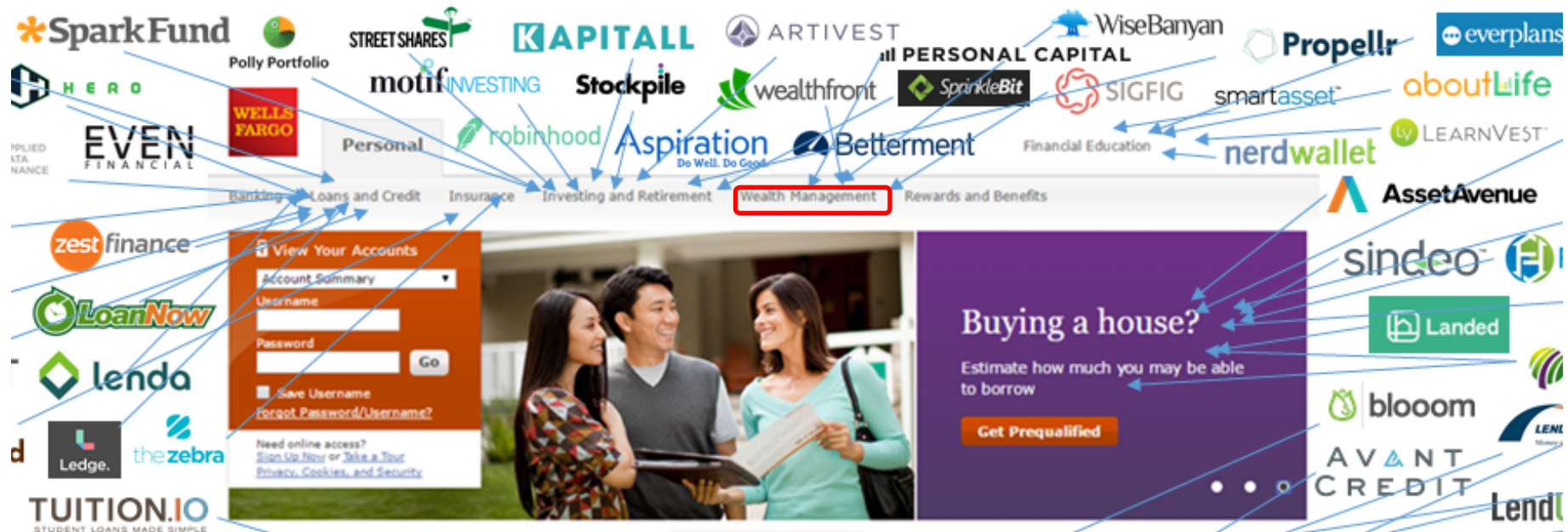
Unbundling of a Bank



Fintech: Unbundling the Bank

Wealth Management: Wealthfront

Unbundling of a Bank



Fintech: Financial Technology

Disrupting

European Banking:

The FinTech Startups

That Are Unbundling

HSBC, Santander, and

BNP

Unbundling of a European Bank

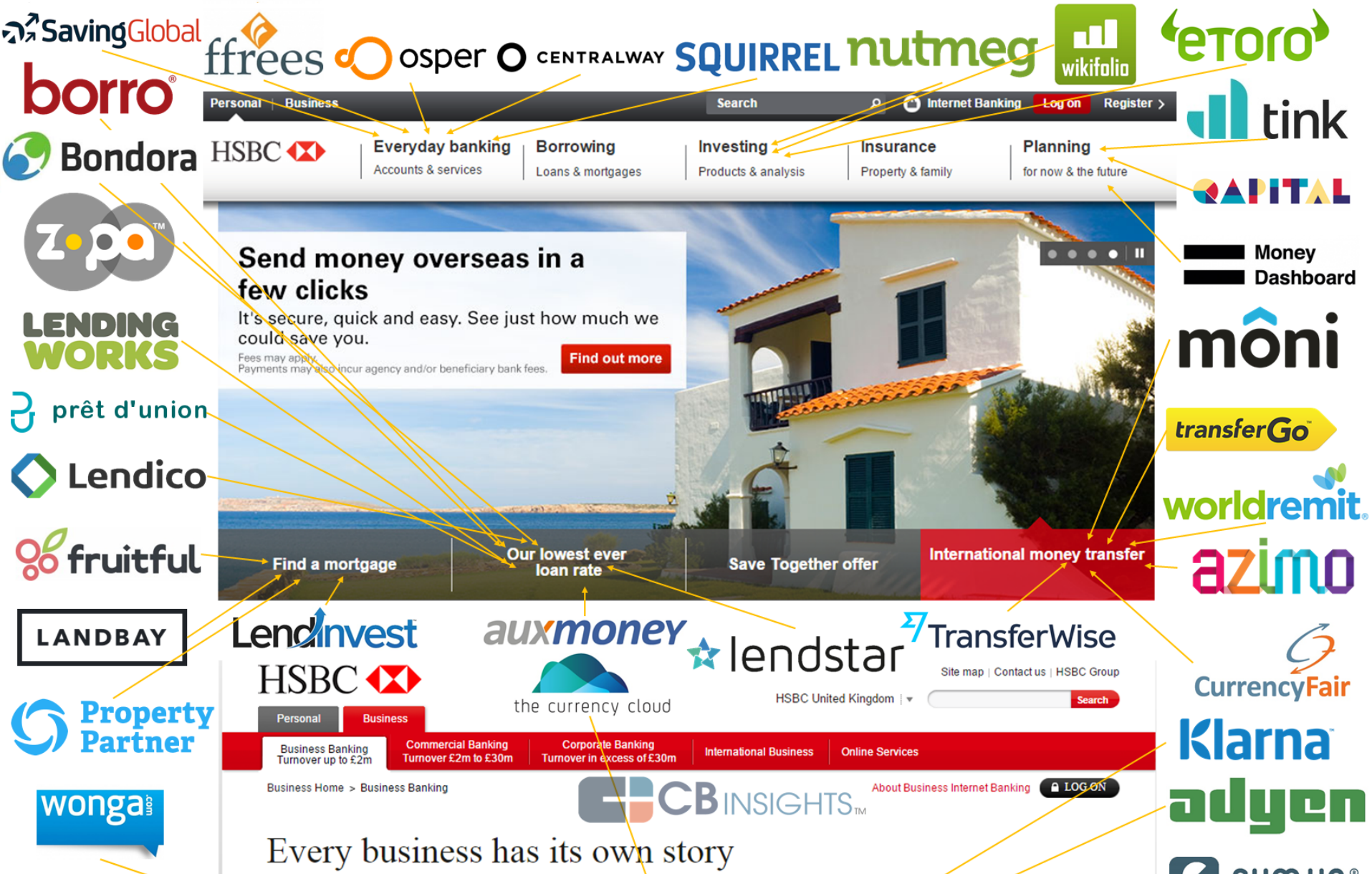
The image illustrates the unbundling of a European bank (HSBC) into various fintech services. The central screenshot shows the HSBC website with several key sections and features highlighted by arrows from surrounding fintech logos:

- Top Navigation:** Personal, Business, Search, Internet Banking, Log on, Register.
- Main Menu:** Everyday banking (Accounts & services), Borrowing (Loans & mortgages), Investing (Products & analysis), Insurance (Property & family), Planning (for now & the future).
- Hero Section:** "Send money overseas in a few clicks" with a sub-headline "It's secure, quick and easy. See just how much we could save you." and a "Find out more" button.
- Service Tiles:** Find a mortgage, Our lowest ever loan rate, Save Together offer, International money transfer.
- Business Banking Section:** Business Banking (Turnover up to £2m), Commercial Banking (Turnover £2m to £30m), Corporate Banking (Turnover in excess of £30m), International Business, Online Services.
- CB Insights Section:** "Every business has its own story" with a sub-headline "We create different business bank accounts to suit different needs".
- Product Grid:** Community account, Other accounts, Finance & borrowing, Credit cards & debit cards, Payment services, Business insurance policies, Business savings & investments, Ways to Bank, International business, Pensions.
- Get in touch:** "Have a query? There are lots of ways we can help you feel you're making the right choice." with options to call, find a branch, retrieve an application, or retrieve an online application.

Surrounding logos and services include:

- Top Row:** SavingGlobal, ffrees, osper, CENTRALWAY, SQUIRREL, nutmeg, wikifolio, etoro.
- Second Row:** borro, Bondora, HSBC, LendingWorks, tink, CAPITAL.
- Third Row:** prêt d'union, Lendico, fruitful, LANDBAY, Lendinvest, auxmoney, lendstar, TransferWise, CurrencyFair, Klarna, adyen, sum up, iZettle, BILLPAY, GOCARDLESS, PAYMILL, payleven.
- Bottom Row:** Spotcap, Funding Circle, FINEXKAP, fleximize, iwoca, capiota, HOLVI, Trade River, Ebury, Lydia, jusp, ensygnio.

Unbundling of a European Bank



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



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



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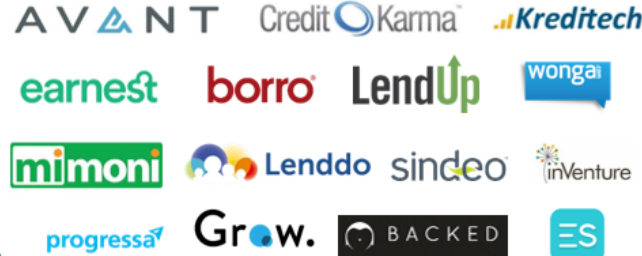
Lending, Investments, And Personal Finance: 102 Startups Attacking The Retail Banking Value Chain

The Digital Banking Market Map

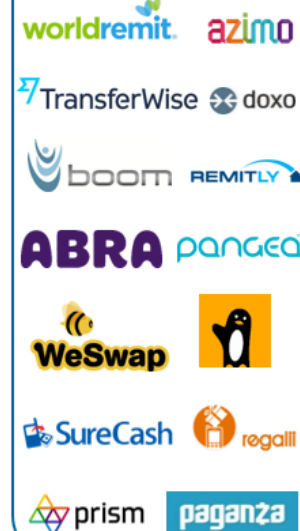
Marketplace Lending



Direct Lending & Underwriting



Bill Pay / Money Transfer



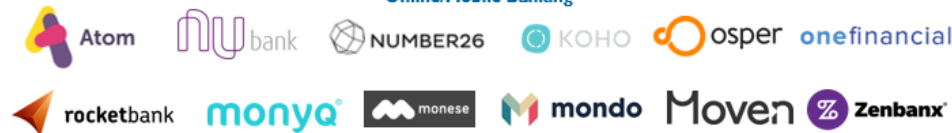
Investment Management



Created By



Online/Mobile Banking



Personal Finance



Robo-advisor



From Point-Of-Sale To Money Transfers: 109 Startups Disrupting The Payments Industry

The Payments Market Map



Insurance Tech Rising: 135+ Insurance Startups Across P2P, Life, Commercial & More

Insurance Tech Rising: 130+ Startups Across P2P, Life, Renters, & More

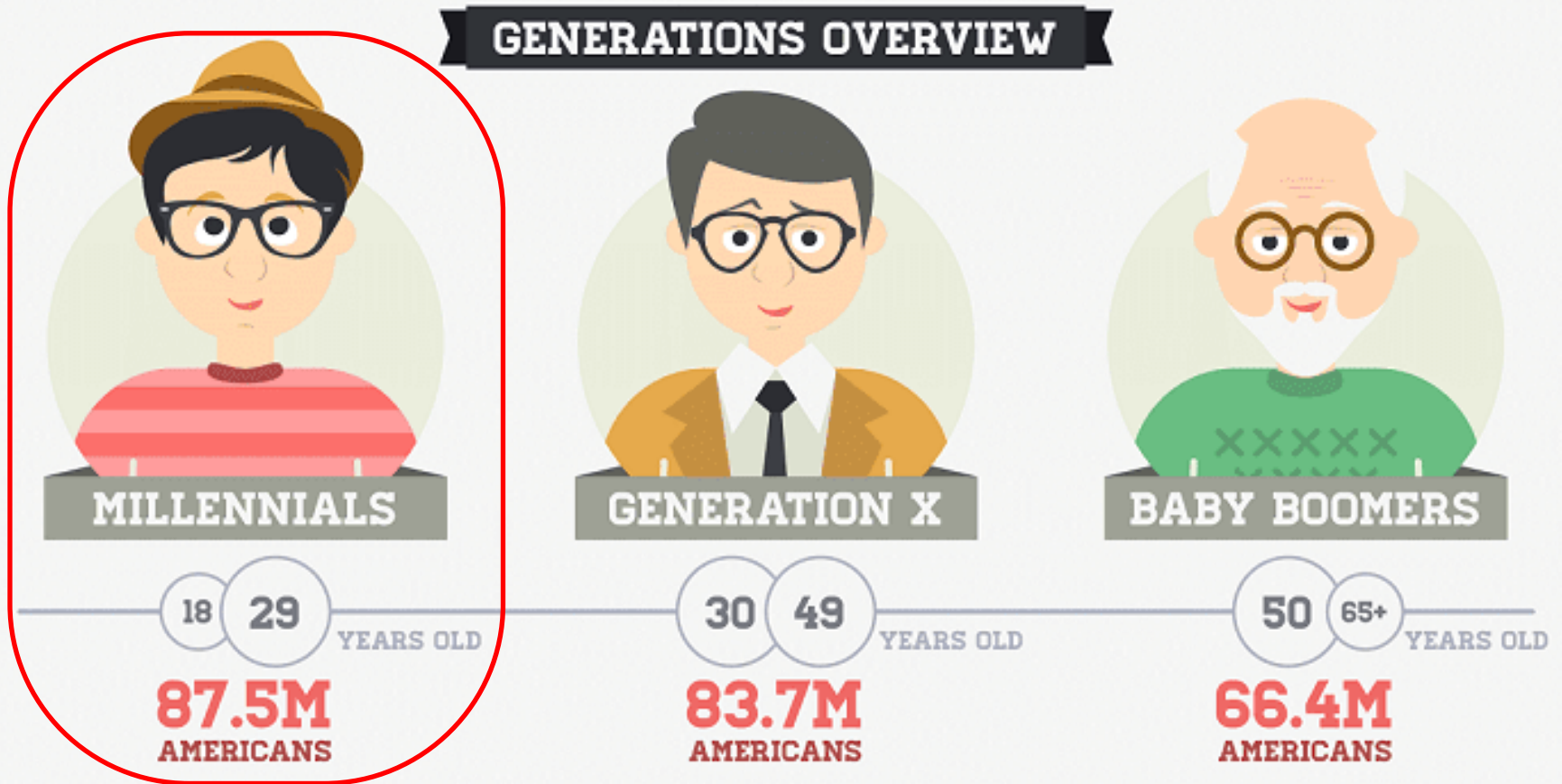


Millennial Personal Finance: 63 Fintech Startups Targeting Millennials

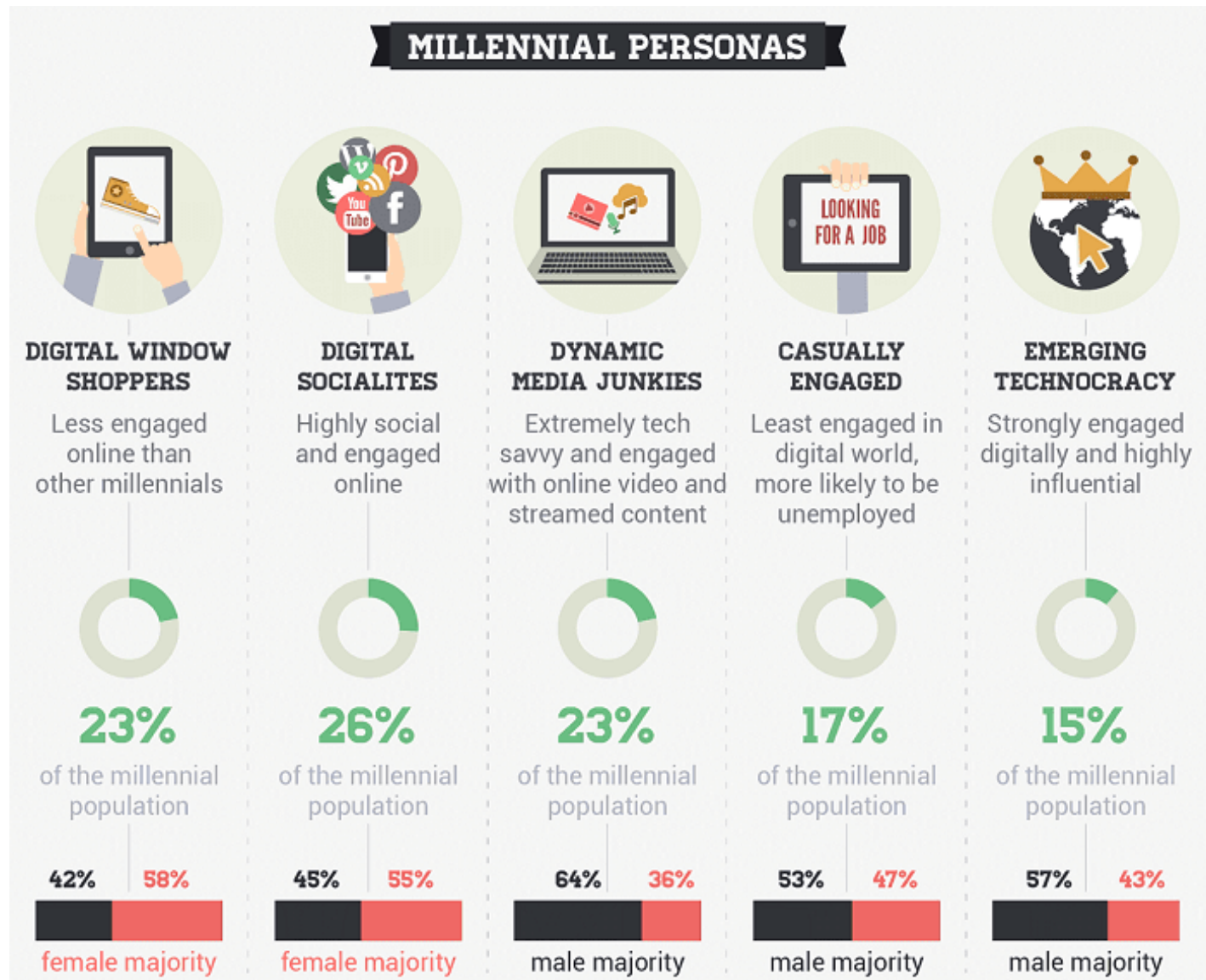
Fin Tech Startups for Millennials



Marketing to Millennials



Marketing to Millennials



Source: [http://www.digitalinformationworld.com/2016/07/infographic-how-millennials-view-your-site-and-why-it-matters.html?utm_source=feedburner&utm_medium=email&utm_campaign=Feed:+blogspot/qtdAg+\(Digital+Information+World\)](http://www.digitalinformationworld.com/2016/07/infographic-how-millennials-view-your-site-and-why-it-matters.html?utm_source=feedburner&utm_medium=email&utm_campaign=Feed:+blogspot/qtdAg+(Digital+Information+World))

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



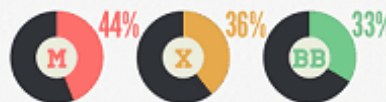
SOCIAL MEDIA PRESENCE

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

Conversational Commerce

Intelligent Chatbots

**From
E-Commerce
to
Conversational Commerce:
Chatbots
and
Virtual Assistants**

Question Answering

Dialogue System

Chatbot



Can machines think?

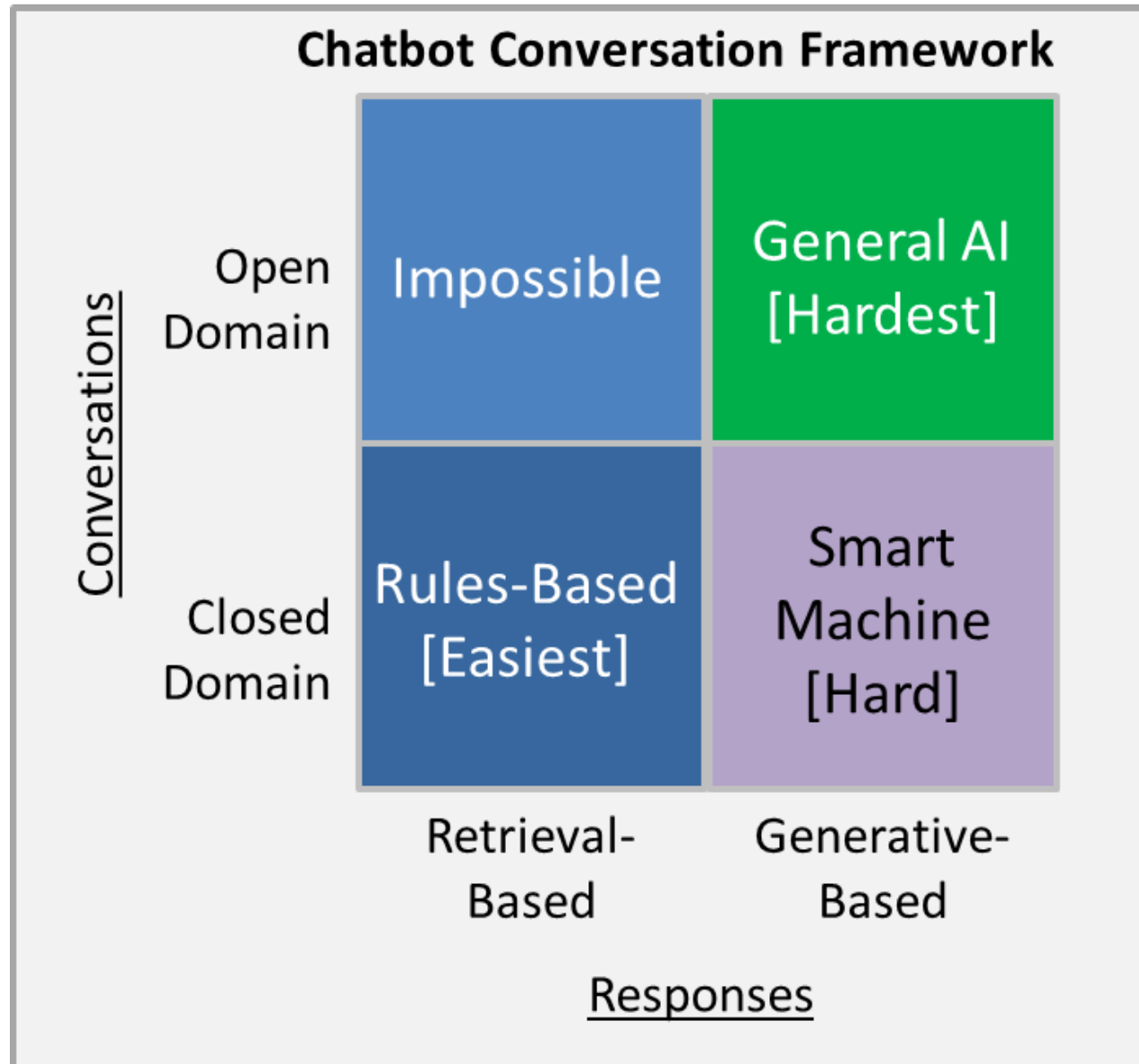
(Alan Turing ,1950)

Source: Cahn, Jack. "CHATBOT: Architecture, Design, & Development."
PhD diss., University of Pennsylvania, 2017.

Chatbot

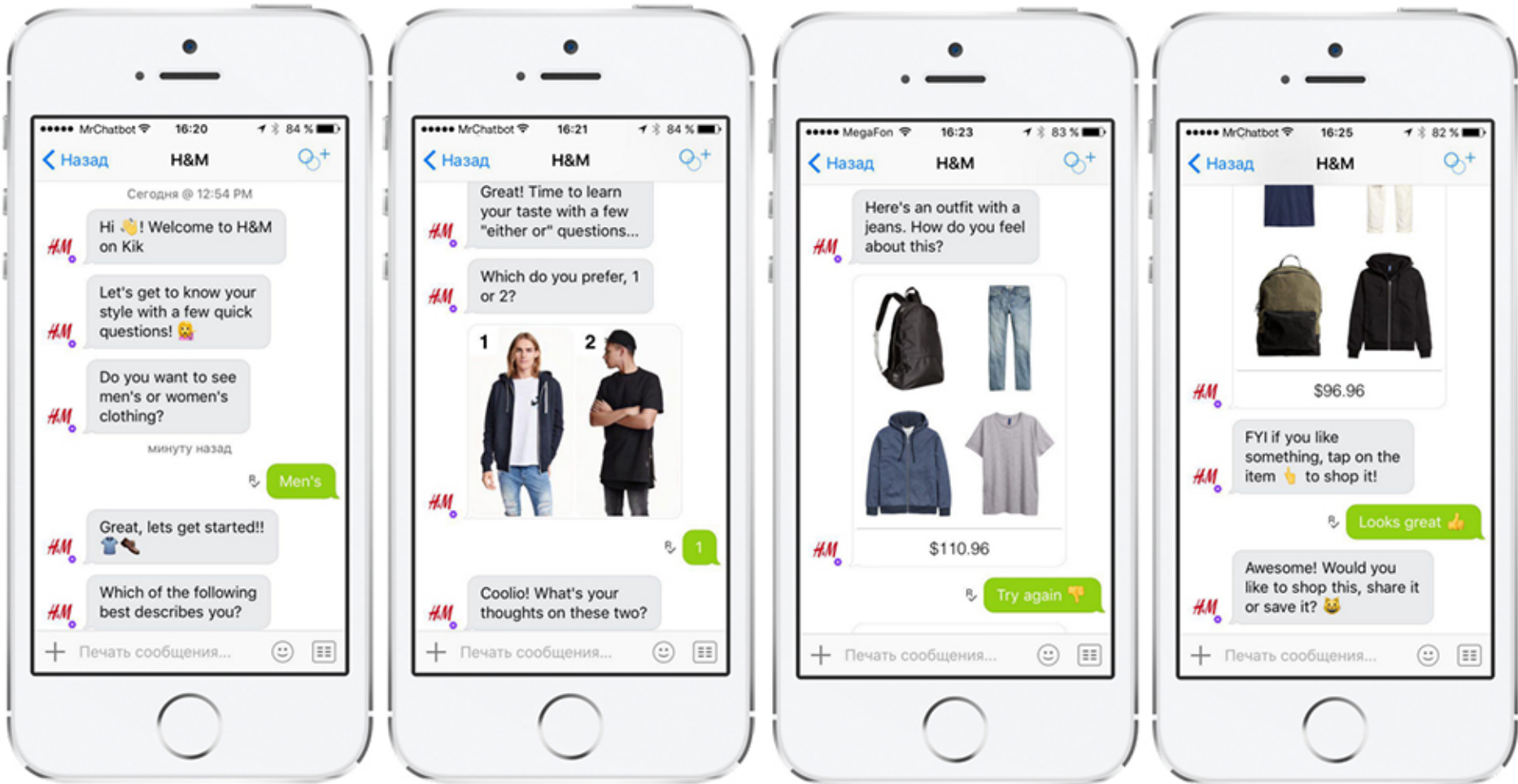
**“online human-computer
dialog system
with
natural language.”**

Chatbot Conversation Framework

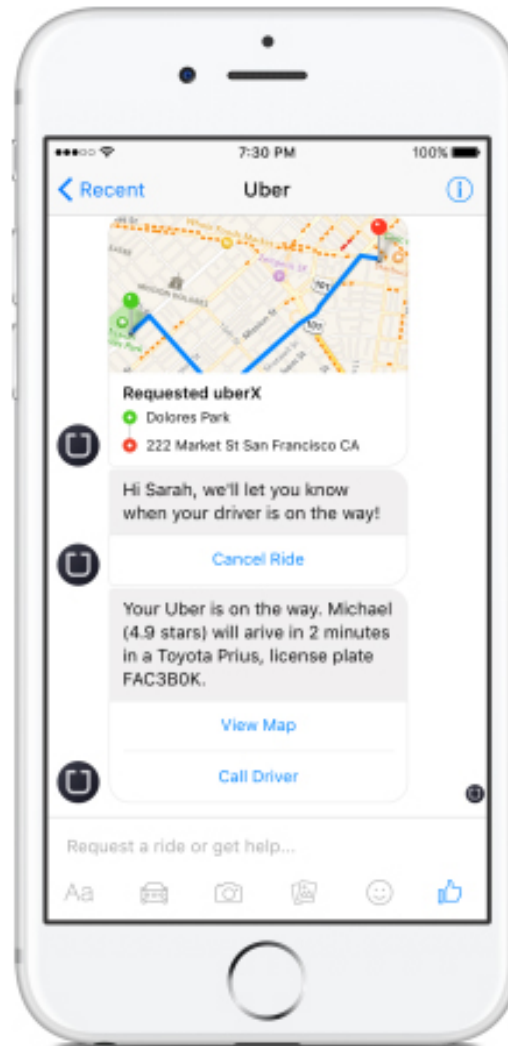


**From
E-Commerce
to
Conversational Commerce:
Chatbots
and
Virtual Assistants**

H&M's chatbot on Kik



Uber's chatbot on Facebook's messenger

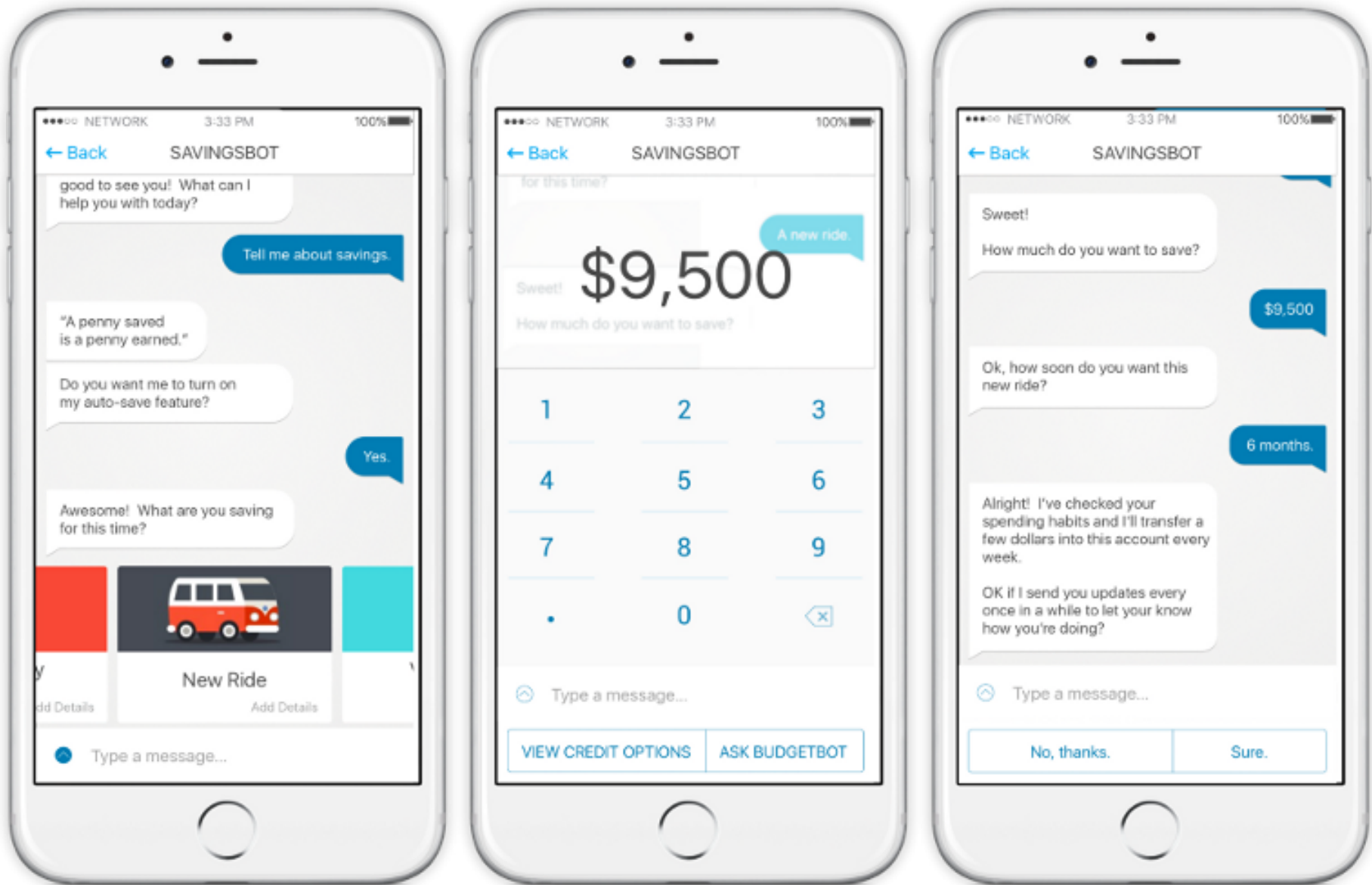


Uber's chatbot on Facebook's messenger

- one main benefit: it loads much faster than the Uber app

Source: <http://www.guided-selling.org/from-e-commerce-to-conversational-commerce/>

Savings Bot



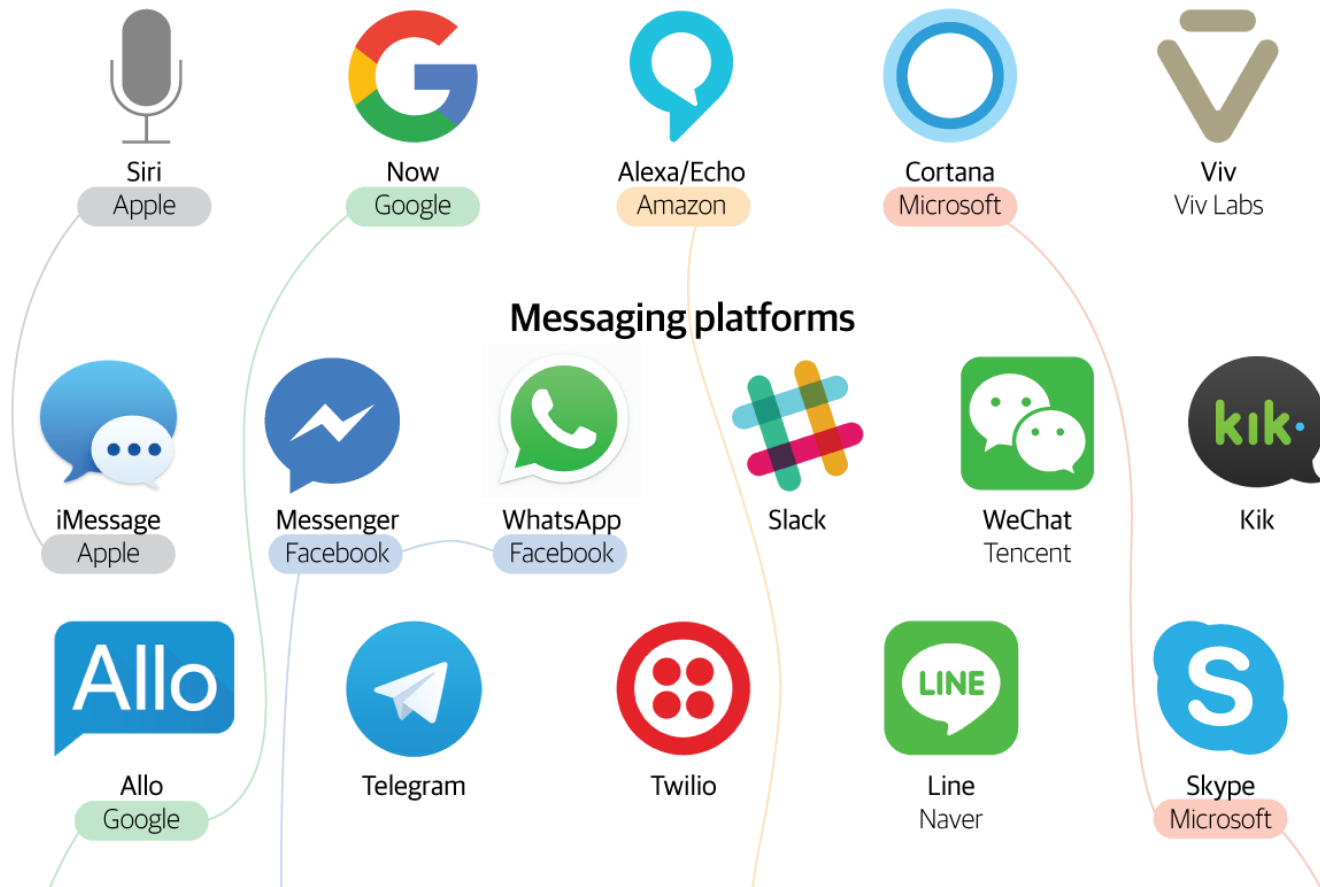
Bot Platform Ecosystem

The bot platform ecosystem and the emerging giants

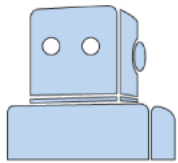
Nearly every large software company has announced some sort of bot strategy in the last year. Here's a look at a handful of leading platforms that developers might use to send messages, interpret natural language, and deploy bots, with the emerging bot-ecosystem giants highlighted.

General AI agents with platforms

Developer access available now or announced



Bot frameworks and deployment platforms



Wit.ai
Facebook



BotKit
Howdy



Chatfuel

AUTOMAT

Automat



Bot Framework
Microsoft



Api.ai
Google



Pandorabots



MindMeld



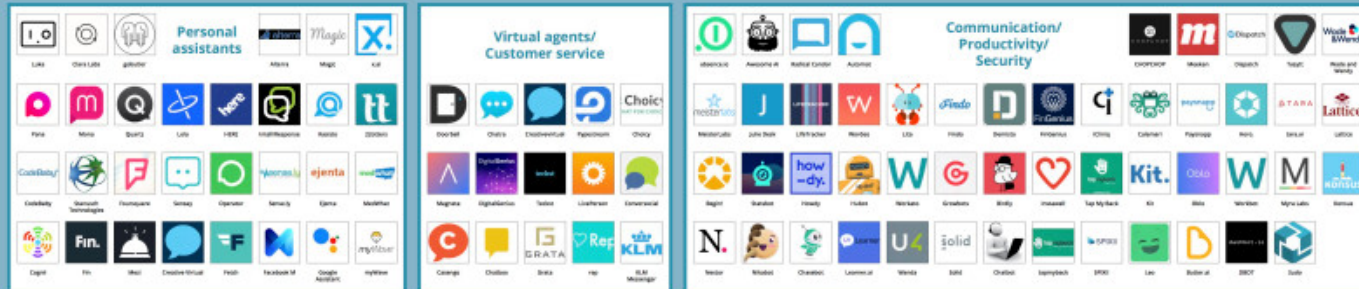
Gupshup



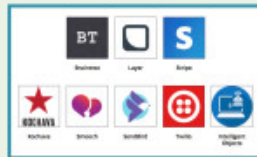
Sequel

Bots Landscape

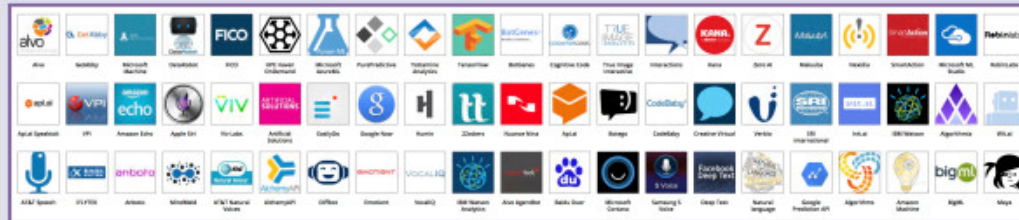
Bots with traction



Connectors/ Shared Services



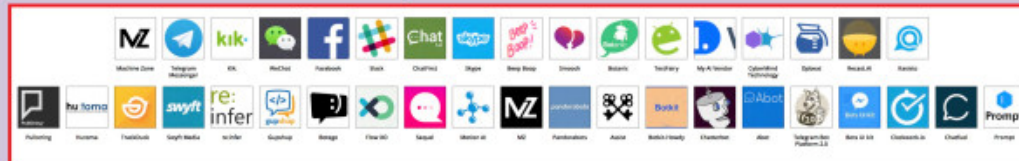
AI Tools: Natural Language Processing, Machine Learning, Speech & Voice Recognition



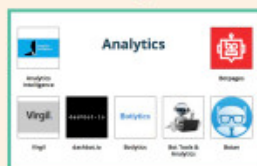
Bot Discovery



Bot developer frameworks and tools



Analytics



Messaging



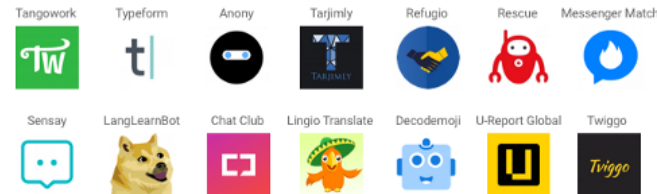
RECAST.AI Messenger Bot Landscape

May 2017

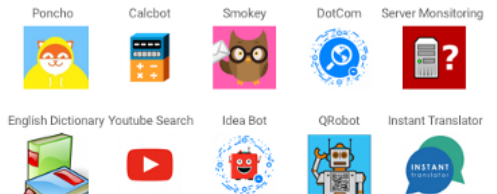
Food



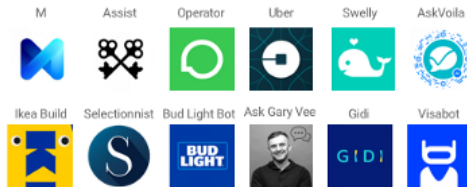
Communication



Utilities



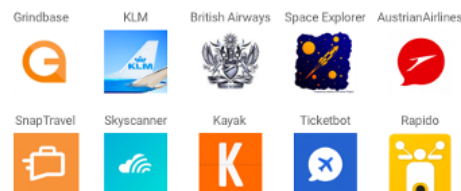
Personal



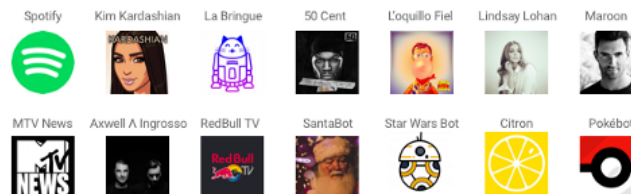
Analytics



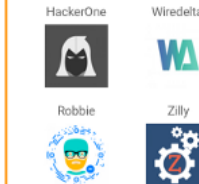
Travel



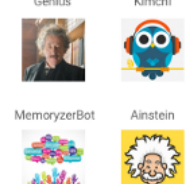
Entertainment



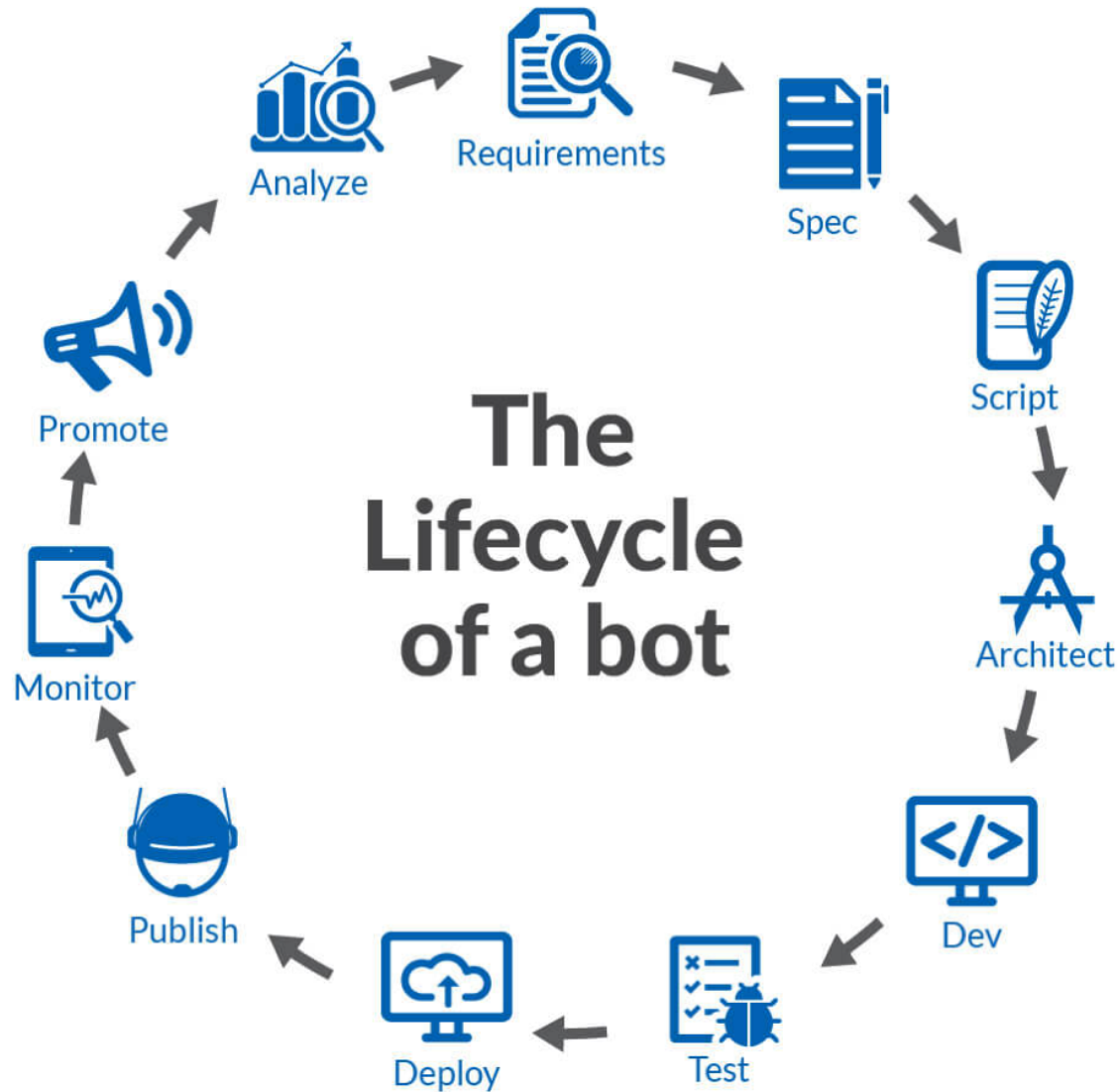
Developer Tools



Education



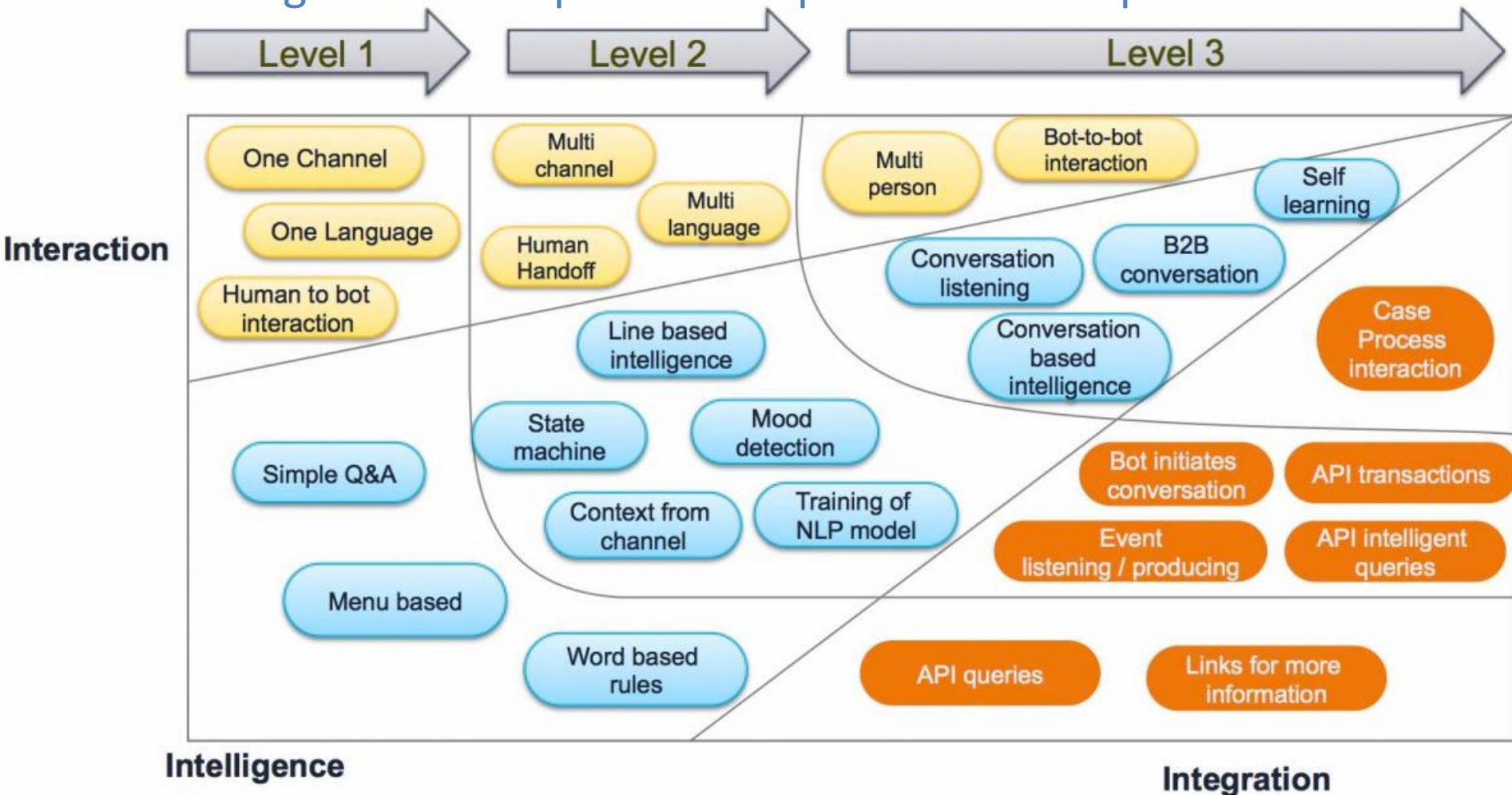
The Bot Lifecycle



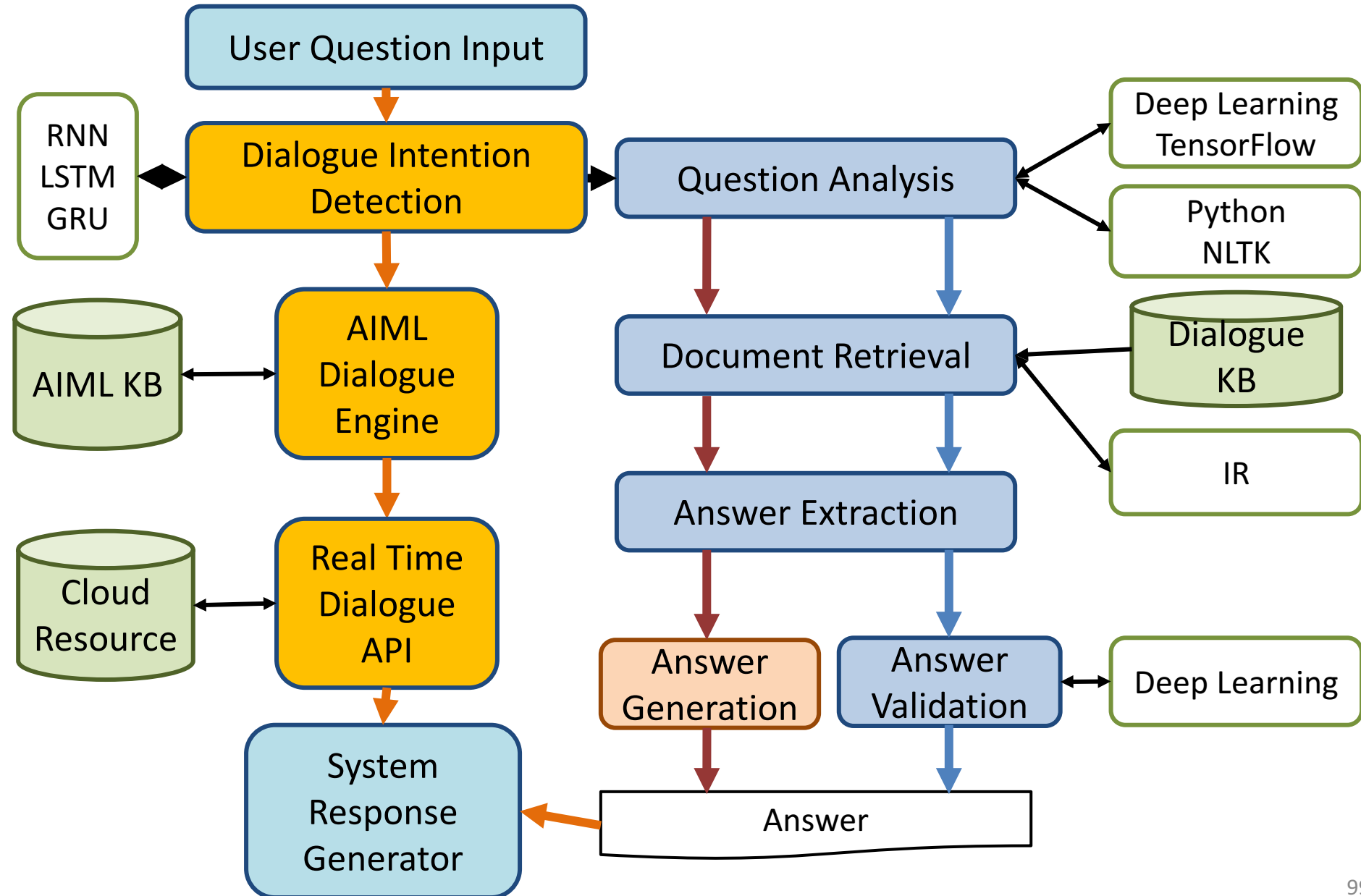
Chatbots

Bot Maturity Model

Customers want to have simpler means to interact with businesses and get faster response to a question or complaint.



System Architecture of Intelligent Dialogue and Question Answering System



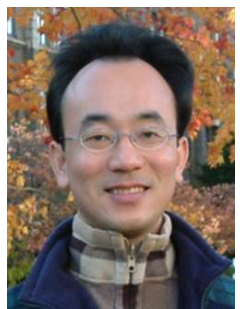
Question Answering

IMTKU Question Answering System for World History Exams at NTCIR-12 QA Lab2

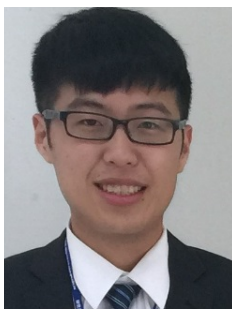
IMTKU Question Answering System for World History Exams at NTCIR-12 QA Lab2

Department of Information Management
Tamkang University, Taiwan

Sagacity Technology



Min-Yuh Day



Cheng-Chia Tsai



Wei-Chun Chung



Hsiu-Yuan Chang



Tzu-Jui Sun



Yuan-Jie Tsai



Jin-Kun Lin



Cheng-Hung Lee



Yu-Ming Guo



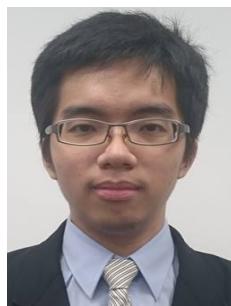
Yue-Da Lin



Wei-Ming Chen



Yun-Da Tsai



Cheng-Jhih Han



Yi-Jing Lin



Yi-Heng Chiang

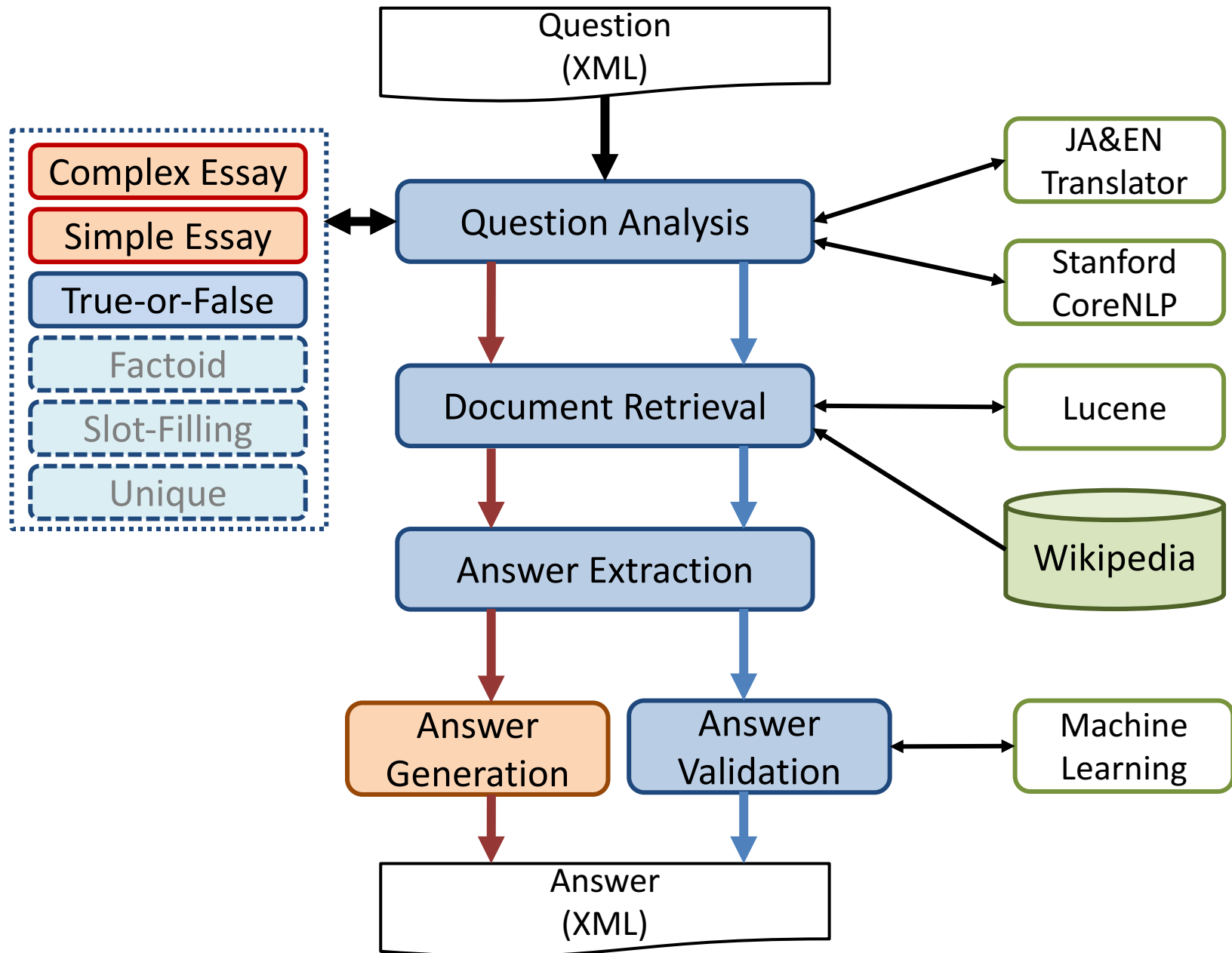


Ching-Yuan Chien

myday@mail.tku.edu.tw

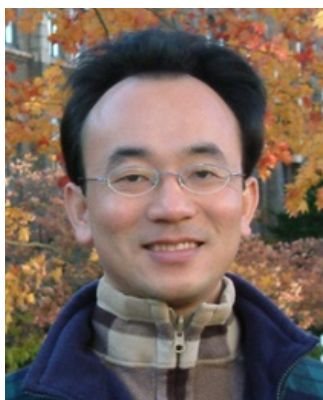
NTCIR-12 Conference, June 7-10, 2016, Tokyo, Japan

IMTKU System Architecture for NTCIR-12 QALab2



IMTKU Textual Entailment System for Recognizing Inference in Text at NTCIR-9 RITE

**Department of Information Management
Tamkang University, Taiwan**



Min-Yuh Day

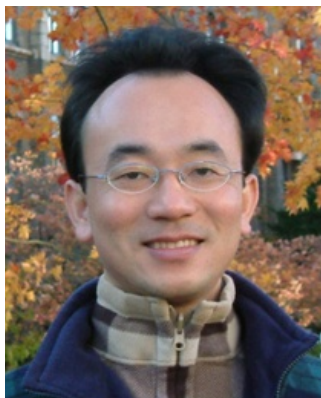


Chun Tu

myday@mail.tku.edu.tw

IMTKU Textual Entailment System for Recognizing Inference in Text at NTCIR-10 RITE-2

**Department of Information Management
Tamkang University, Taiwan**



Min-Yuh Day



Chun Tu



Hou-Cheng Vong



Shih-Wei Wu



Shih-Jhen Huang

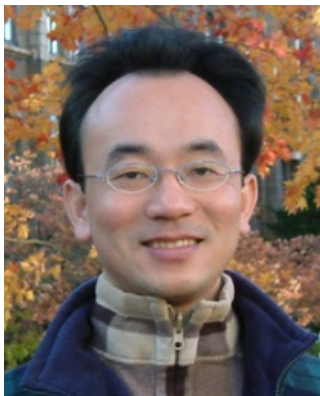
myday@mail.tku.edu.tw

IMTKU Textual Entailment System for Recognizing Inference in Text at NTCIR-11 RITE-VAL

Tamkang University

淡江大學

2014



Min-Yuh Day



Ya-Jung Wang



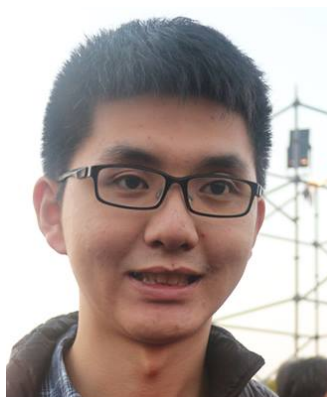
Che-Wei Hsu



En-Chun Tu



Huai-Wen Hsu



Yu-An Lin



Shang-Yu Wu



Yu-Hsuan Tai

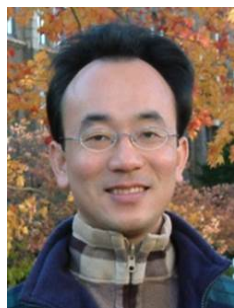


Cheng-Chia Tsai

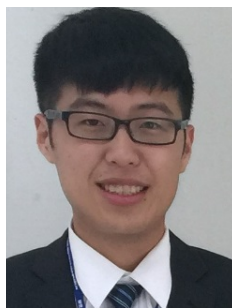
IMTKU Question Answering System for World History Exams at NTCIR-12 QA Lab2

Department of Information Management
Tamkang University, Taiwan

Sagacity Technology



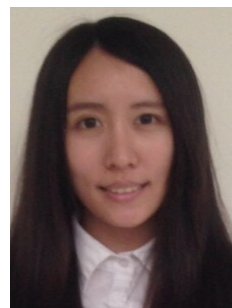
Min-Yuh Day



Cheng-Chia Tsai



Wei-Chun Chung



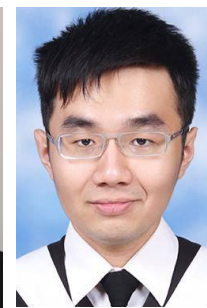
Hsiu-Yuan Chang



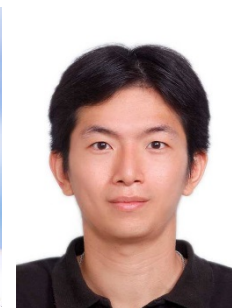
Tzu-Jui Sun



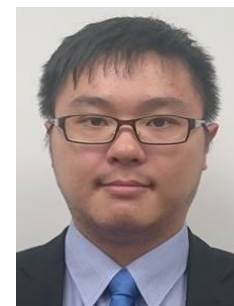
Yuan-Jie Tsai



Jin-Kun Lin



Cheng-Hung Lee



Yu-Ming Guo



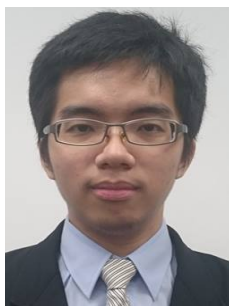
Yue-Da Lin



Wei-Ming Chen



Yun-Da Tsai



Cheng-Jhih Han



Yi-Jing Lin



Yi-Heng Chiang



Ching-Yuan Chien

myday@mail.tku.edu.tw

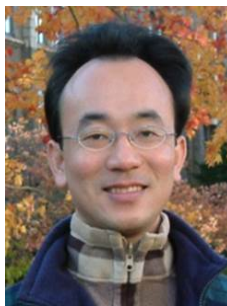
NTCIR-12 Conference, June 7-10, 2016, Tokyo, Japan

2017



IMTKU Question Answering System for World History Exams at NTCIR-13 QA Lab3

Department of Information Management
Tamkang University, Taiwan



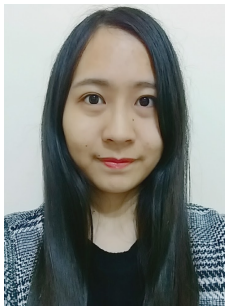
Min-Yuh Day



Chao-Yu Chen



Wanchu Huang



Shi-Ya Zheng



I-Hsuan Huang



Tz-Rung Chen



Min-Chun Kuo



Yue-Da Lin



Yi-Jing Lin

myday@mail.tku.edu.tw

Can a robot pass a university entrance exam?

Noriko Arai at TED2017

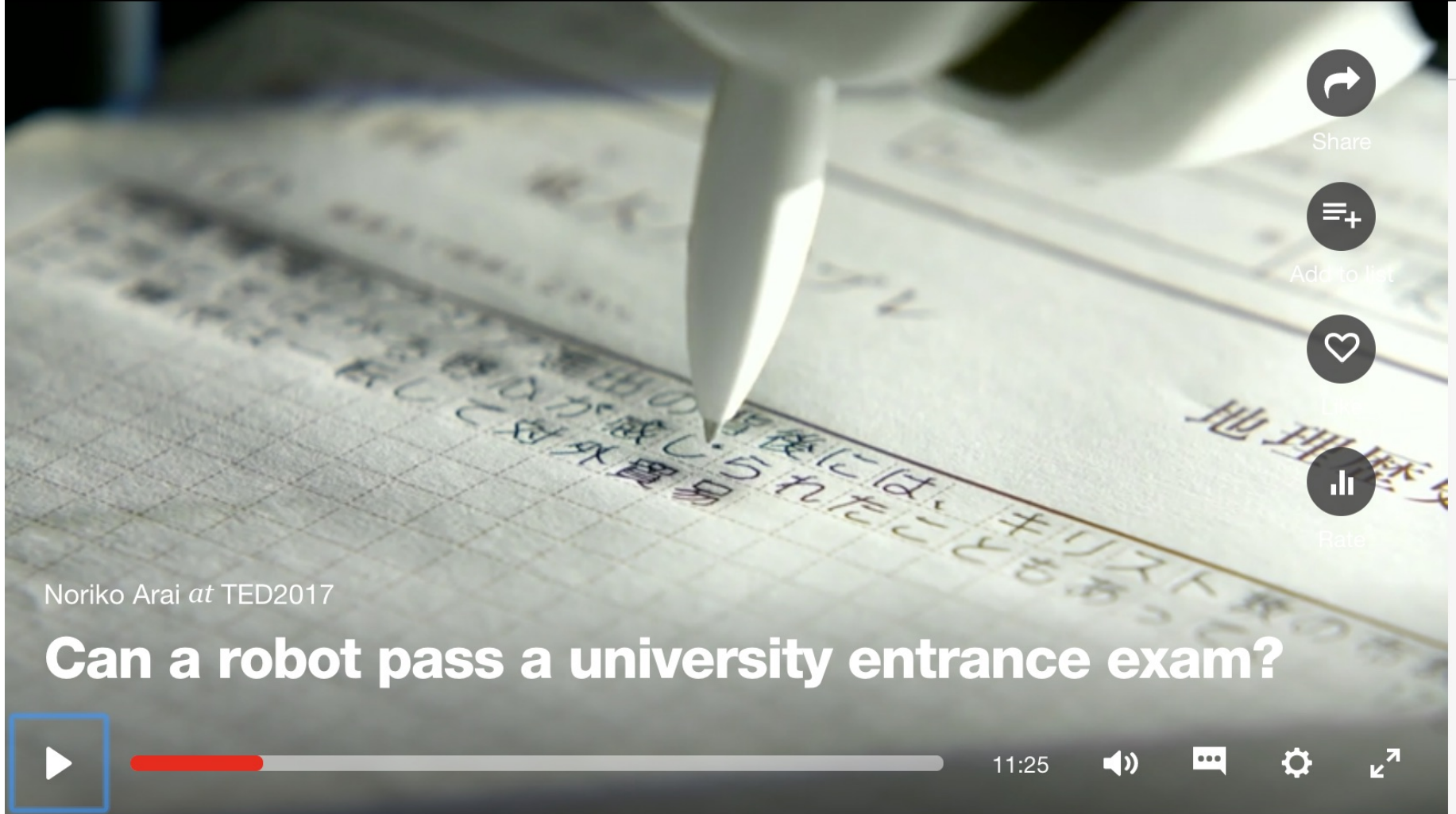


Ideas worth spreading

WATCH

DISCOVER

ATT



Share



Add to list



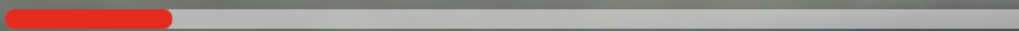
Like



Rate

Noriko Arai at TED2017

Can a robot pass a university entrance exam?



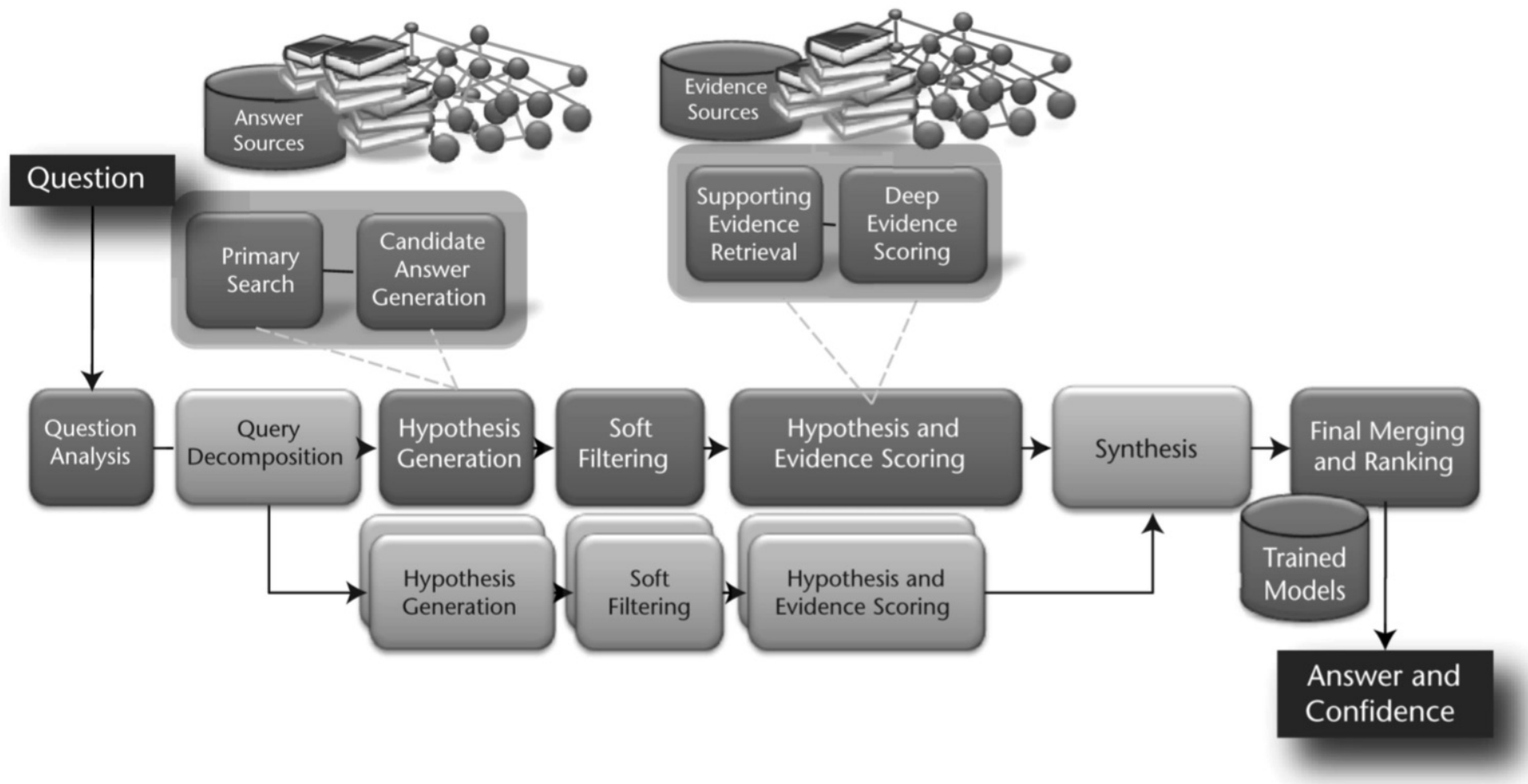
11:25



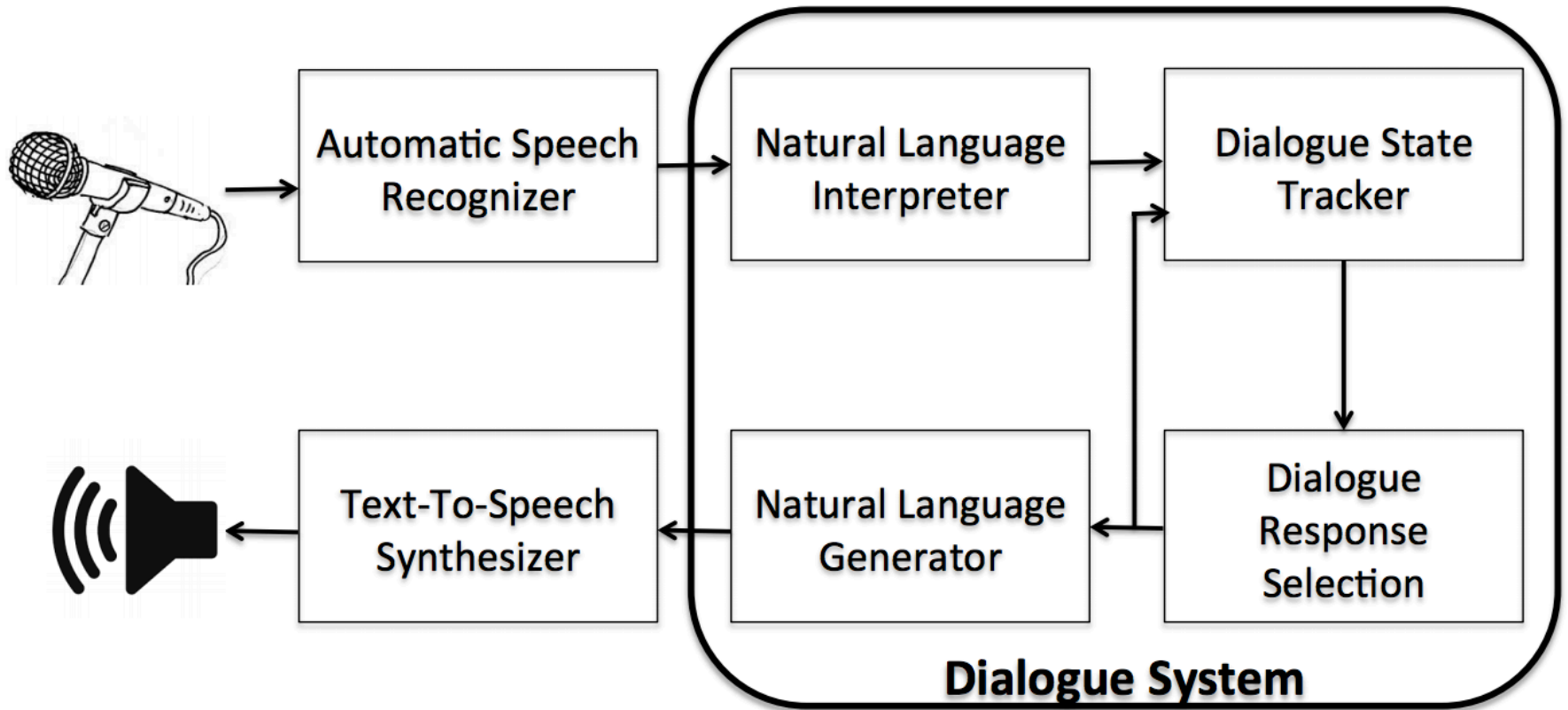
https://www.ted.com/talks/noriko_arai_can_a_robot_pass_a_university_entrance_exam

<https://www.youtube.com/watch?v=XQZjkPyJ8KU>

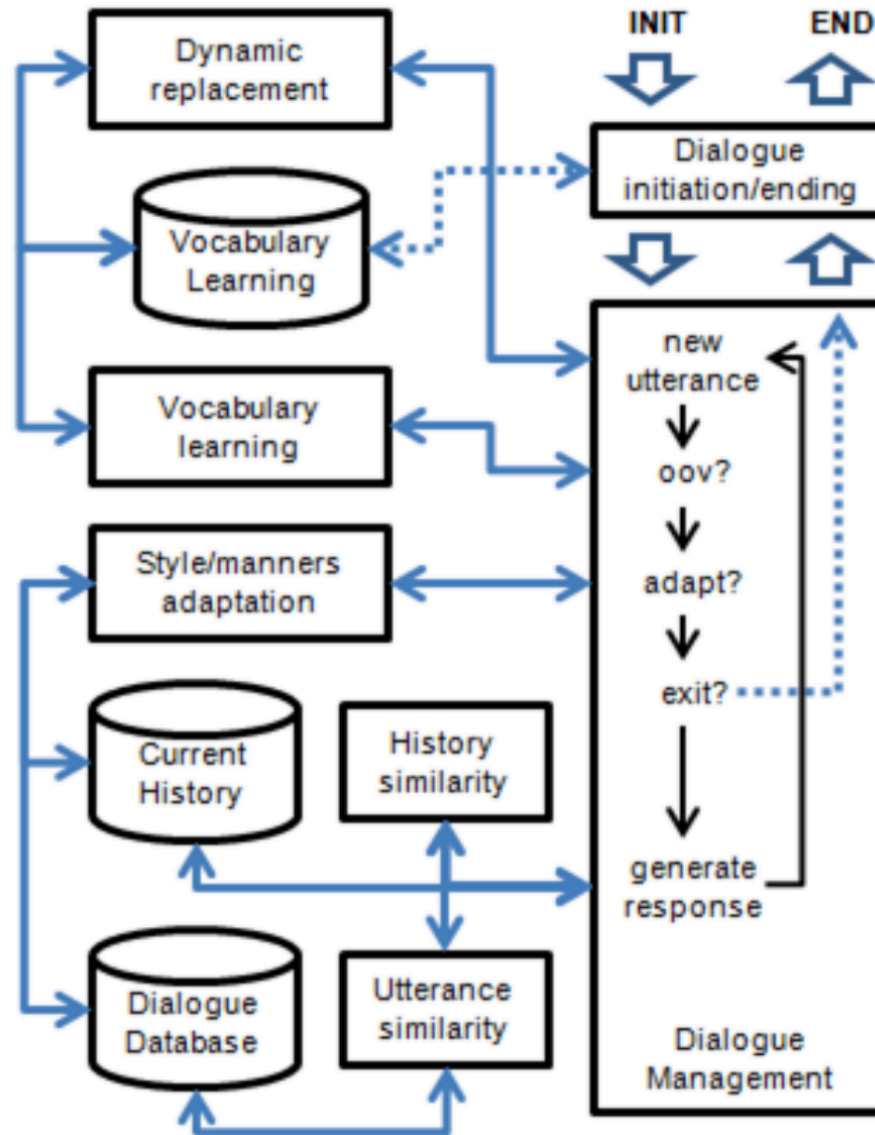
Watson DeepQA Architecture



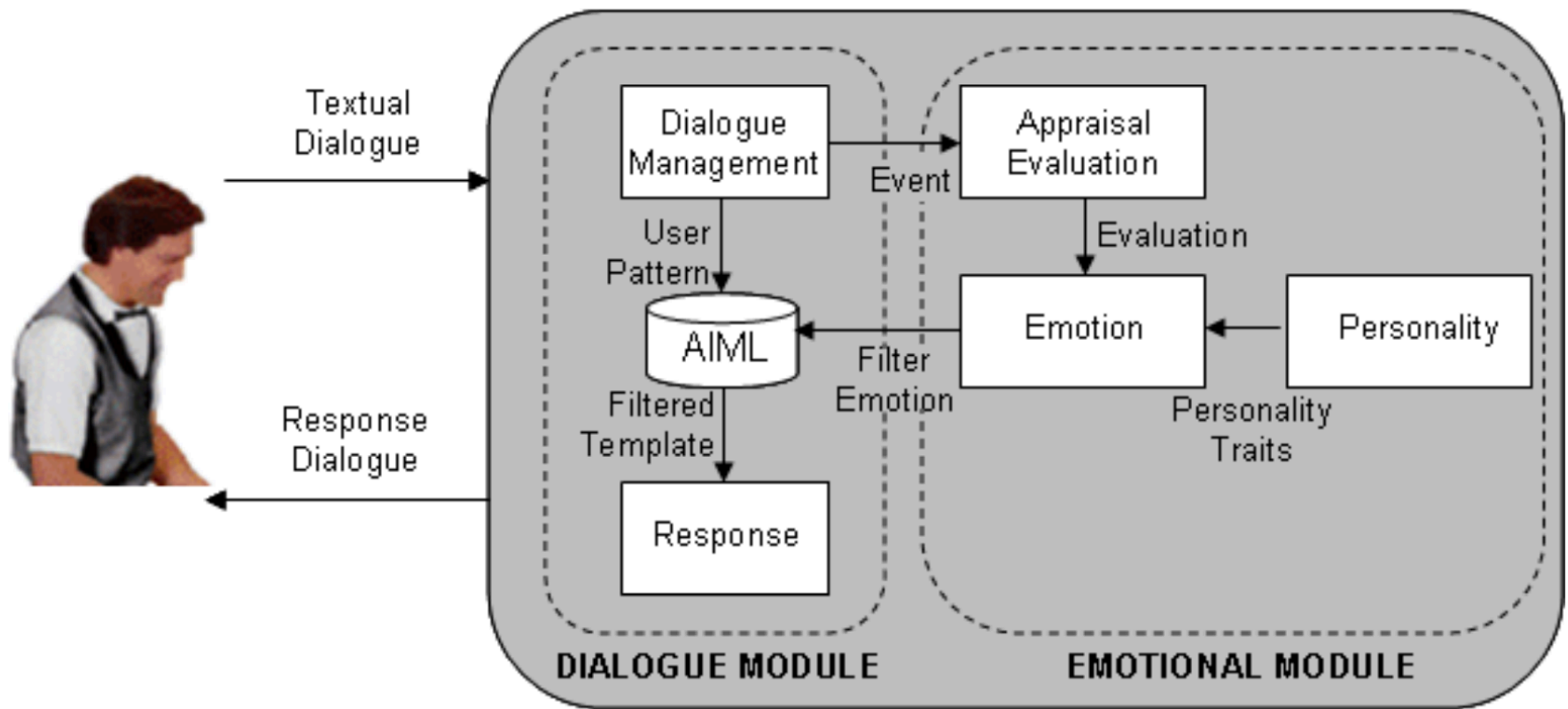
Dialogue System



Chat-oriented Dialogue System



AIML Dialogue System



ALICE and AIML



A.L.I.C.E. Silver Edition

DAVE E.S.L. bot

C.L.A.U.D.I.O Personality Test

GET SITEPAL AVATARS

Free Live Chat with the award winning A. I. chat robot **A. L. I. C. E.**

Get Started

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[Chat with Fake Kirk](#)

[What is AIML?](#)
[Foundation Bot Directory](#)
[Bot Industry Survey](#)
[AIML Overview](#)

Software

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[AIML Sets](#)
[AIML 1.1 Specification](#)
[AIML 2.0 Working Draft](#)
[Documentation](#)
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alicebot.org

Rank: 257,092

Links in: 638

AIML: Artificial Intelligence Markup Language

AIML (Artificial Intelligence Markup Language) is an XML-compliant language that's easy to learn, and makes it possible for you to begin customizing an Alicebot or creating one from scratch within minutes.

The most important units of AIML are:

- `<aiml>`: the tag that begins and ends an AIML document
- `<category>`: the tag that marks a "unit of knowledge" in an Alicebot's knowledge base
- `<pattern>`: used to contain a simple pattern that matches what a user may say or type to an Alicebot
- `<template>`: contains the response to a user input

There are also 20 or so additional more tags often found in AIML files, and it's possible to create your own so-called "custom predicates". Right now, a beginner's guide to AIML can be found in the [AIML Primer](#).

The free **A.L.I.C.E. AIML** includes a knowledge base of approximately 41,000 categories. Here's an example of one of them:

```
<category>
  <pattern>WHAT ARE YOU</pattern>
  <template>
    <think><set name="topic">Me</set></think>
    I am the latest result in artificial intelligence,
    which can reproduce the capabilities of the human brain
    with greater speed and accuracy.
  </template>
</category>
```

(The opening and closing `<aiml>` tags are not shown here, because this is an excerpt from the middle of a document.)

Everything between `<category>` and `</category>` is -- you guessed it -- a category. A category can have one pattern and one template. (It can also contain a `<that>` tag, but we won't get into that here.)

The pattern shown will match *only* the exact phrase "what are you" (capitalization is ignored).

But it's possible that this category may be invoked by another category, using the `<srai>` tag (not shown) and the principle of **reductionism**.

In any case, if this category is called, it will produce the response "I am the latest result in artificial intelligence..." shown above. In addition, it will do something else interesting. Using the `<think>` tag, which causes Alicebot to perform whatever it contains but hide the result from the user, the Alicebot engine will set the "topic" in its memory to "Me". This allows any categories elsewhere with an

Subscription Bots

[A.L.I.C.E. Silver Edition](#)
[DAVE E.S.L. Bot](#)
[CLAUDIO Personality Test](#)



Build native
iOS, Android,
and Windows
apps in C#



AIML

(Artificial Intelligence Markup Language)

<category>

<pattern>HELLO</pattern>

<template>Hi, I am a robot</template>

</category>

AIML

(Artificial Intelligence Markup Language)

- `<aiml>`
 - the tag that begins and ends an AIML document
- `<category>`
 - the tag that marks a "unit of knowledge" in an Alicebot's knowledge base
- `<pattern>`
 - used to contain a simple pattern that matches what a **user** may say or type to an Alicebot
- `<template>`
 - contains the **response** to a user input

AIML

(Artificial Intelligence Markup Language)

<category>

<pattern>WHAT ARE YOU</pattern>

<template>

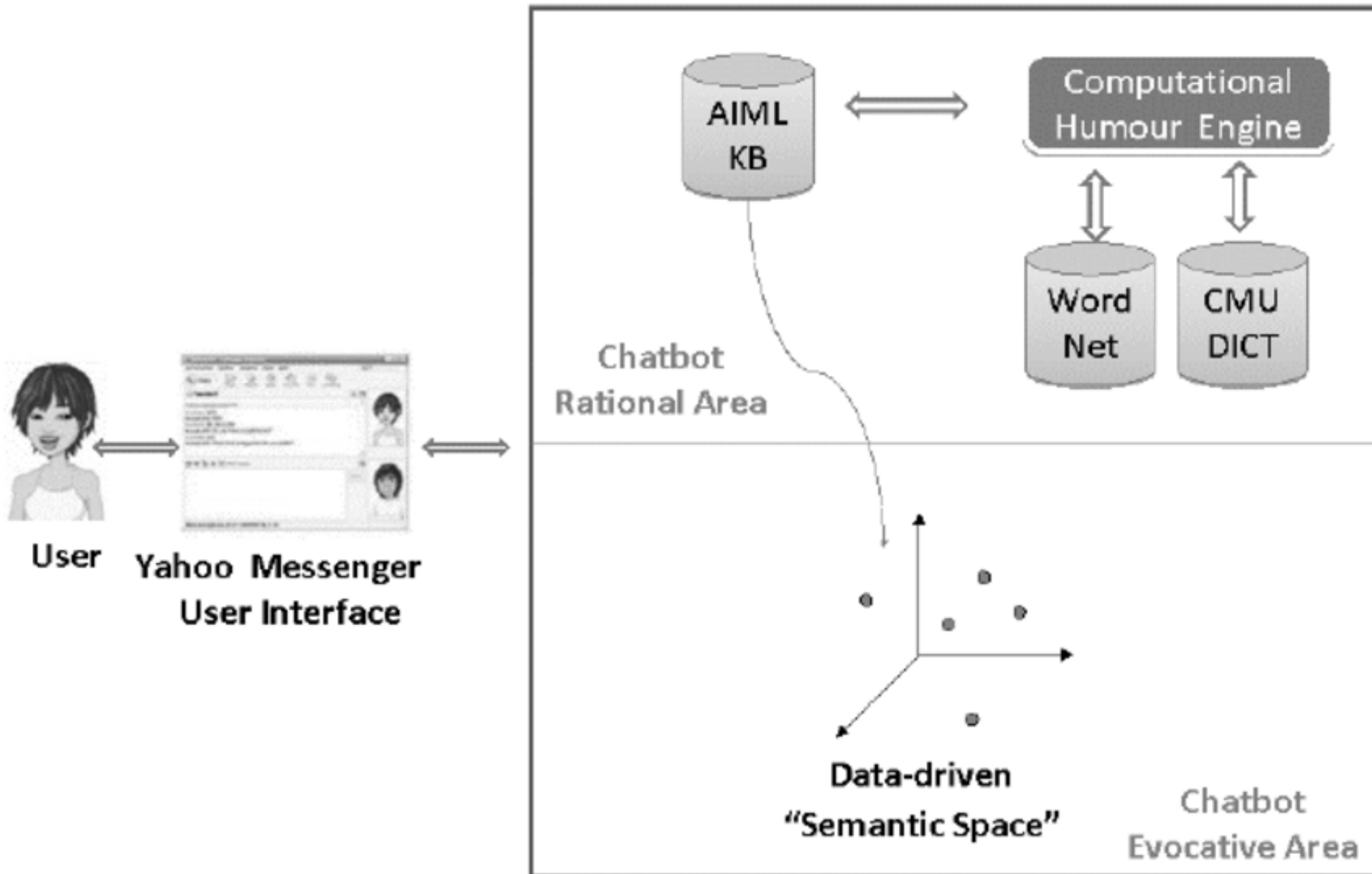
<think><set name="topic">Me</set></think>

I am the latest result in artificial intelligence,
which can reproduce the capabilities of the human brain
with greater speed and accuracy.

</template>

</category>

Humorist Chat-bot



Deep Learning for Dialogues

Intent Classification

Intent LSTM

LSTM (Long-Short Term Memory)

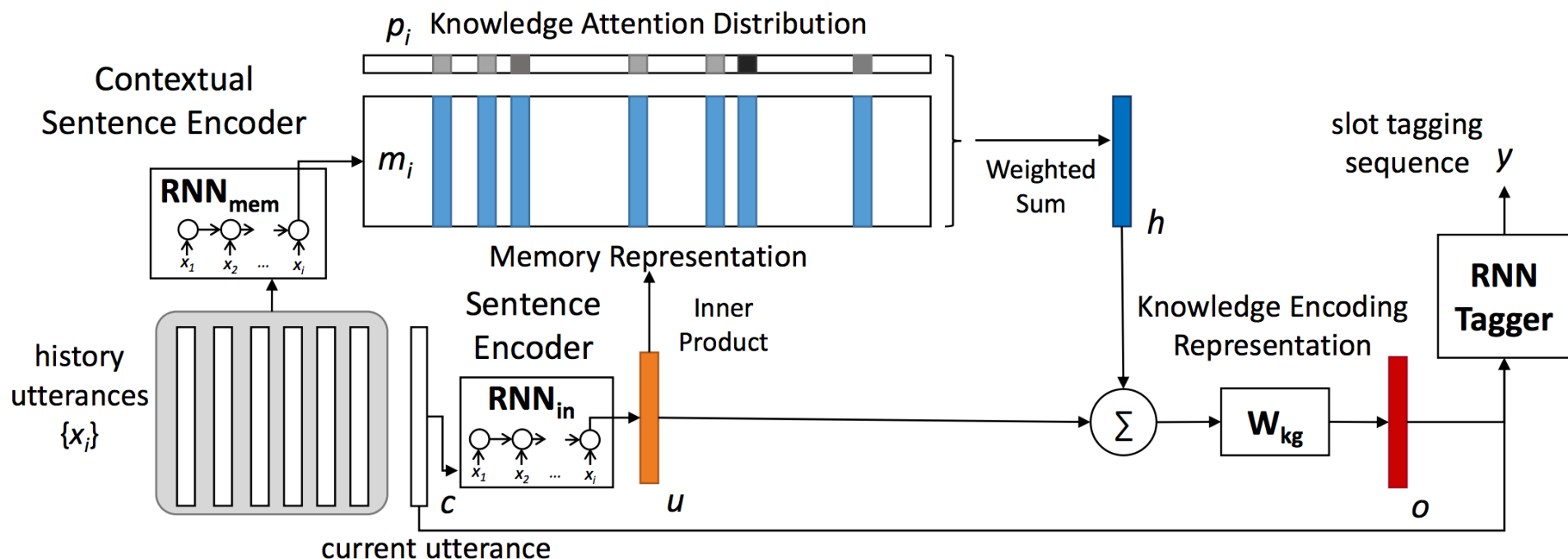
GRU (Gated Recurrent Unit)

Dialogue Utterance

W	find	recent	comedies	by	james	cameron
	↓	↓	↓	↓	↓	↓
S	O	B-date	B-genre	O	B-dir	I-dir
D	movies					
I	find_movie					

An example utterance with annotations of semantic slots in IOB format (S), domain (D), and intent (I), B-dir and I-dir denote the director name.

End-to-end Memory Network Model for Multi-turn SLU



D communication

I send_email

U just sent email to bob about fishing this weekend

↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓

S O O O O ↓ O ↓ ↓ ↓

B-contact_name B-subject I-subject I-subject

→ send_email(contact_name="bob", subject="fishing this weekend")

U₁ send email to bob



S₁ B-contact_name

→ send_email(contact_name="bob")

U₂ are we going to fish this weekend

↓ ↓ ↓ ↓ ↓ ↓ ↓

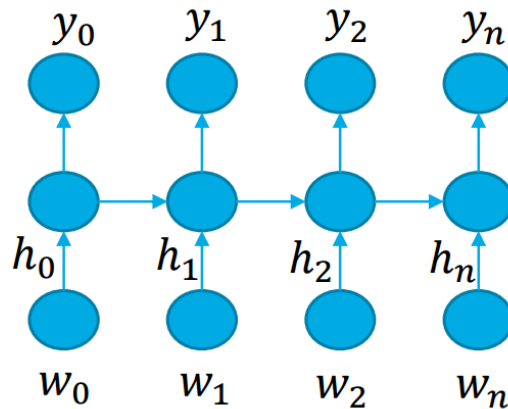
S₂ B-message I-message I-message I-message I-message

I-message I-message I-message

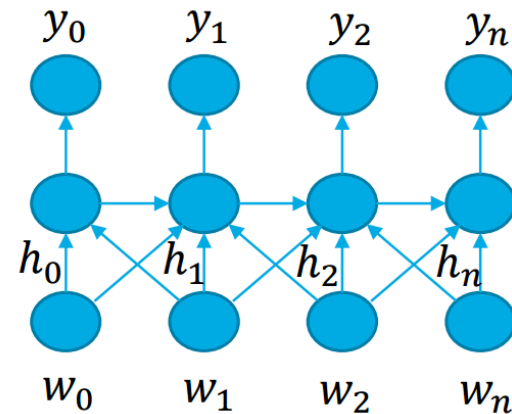
→ send_email(message="are we going to fish this weekend")

Deep Learning for SLU

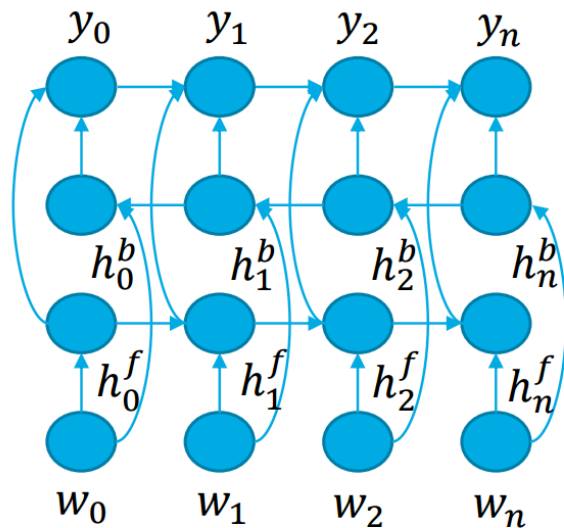
(Spoken Language Understanding)



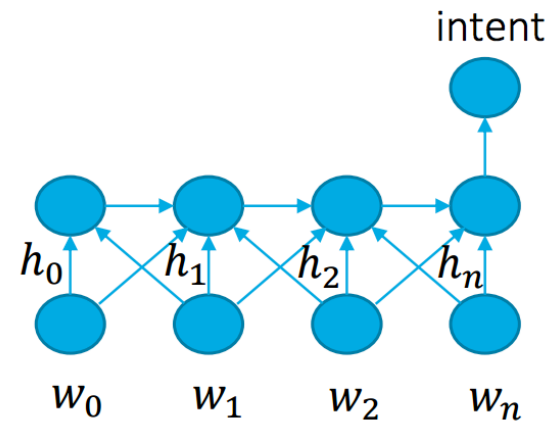
(a) LSTM



(b) LSTM-LA

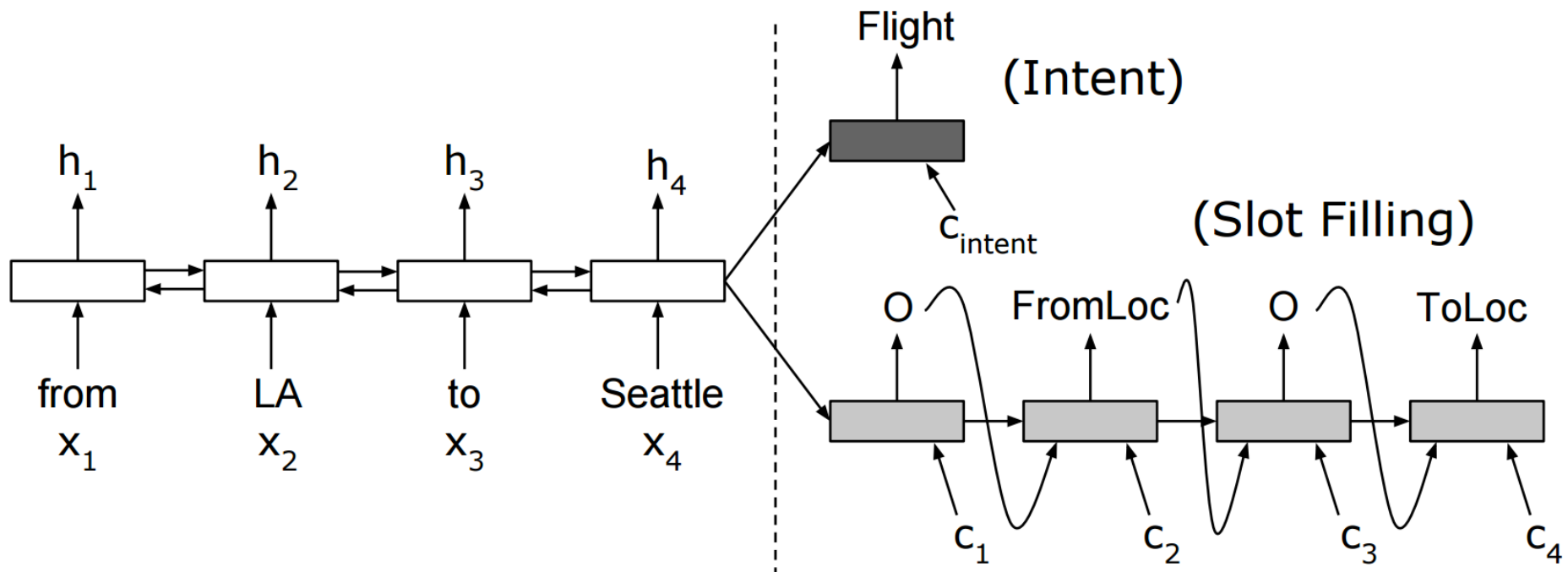


(c) bLSTM-LA



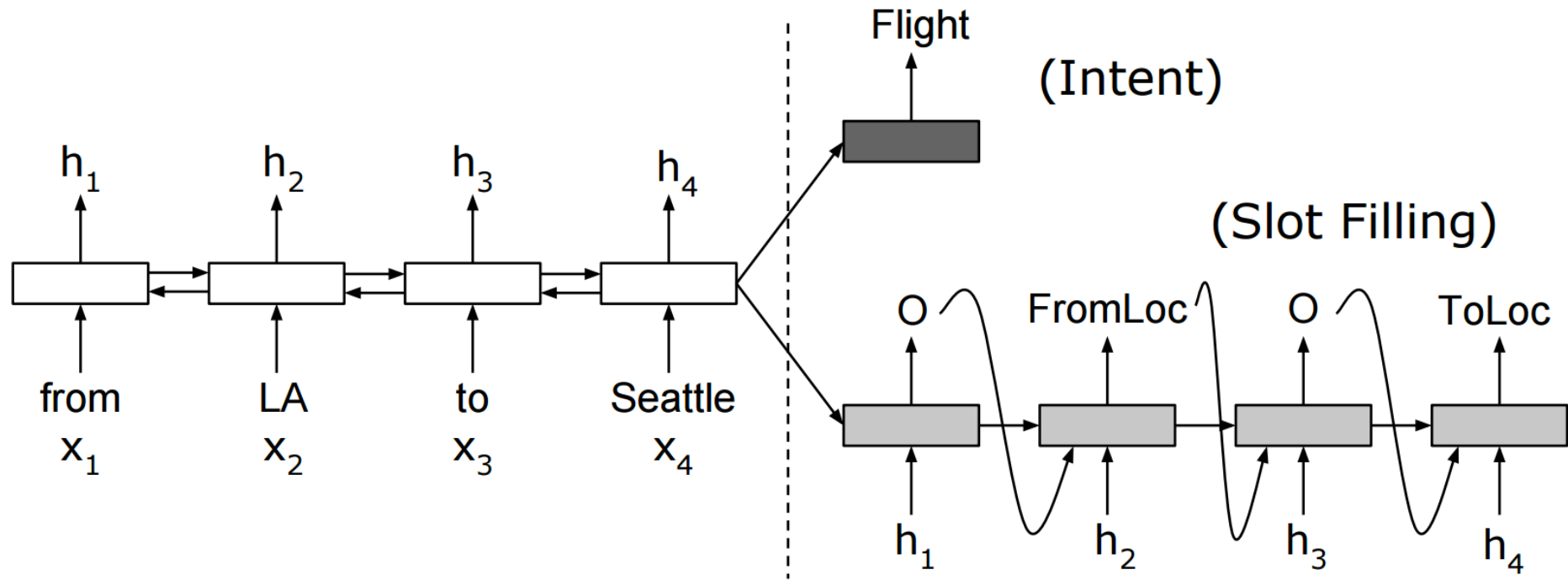
(b) Intent LSTM

Encoder-decoder model for joint intent detection and slot filling



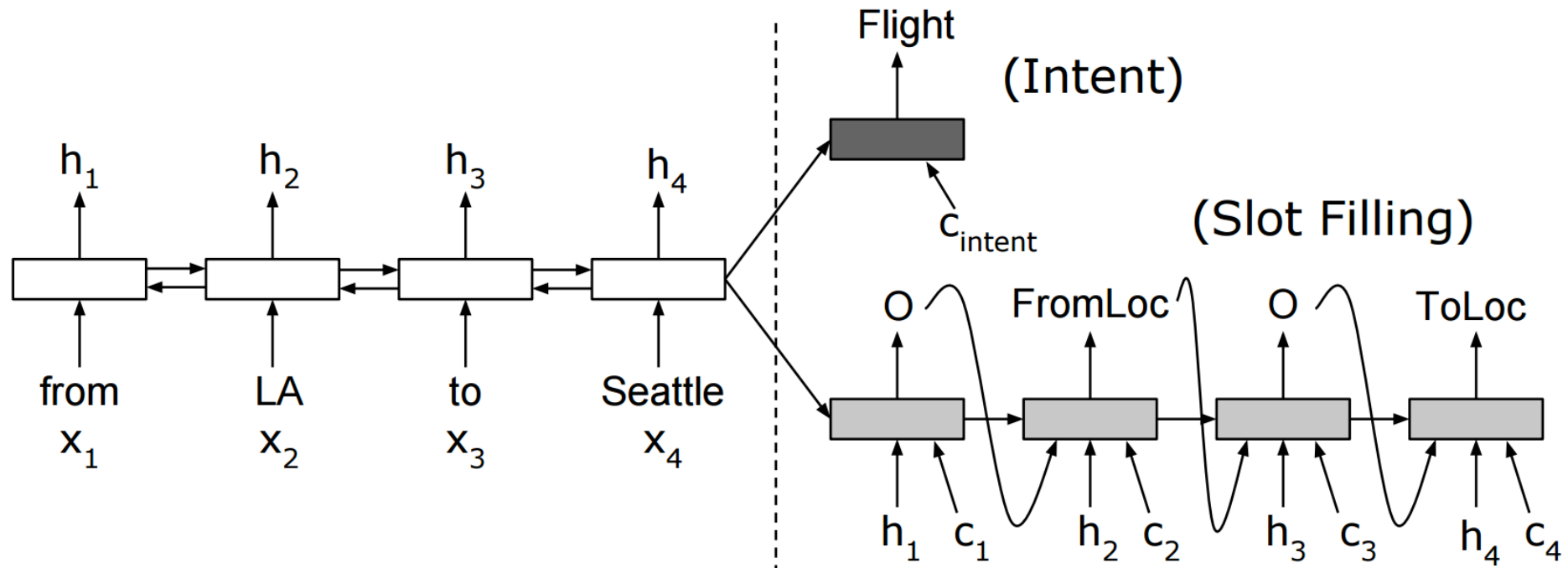
(a) with no aligned inputs.

Encoder-decoder model for joint intent detection and slot filling



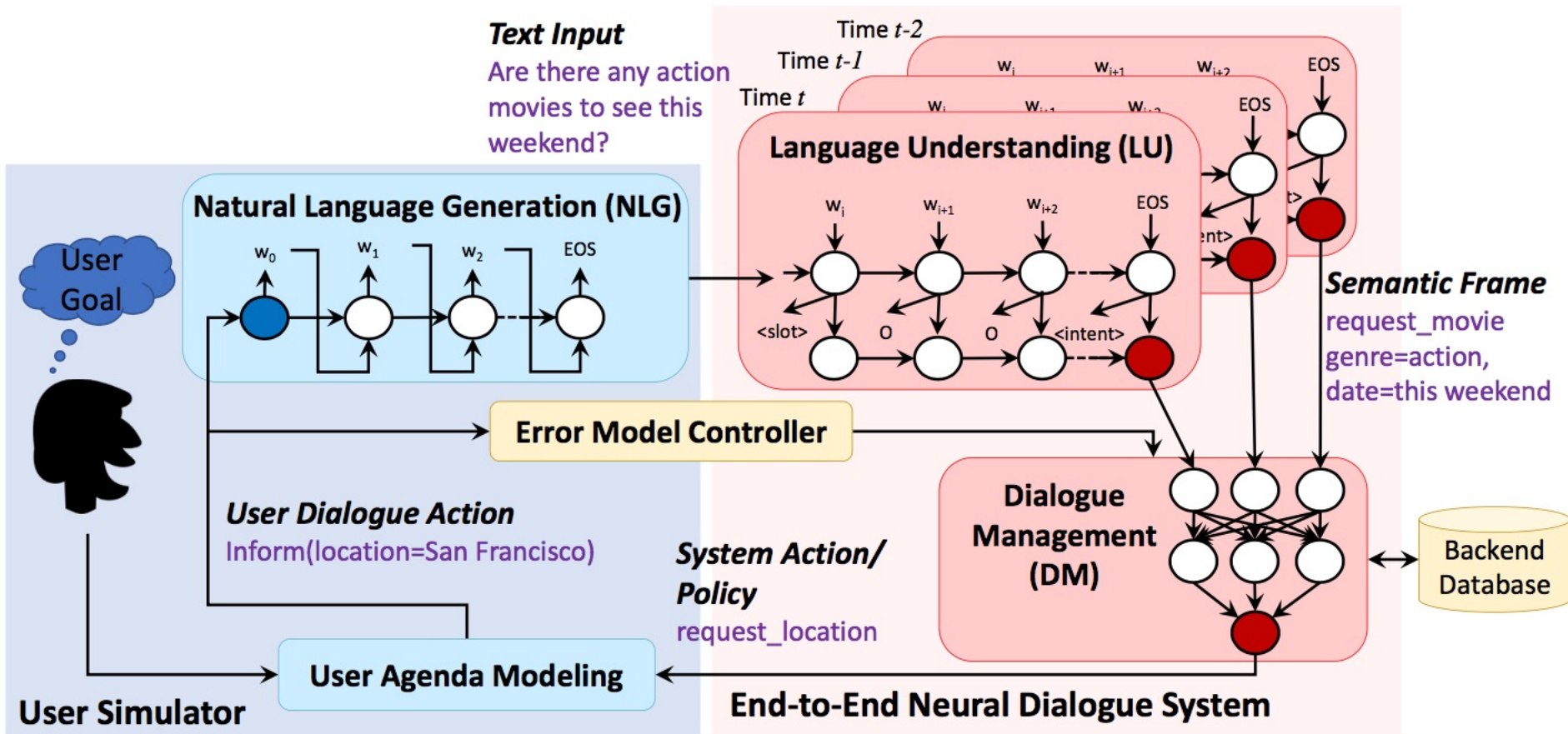
(b) with aligned inputs.

Encoder-decoder model for joint intent detection and slot filling



(c) with aligned inputs and attention

End-to-End Task-Completion Neural Dialogue Systems



Reinforcement learning is used to train all components in an end-to-end fashion

Slot Intent

W	find	action	movies	this	weekend
	↓	↓	↓	↓	↓
S	O	B-genre	O	B-date	I-date
I	find_movie				

Slot Intent

Annotations	
Intent	request, inform, deny, confirm_question, confirm_answer, greeting, closing, not_sure, multiple_choice, thanks, welcome
Slot	actor, actress, city, closing, critic_rating, date, description, distanceconstraints, greeting, implicit_value, movie_series, moviename, mpaa_rating, numberofpeople, numberofkids, taskcomplete, other, price, seating, starttime, state, theater, theater_chain, video_format, zip, result, ticket, mc_list

Sample dialogues generated by rule-based and RL agents

Rule-based agent

User: Can I get some tickets for zoolander 2?

Agent: What movie are you interested in?

User: I want to watch zoolander 2.

Agent: What time would you like to see it?

User: I want to watch at 9:25 pm.

Agent: What city you would like?

User: I want to watch at seattle.

Agent: What date would you like to watch it?

User: I want to set it up tomorrow.

Agent: Which theater would you like?

User: I want to watch at regal meridian 16.

Agent: How many tickets do you need?

User: I want 2 tickets please!

Agent: Great - I was able to purchase 2 tickets for you to see zoolander 2 tomorrow at regal meridian 16 theater in seattle at 9:25 pm.

User: Thank you.

Agent: Thank you.

Success

Sample dialogues generated by rule-based and RL agents

RL agent

User: Can I get tickets for zoolander 2 tomorrow?

Agent: Which city would you like?

User: I want to watch at seattle.

Agent: How many tickets do you need?

User: I want 2 tickets please!

Agent: 9:25 pm is available.

User: I want to watch at regal meridian 16.

Agent: Great - I was able to purchase 2 tickets for you to see zoolander 2 tomorrow at regal meridian 16 theater in seattle at 9:25 pm.

User: Thank you.

Agent: Thank you.

Success

Sample dialogues generated by rule-based and RL agents

New episode, user goal:

```
{  
  "request_slots": {  
    "ticket": "UNK"  
  },  
  "inform_slots": {  
    "city": "seattle",  
    "numberofpeople": "2",  
    "theater": "regal meridian 16",  
    "starttime": "9:25 pm",  
    "date": "tomorrow",  
    "moviename": "zoolander 2"  
  }  
}
```

A Deep Reinforcement Learning Chatbot

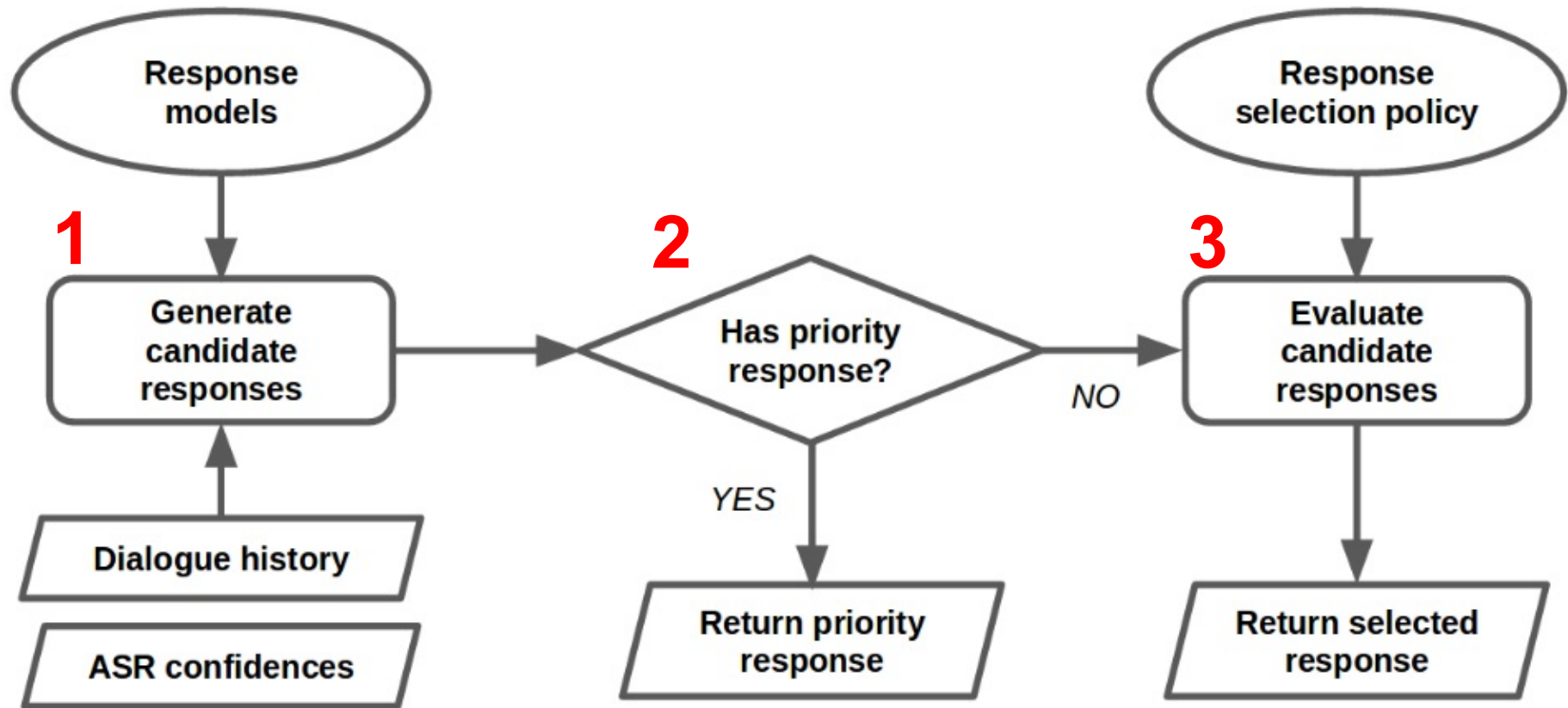
Iulian V. Serban, Chinnadhurai Sankar, Mathieu Germain, Saizheng Zhang, Zhouhan Lin, Sandeep Subramanian, Taesup Kim, Michael Pieper, Sarath Chandar, Nan Rosemary Ke, Sai Mudumba, Alexandre de Brebisson Jose M. R. Sotelo, Dendi Suhubdy, Vincent Michalski, Alexandre Nguyen, Joelle Pineau and Yoshua Bengio

**Montreal Institute for Learning Algorithms,
Montreal, Quebec, Canada**

**A Deep Reinforcement Learning
Chatbot
MILABOT:
Chatbot developed by the
Montreal Institute for Learning
Algorithms (MILA)
for the
Amazon Alexa Prize competition**

MILABOT

Dialogue manager control flow



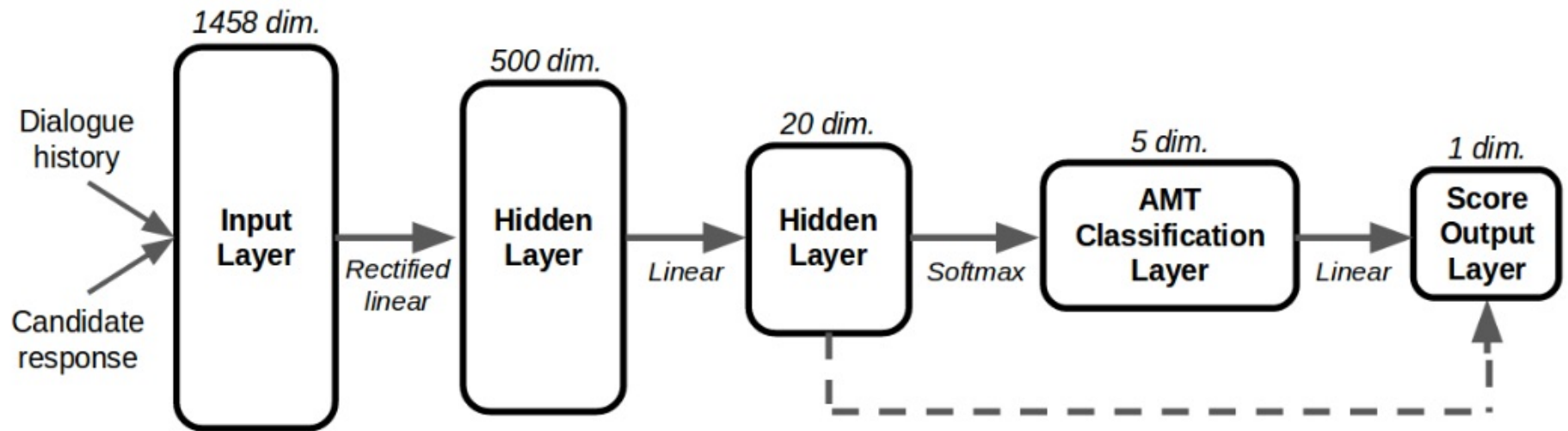
Q: "What is your name?"

R: "I am an Alexa Prize Socialbo"

Dialogue	Dialogue
<p>SYSTEM: Hi. This is an Alexa Prize socialbot.</p> <p>USER: Hi</p> <p>SYSTEM: Do you have pets?</p> <p>USER: Yes, I have two rabbits.</p>	<p>...</p> <p>USER: Let's talk about movies.</p> <p>SYSTEM: What's your favorite movie?</p> <p>USER: star wars movie</p>
Candidate Responses	Candidate Responses
<p>BoWEscapePlan: I don't have an answer for this.</p> <p>BoWFactGenerator: Did you know that male rabbits are called bucks, females are does?</p> <p>GRUQuestionGenerator: How about the American family of it?</p> <p>Initiatorbot: Do you believe in love at first sight?</p> <p>LSTMClassifierMSMarco: Mar 23, 2017 Two Parts: Learning What to Feed Your Rabbit Learning How to ...</p> <p>DualEncoderRedditNews: bye doggie</p> <p>DualEncoderRedditPolitics: Who's edger u shboys?</p> <p>Alicebot: Hurrah! Two is a good number of rabbits.</p> <p>Elizabot: OK, but can you elaborate a bit?</p> <p>VHREDRedditMovies: Hmm. Nope, never heard of it.</p> <p>VHREDSubtitles: Would you like to see them?</p> <p>HelpResponse: I would really like to talk about news, politics or movies.</p>	<p>BoWEscapePlan: I don't have an answer for this.</p> <p>BoWFactGenerator: Here's an interesting fact. The international telephone dialing code for Antarctica is 672.</p> <p>GRUQuestionGenerator: how about your New York City?</p> <p>Initiatorbot: How was your day?</p> <p>LSTMClassifierMSMarco: A third Anthology film will be released in 2020.</p> <p>DualEncoderRedditNews: Now whisper it to me , one more time bby.</p> <p>DualEncoderRedditPolitics: hahaha on mobile this ain't even close. I wish I could show you but this looks awful I'm sorry man.</p> <p>Alicebot: What did you like about the robots in that movie?</p> <p>Elizabot: How does that make you feel?</p> <p>Evi: Star Wars movie a movie in the Star Wars series.</p> <p>VHREDRedditMovies: Oh please. Please. Pleecease. Let this happen.</p> <p>VHREDSubtitles: What?</p> <p>HelpResponse: I would really like to talk about news, politics or movies.</p>

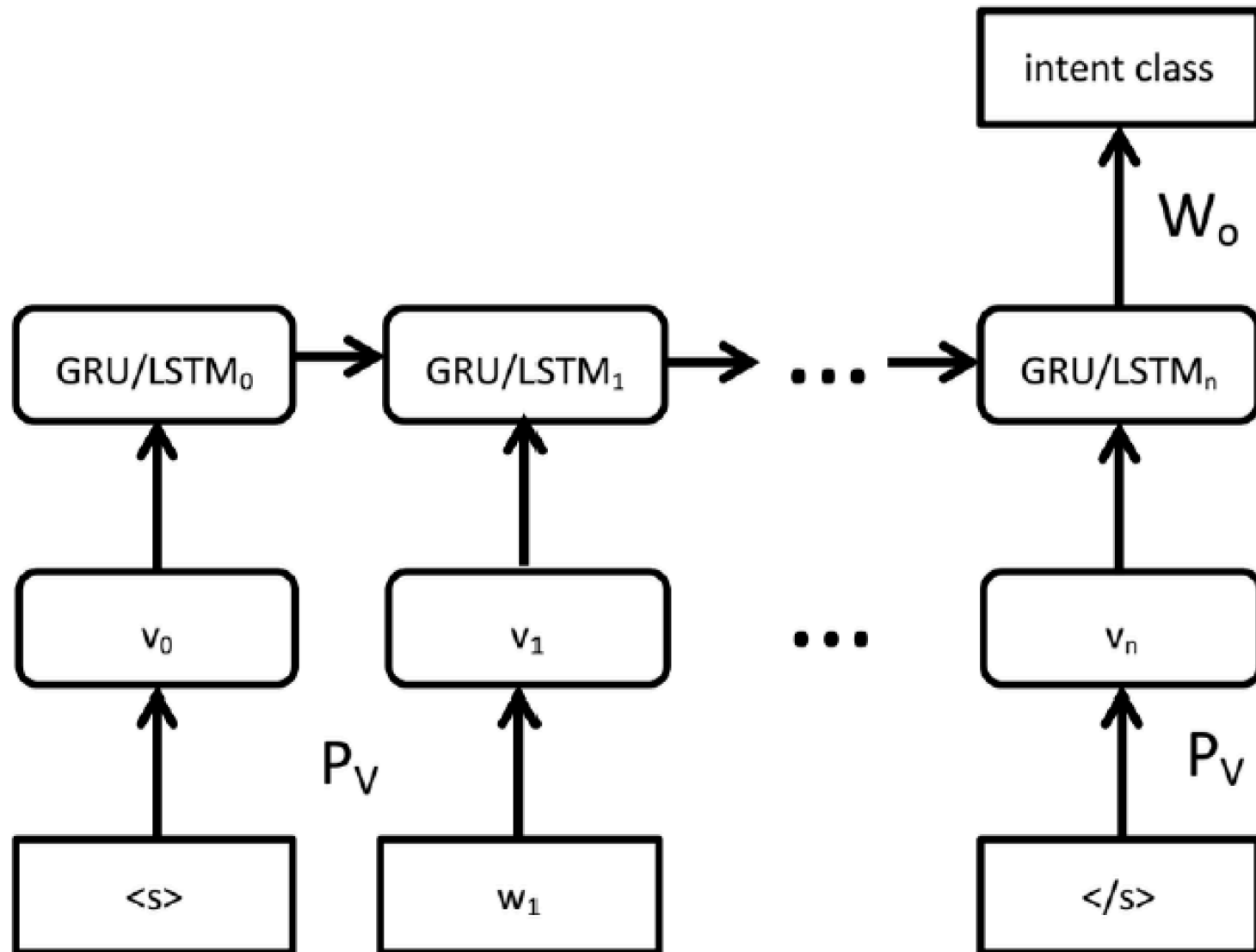
MILABOT

Computational graph for scoring model

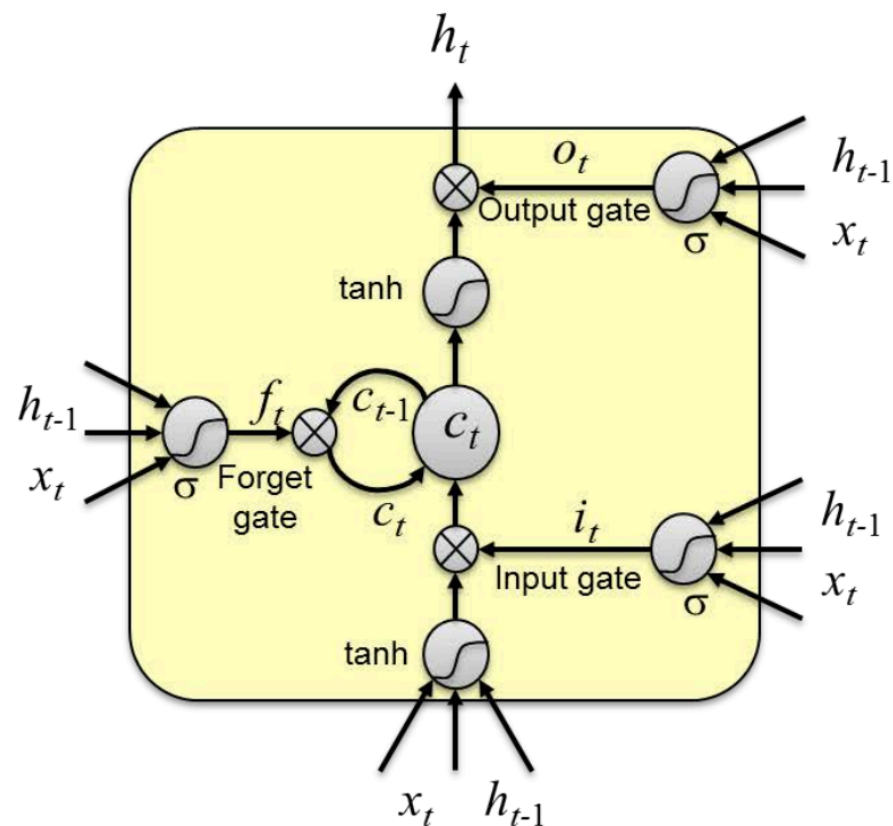
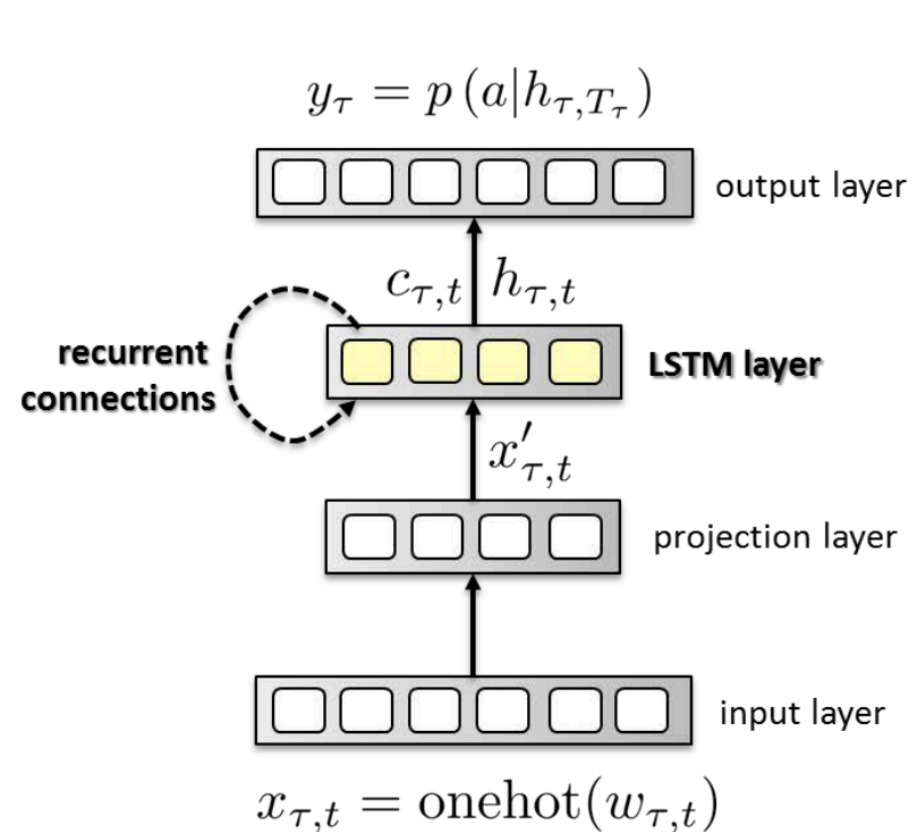


model selection policies based on
both action-value function and stochastic policy parametrizations

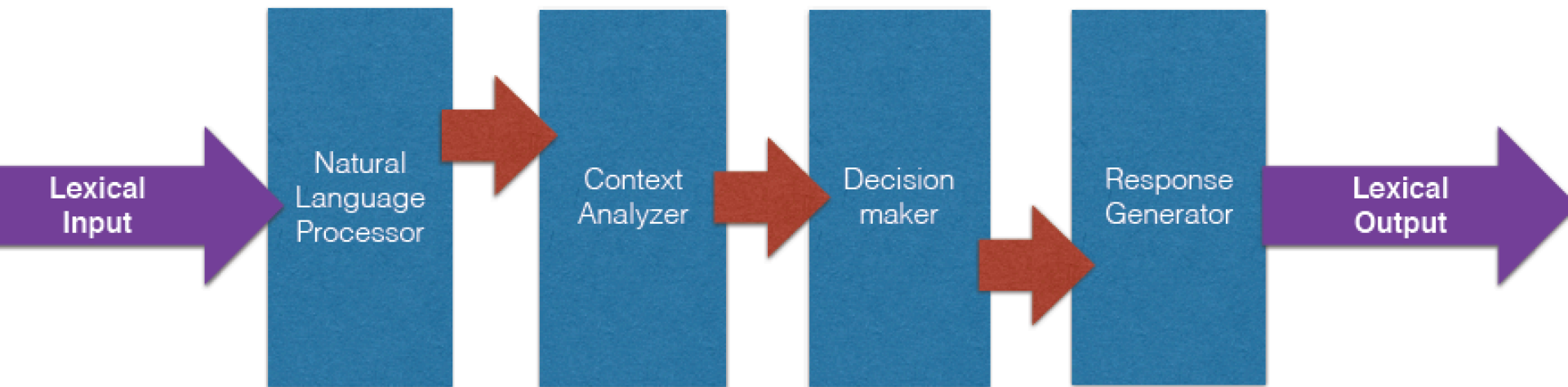
LSTM/GRU Utterance Classifier



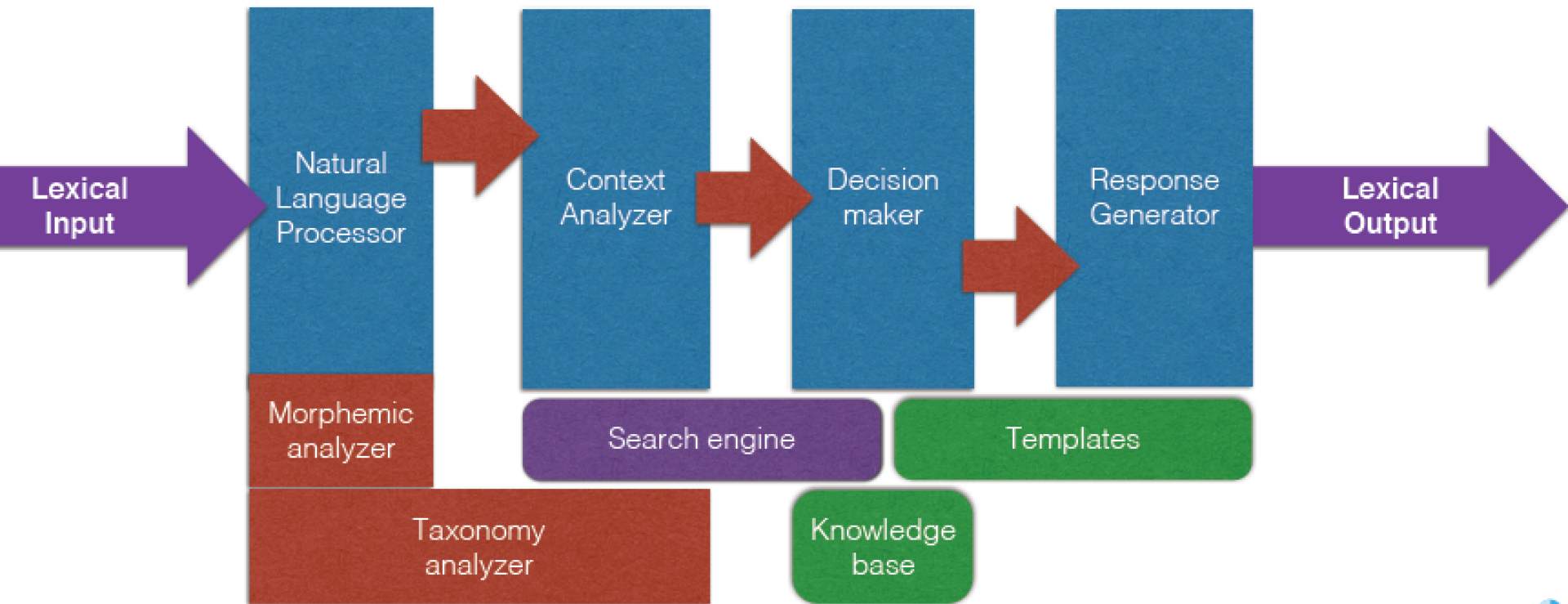
RNN and LSTM cell



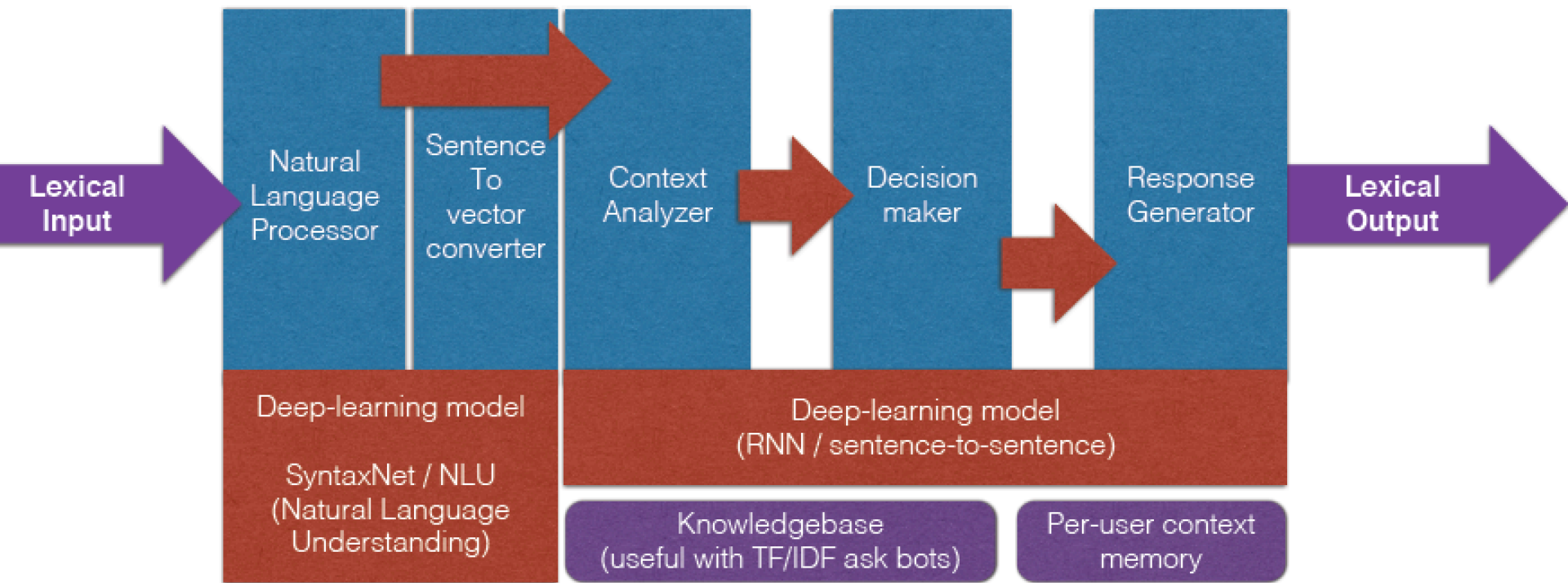
Basic Chat Bot Components



Traditional Chat Bots

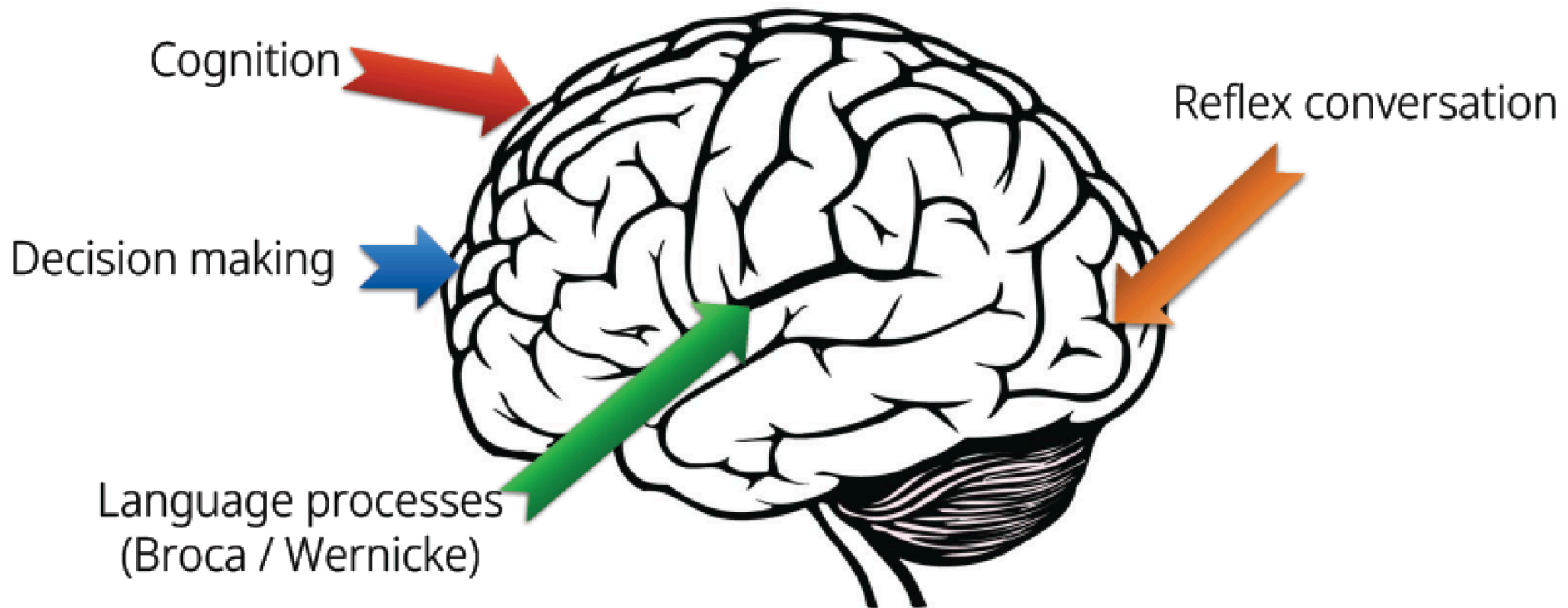


Chatbots with Machine Learning



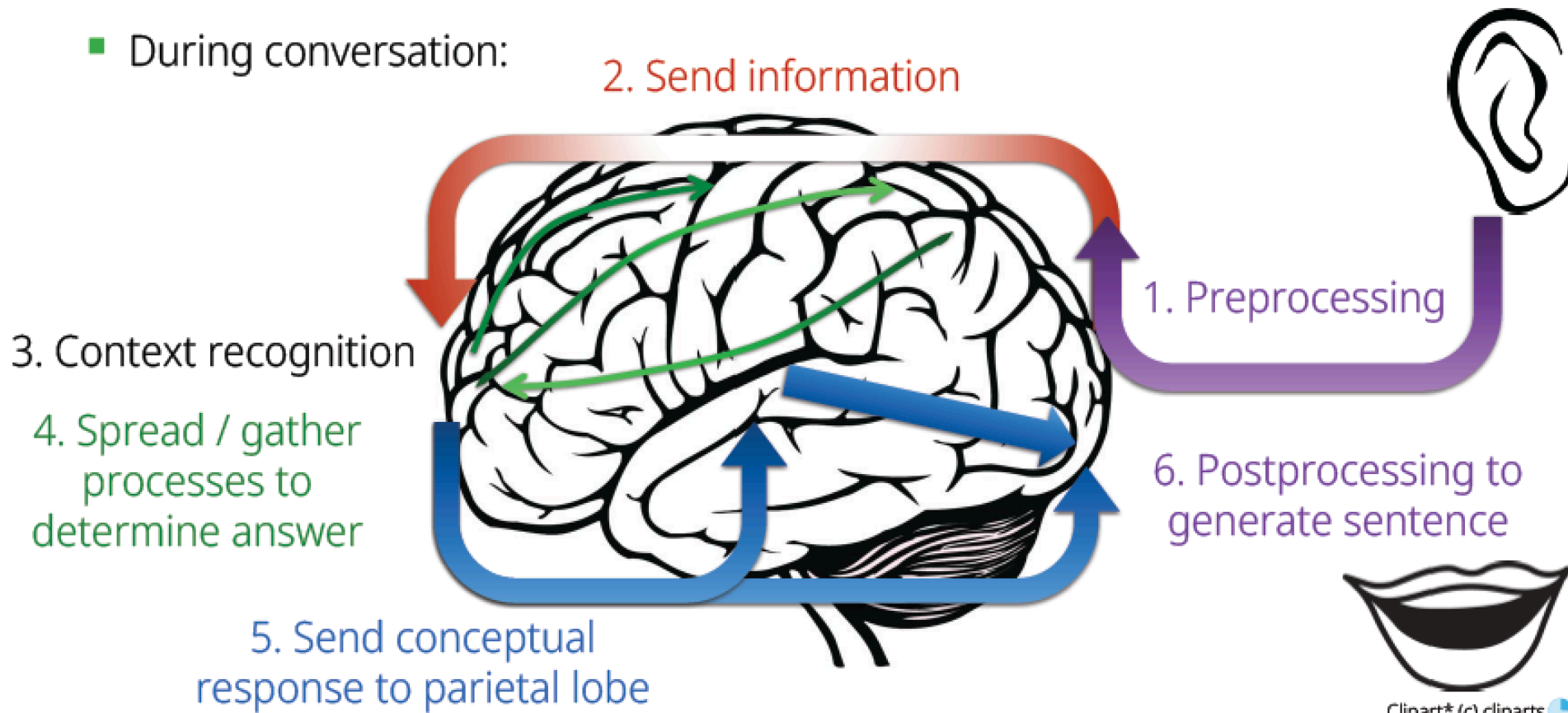
How Brain Works

- Parallelism: performing a task at separated areas



Information Pathway During Conversation

- During conversation:



Clipart* (c) cliparts.

Idea from Structure

- During conversation:

2. Send information

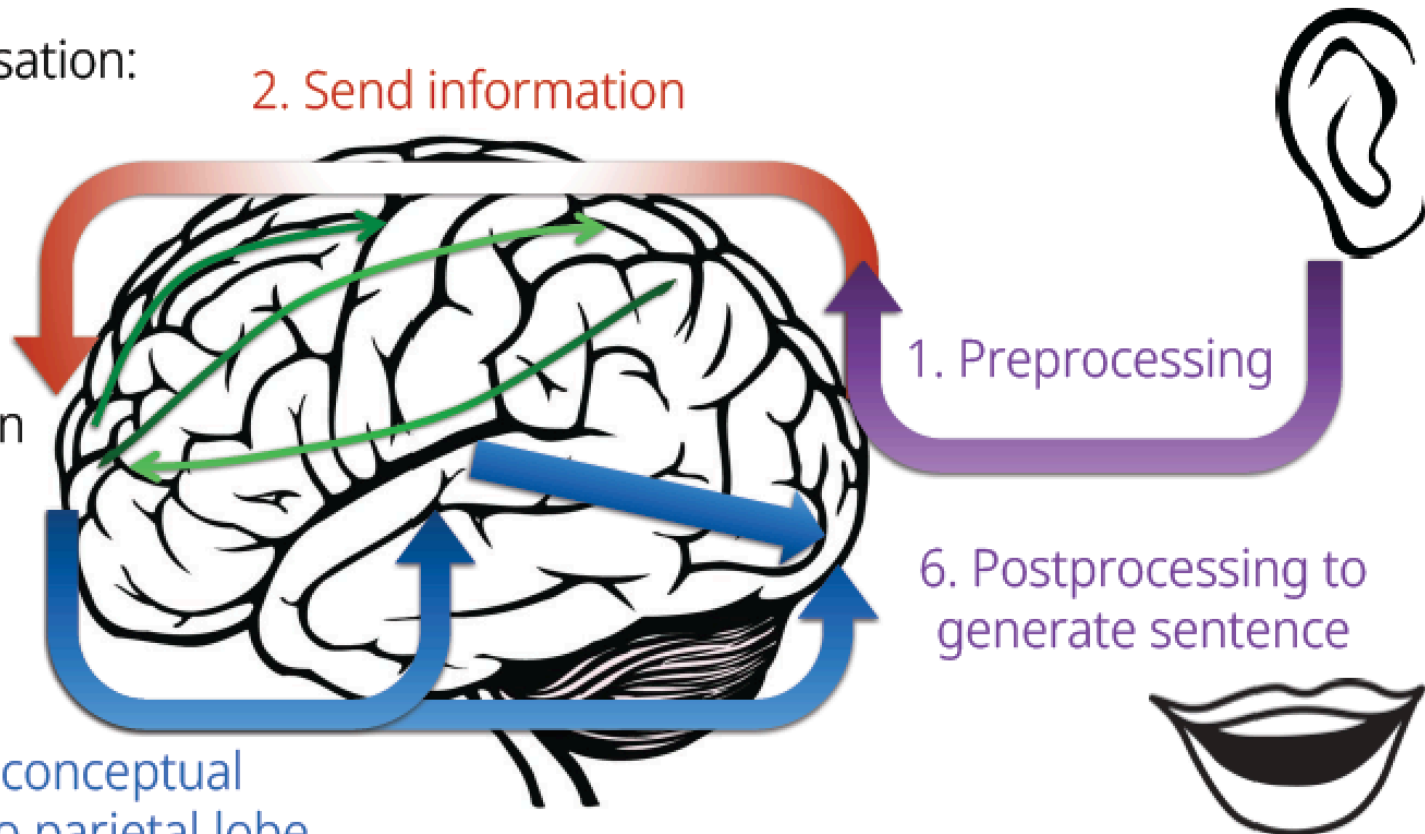
1. Preprocessing

3. Context recognition

4. Spread / gather
processes to
determine answer

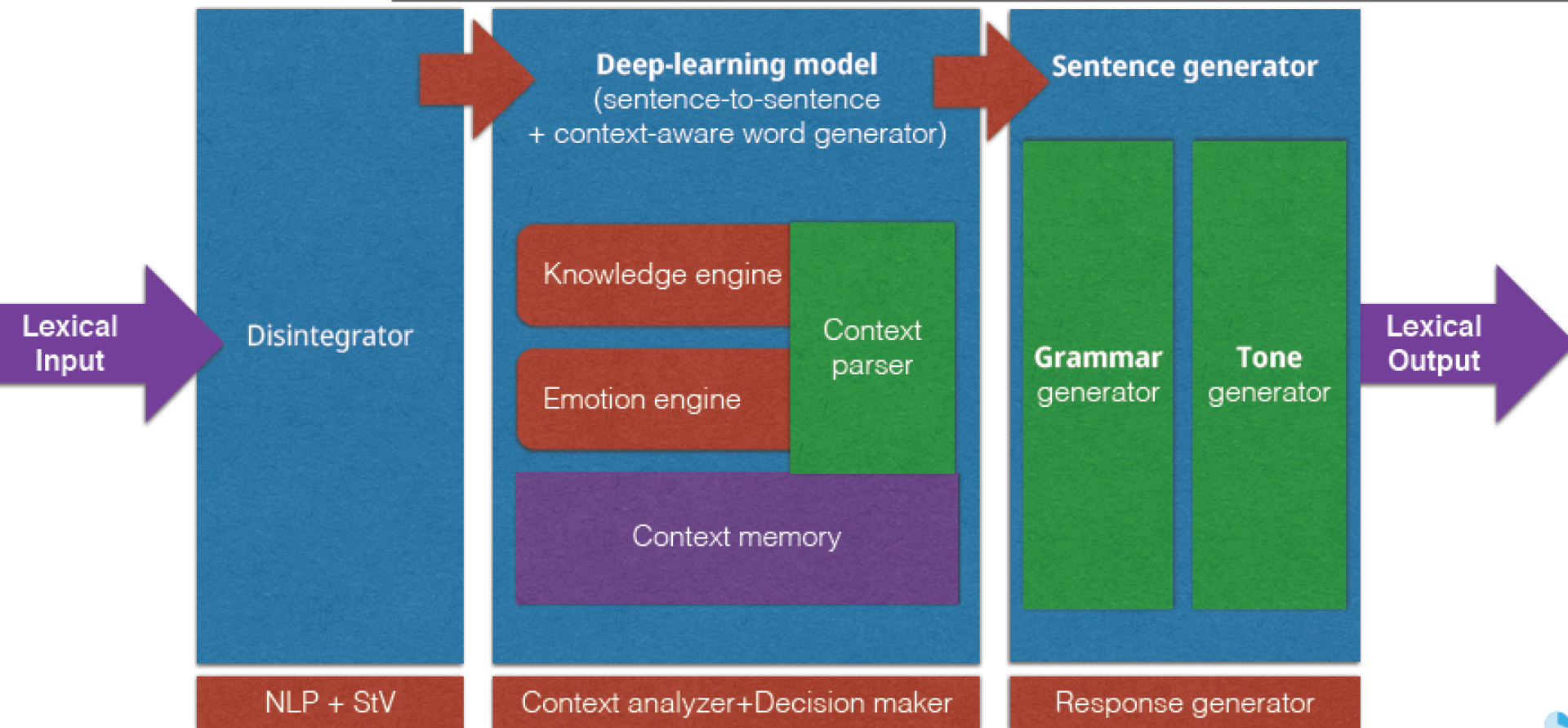
5. Send conceptual
response to parietal lobe

6. Postprocessing to
generate sentence

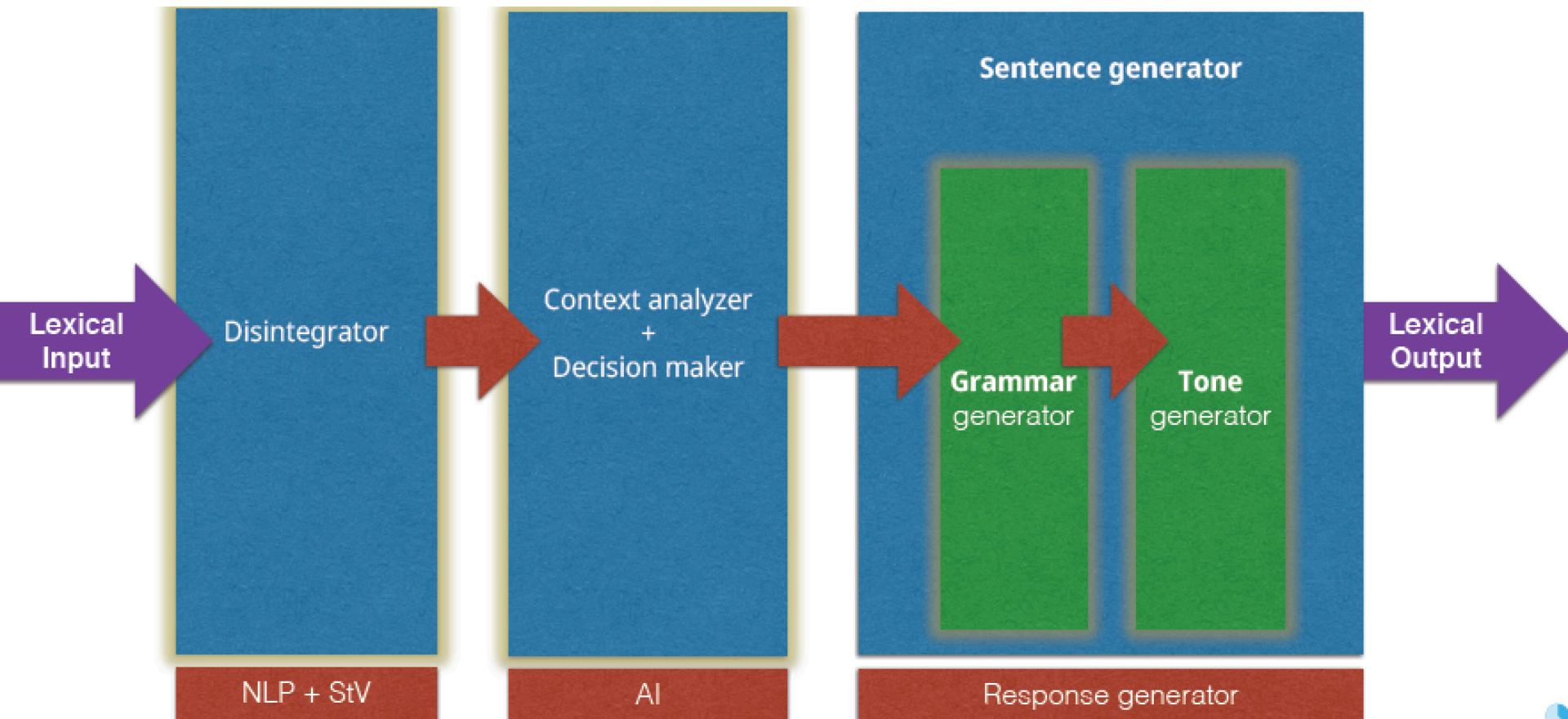


Clipart* (c) cliparts.

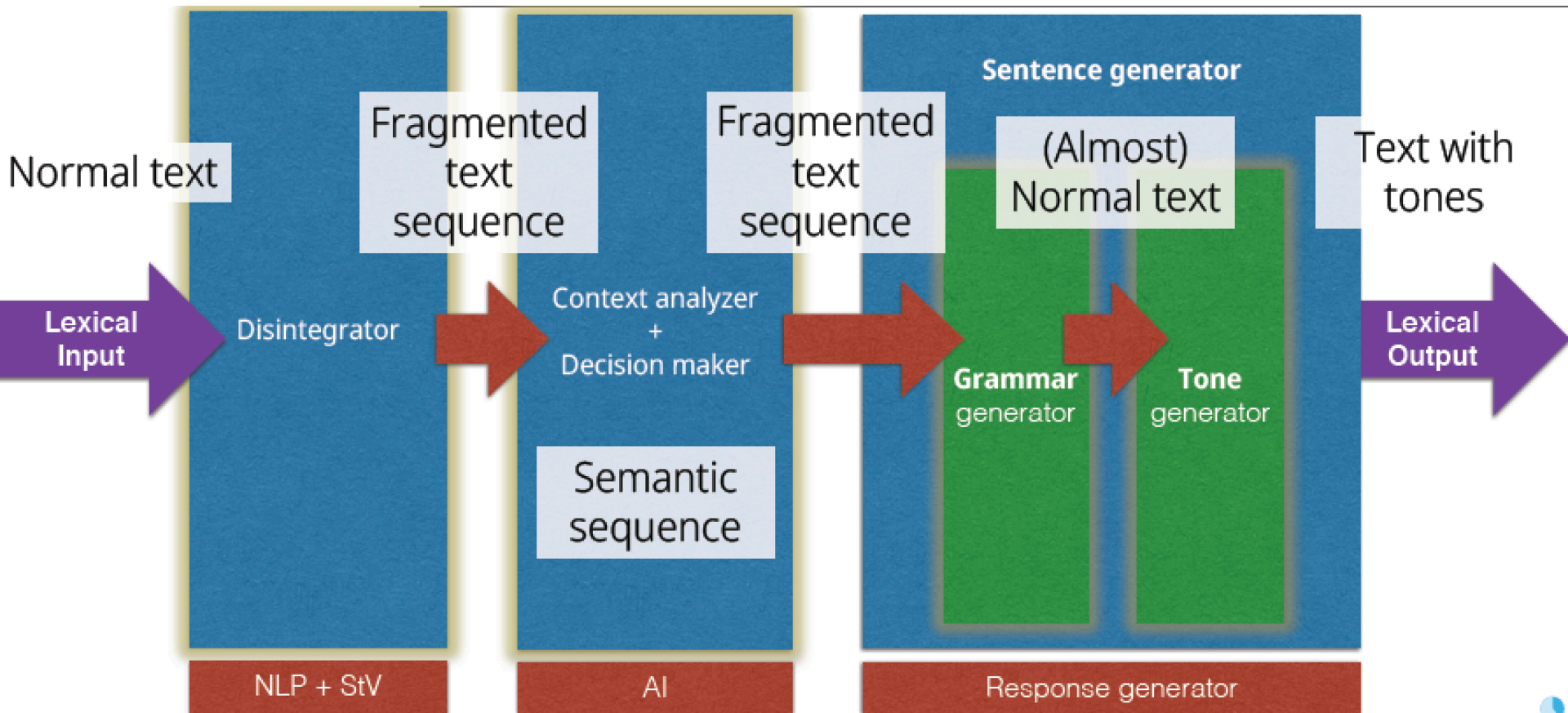
AI Deep Learning Chatbot Architecture



Model Chain Order



Model Chain Order



AI Deep Learning for Chatbot

No way, are you caring me now?



Disintegrator

no way you care I now



Context analyzer

[GUESS] I [CARE] [PRESENT]



Decision maker

because yesterday you tired



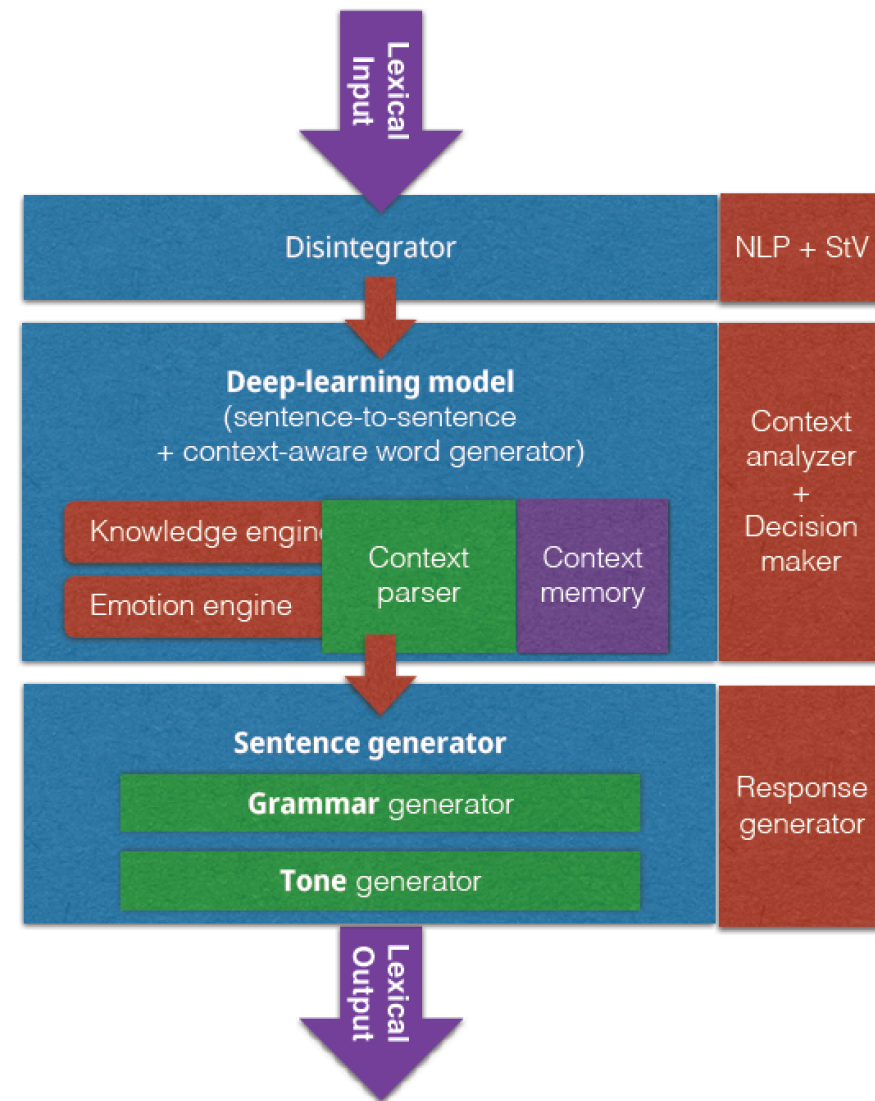
Grammar generator

Because you looked tired yesterday



Tone generator

Because you looked tired yesterday hmm



Data Converter for Chatbot Subtitle Files from Movie

.smi to .srt

Join
.srt files into one .txt

```
cat *.srt >> data.txt
```

Remove
timestamps
and
blank lines

Remove
Logo / Ending
Song scripts

: Lines with
Japanese
Characters
and
the next lines
of them

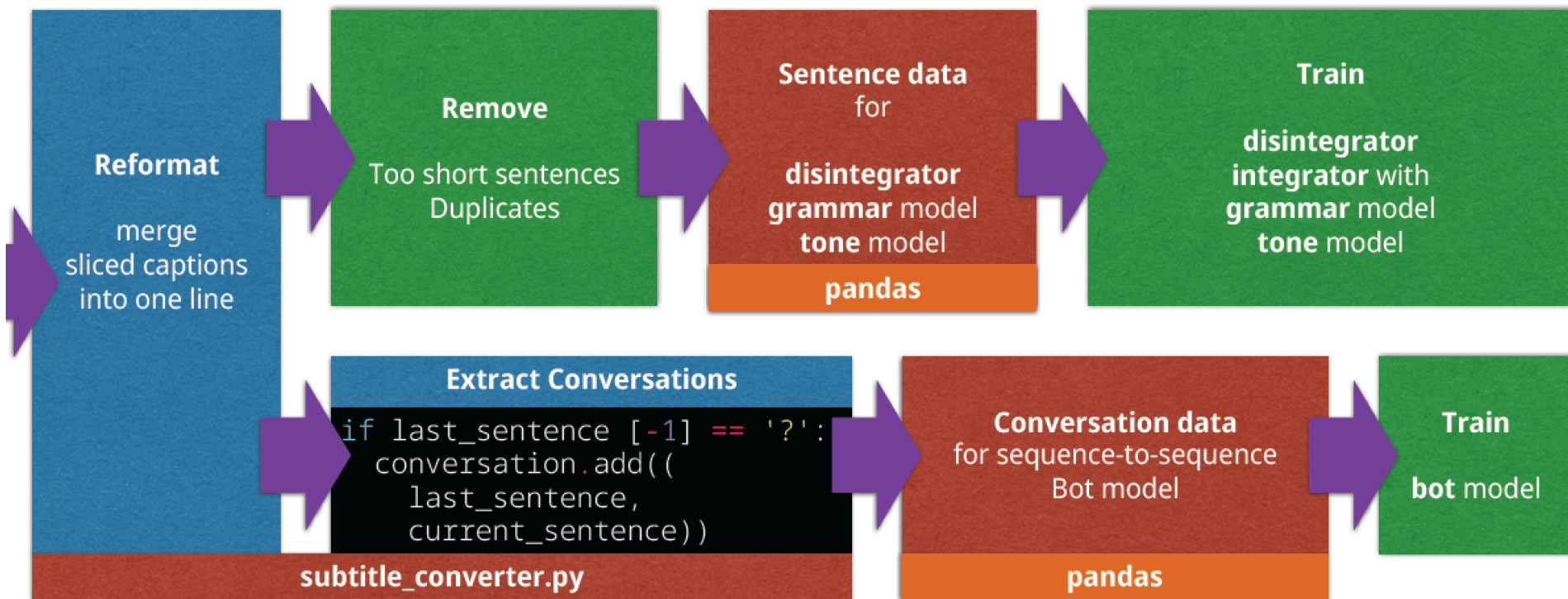
Fetch

Character names
Nouns
Numbers
using
custom dictionary

(Anime characters,
Locations,
Specific nouns)

subtitle_converter.py

Data Converter for Chatbot Subtitle Files from Movie



Conversation Bot Model

- Embedding RNN Sequence-to-sequence model
 - Testing
 - 4-layer to 8-layer swallow learning (without input/output layer)
- Use `tensorflow.contrib.learn` (formally `sklearn` package)
 - Simpler and easier than traditional handcrafted RNN
 - Seq2seq, LSTMCell, GRUCell

Chatbot Architectures

- Information Retrieval based Bot (IR-Bot)
- Task Oriented Bot (Task-Bot)
- Chitchat-Bot (Chatbot)

Ask Me Anything: Dynamic Memory Networks for Natural Language Processing

Dynamic Memory Networks (DMN)

- I: Jane went to the hallway.
- I: Mary walked to the bathroom.
- I: Sandra went to the garden.
- I: Daniel went back to the garden.
- I: Sandra took the milk there.
- Q: Where is the milk?

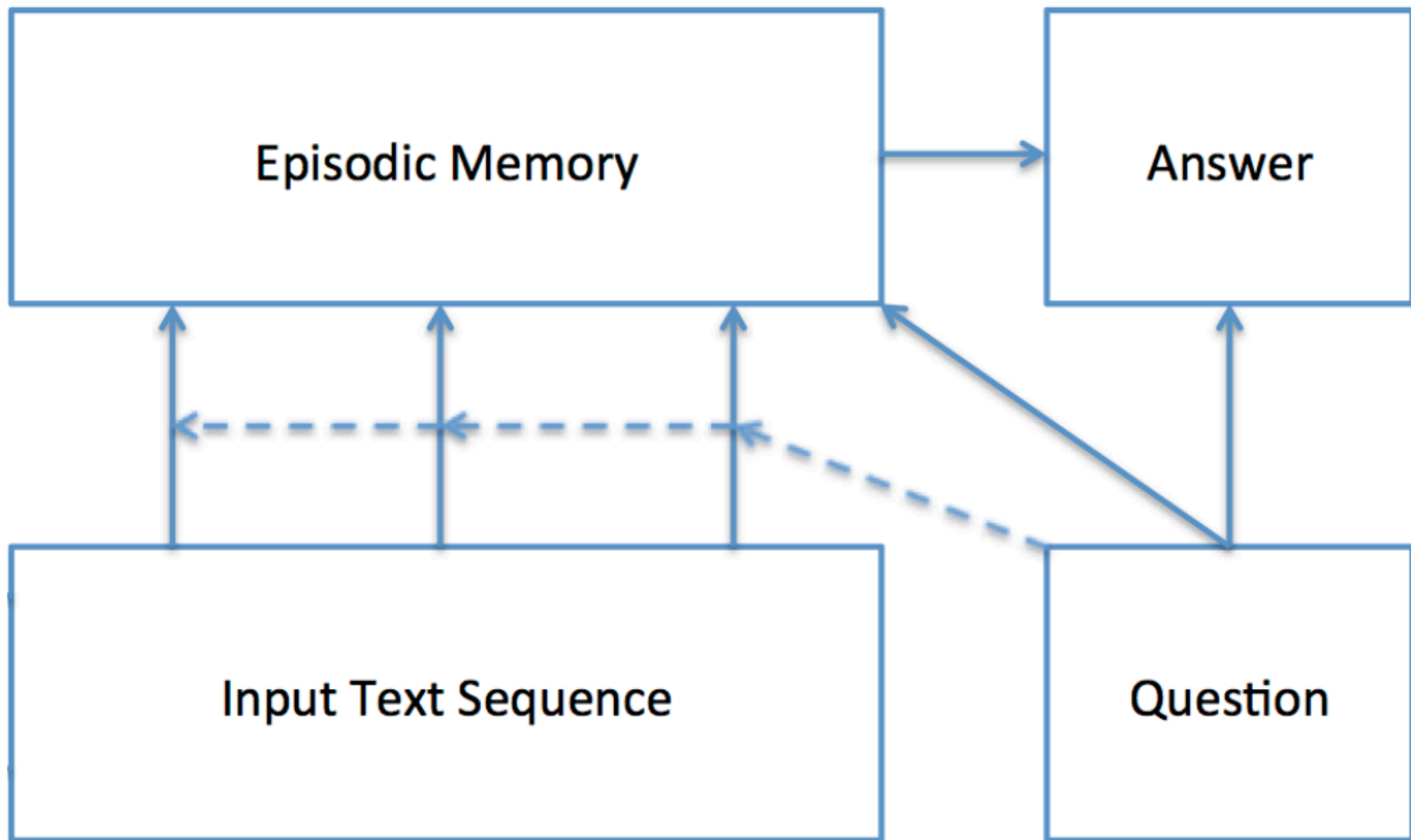
Dynamic Memory Networks (DMN)

- I: Jane went to the hallway.
- I: Mary walked to the bathroom.
- I: Sandra went to the garden.
- I: Daniel went back to the garden.
- I: Sandra took the milk there.
- Q: Where is the milk?
- A: garden

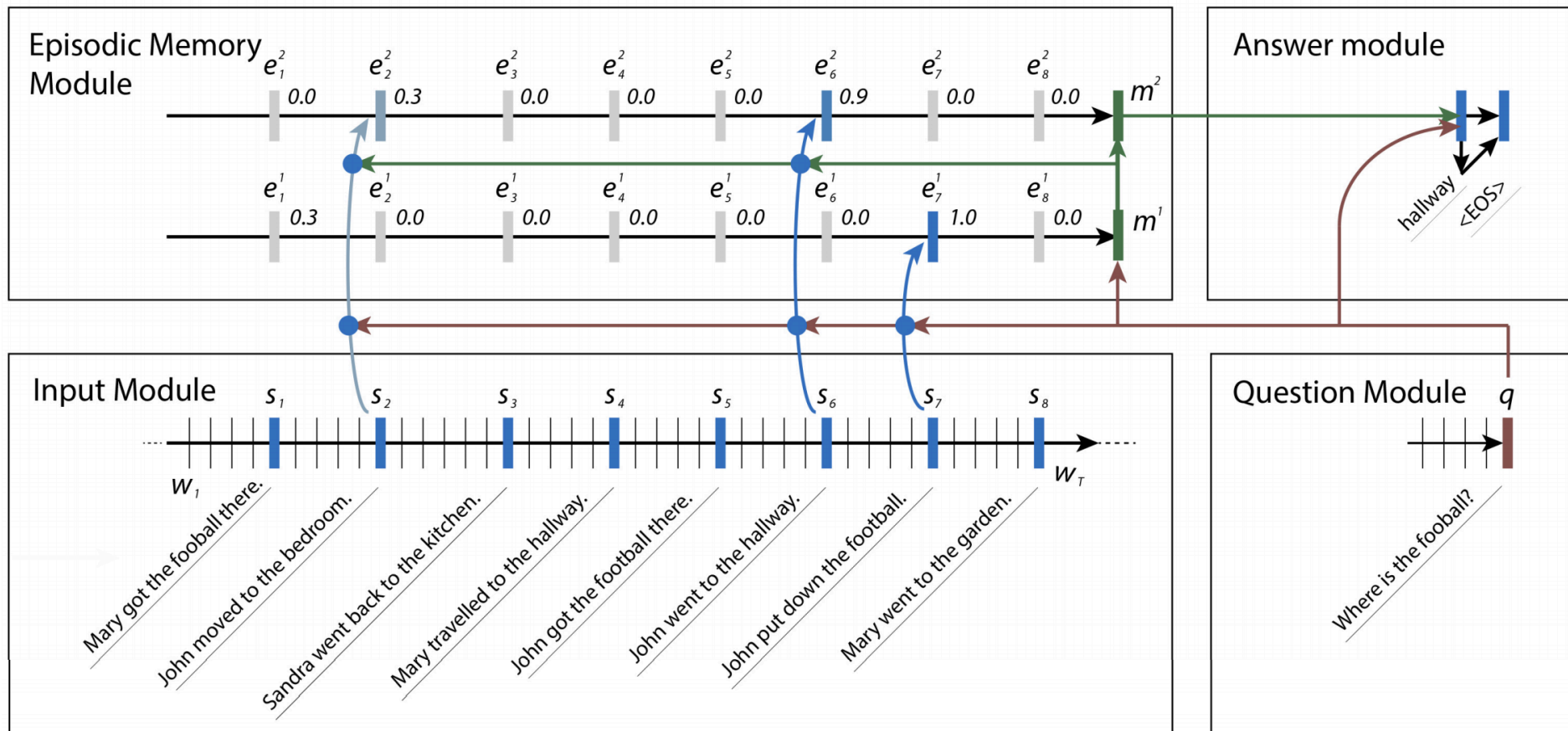
Dynamic Memory Networks (DMN)

- I: Jane went to the hallway.
- I: Mary walked to the bathroom.
- I: Sandra went to the garden.
- I: Daniel went back to the garden.
- I: Sandra took the milk there.
- Q: Where is the milk?
- A: garden
- I: It started boring, but then it got interesting.
- Q: What's the sentiment?
- A: positive
- Q: POS tags?
- A: PRP VBD JJ , CC RB PRP VBD JJ .

Dynamic Memory Networks (DMN)



Dynamic Memory Networks (DMN)



Dynamic Memory Networks (DMN)

Question: **Where was Mary before the Bedroom?**

Facts	Episode 1	Episode 2	Episode 3
Yesterday Julie traveled to the school.			
Yesterday Marie went to the cinema.			
This morning Julie traveled to the kitchen.			
Bill went back to the cinema yesterday.			
Mary went to the bedroom this morning.			
Julie went back to the bedroom this afternoon.			
[done reading]			

Dynamic Memory Networks (DMN)

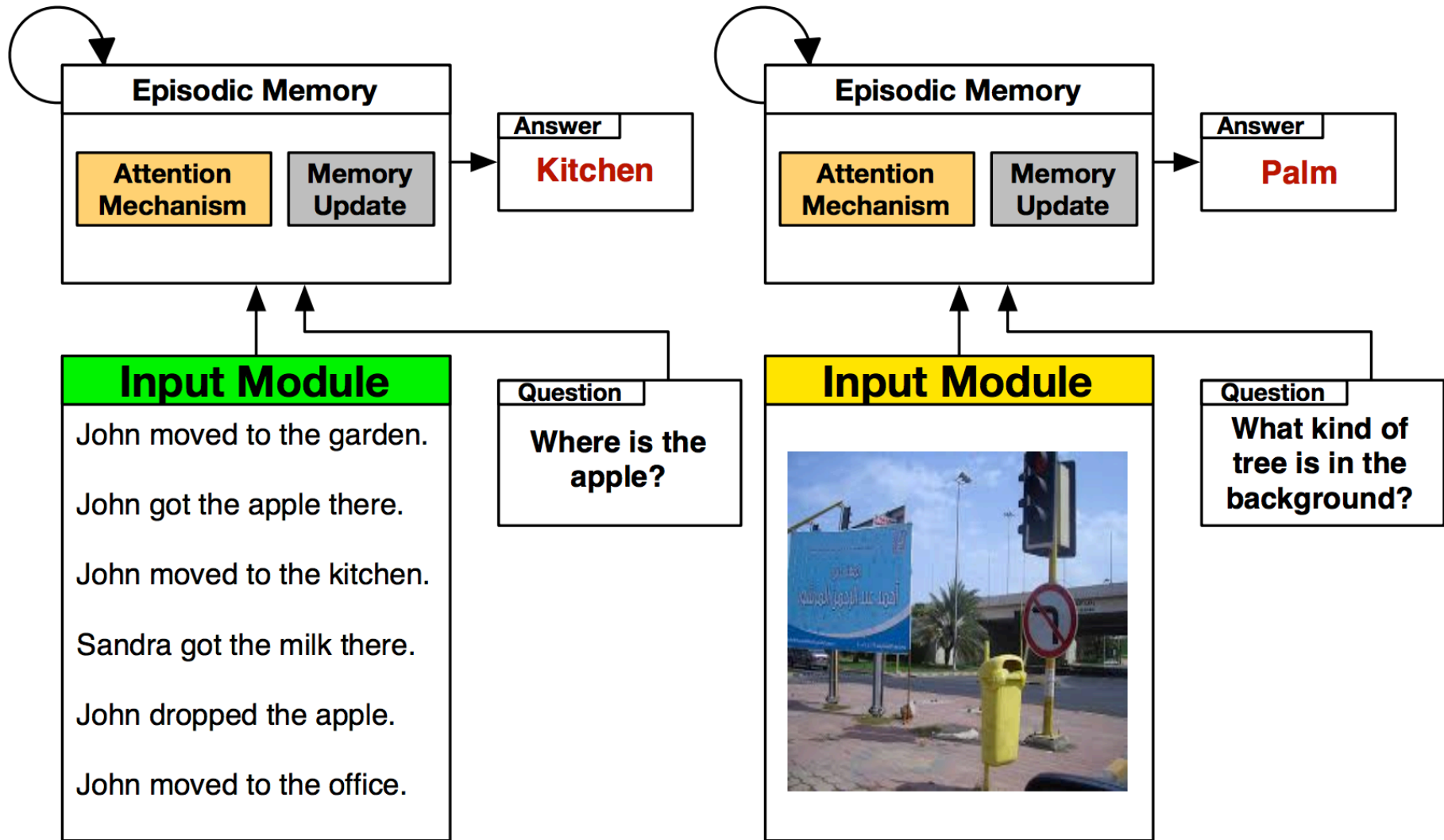
Question: Where was Mary before the Bedroom?

Answer: Cinema.

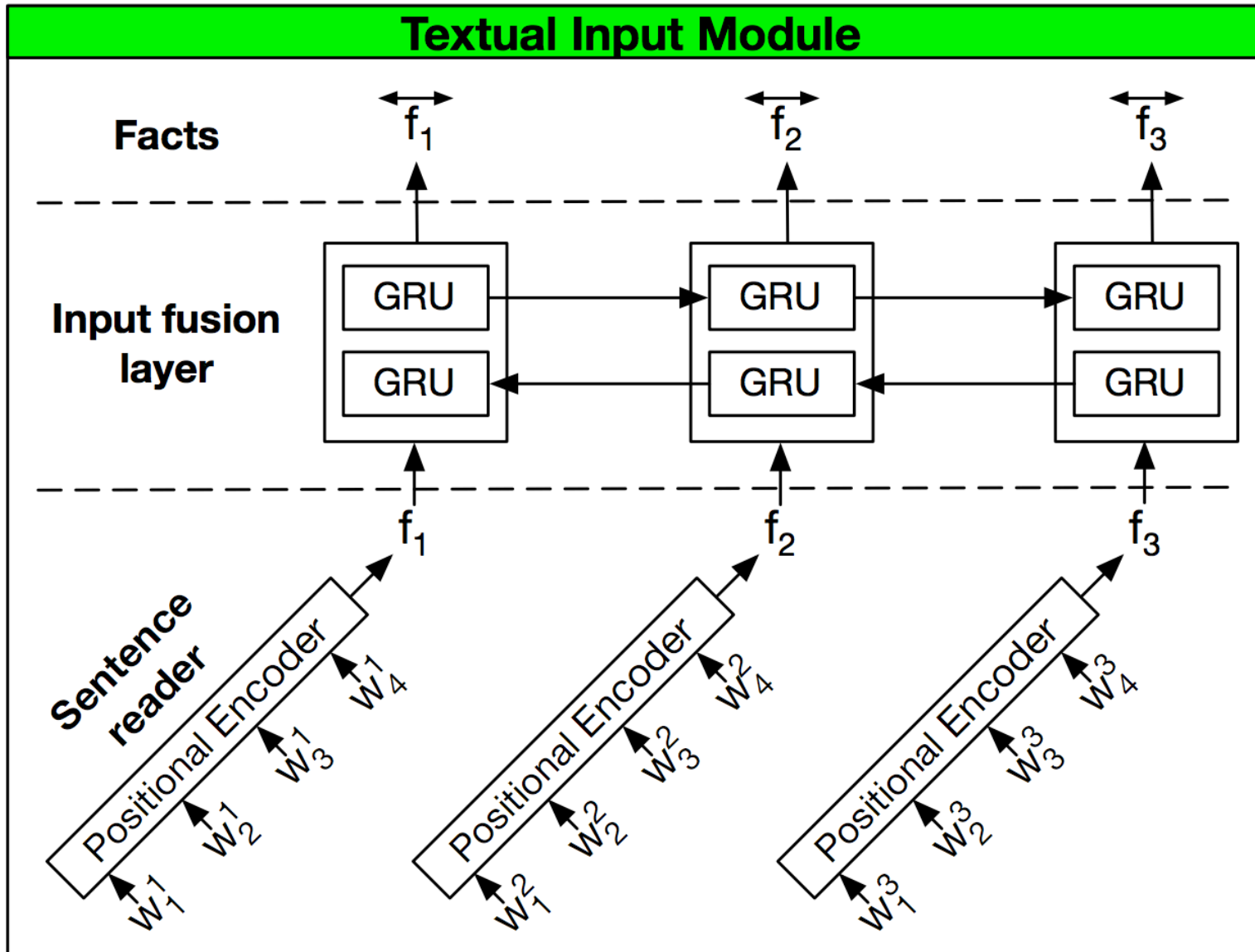
Facts	Episode 1	Episode 2	Episode 3
Yesterday Julie traveled to the school.			
Yesterday Marie went to the cinema.			
This morning Julie traveled to the kitchen.			
Bill went back to the cinema yesterday.			
Mary went to the bedroom this morning.			
Julie went back to the bedroom this afternoon.			
[done reading]			

Dynamic Memory Networks for Visual and Textual Question Answering

Question Answering with Dynamic Memory Network (DMN+)

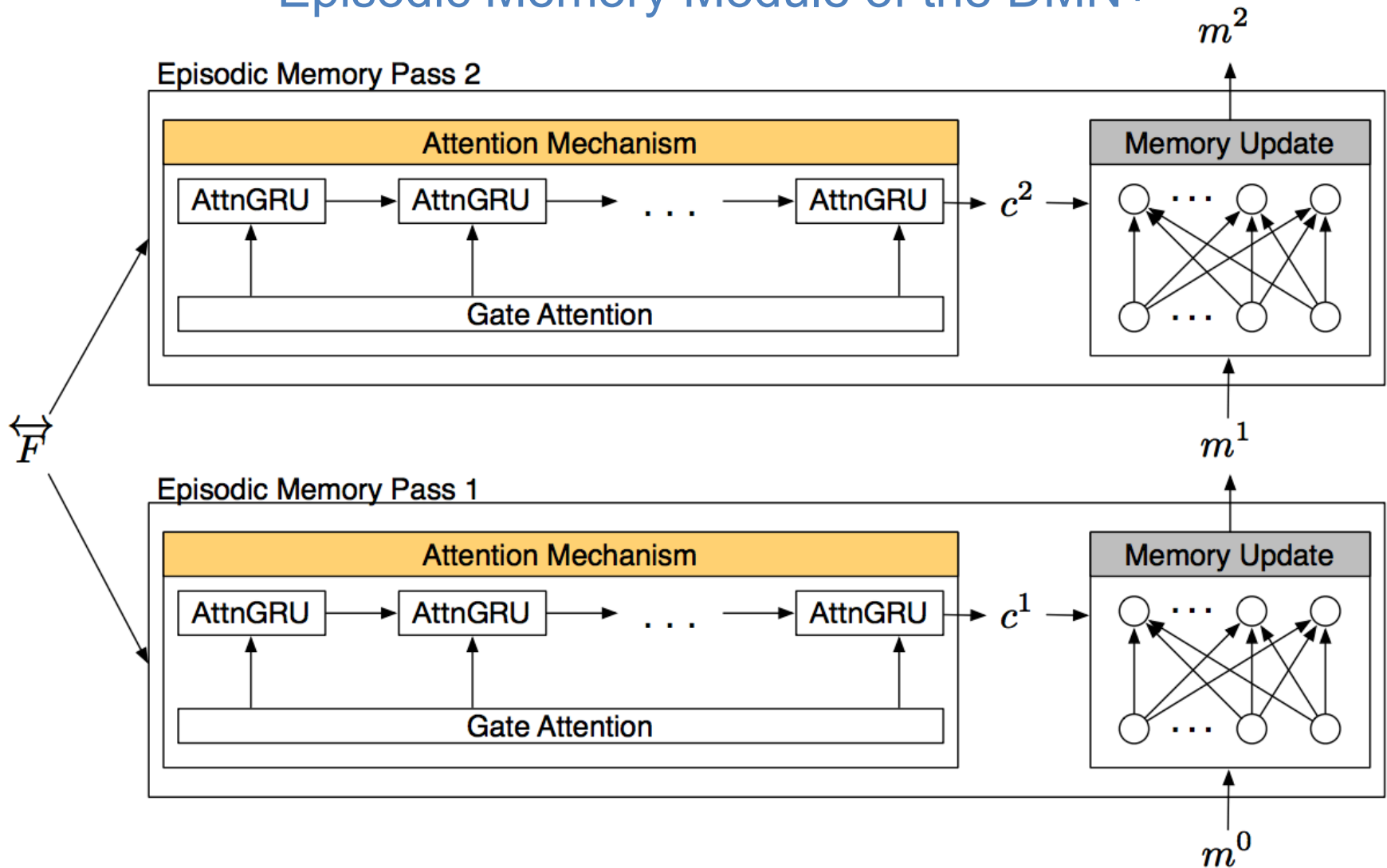


Dynamic Memory Network (DMN+)

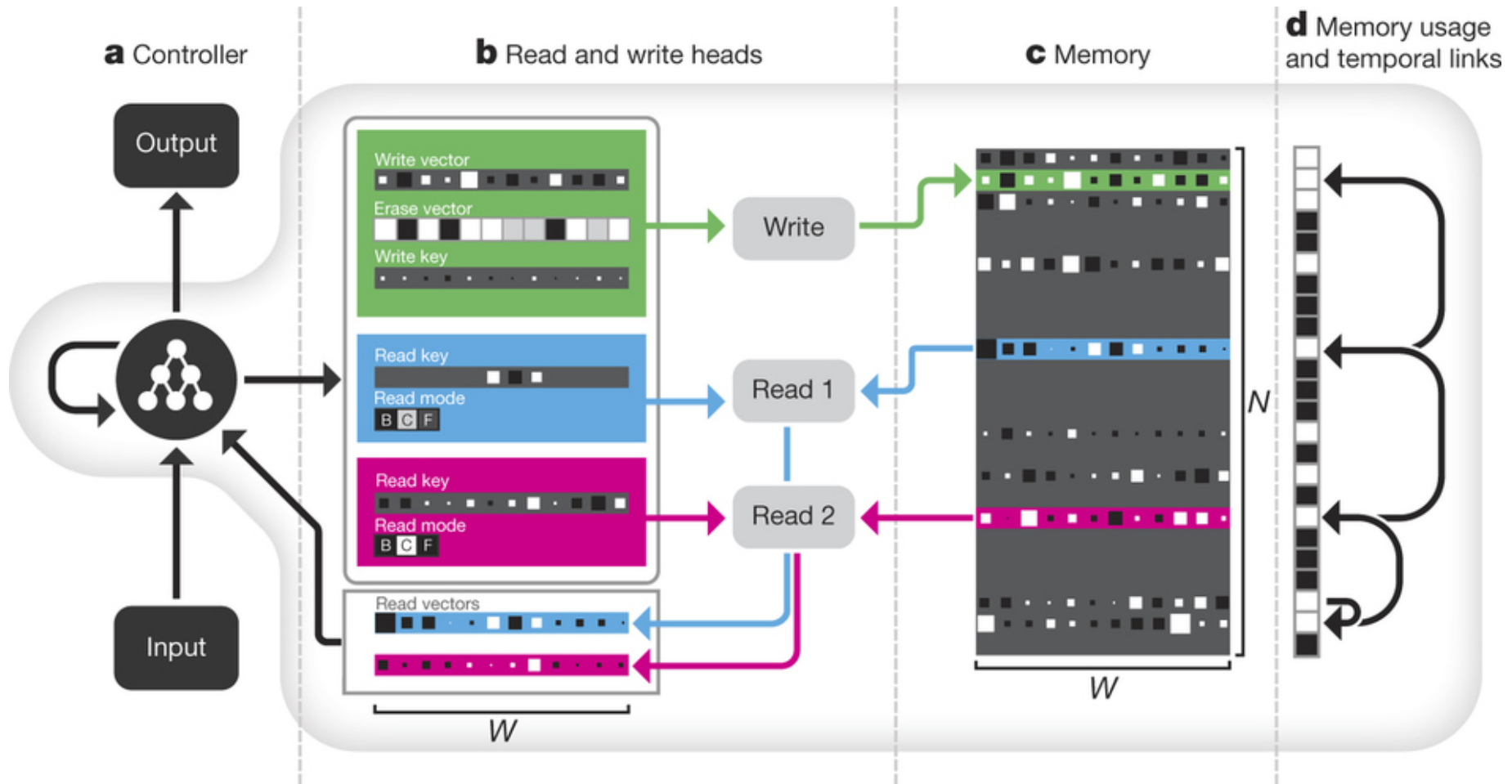


Dynamic Memory Network (DMN+)

Episodic Memory Module of the DMN+



Differentiable Neural Computer (DNC)



Facebook AI Research :

bAbI Project

- The (20) QA bAbI tasks
- The (6) dialog bAbI tasks
- The Children's Book Test
- The Movie Dialog dataset
- The WikiMovies dataset
- The Dialog-based Language Learning dataset
- The SimpleQuestions dataset

Facebook bAbI QA Datasets

- 1 Mary moved to the bathroom.
- 2 John went to the hallway.
- 3 Where is Mary? bathroom 1
- 4 Daniel went back to the hallway.
- 5 Sandra moved to the garden.
- 6 Where is Daniel? hallway 4
- 7 John moved to the office.
- 8 Sandra journeyed to the bathroom.
- 9 Where is Daniel? hallway 4
- 10 Mary moved to the hallway.
- 11 Daniel travelled to the office.
- 12 Where is Daniel? office 11
- 13 John went back to the garden.
- 14 John moved to the bedroom.
- 15 Where is Sandra? bathroom 8
- 1 Sandra travelled to the office.
- 2 Sandra went to the bathroom.
- 3 Where is Sandra? bathroom 2

Facebook bAbI QA Datasets

Task 1: Single Supporting Fact

Mary went to the bathroom.
John moved to the hallway.
Mary travelled to the office.
Where is Mary? A: office

Task 2: Two Supporting Facts

John is in the playground.
John picked up the football.
Bob went to the kitchen.
Where is the football? A: playground

Task 3: Three Supporting Facts

John picked up the apple.
John went to the office.
John went to the kitchen.
John dropped the apple.
Where was the apple before the kitchen? A: office

Task 4: Two Argument Relations

The office is north of the bedroom.
The bedroom is north of the bathroom.
The kitchen is west of the garden.
What is north of the bedroom? A: office
What is the bedroom north of? A: bathroom

Task 5: Three Argument Relations

Mary gave the cake to Fred.
Fred gave the cake to Bill.
Jeff was given the milk by Bill.
Who gave the cake to Fred? A: Mary
Who did Fred give the cake to? A: Bill

Task 6: Yes/No Questions

John moved to the playground.
Daniel went to the bathroom.
John went back to the hallway.
Is John in the playground? A: no
Is Daniel in the bathroom? A: yes

Facebook bAbI QA Datasets

Task 7: Counting

Daniel picked up the football.
Daniel dropped the football.
Daniel got the milk.
Daniel took the apple.
How many objects is Daniel holding? **A: two**

Task 8: Lists/Sets

Daniel picks up the football.
Daniel drops the newspaper.
Daniel picks up the milk.
John took the apple.
What is Daniel holding? **milk, football**

Task 9: Simple Negation

Sandra travelled to the office.
Fred is no longer in the office.
Is Fred in the office? **A:no**
Is Sandra in the office? **A:yes**

Task 10: Indefinite Knowledge

John is either in the classroom or the playground.
Sandra is in the garden.
Is John in the classroom? **A:maybe**
Is John in the office? **A:no**

Task 11: Basic Coreference

Daniel was in the kitchen.
Then he went to the studio.
Sandra was in the office.
Where is Daniel? **A:studio**

Task 12: Conjunction

Mary and Jeff went to the kitchen.
Then Jeff went to the park.
Where is Mary? **A:kitchen**
Where is Jeff? **A: park**

Task 13: Compound Coreference

Daniel and Sandra journeyed to the office.
Then they went to the garden.
Sandra and John travelled to the kitchen.
After that they moved to the hallway.
Where is Daniel? **A: garden**

Task 14: Time Reasoning

In the afternoon Julie went to the park.
Yesterday Julie was at school.
Julie went to the cinema this evening.
Where did Julie go after the park? **A:cinema**
Where was Julie before the park? **A:school**

Facebook bAbI QA Datasets

Task 15: Basic Deduction

Sheep are afraid of wolves.

Cats are afraid of dogs.

Mice are afraid of cats.

Gertrude is a sheep.

What is Gertrude afraid of? **A:wolves**

Task 16: Basic Induction

Lily is a swan.

Lily is white.

Bernhard is green.

Greg is a swan.

What color is Greg? **A:white**

Task 17: Positional Reasoning

The triangle is to the right of the blue square.

The red square is on top of the blue square.

The red sphere is to the right of the blue square.

Is the red sphere to the right of the blue square? **A:yes**

Is the red square to the left of the triangle? **A:yes**

Task 18: Size Reasoning

The football fits in the suitcase.

The suitcase fits in the cupboard.

The box is smaller than the football.

Will the box fit in the suitcase? **A:yes**

Will the cupboard fit in the box? **A:no**

Task 19: Path Finding

The kitchen is north of the hallway.

The bathroom is west of the bedroom.

The den is east of the hallway.

The office is south of the bedroom.

How do you go from den to kitchen? **A: west, north**

How do you go from office to bathroom? **A: north, west**

Task 20: Agent's Motivations

John is hungry.

John goes to the kitchen.

John grabbed the apple there.

Daniel is hungry.

Where does Daniel go? **A:kitchen**

Why did John go to the kitchen? **A:hungry**

Learning End-to-End Goal-Oriented Dialog

Facebook bAbI Dialogue Datasets

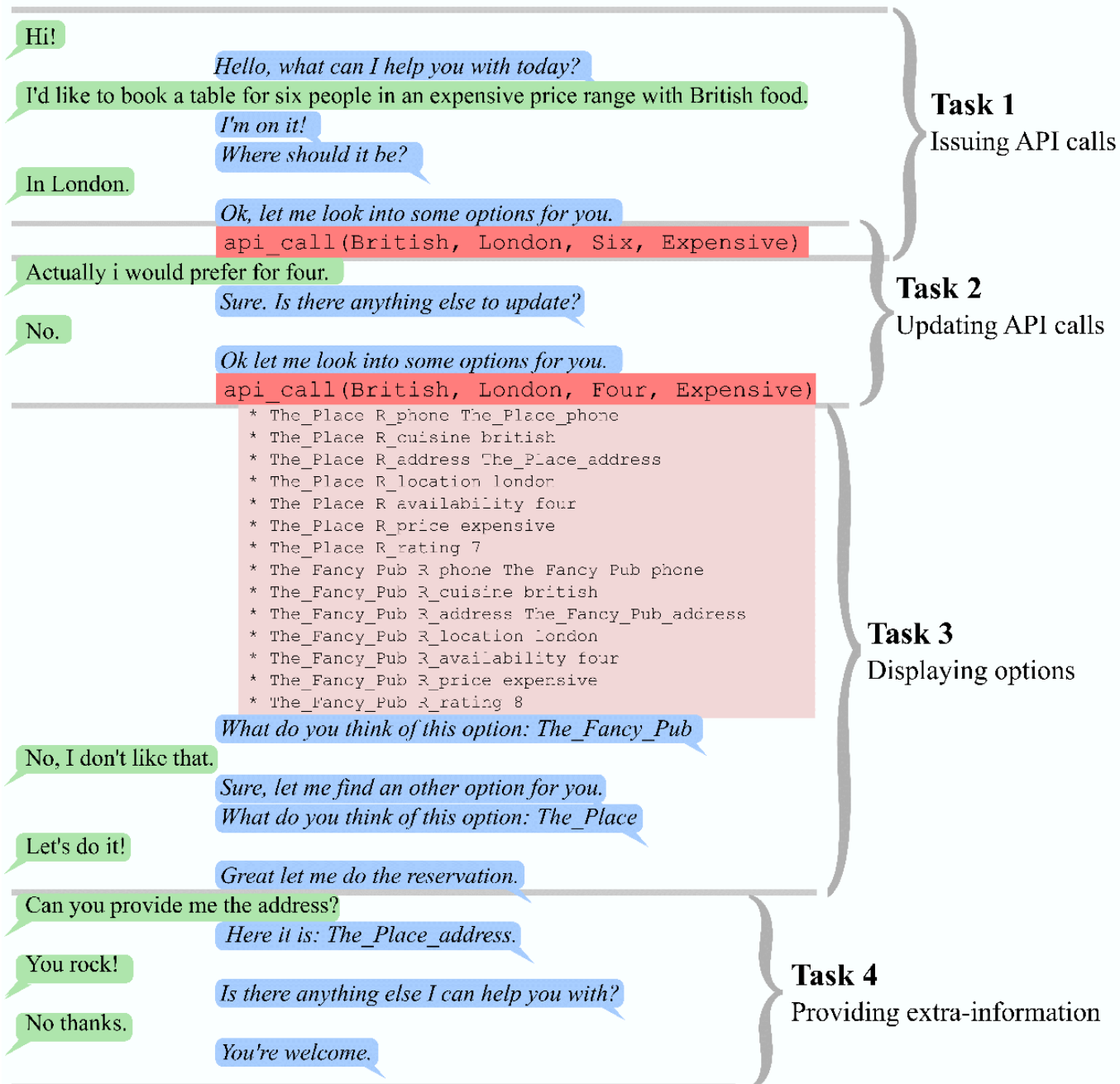
1 hi hello what can i help you with today

2 can you make a restaurant reservation with italian cuisine for six people in a
cheap price range i'm on it

3 <SILENCE> where should it be

4 rome please ok let me look into some options for you

5 <SILENCE> api_call italian rome six cheap



Task 5 Conducting full dialogs

The Dialog bAbI Tasks

Hi!

Hello, what can I help you with today?

I'd like to book a table for six people in an expensive price range with British food.

I'm on it!

Where should it be?

In London.

Ok, let me look into some options for you.

`api_call(British, London, Six, Expensive)`

Actually i would prefer for four.

Sure. Is there anything else to update?

No.

Ok let me look into some options for you.

`api_call(British, London, Four, Expensive)`

Task 1

Issuing API calls

Task 2

Updating API calls

The Dialog bAbI Tasks

```
* The_Place R_phone The_Place_phone
* The_Place R_cuisine british
* The_Place R_address The_Place_address
* The_Place R_location london
* The_Place R_availability four
* The_Place R_price expensive
* The_Place R_rating 7
* The_Fancy_Pub R_phone The_Fancy_Pub_phone
* The_Fancy_Pub R_cuisine british
* The_Fancy_Pub R_address The_Fancy_Pub_address
* The_Fancy_Pub R_location london
* The_Fancy_Pub R_availability four
* The_Fancy_Pub R_price expensive
* The_Fancy_Pub R_rating 8
```

Task 3 Displaying options

What do you think of this option: The_Fancy_Pub

No, I don't like that.

Sure, let me find an other option for you.

What do you think of this option: The_Place

Let's do it!

Great let me do the reservation.

The Dialog bAbI Tasks

What do you think of this option: The_Fancy_Pub

No, I don't like that.

Sure, let me find an other option for you.

What do you think of this option: The_Place

Let's do it!

Great let me do the reservation.

Can you provide me the address?

Here it is: The_Place_address.

You rock!

Is there anything else I can help you with?

No thanks.

You're welcome.

Task 4
Providing extra-information

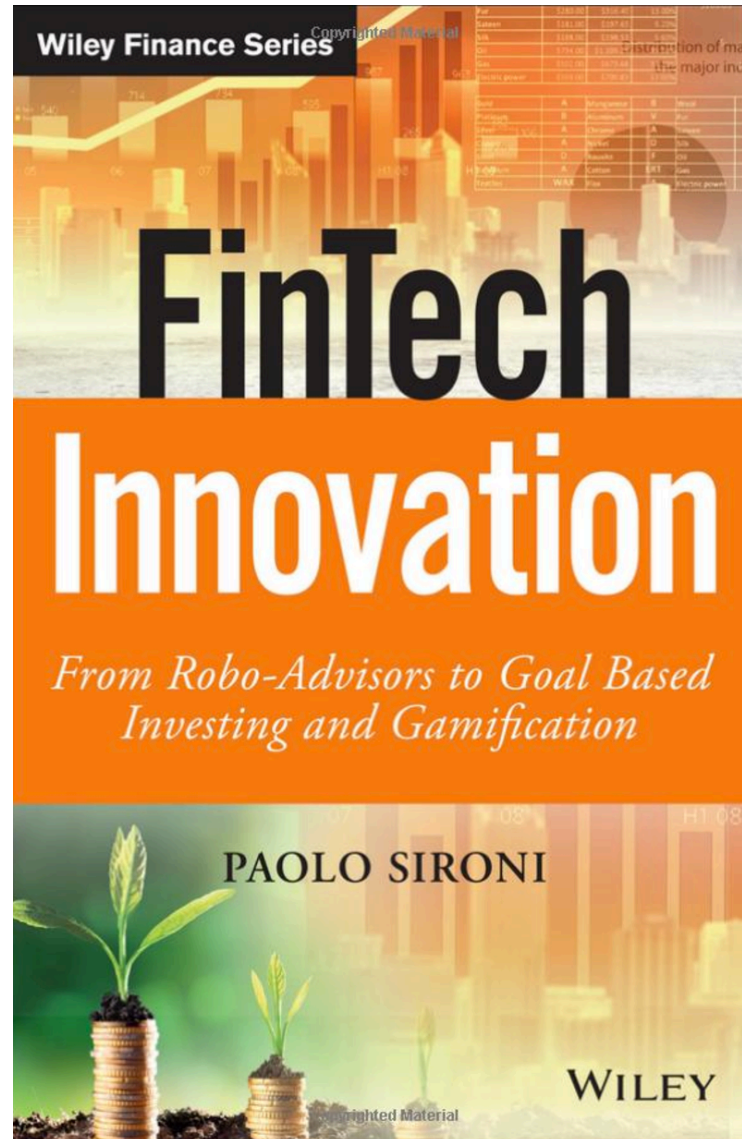
Task 5 Conducting full dialogs

Robo- Advisors

FinTech Innovation:

From Robo-Advisors to Goal Based Investing and Gamification,

Paolo Sironi, Wiley, 2016



Financial Technology

FinTech

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

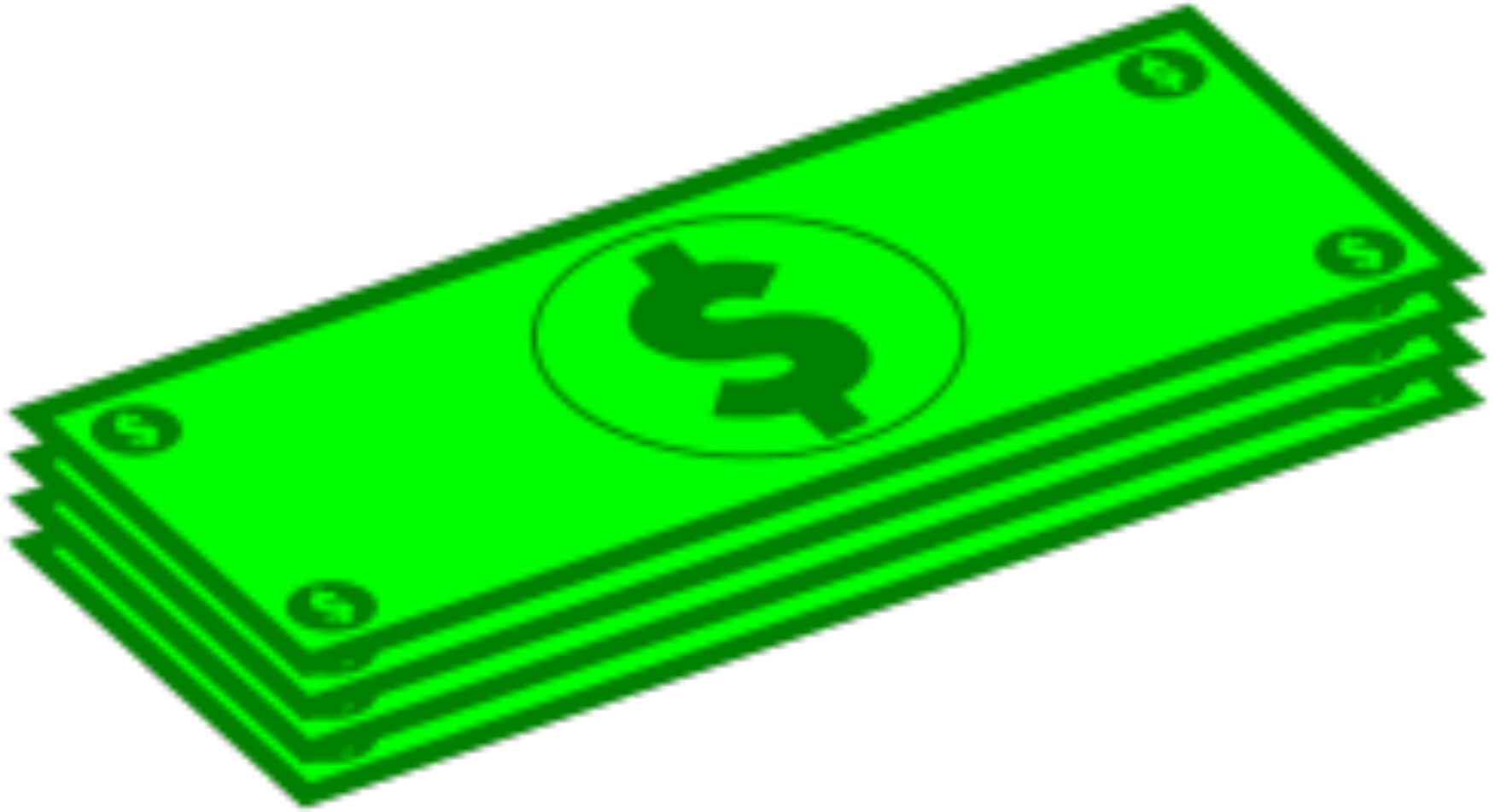
Financial Services

Financial Services



Money

Money



Money

Makes

Money

Treasure



Wealth Management

Investment Analysis

Time Value of Money

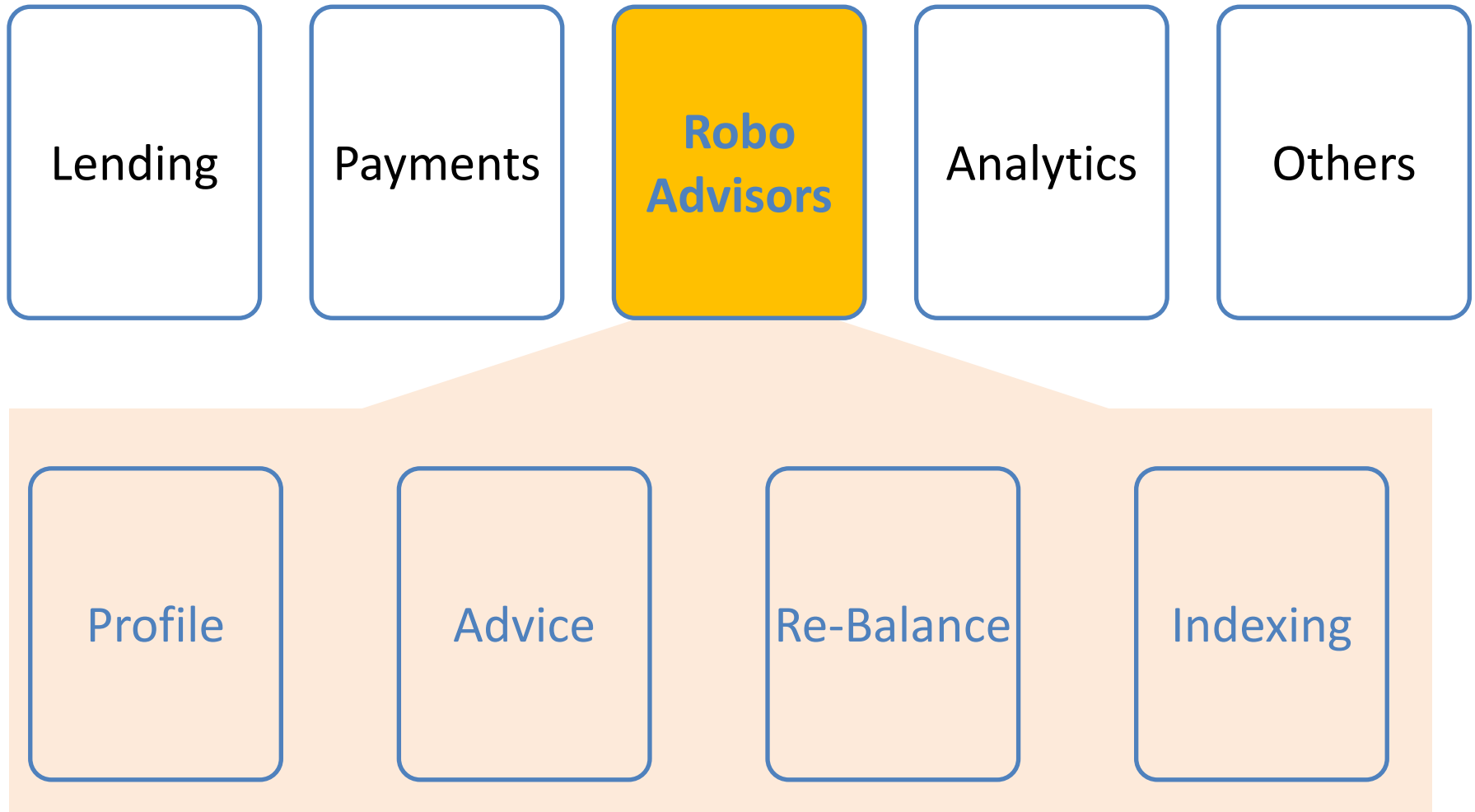
Risk

Return

Fintech Robo Advisors

Big Data Driven Disruption: Robo-Advisor

FinTech high-level classification



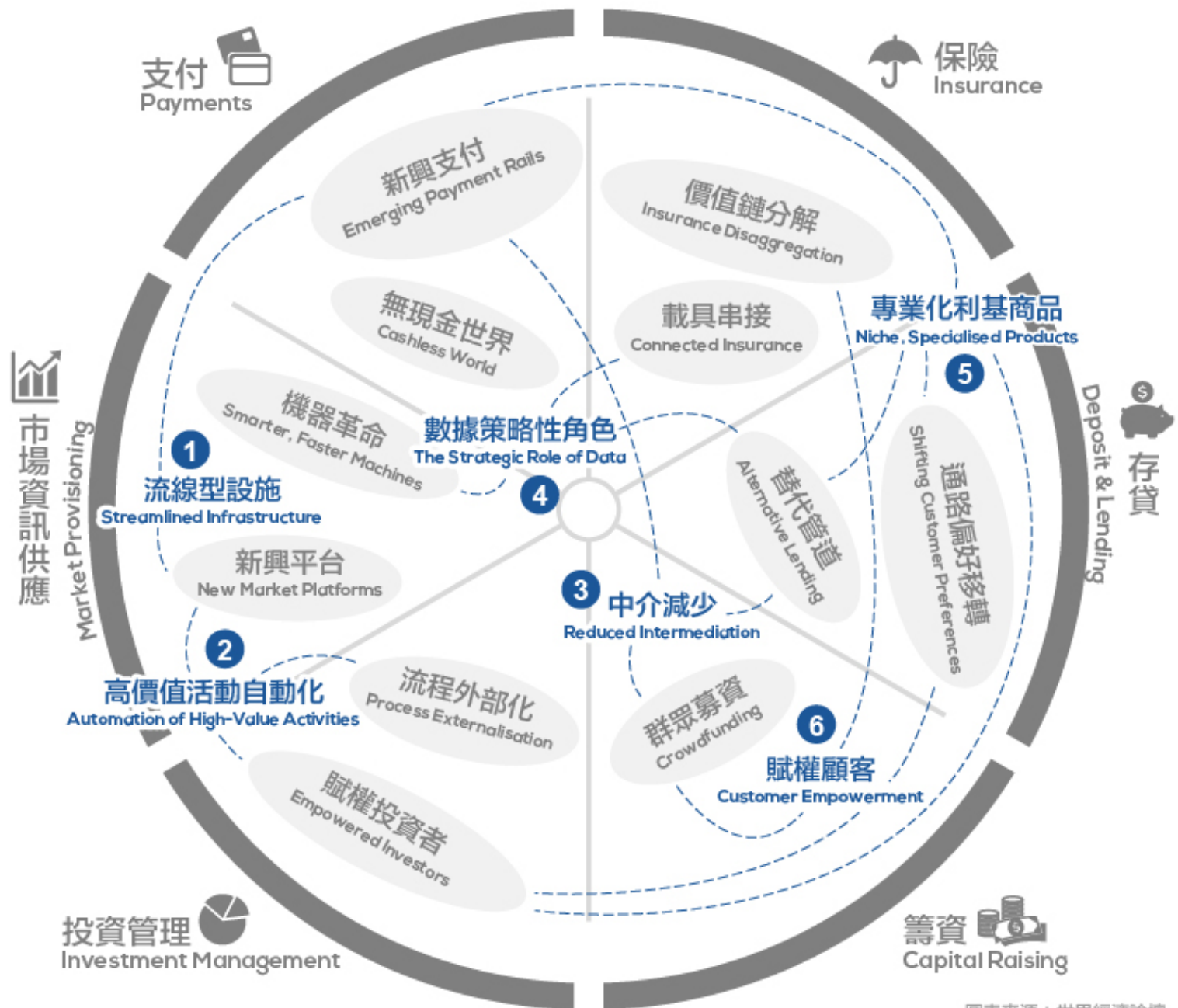
FinTech: Financial Services Innovation



FinTech:

Financial Services Innovation

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



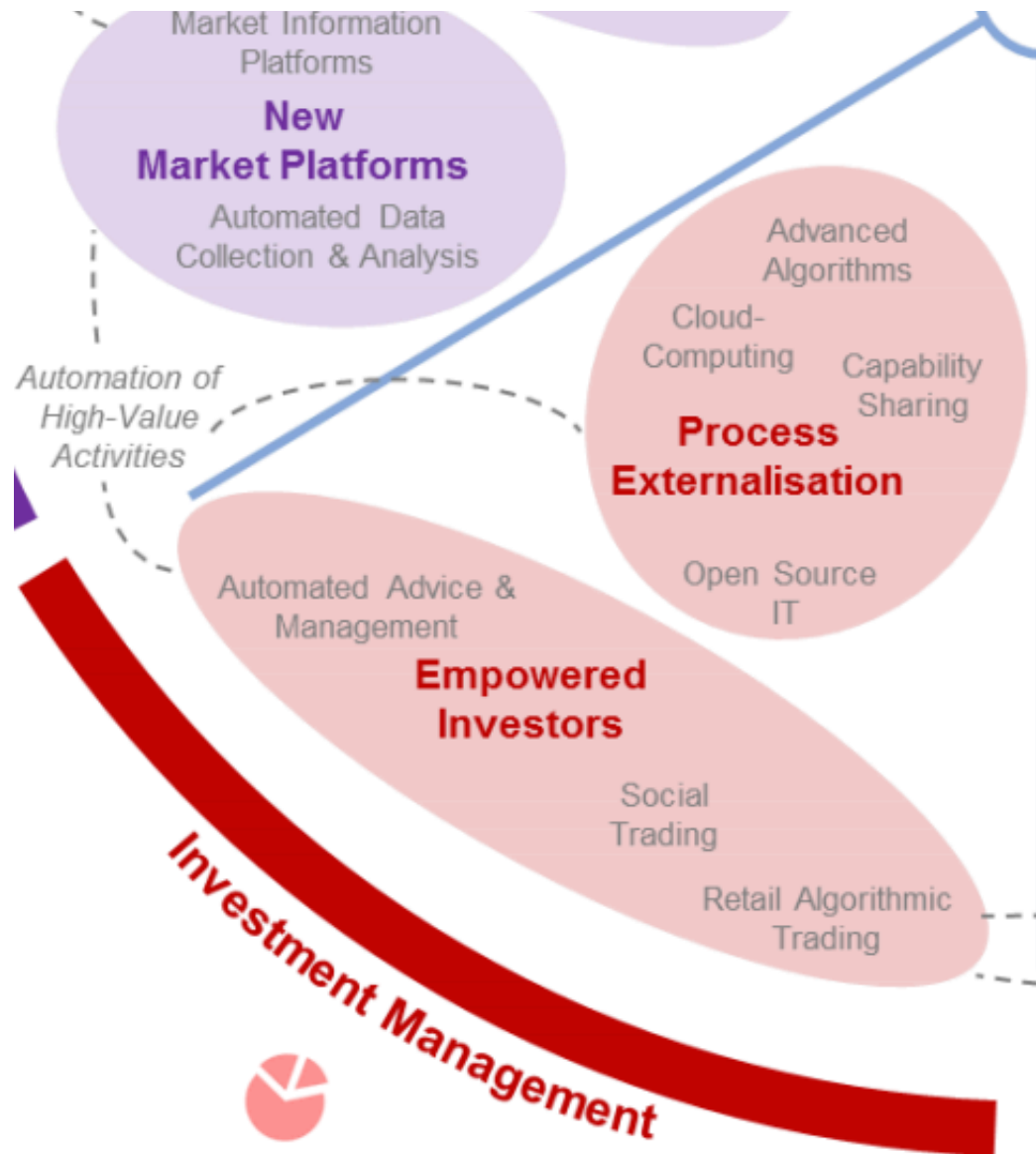
圖表來源：世界經濟論壇

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

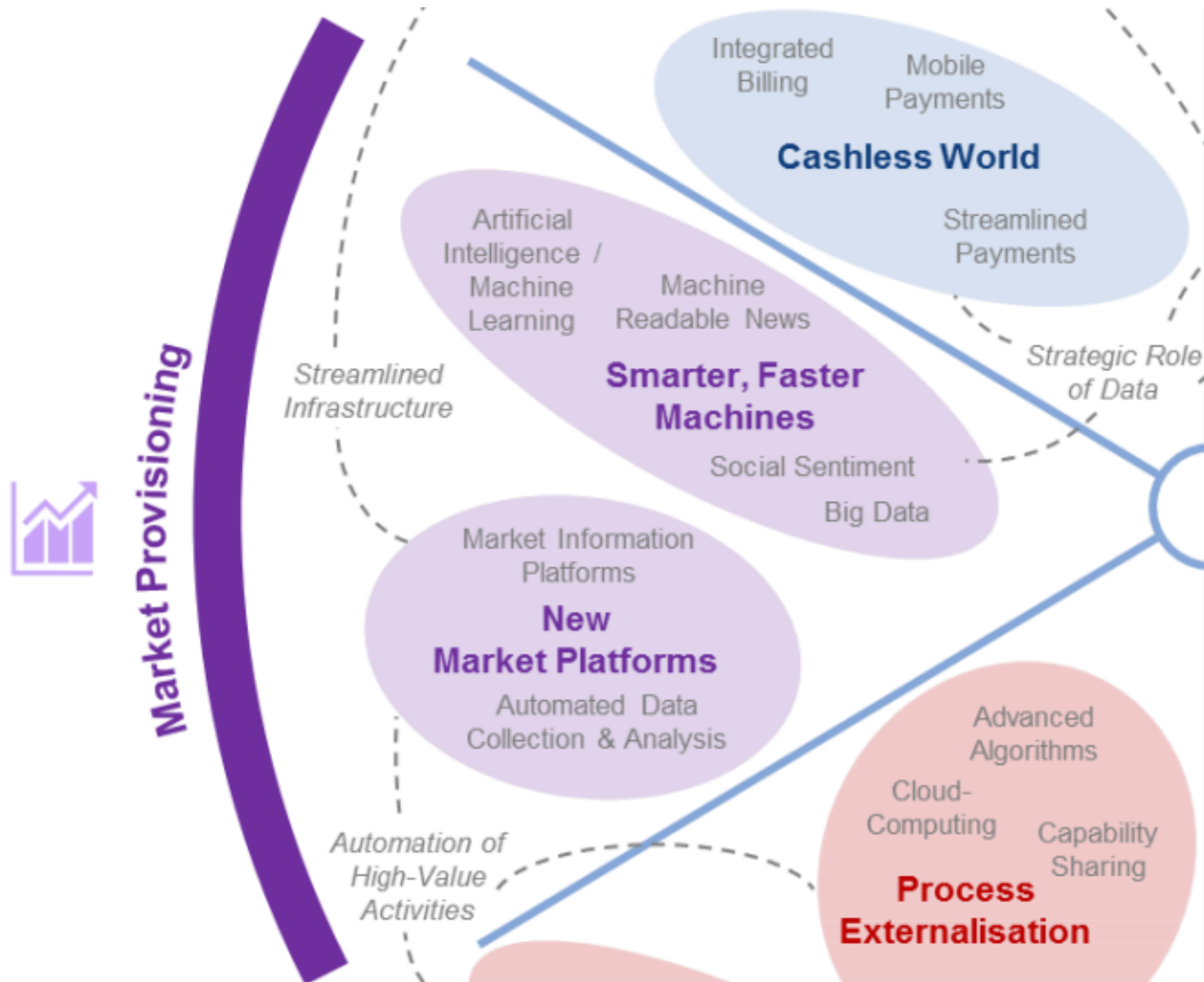
Process Externalization



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

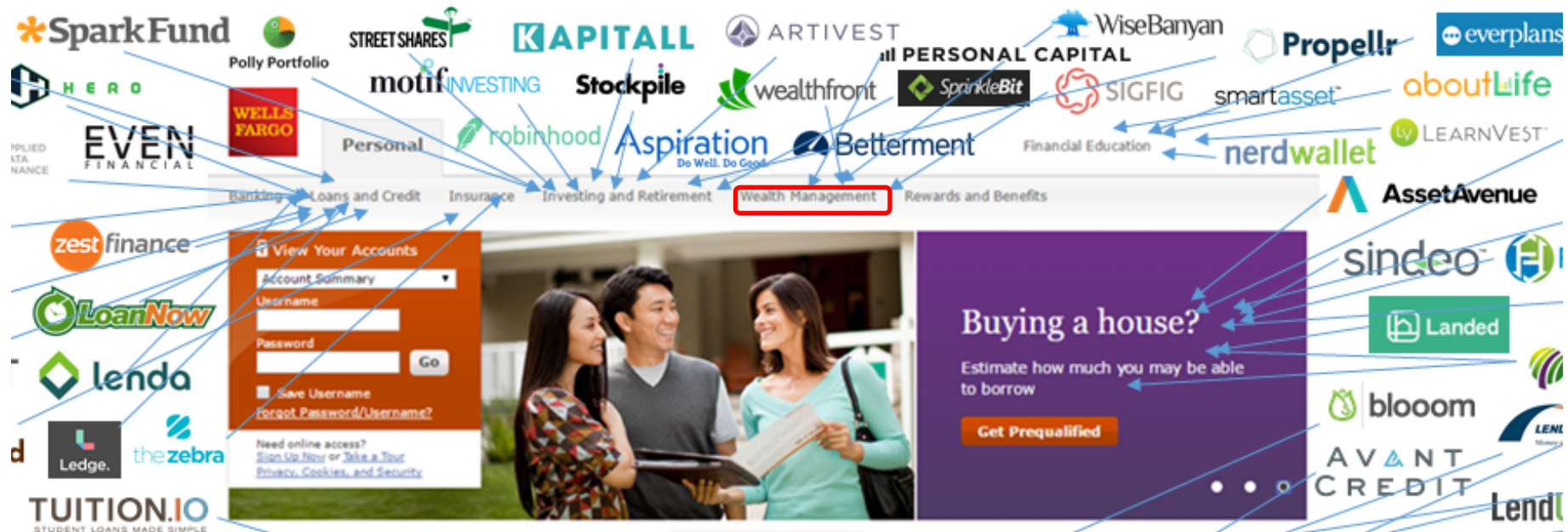
固定收益商品平台 ALGOMI、基金 / 組合型基金平台 NOVUS、私募 / 創投平台 BISON、未公發股權平台 LIQUITY、原物料商品與衍生性合約平台 ClauseMatch

圖表來源：Fugle團隊整理

Fintech: Unbundling the Bank

Wealth Management: Wealthfront

Unbundling of a Bank



Wealthfront: Fintech Robo Advisor



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Products ▾

Who we are ▾

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Blog

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Invest now

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

Invest with Wealthfront

See Our Journey

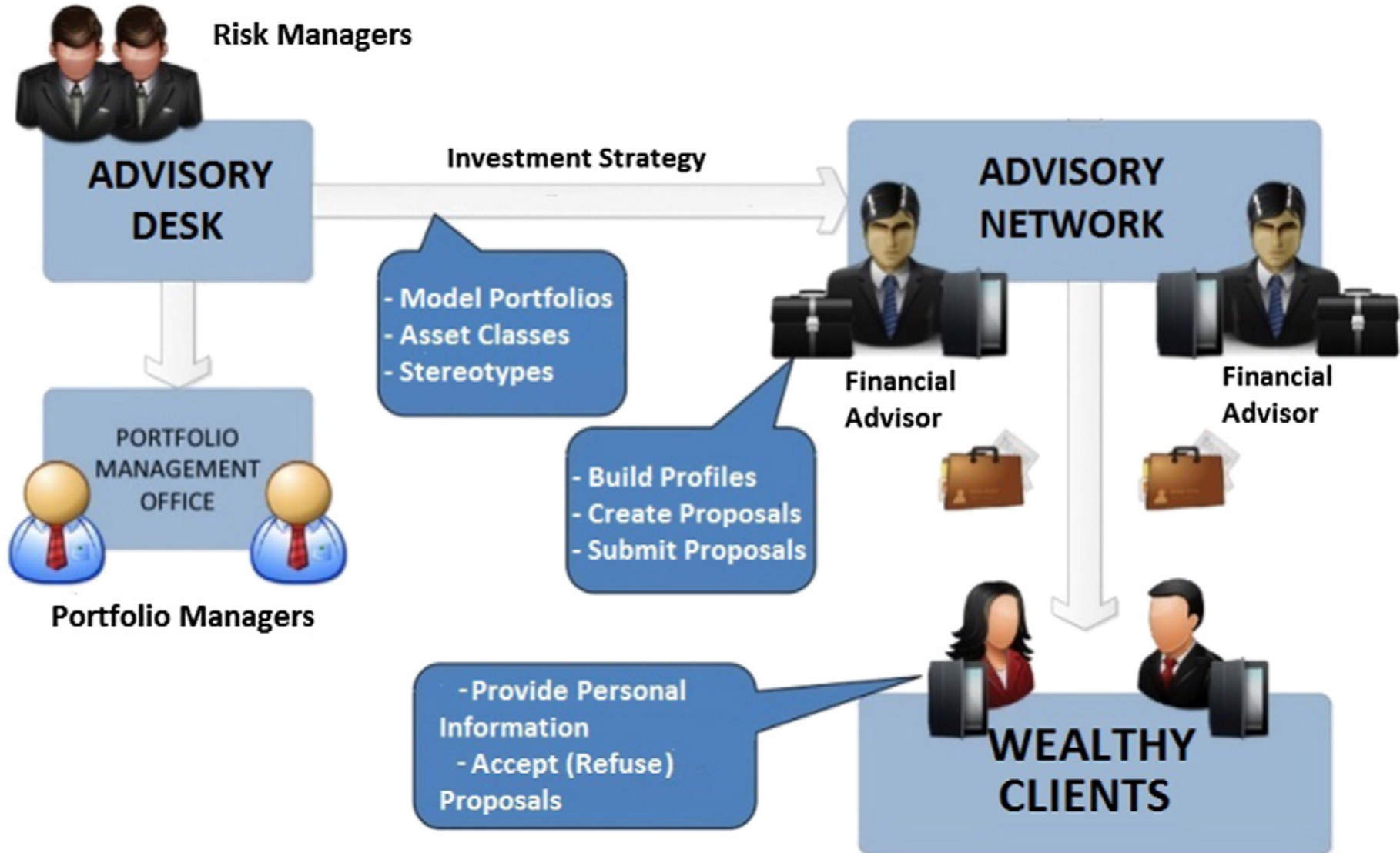


Do you have the time to invest well?

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/>

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

Robo-Advisor Business Models

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- **Pure online advisor**
 - primarily human in nature

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%

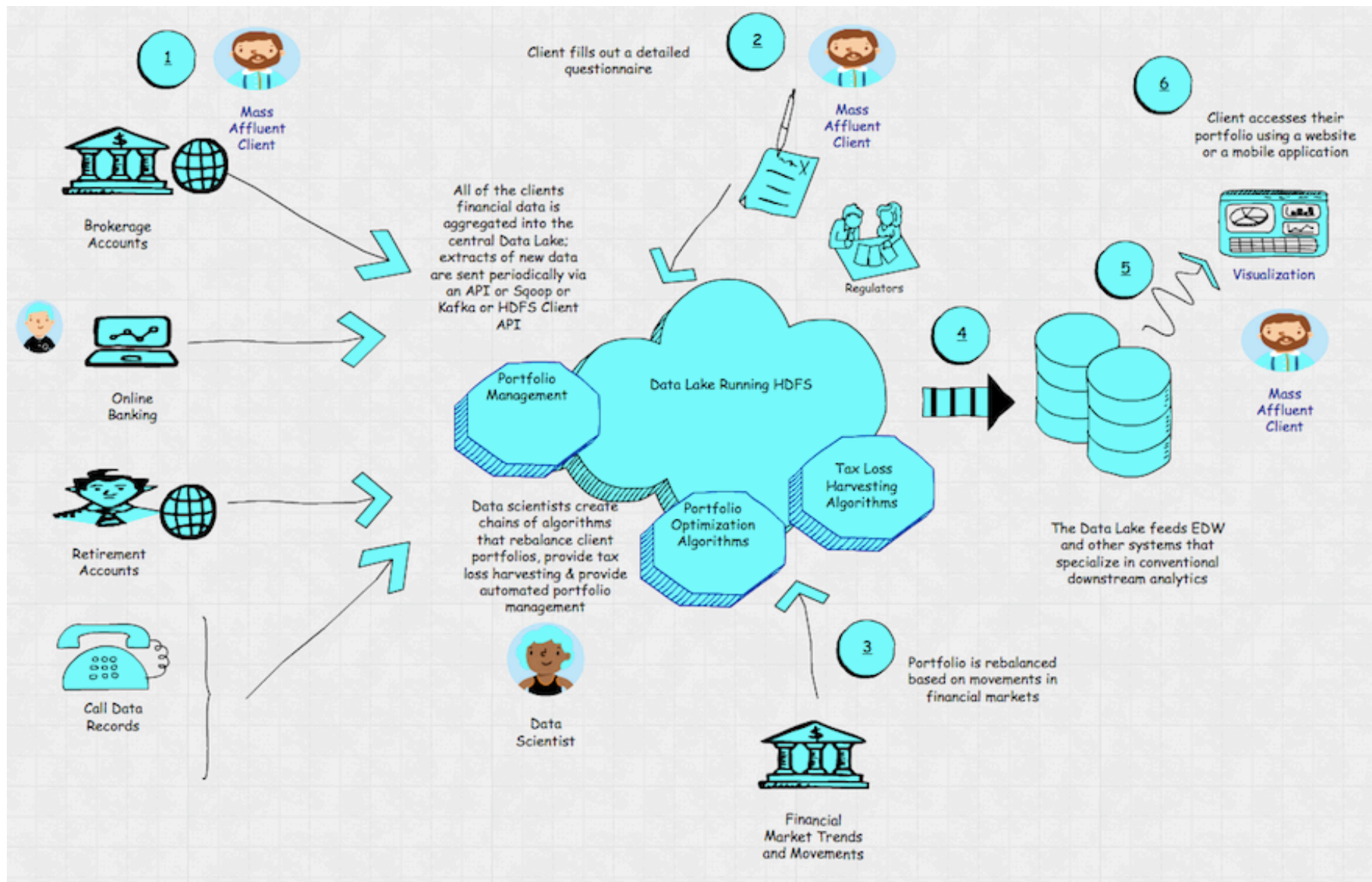
B) Currencies – 0%

C) Gold and Precious Metals – 0%

D) Commodities – 2%

4. Cash – 5%

Architecture of a Robo-Advisor (RA)



Robo-Advisor



Wealthfront: Fintech Robo Advisor



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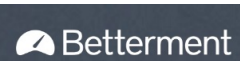
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Betterment vs. Wealthfront

	 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

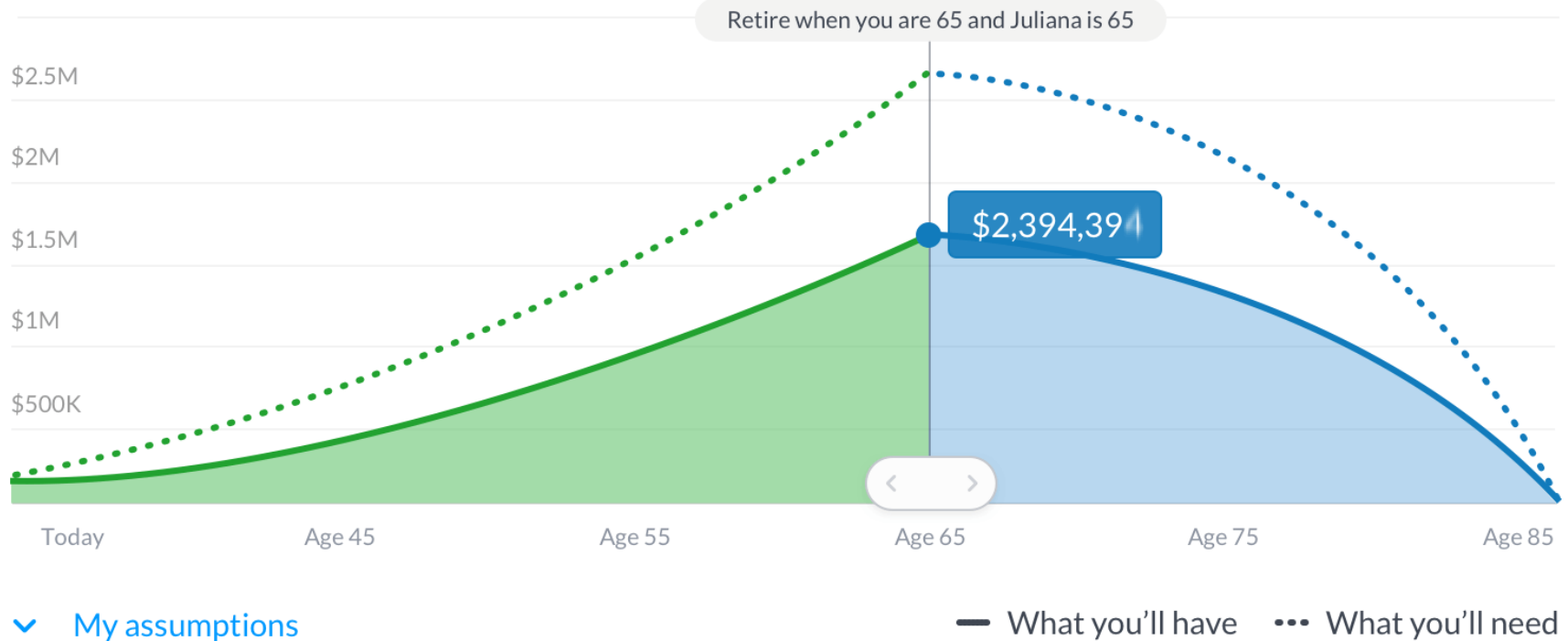
Wealthfront

Powering your financial life with technology

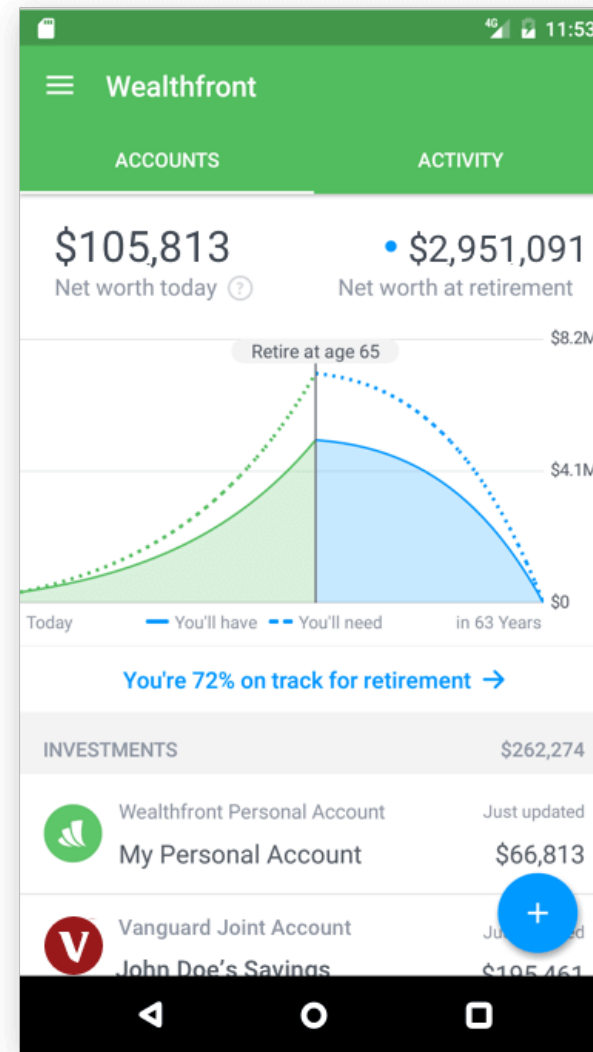
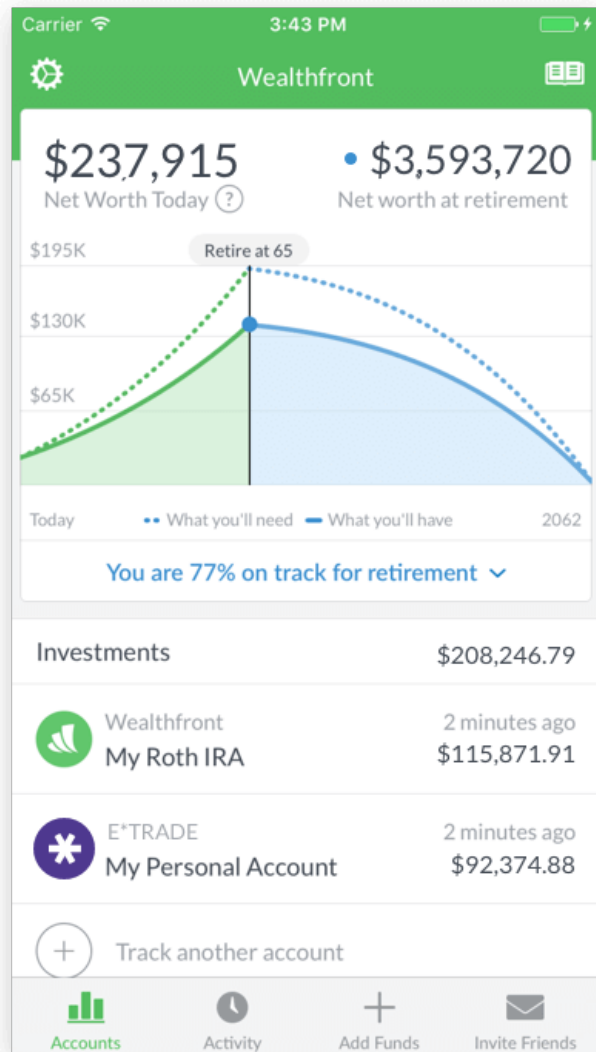


Wealthfront Robo Advisor

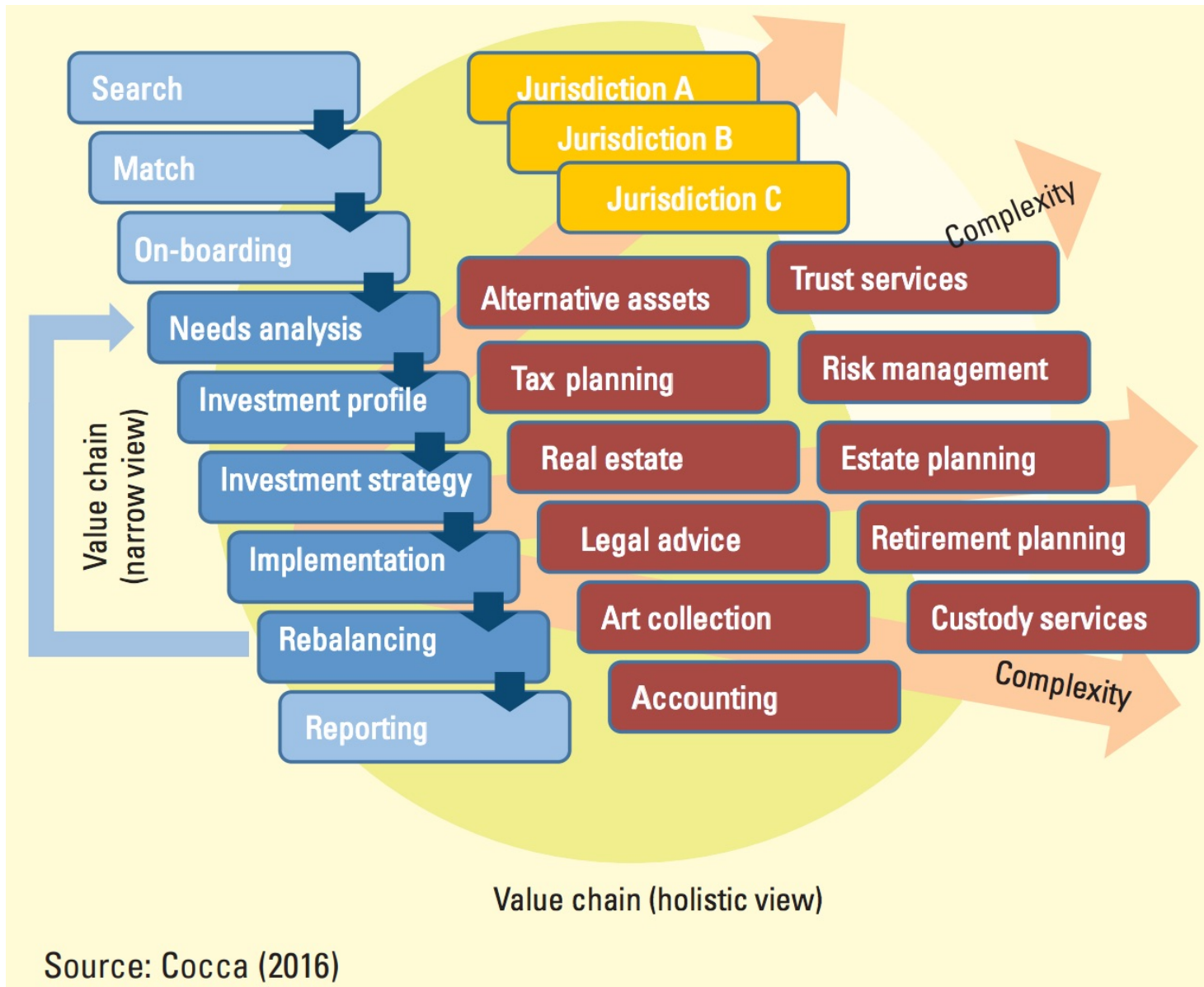
You're on track to have \$8,000 per month to spend in retirement. That's 76% of your target.



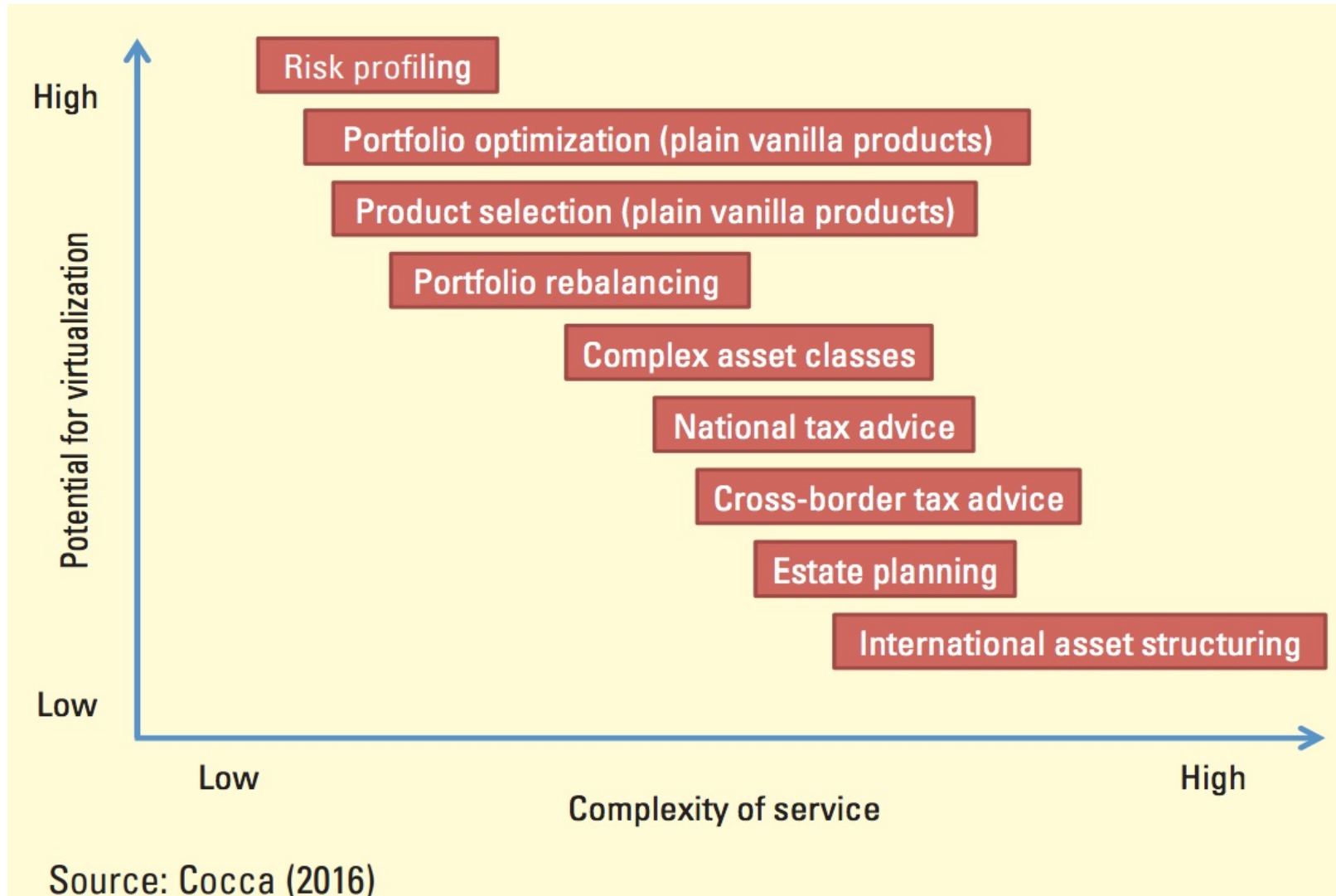
Wealthfront Robo Advisor



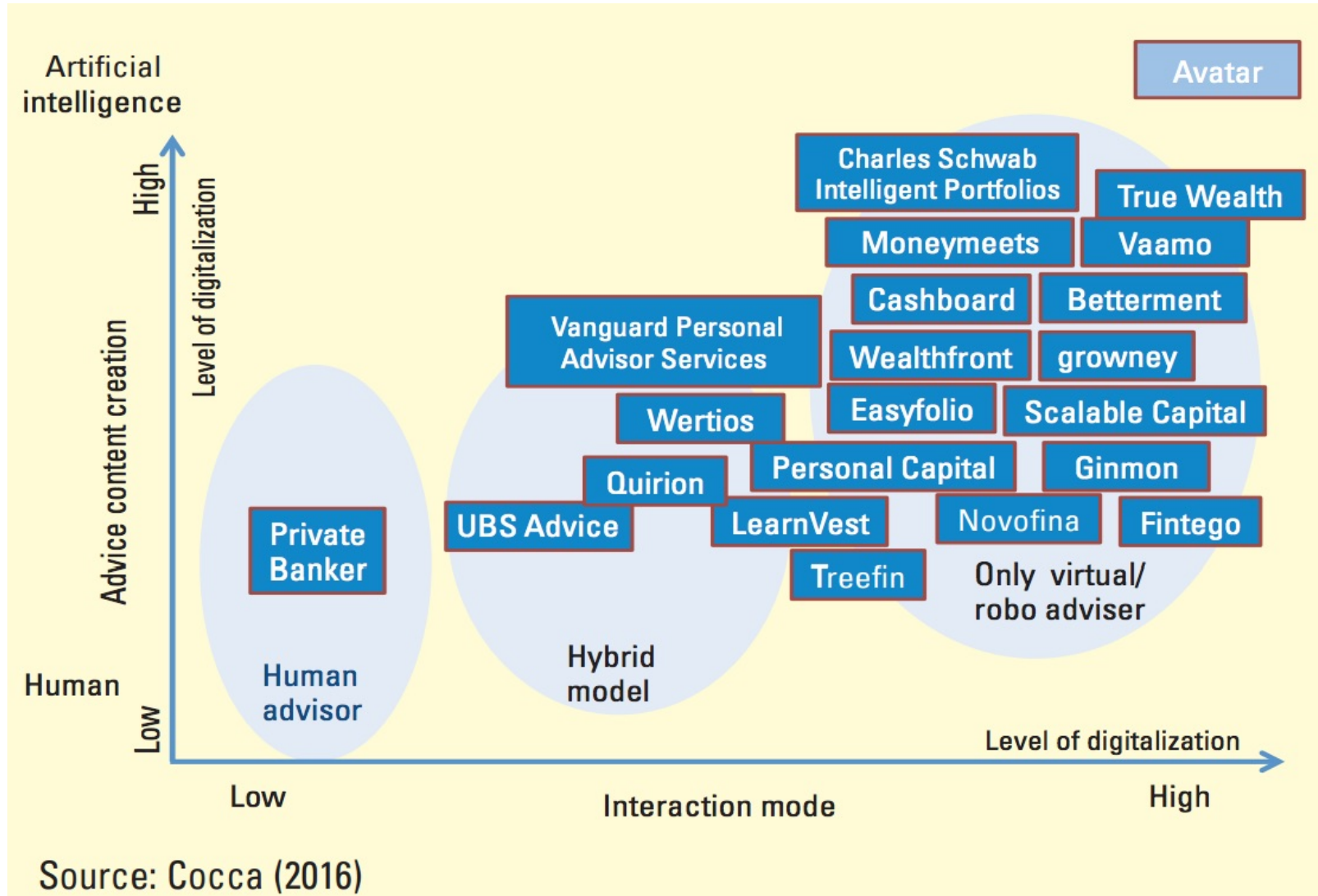
Wealth Management Value Chain



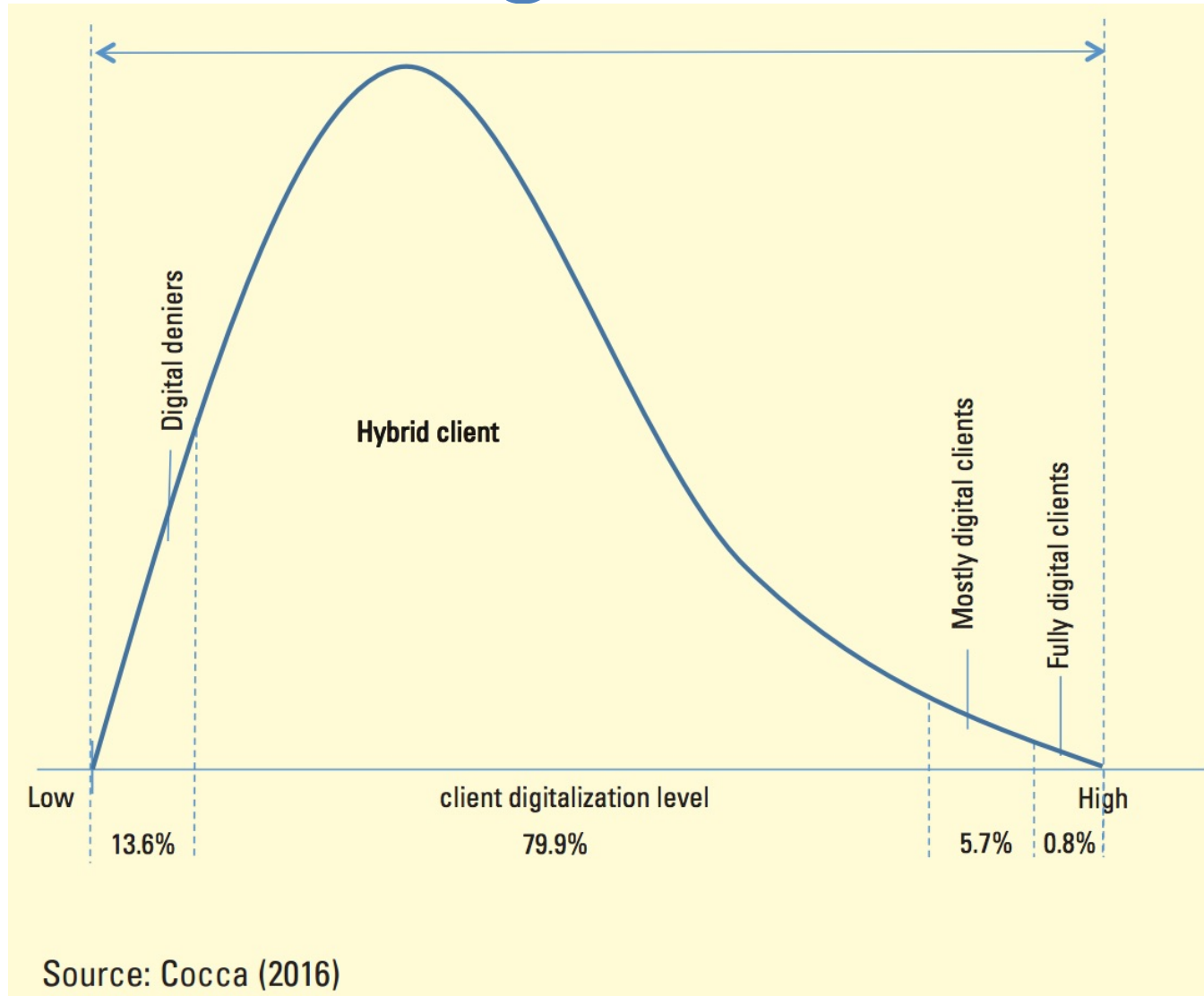
Wealth Management Service and Potential for virtualization



AI and Robo Advisor Virtualization Dimensions

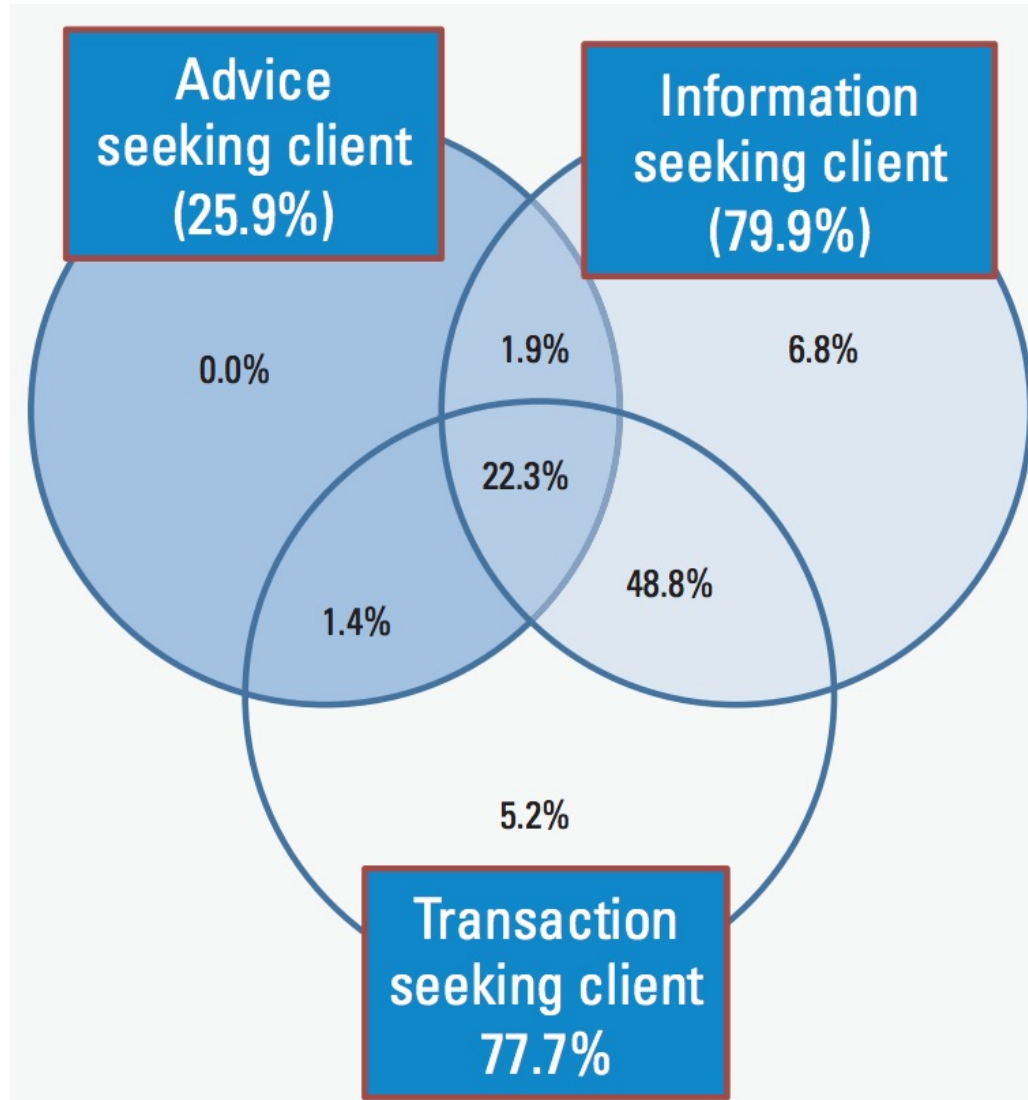


Degree of Digitalization of Wealth Management Customers



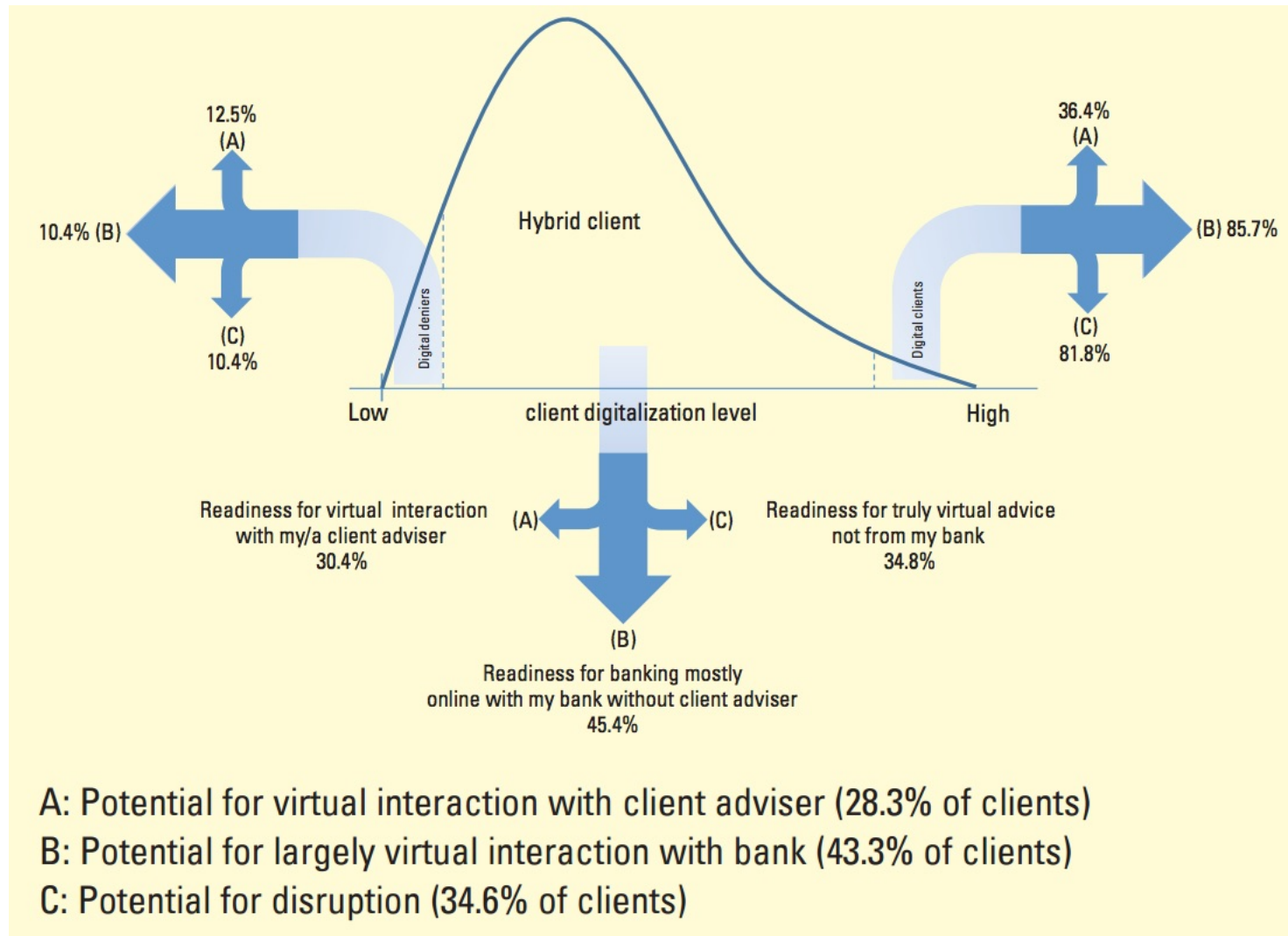
Source: Cocca, Teodoro (2016). "Potential and Limitations of Virtual Advice in Wealth Management." Journal of Financial Transformation, 44, 45-57.

Use of Online Services by Hybrid Customers

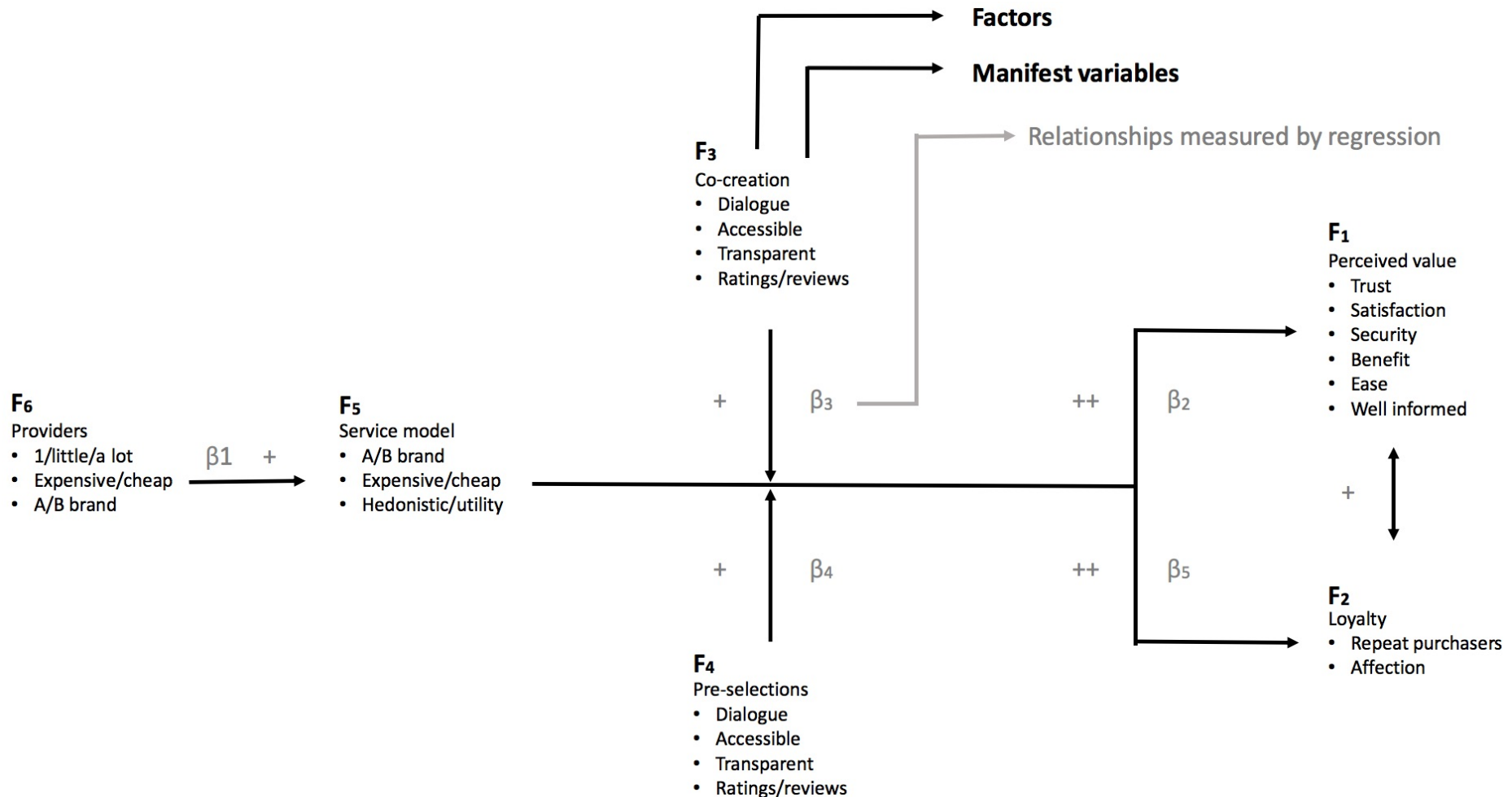


Source: Cocca, Teodoro (2016). "Potential and Limitations of Virtual Advice in Wealth Management." Journal of Financial Transformation, 44, 45-57.

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

Summary

- Introduction to Artificial Intelligence (AI)
- AI in FinTech
- Conversational Commerce
- Robo-Advisors

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Q & A



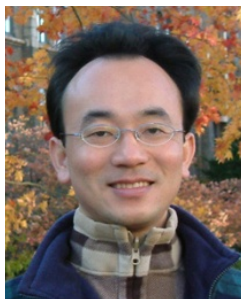
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University
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AI 人工智慧理財機器人 (AI Robo-Advisors)

主持人：汪志堅 教授、楊運秀 教授
電子商務

時間：2017/11/20 19:00-21:00

地點：國立台北大學電子商務碩士學程
民生東路教學大樓719教室



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2017-11-20

