AI Task-Oriented Dialogue System for Conversational Commerce in FinTech

Host: Prof. Kuan-Yu Menphis Chen

Computer Science and Information Engineering, National Taiwan University of Science and Technology

Time: 14:00-15:00, May 10, 2021 (Monday)

Place: CSIE, NTUST

Address: No.43, Keelung Rd., Sec.4, Da'an Dist., Taipei, Taiwan

Min-Yuh Day

戴敏育

Associate Professor

副教授

Institute of Information Management, National Taipei University

國立臺北大學 資訊管理研究所

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

2021-05-10

戴敏育 博士
(Min-Yuh Day, Ph.D.)

國立台北大學 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-)

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

NTPU
國立臺北大學
National Taipei University

Outline

- Artificial Intelligence
- FinTech
- Conversational Commerce
- Task Oriented Dialogue System

AIWISFIN

AI Conversational Robo-Advisor

(人工智慧對話式理財機器人)

First Place, InnoServe Awards 2018

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

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

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

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

2018 International ICT Innovative Services Awards (InnoServe Awards 2018)
(2018第23屆大專校院資訊應用服務創新競賽)

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

榮譽榜

屆別 23 查詢

第23屆

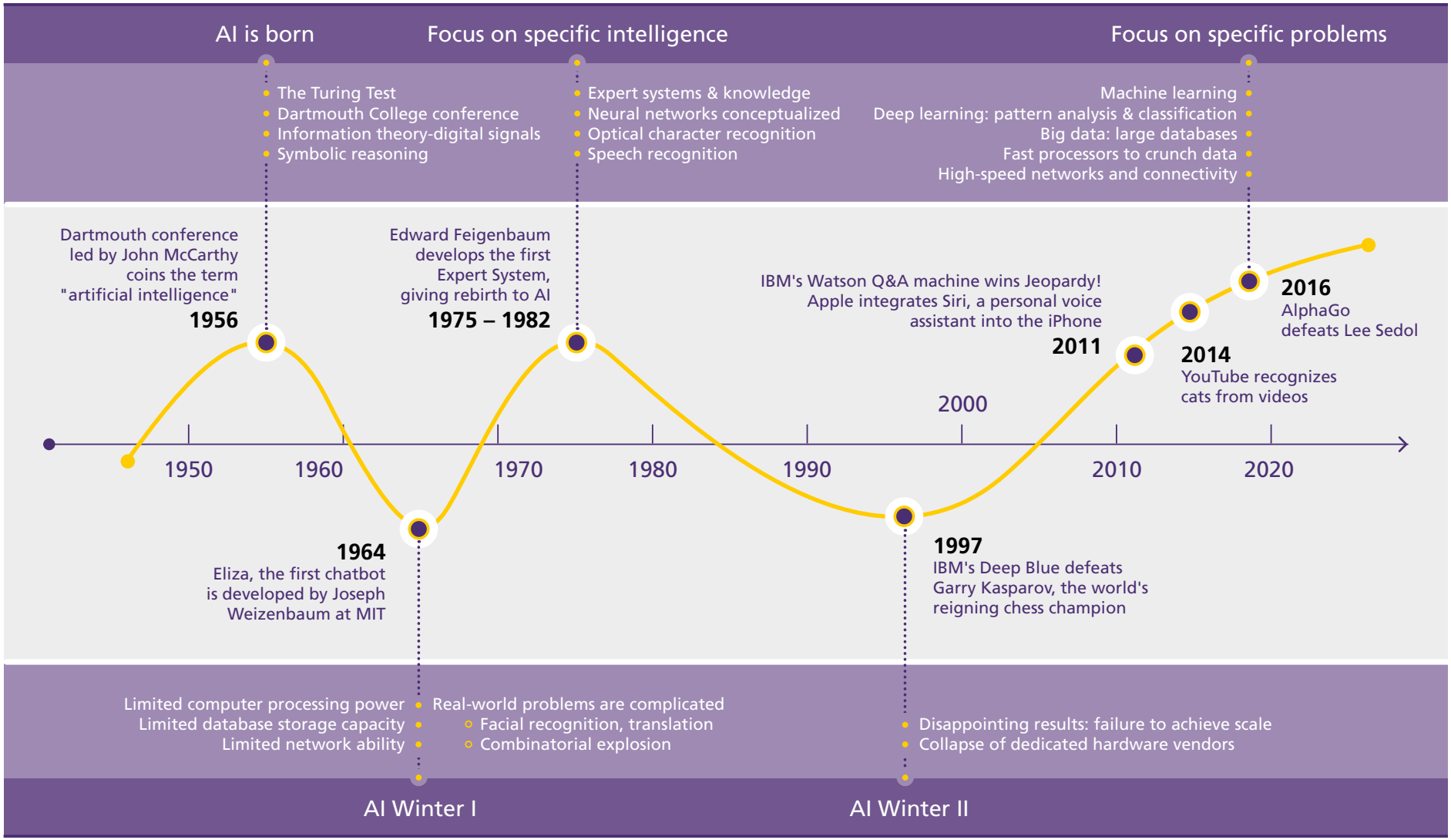
顯示 30 筆資料　　表格內全文檢索: AIWISFIN

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

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


AI

The Rise of AI



Source: DHL (2018), Artificial Intelligence in Logistics, http://www.globalhha.com/doclib/data/upload/doc_con/5e50c53c5bf67.pdf/

Definition of Artificial Intelligence (A.I.)

Artificial Intelligence

"… the science and engineering of making intelligent machines"

(John McCarthy, 1955)

Source: https://digitalintelligencetoday.com/artificial-intelligence-defined-useful-list-of-popular-definitions-from-business-and-science/

Artificial Intelligence

"… technology that thinks and acts like humans"

Source: https://digitalintelligencetoday.com/artificial-intelligence-defined-useful-list-of-popular-definitions-from-business-and-science/

Artificial Intelligence

"… intelligence exhibited by machines or software"

Source: https://digitalintelligencetoday.com/artificial-intelligence-defined-useful-list-of-popular-definitions-from-business-and-science/

4 Approaches of AI

Thinking Humanly	**Thinking Rationally**
Acting Humanly	**Acting Rationally**

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

4 Approaches of AI

2. **Thinking Humanly:** **The Cognitive Modeling Approach**	**3.** **Thinking Rationally:** **The "Laws of Thought" Approach**
1. **Acting Humanly:** **The Turing Test Approach (1950)**	**4.** **Acting Rationally:** **The Rational Agent Approach**

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

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

Tamkang University
淡江大學

2011

Tamkang University

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

NTCIR-9 Workshop, December 6-9, 2011, Tokyo, Japan

Tamkang University
淡江大學

2013

Tamkang University

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

NTCIR-10 Conference, June 18-21, 2013, Tokyo, Japan

IMTKU Textual Entailment System for Recognizing Inference in Text at NTCIR-11 RITE-VAL 2014

Tamkang University

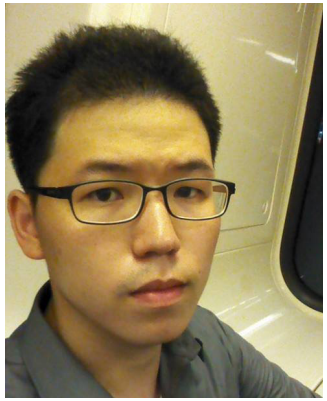
淡江大學


Min-Yuh Day

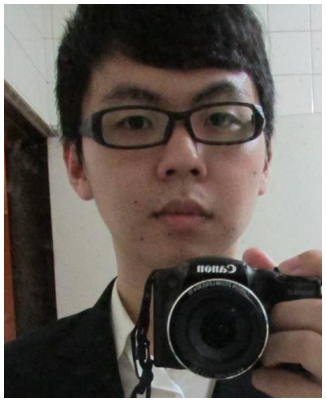

Ya-Jung Wang


Che-Wei Hsu


En-Chun Tu


Huai-Wen Hsu


Yu-An Lin


Shang-Yu Wu


Yu-Hsuan Tai


Cheng-Chia Tsai

NTCIR-11 Conference, December 8-12, 2014, Tokyo, Japan

NTCIR

Tamkang University
淡江大學

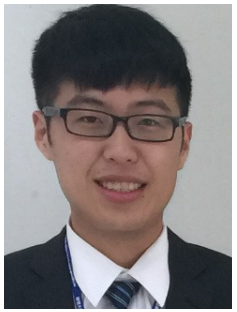
2016

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

Department of Information Management
Tamkang University, Taiwan

Sagacity Technology

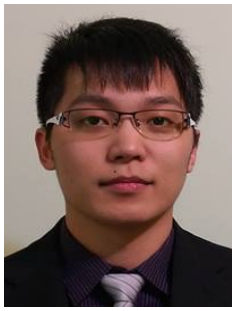

Min-Yuh Day


Cheng-Chia Tsai


Wei-Chun Chung


Hsiu-Yuan Chang

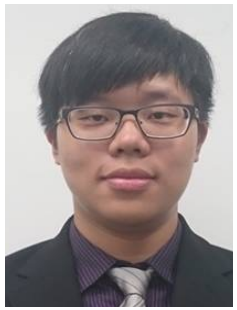

Tzu-Jui Sun


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

NTCIR

2017

Tamkang University
淡江大學

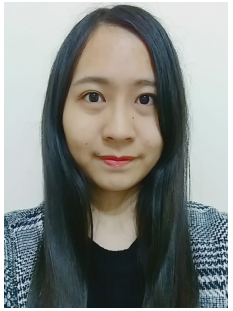
IMTKU Question Answering System for World History Exams at NTCIR-13 QALab-3

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

NTCIR-13 Conference, December 5-8, 2017, Tokyo, Japan

NTCIR

2019

Tamkang University
淡江大學

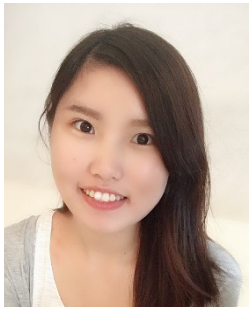
IMTKU Emotional Dialogue System for Short Text Conversation at NTCIR-14 STC-3 (CECG) Task

Department of Information Management
Tamkang University, Taiwan


Min-Yuh Day


Chi-Sheng Hung


Yi-Jun Xie


Jhih-Yi Chen


Yu-Ling Kuo


Jian-Ting Lin

myday@mail.tku.edu.tw

NTCIR-14 Conference, June 10-13, 2019, Tokyo, Japan

NTCIR

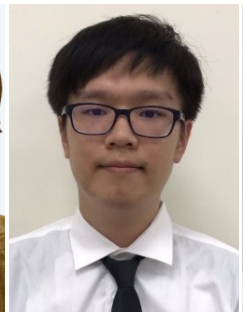
2020

Tamkang University
淡江大學

IMTKU Multi-Turn Dialogue System Evaluation at the NTCIR-15 DialEval-1 Dialogue Quality and Nugget Detection

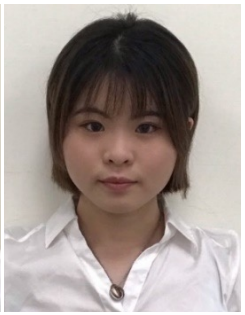
[1] Zeals Co., Ltd. Tokyo, Japan
[2] Information Management, Tamkang University, Taiwan
[3] Information Management, National Taipei University, Taiwan

Mike Tian-Jian Jiang[1]



Zhao-Xian Gu[2]

Cheng-Jhe Chiang[2]



Yueh-Chia Wu[2]

Yu-Chen Huang[2]

Cheng-Han Chiu[2]

Sheng-Ru Shaw[2]

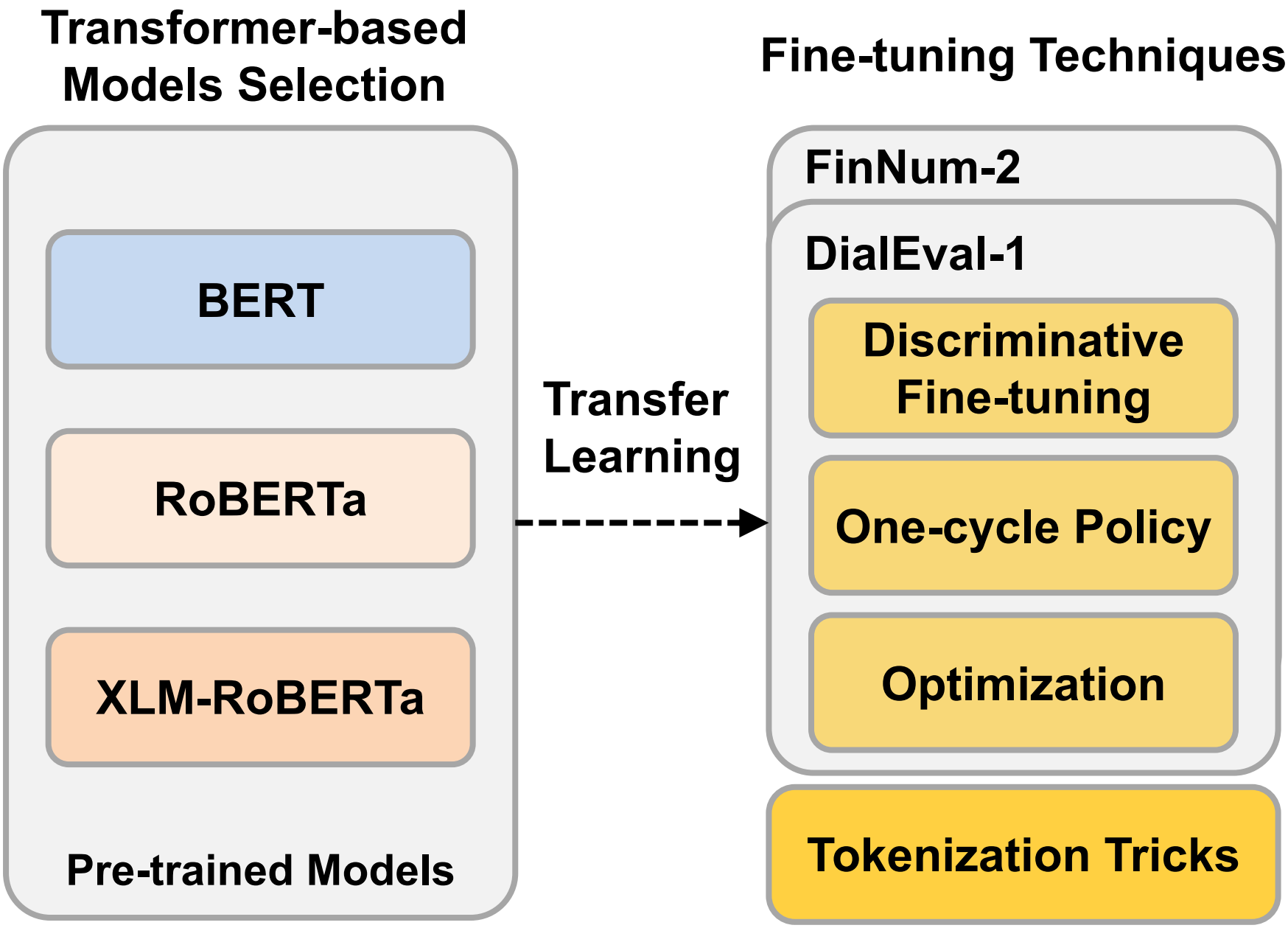
Min-Yuh Day[3]

2020 NTCIR-15 Dialogue Evaluation (DialEval-1) Task
Dialogue Quality (DQ) and Nugget Detection (ND)

Chinese Dialogue Quality (S-score) Results (Zeng et al., 2020)

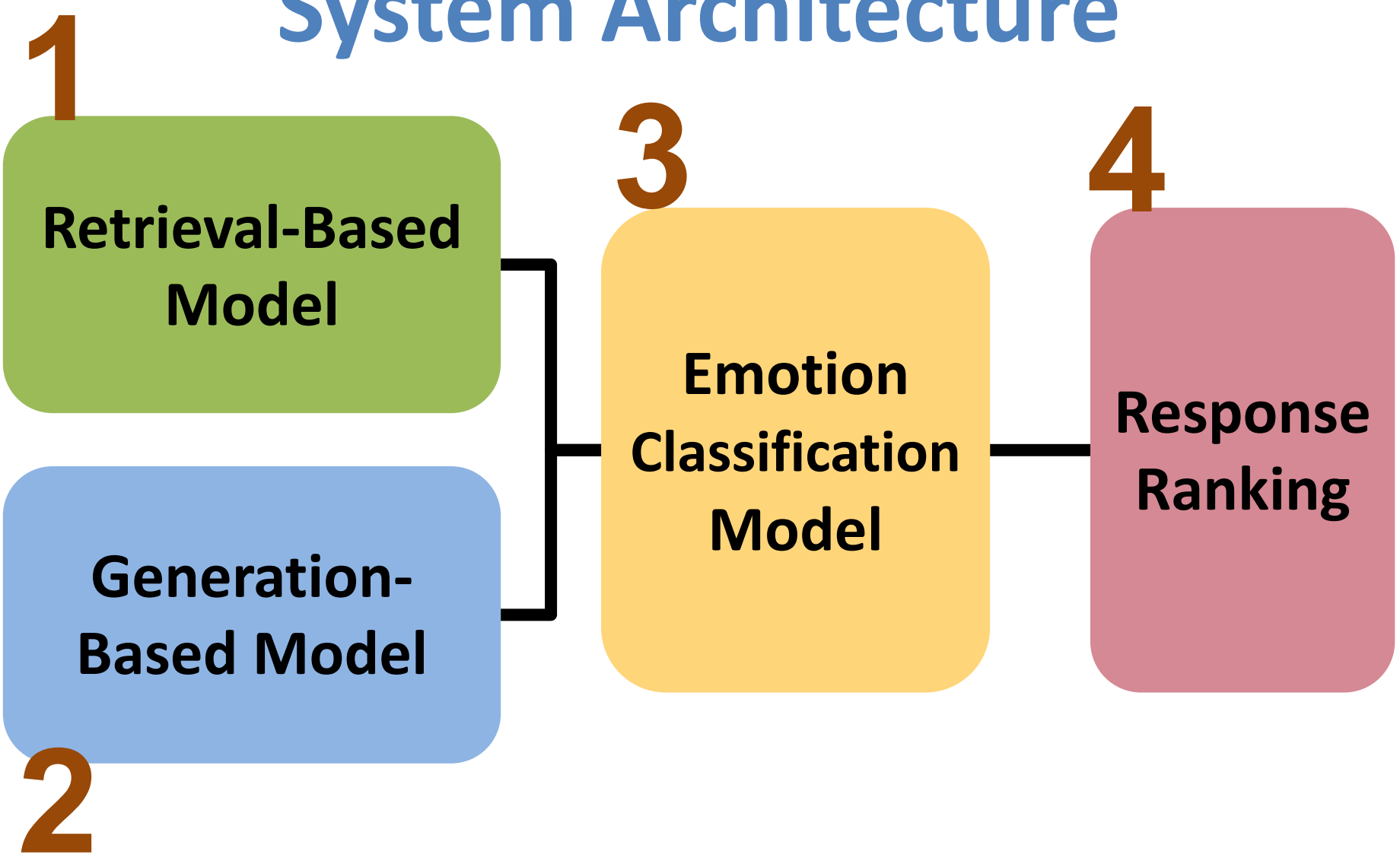
Run	Mean RSNOD	Run	Mean NMD
IMTKU-run2	0.1918	IMTKU-run2	0.1254
IMTKU-run1	0.1964	IMTKU-run0	0.1284
IMTKU-run0	0.1977	IMTKU-run1	0.1290
TUA1-run2	0.2024	TUA1-run2	0.1310
TUA1-run0	0.2053	TUA1-run0	0.1322
NKUST-run1	0.2057	NKUST-run1	0.1363
BL-lstm	0.2088	TUA1-run1	0.1397
WUST-run0	0.2131	BL-popularity	0.1442
RSLNV-run0	0.2141	BL-lstm	0.1455
BL-popularity	0.2288	RSLNV-run0	0.1483
TUA1-run1	0.2302	WUST-run0	0.1540
NKUST-run0	0.2653	NKUST-run0	0.2289
BL-uniform	0.2811	BL-uniform	0.2497

Source: Zeng, Zhaohao, Sosuke Kato, Tetsuya Sakai, and Inho Kang (2020), "Overview of the NTCIR-15 Dialogue Evaluation (DialEval-1) Task", Proceedings of NTCIR-15, 2020



Source: Jiang, Mike Tian-Jian, Shih-Hung Wu, Yi-Kun Chen, Zhao-Xian Gu, Cheng-Jhe Chiang, Yueh-Chia Wu, Yu-Chen Huang, Cheng-Han Chiu, Sheng-Ru Shaw, and Min-Yuh Day (2020). "Fine-tuning techniques and data augmentation on transformer-based models for conversational texts and noisy user-generated content." In 2020 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining (ASONAM), pp. 919-925. IEEE, 2020.

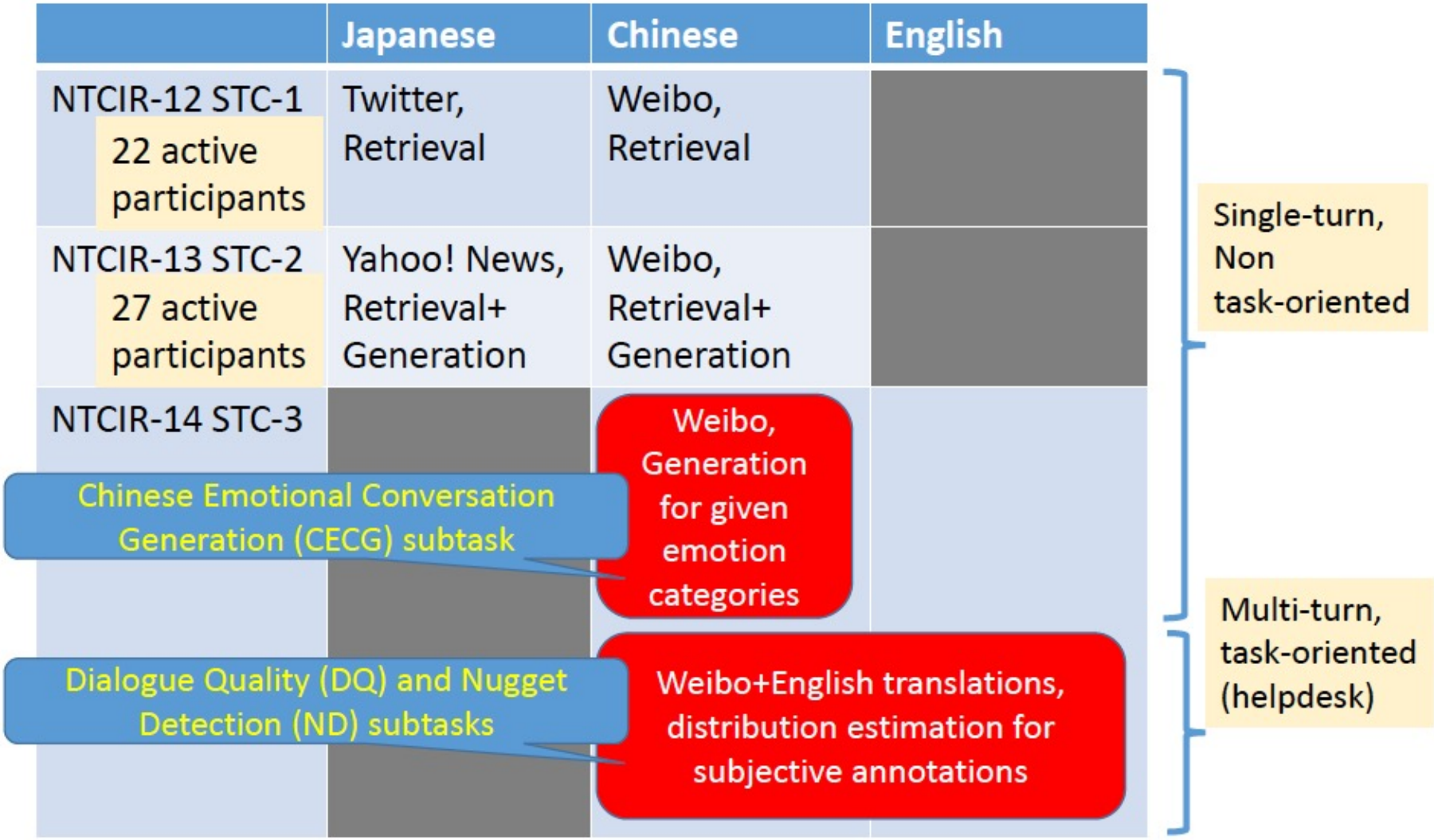
IMTKU Emotional Dialogue System Architecture



Short Text Conversation Task (STC-3)
Chinese Emotional Conversation Generation (CECG) Subtask

Source: http://coai.cs.tsinghua.edu.cn/hml/challenge.html

NTCIR Short Text Conversation STC-1, STC-2, STC-3

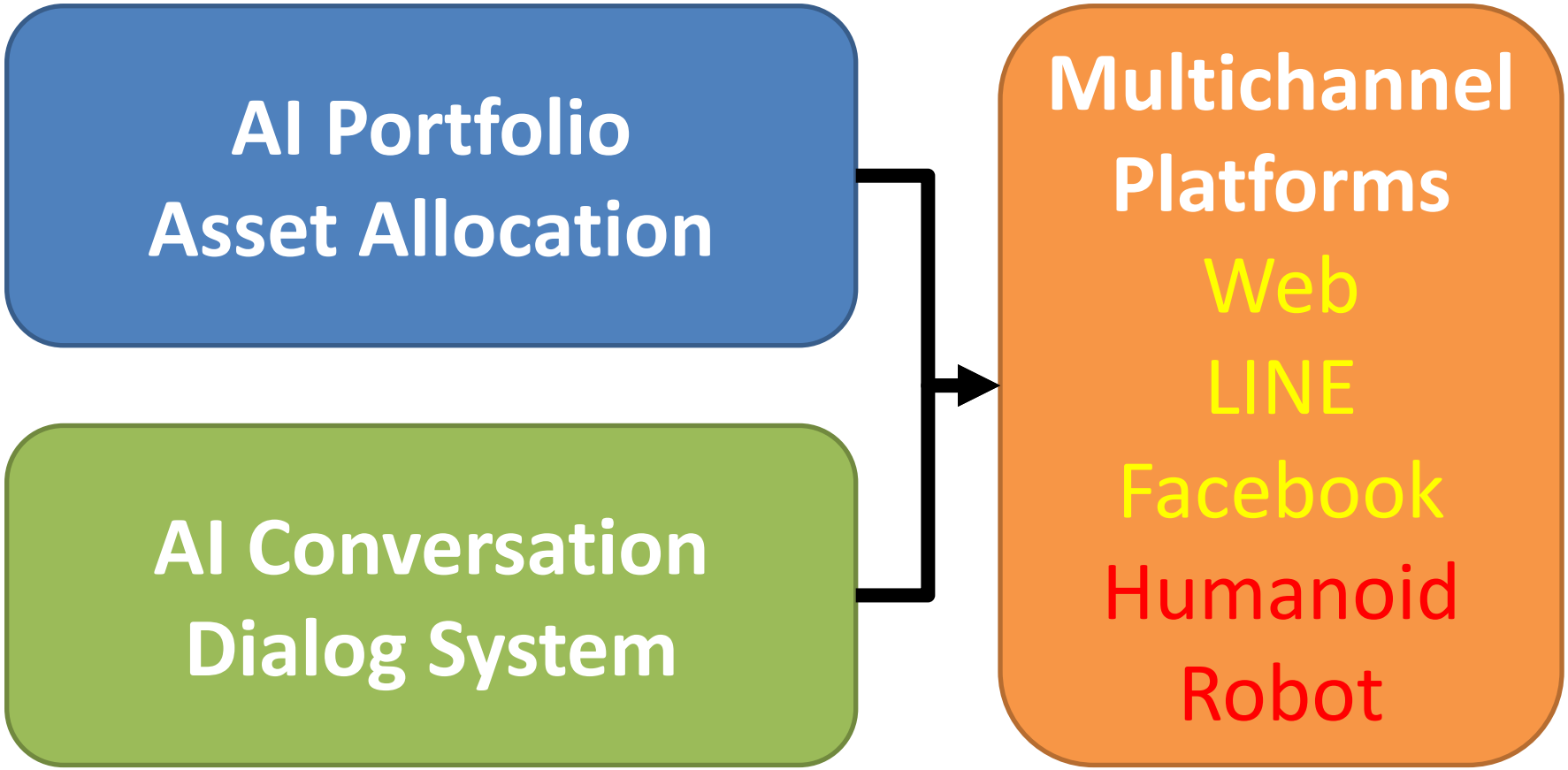


Source: https://waseda.app.box.com/v/STC3atNTCIR-14

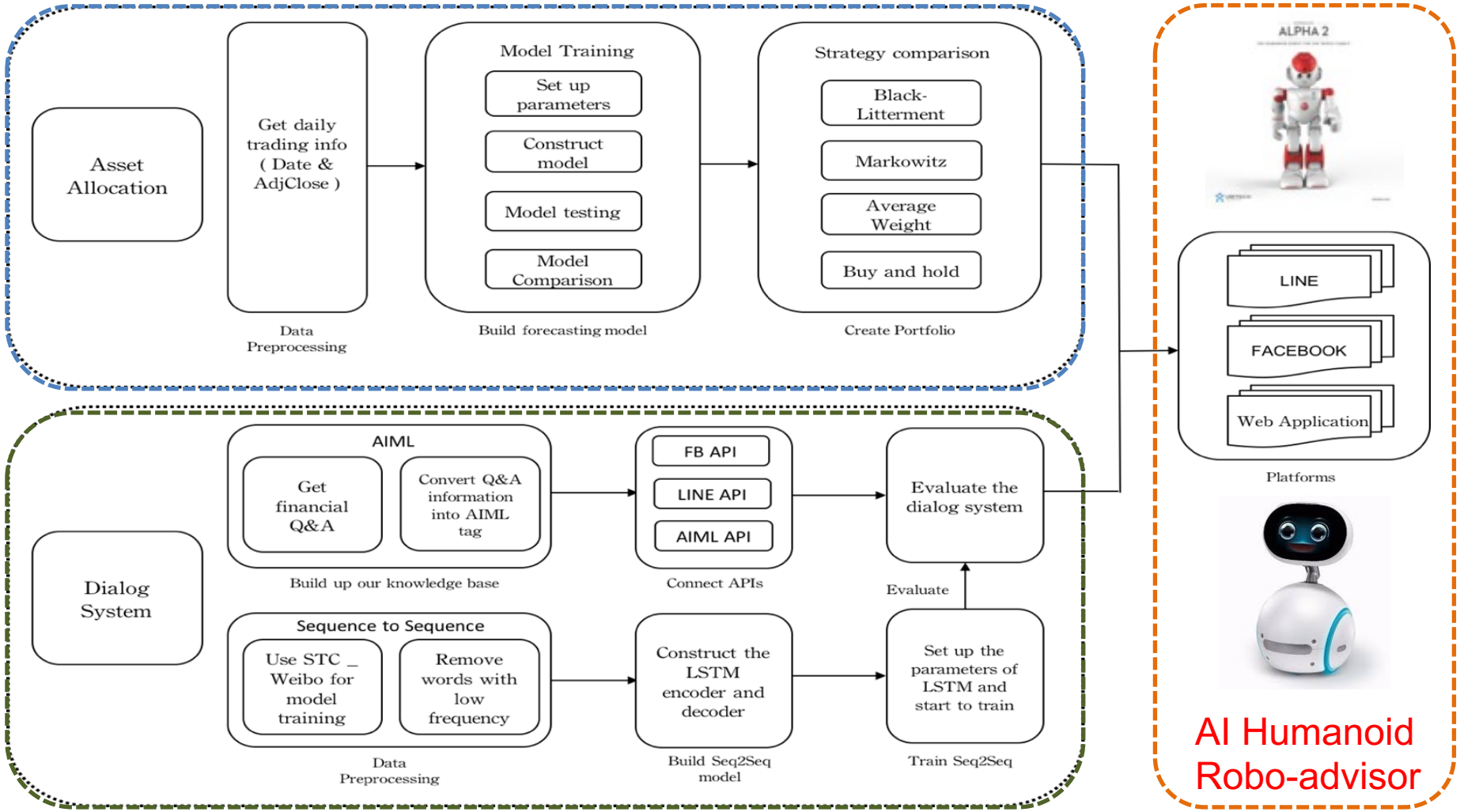
AI Humanoid Robo-Advisor

AI Humanoid Robo-Advisor

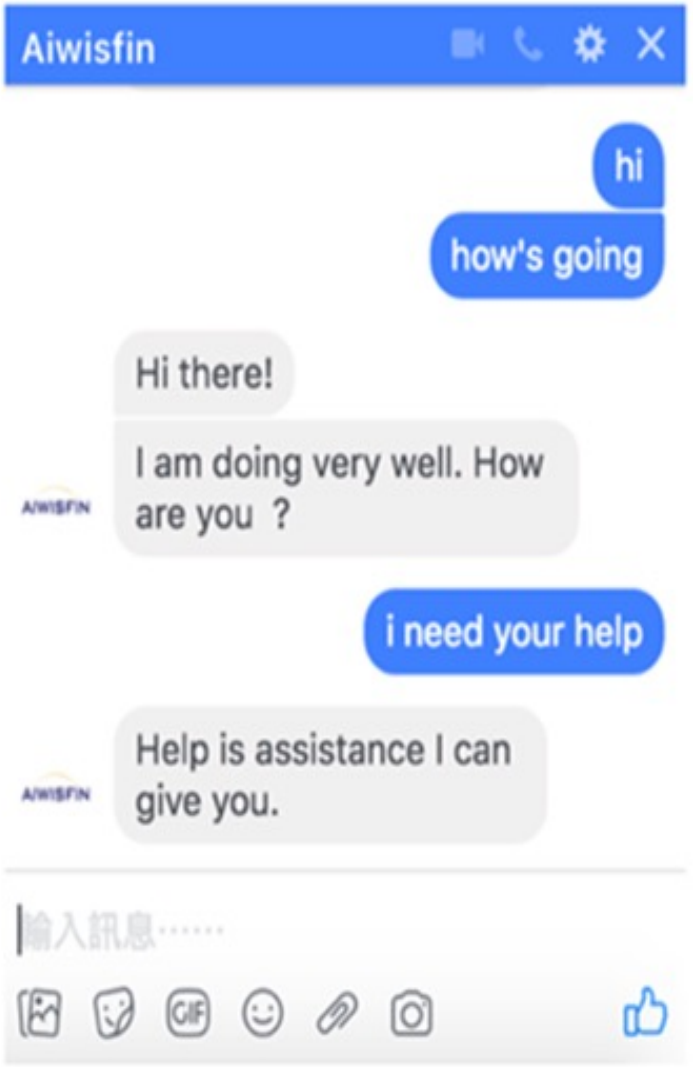
for Multi-channel Conversational Commerce



System Architecture of AI Humanoid Robo-Advisor



Conversational Model
(LINE, FB Messenger)



Conversational Robo-Advisor Multichannel UI/UX Robots

ALPHA 2

ZENBO

FinTech

Financial Technology
FinTech

"providing
financial services
by making use of
software and
modern technology"

Source: https://www.fintechweekly.com/fintech-definition

Financial Services

Financial Services

Source: http://www.crackitt.com/7-reasons-why-your-fintech-startup-needs-visual-marketing/

FinTech: Financial Services Innovation

Source: http://www3.weforum.org/docs/WEF_The_future__of_financial_services.pdf

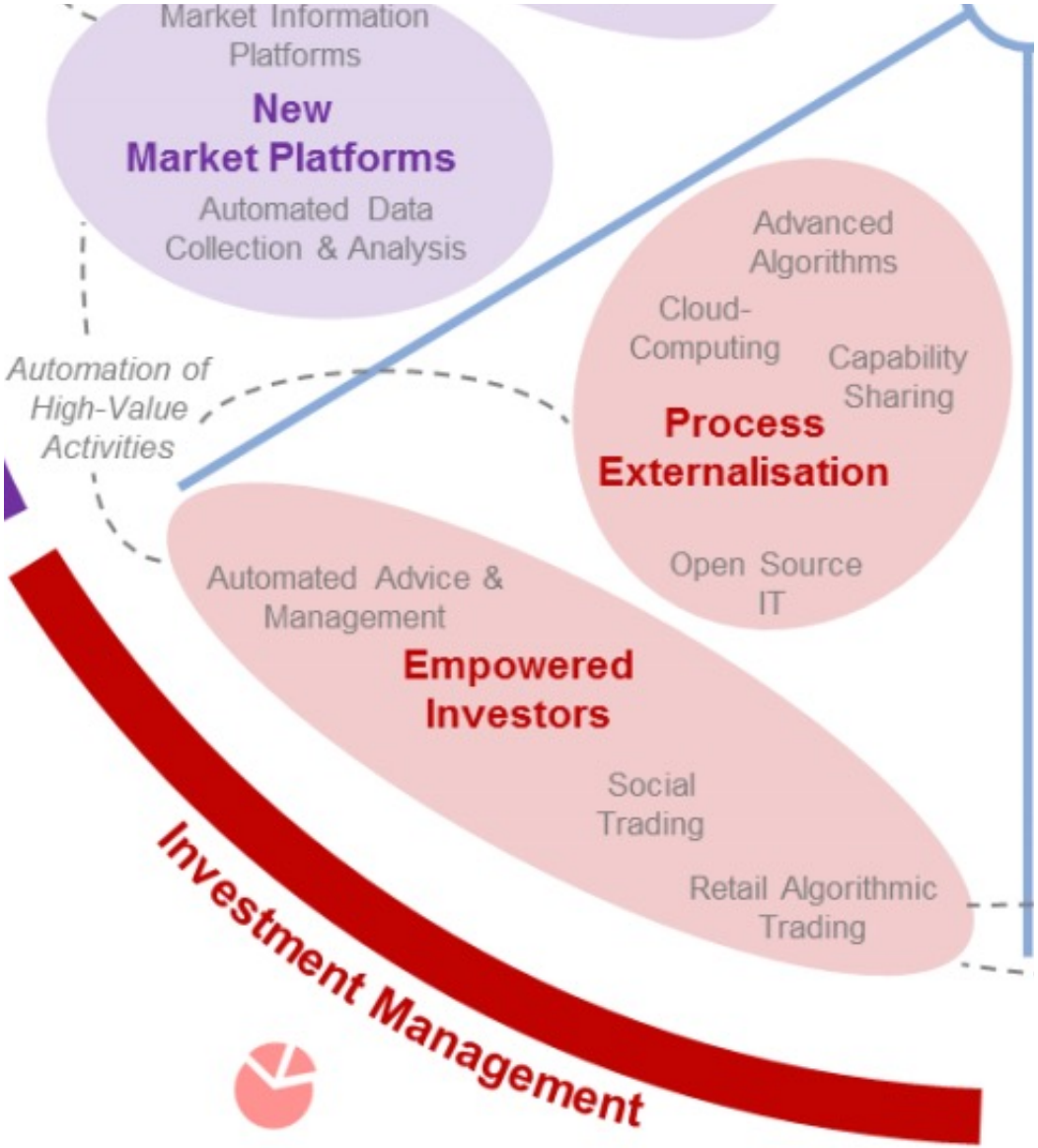
FinTech:

Financial Services Innovation

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

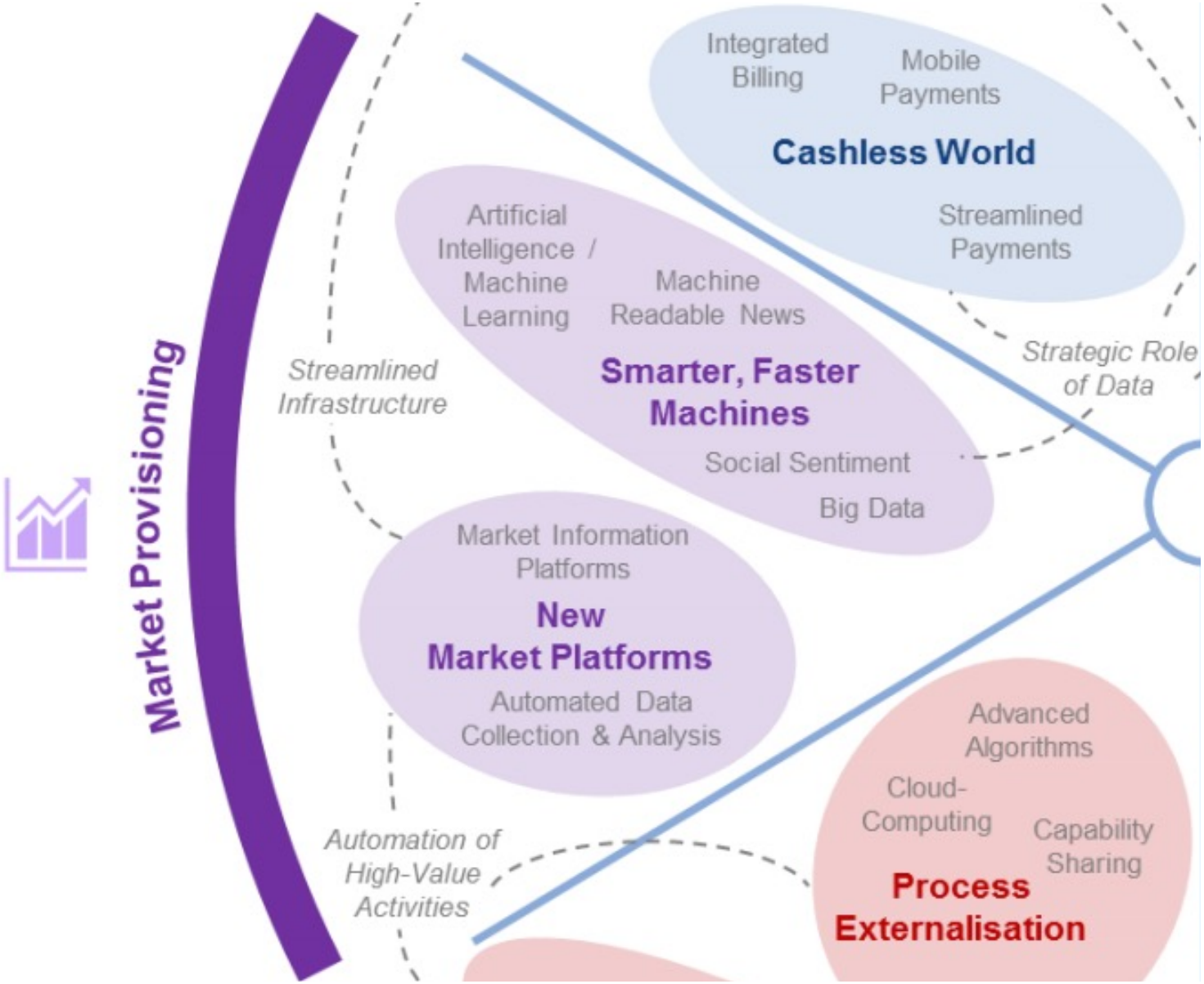
Source: http://www3.weforum.org/docs/WEF_The_future__of_financial_services.pdf

5 FinTech: Investment Management



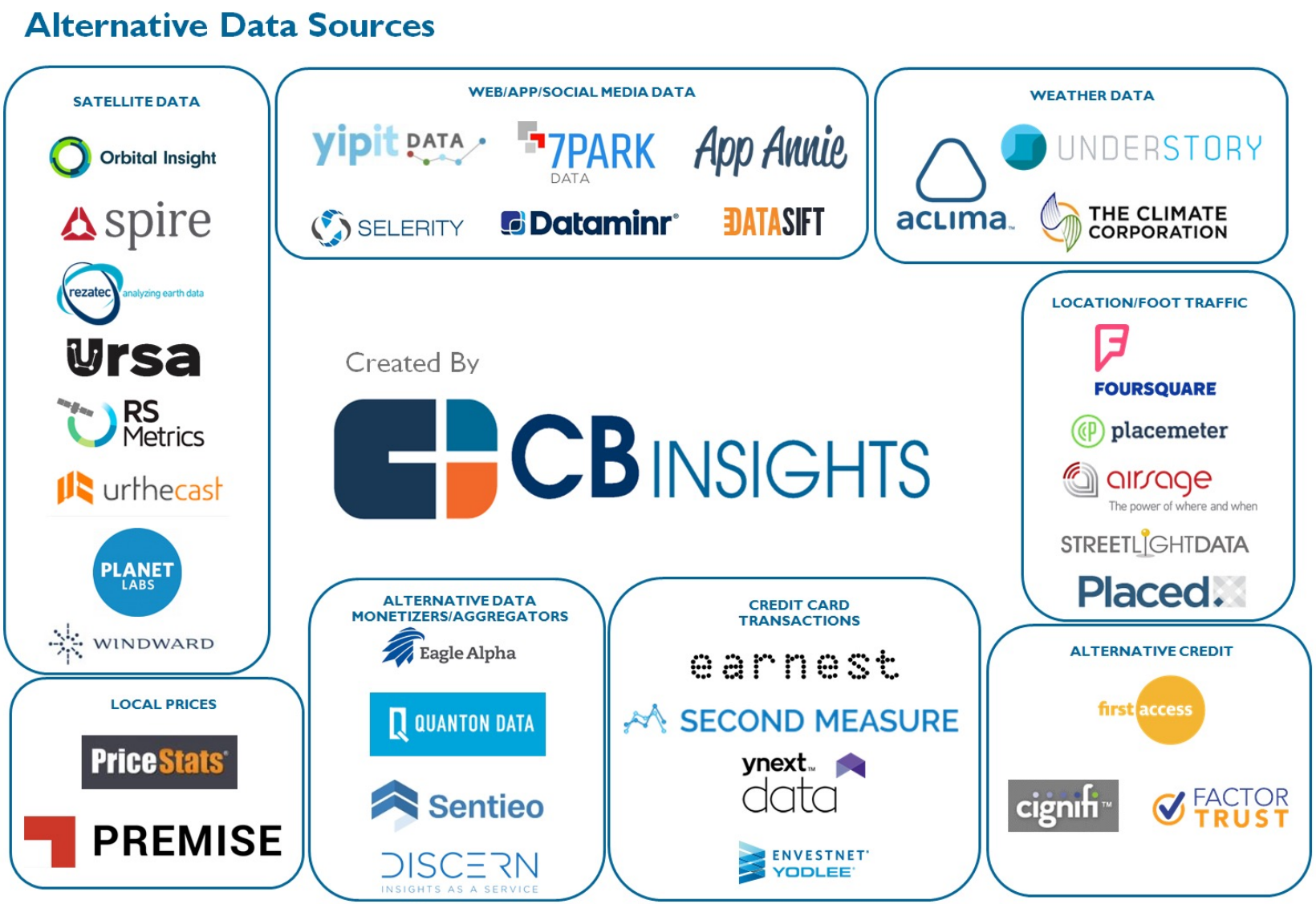
Source: http://www3.weforum.org/docs/WEF_The_future__of_financial_services.pdf

6 FinTech: Market Provisioning



Source: http://www3.weforum.org/docs/WEF_The_future__of_financial_services.pdf

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

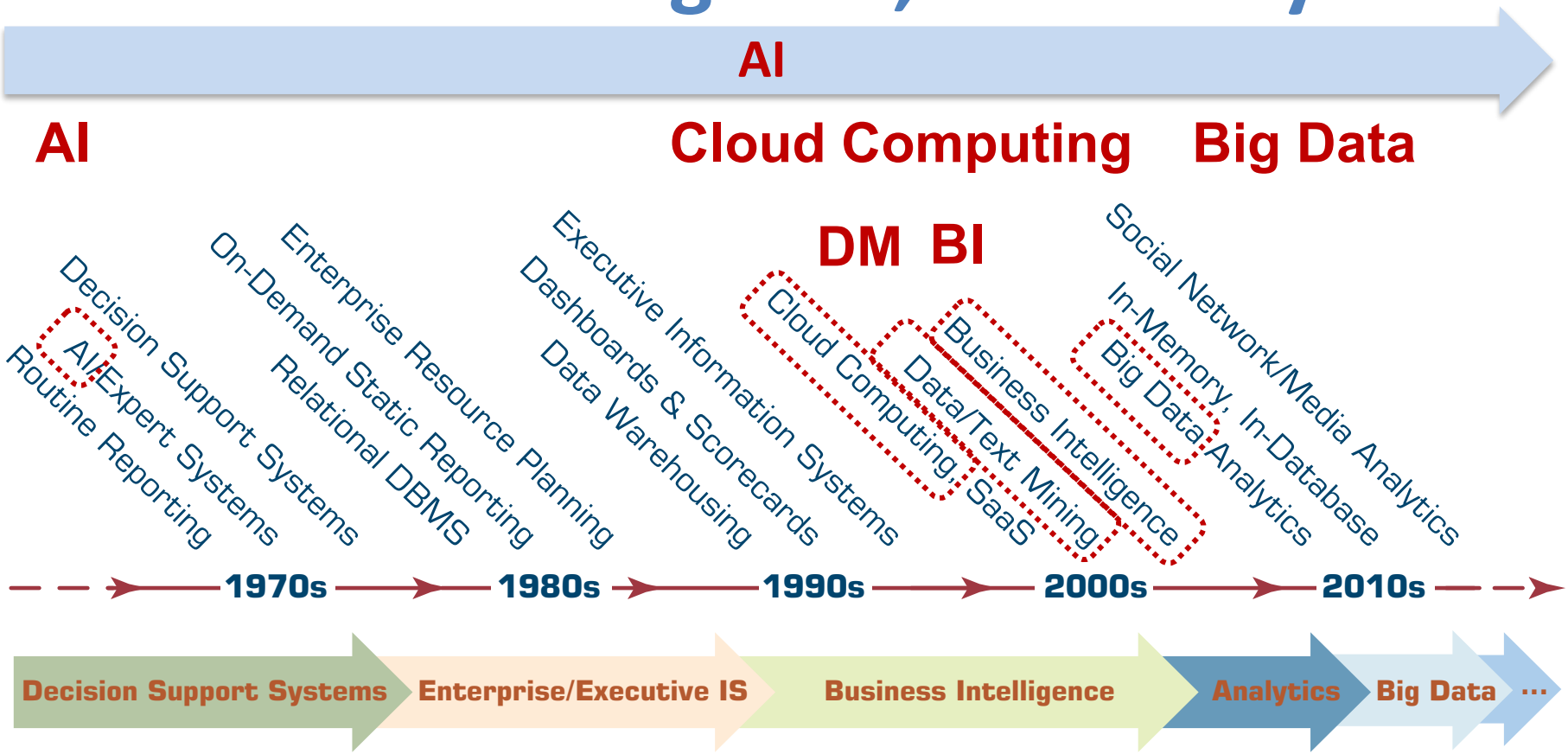


Source: https://www.cbinsights.com/blog/alternative-data-startups-market-map-company-list/

AI in FinTech

AI, Big Data, Cloud Computing

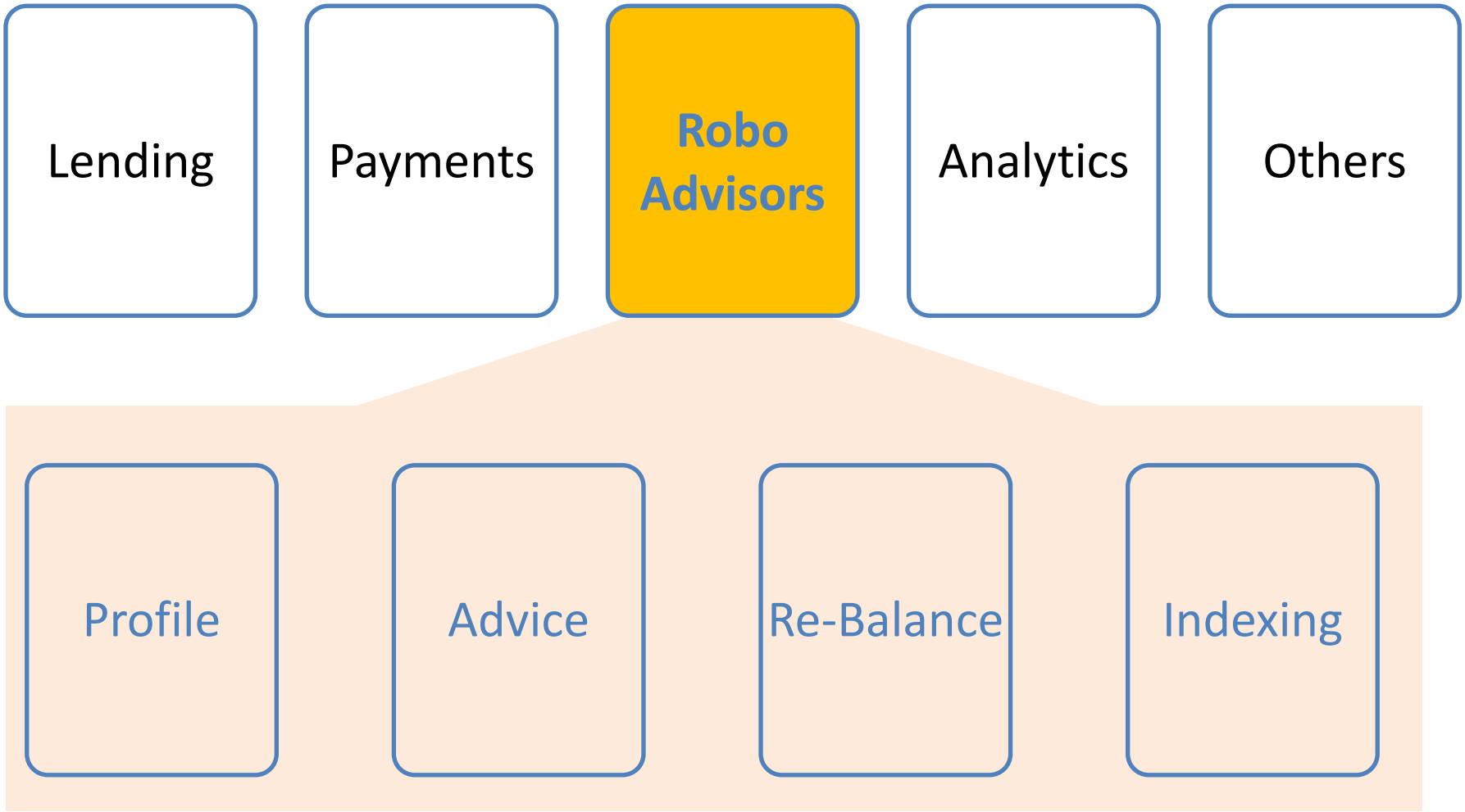
Evolution of Decision Support, Business Intelligence, and Analytics



Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017),
Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson

Robo-Advisors

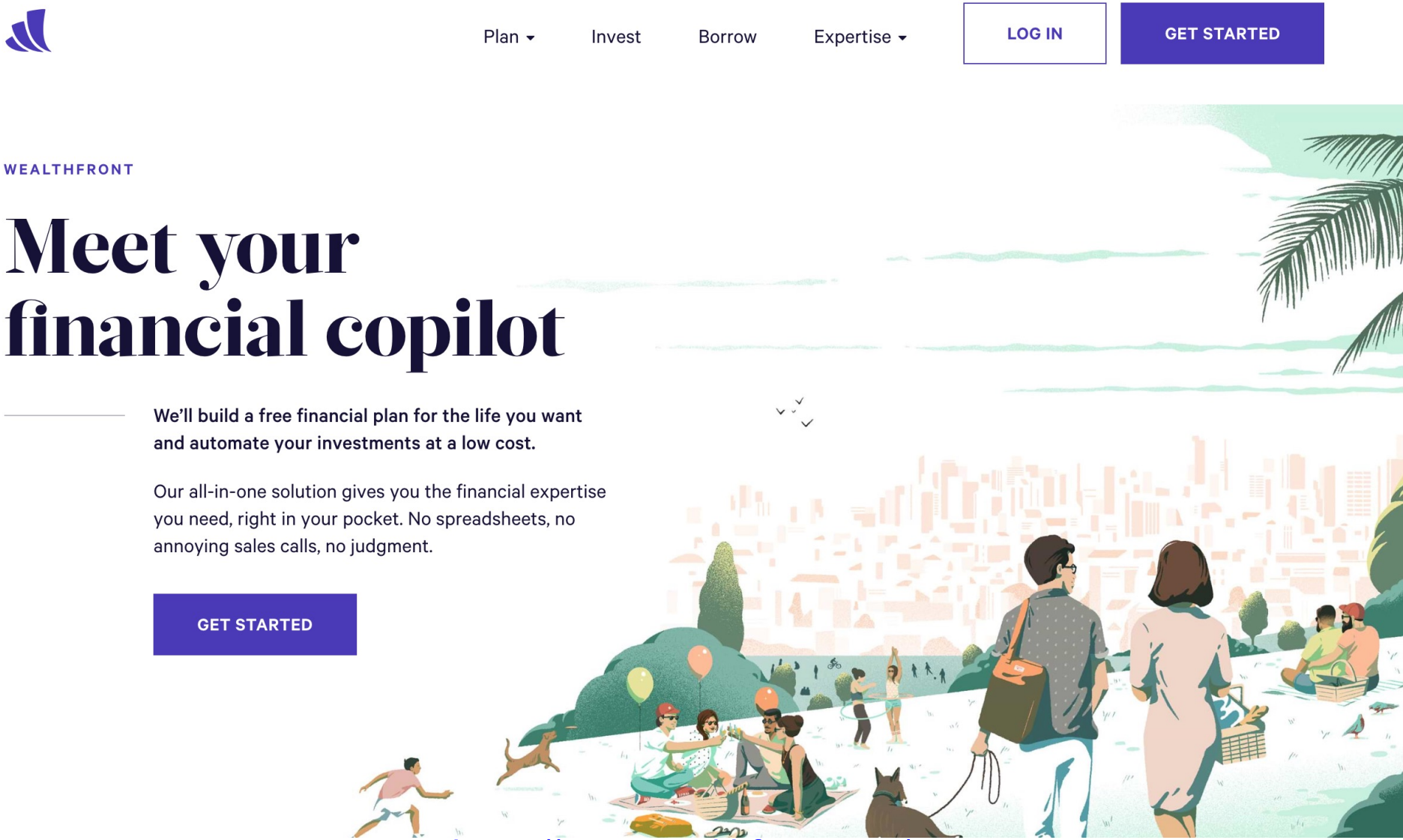
FinTech high-level classification



Source: Paolo Sironi (2016), “FinTech Innovation: From Robo-Advisors to Goal Based Investing and Gamification”, Wiley.

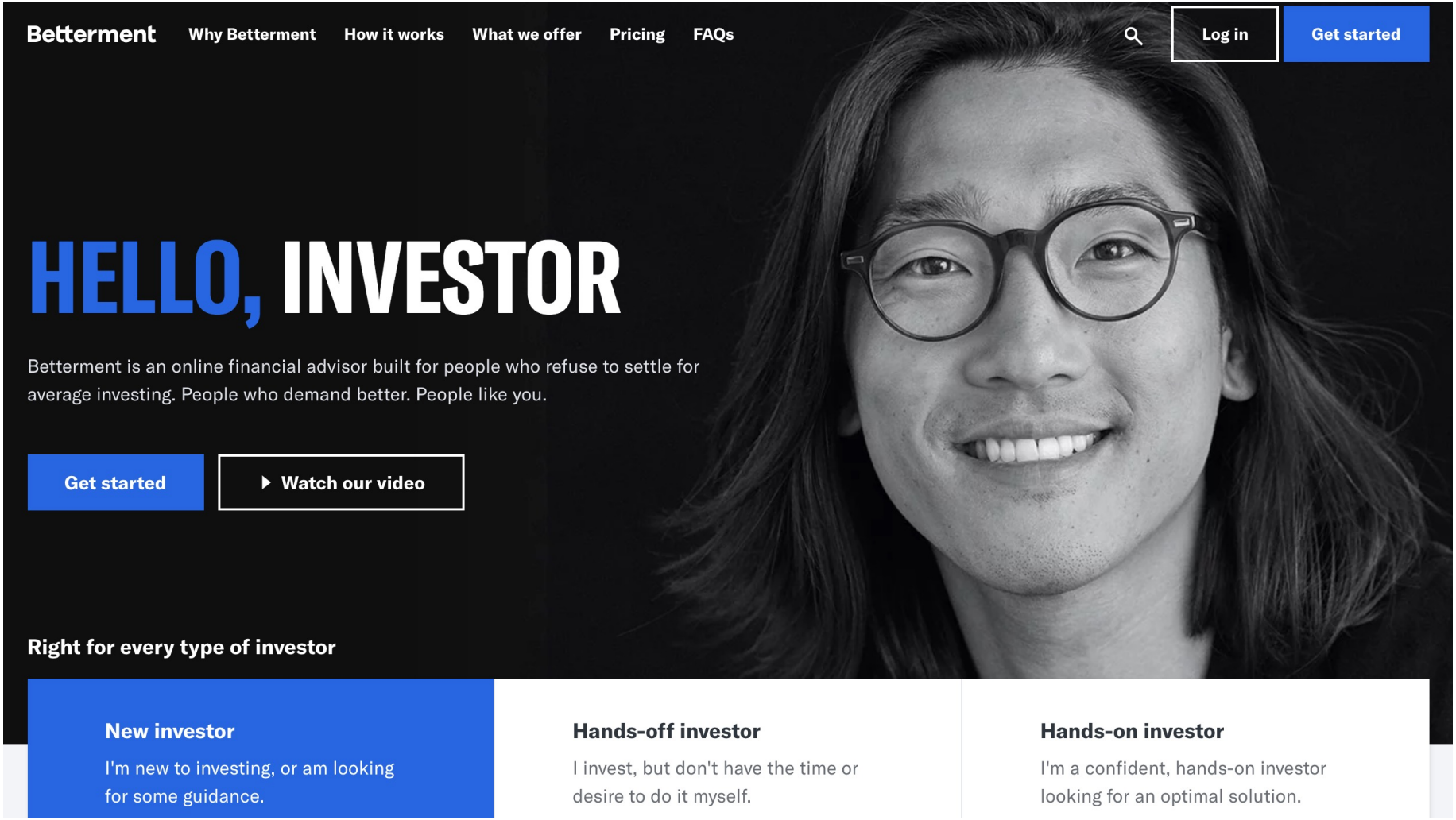
Wealthfront

Financial Planning & Robo-Investing for Millennials



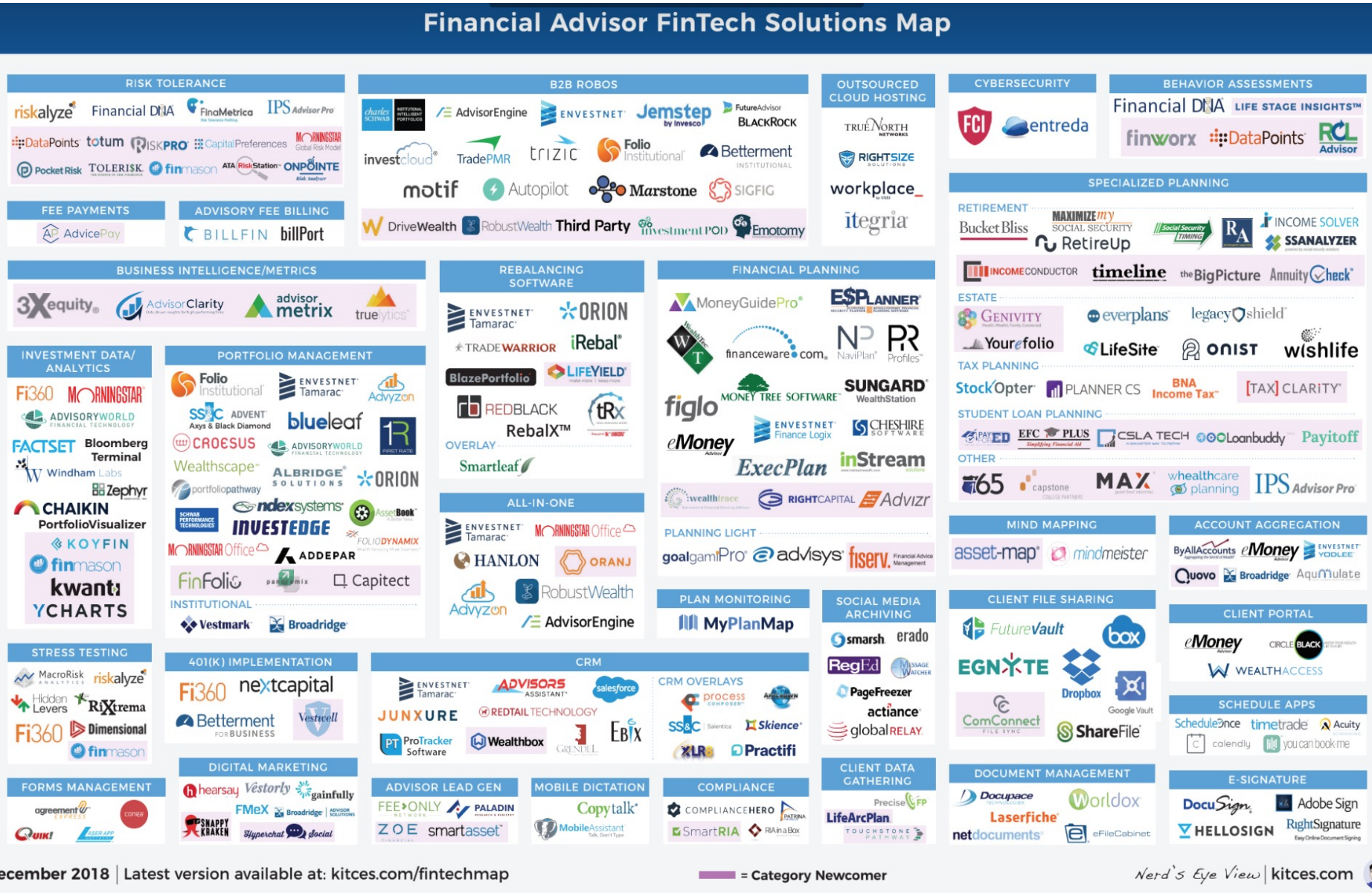
https://www.wealthfront.com/

Betterment
Online Financial Advisor



https://www.betterment.com/

Financial Advisor FinTech Solutions



Source: https://www.kitces.com/fintechmap

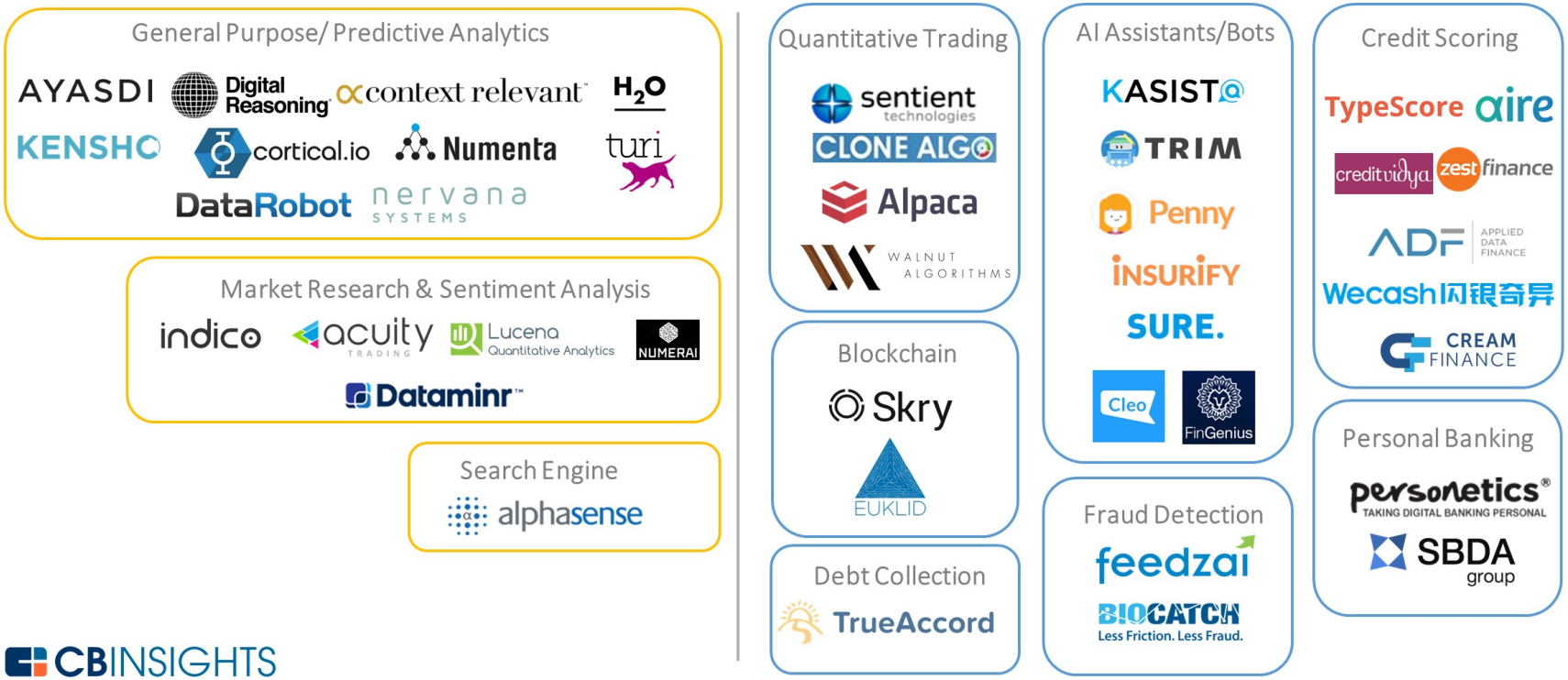
From Algorithmic Trading to Personal Finance Bots: 41 Startups Bringing AI to Fintech

Source: https://www.cbinsights.com/blog/artificial-intelligence-fintech-market-map-company-list/

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

AI in Fintech

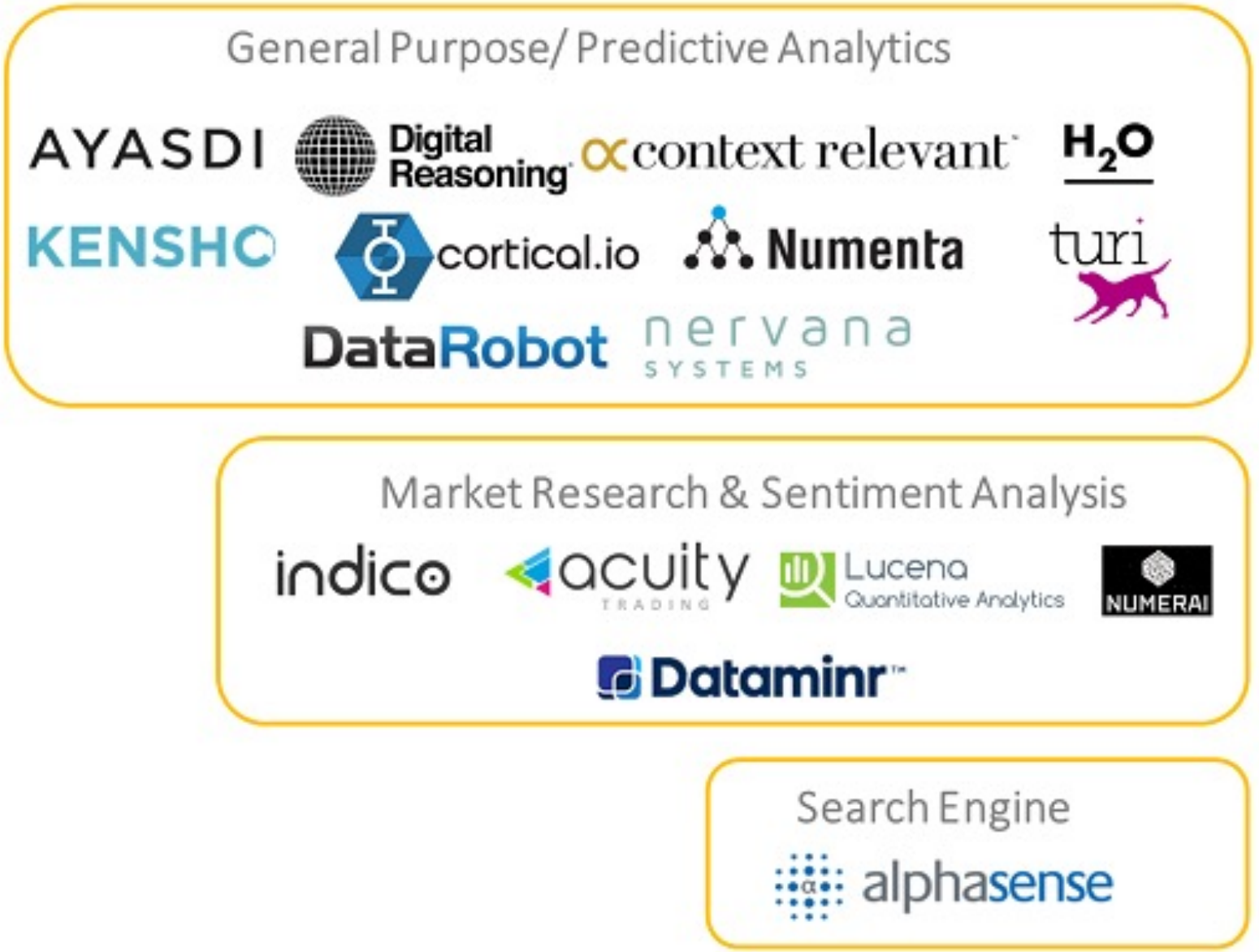
41 Startups Bringing Artificial Intelligence To Fintech



CBINSIGHTS
www.cbinsights.com

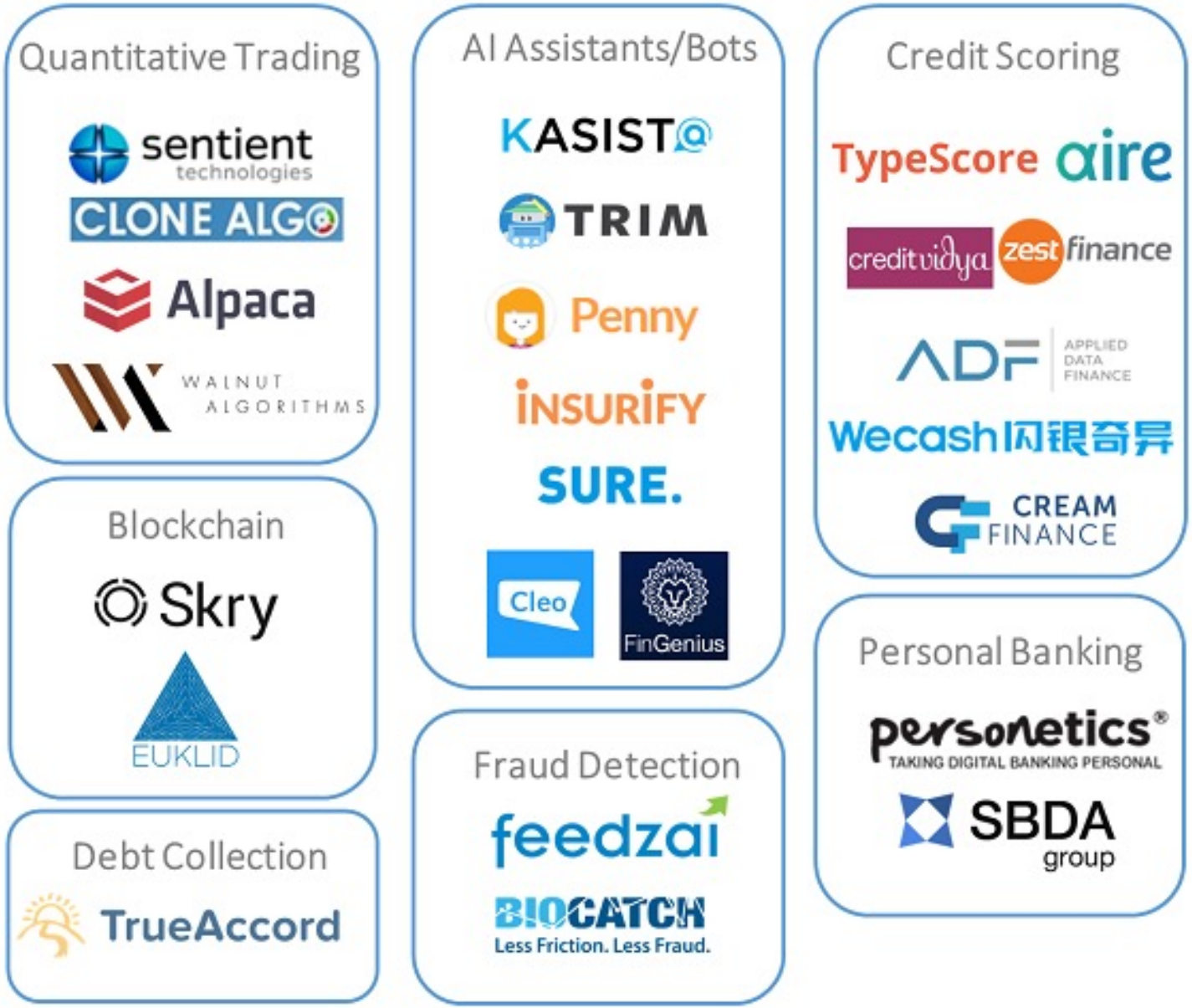
Source: https://www.cbinsights.com/blog/artificial-intelligence-fintech-market-map-company-list/

Artificial Intelligence (AI) in Fintech



Source: https://www.cbinsights.com/blog/artificial-intelligence-fintech-market-map-company-list/

Artificial Intelligence (AI) in Fintech



Source: https://www.cbinsights.com/blog/artificial-intelligence-fintech-market-map-company-list/

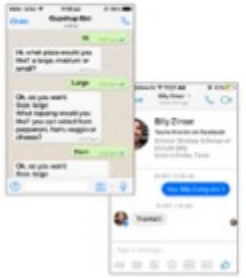
Conversational Commerce

Chatbot

Dialogue System

Intelligent Agent

Chatbots: Evolution of UI/UX

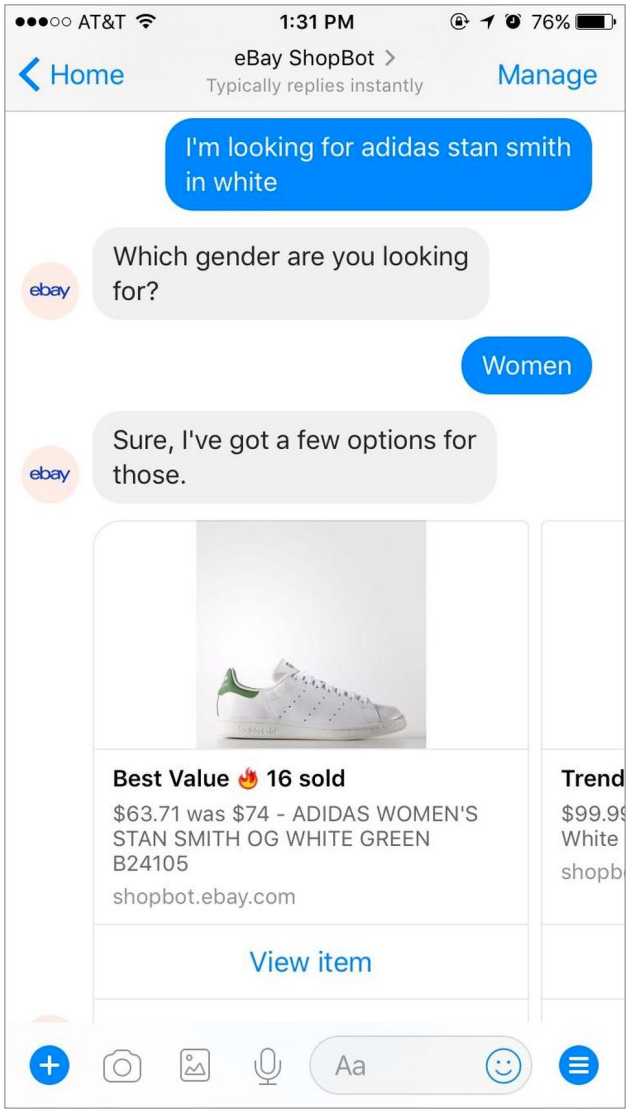
	mid - 80s	mid - 90s	mid - 00s	mid - 10s
Paradigm	**PC**	**Web**	**Smartphone**	**Messaging**
				
Platform *Examples*	**Desktop** *DOS, Windows, Mac OS*	**Browser** *Mosaic, Explorer, Chrome*	**Mobile OS** *iOS, Android*	**Messaging Apps** *WhatsApp, Messenger, Slack*
Applications *Examples*	**Clients** *Excel, PPT, Lotus*	**Website** *Yahoo, Amazon*	**Apps** *Angry Birds, Instagram*	**Bots** *Weather, Travel*
UI/UX	**Native Screens**	**Web Pages**	**Native Mobile Screens**	**Message**
S/w Dev	**Client-side**	**Server-side**	**Client-side**	**Server-side**

Source: https://bbvaopen4u.com/en/actualidad/want-know-how-build-conversational-chatbot-here-are-some-tools

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

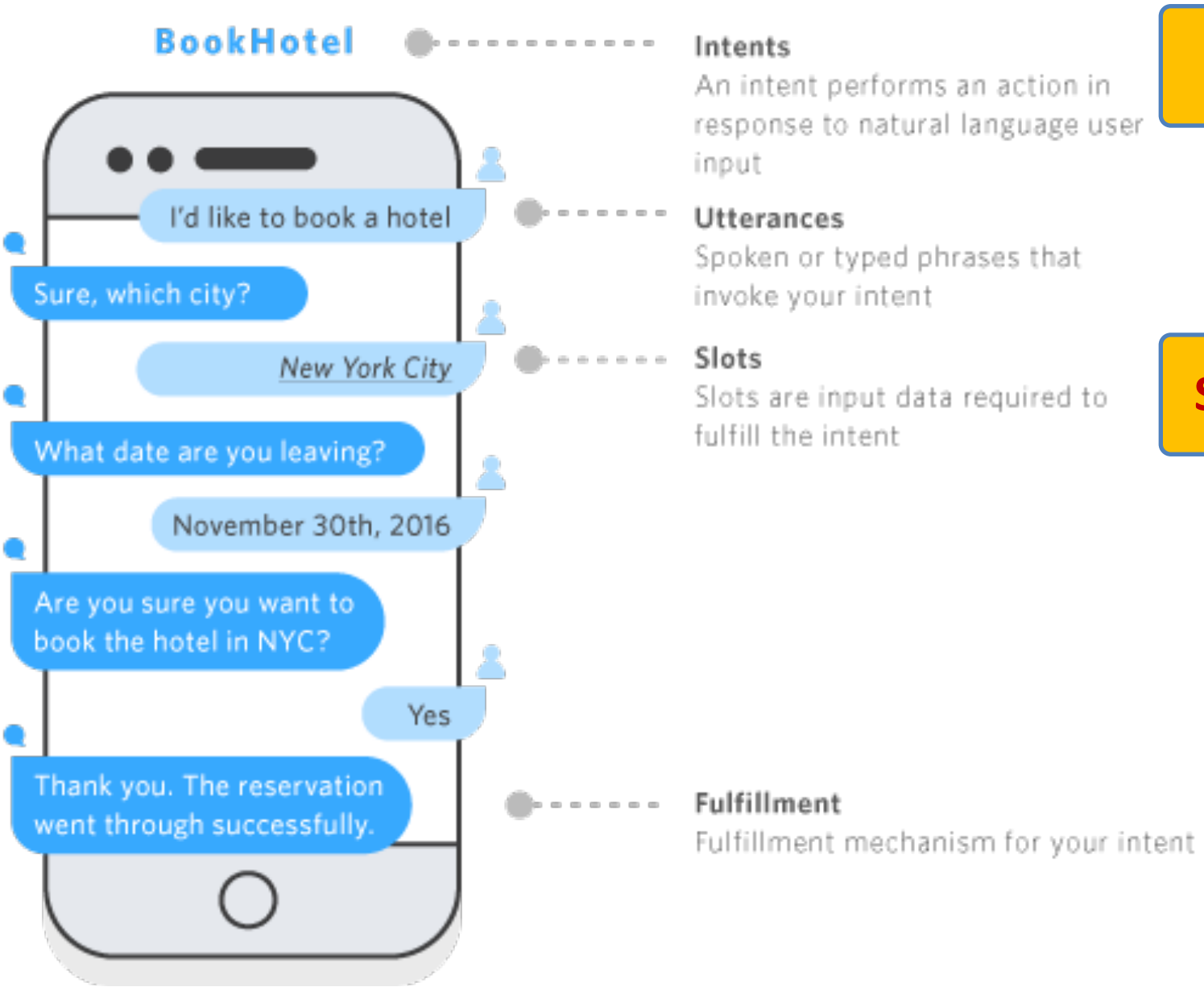
Source: http://www.guided-selling.org/from-e-commerce-to-conversational-commerce/

Conversational Commerce: eBay AI Chatbots



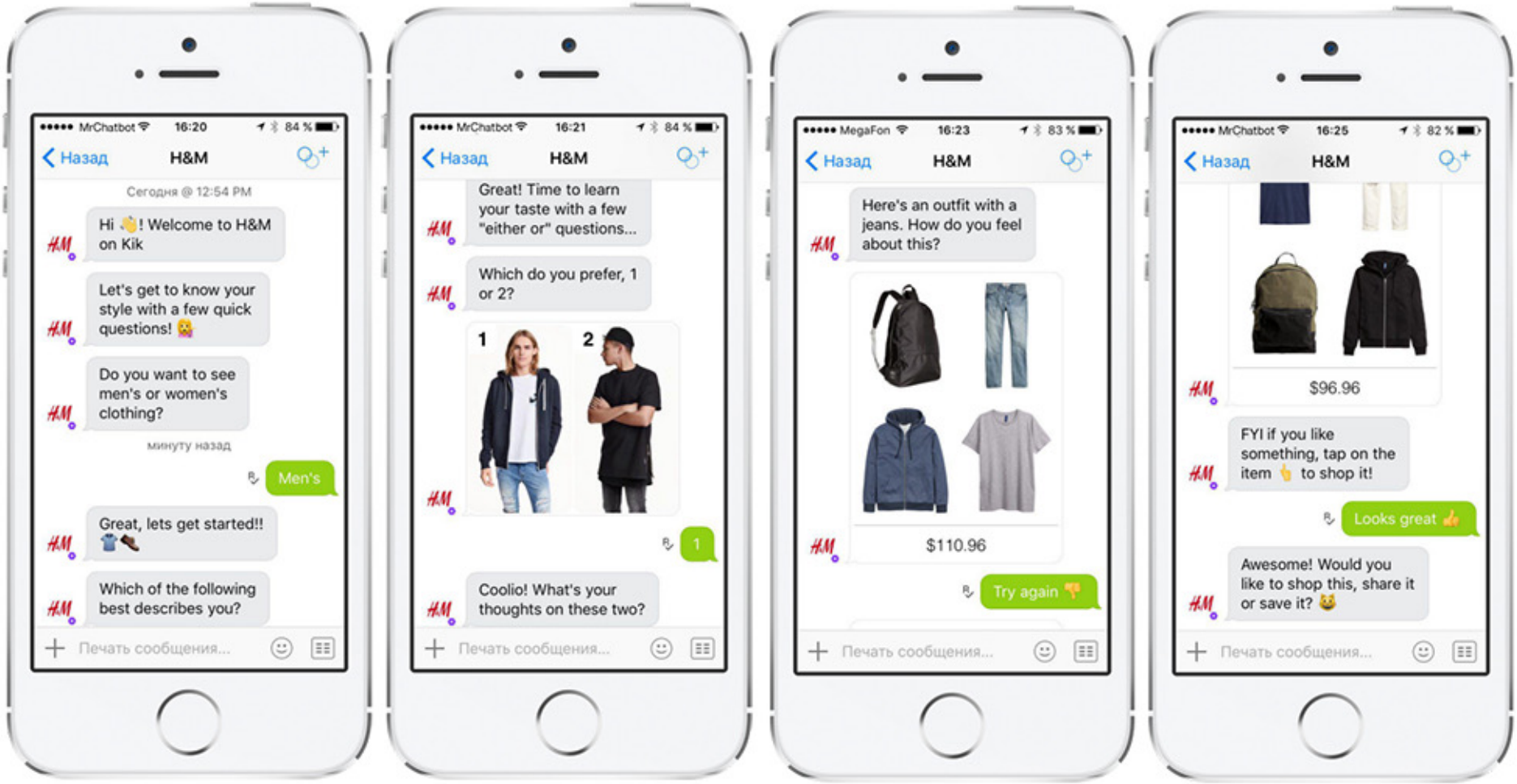
Source: https://www.forbes.com/sites/rachelarthur/2017/07/19/conversational-commerce-ebay-ai-chatbot/

Hotel Chatbot



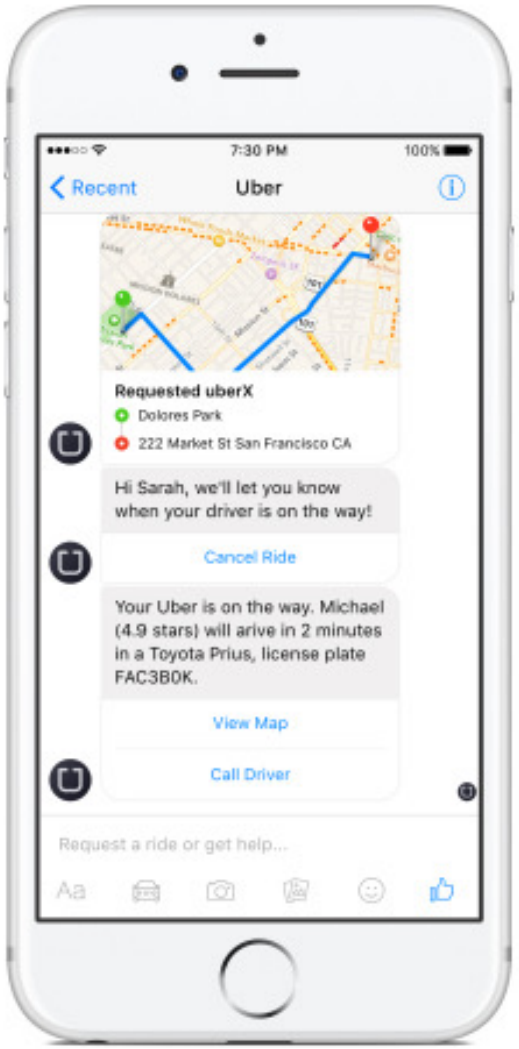
Source: https://sdtimes.com/amazon/guest-view-capitalize-amazon-lex-available-general-public/

H&M's Chatbot on Kik



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

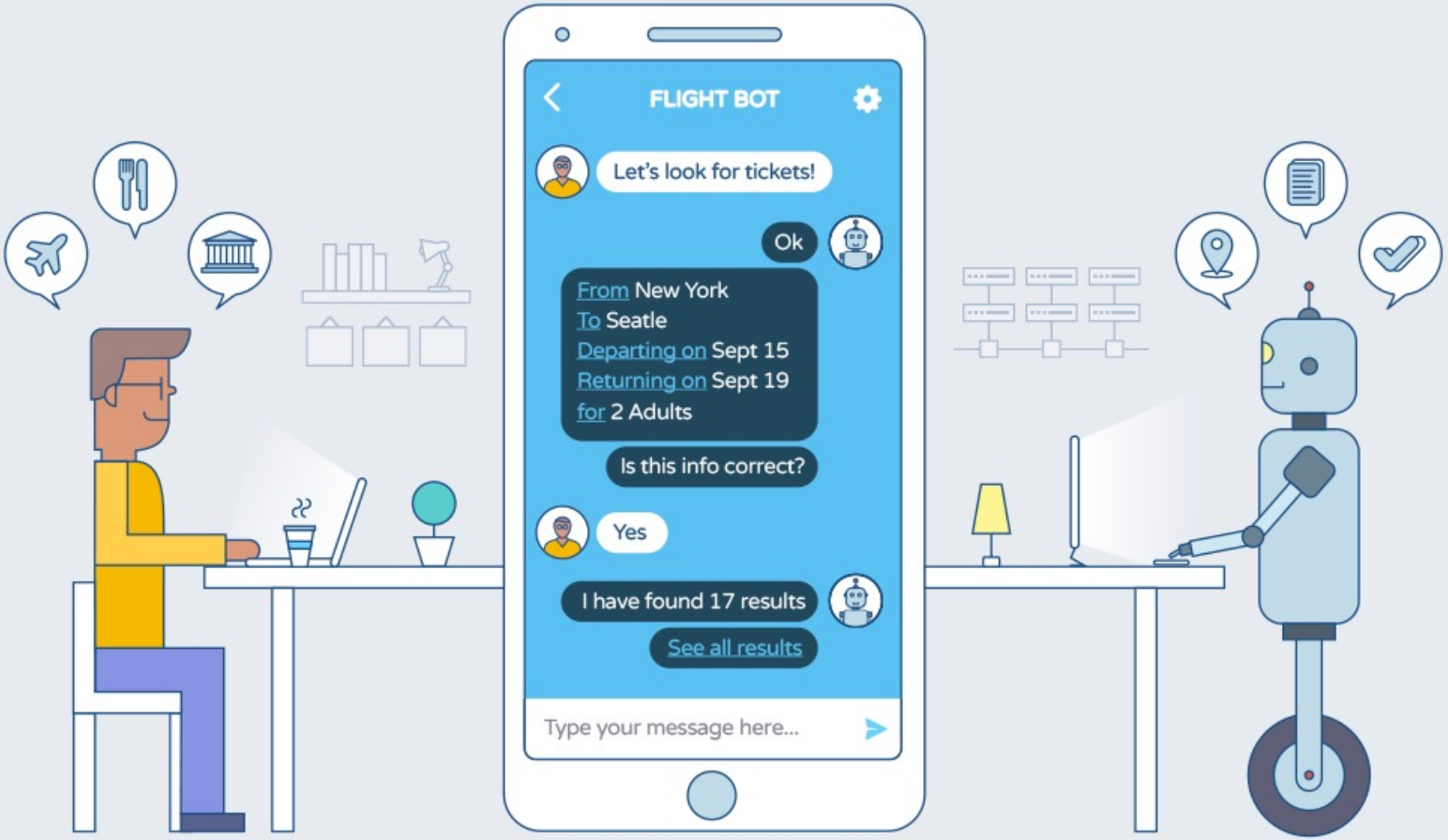
Uber’s Chatbot on Facebook’s Messenger



Uber’s chatbot on Facebook’s messenger
- one main benefit: it loads much faster than the Uber app

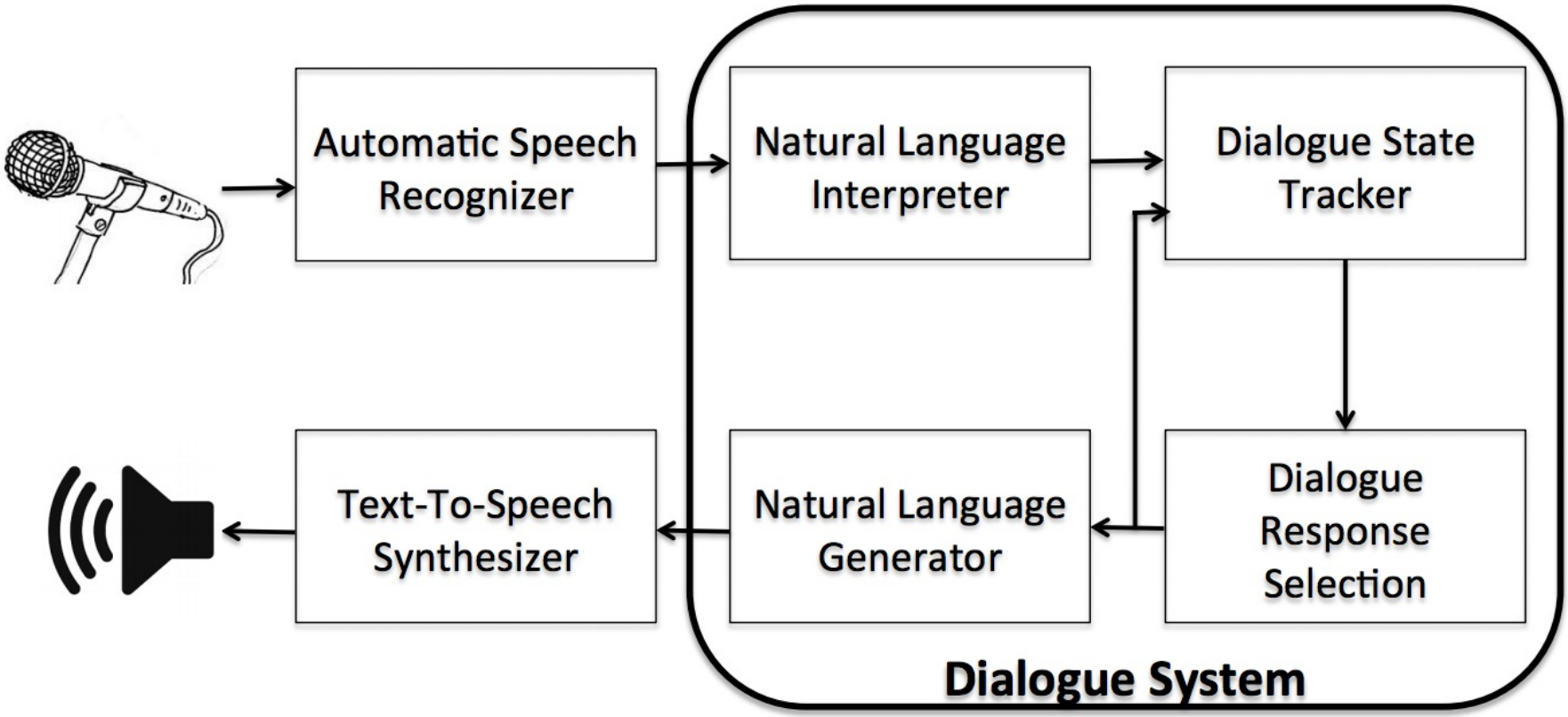
Source: http://www.guided-selling.org/from-e-commerce-to-conversational-commerce/

Chatbot



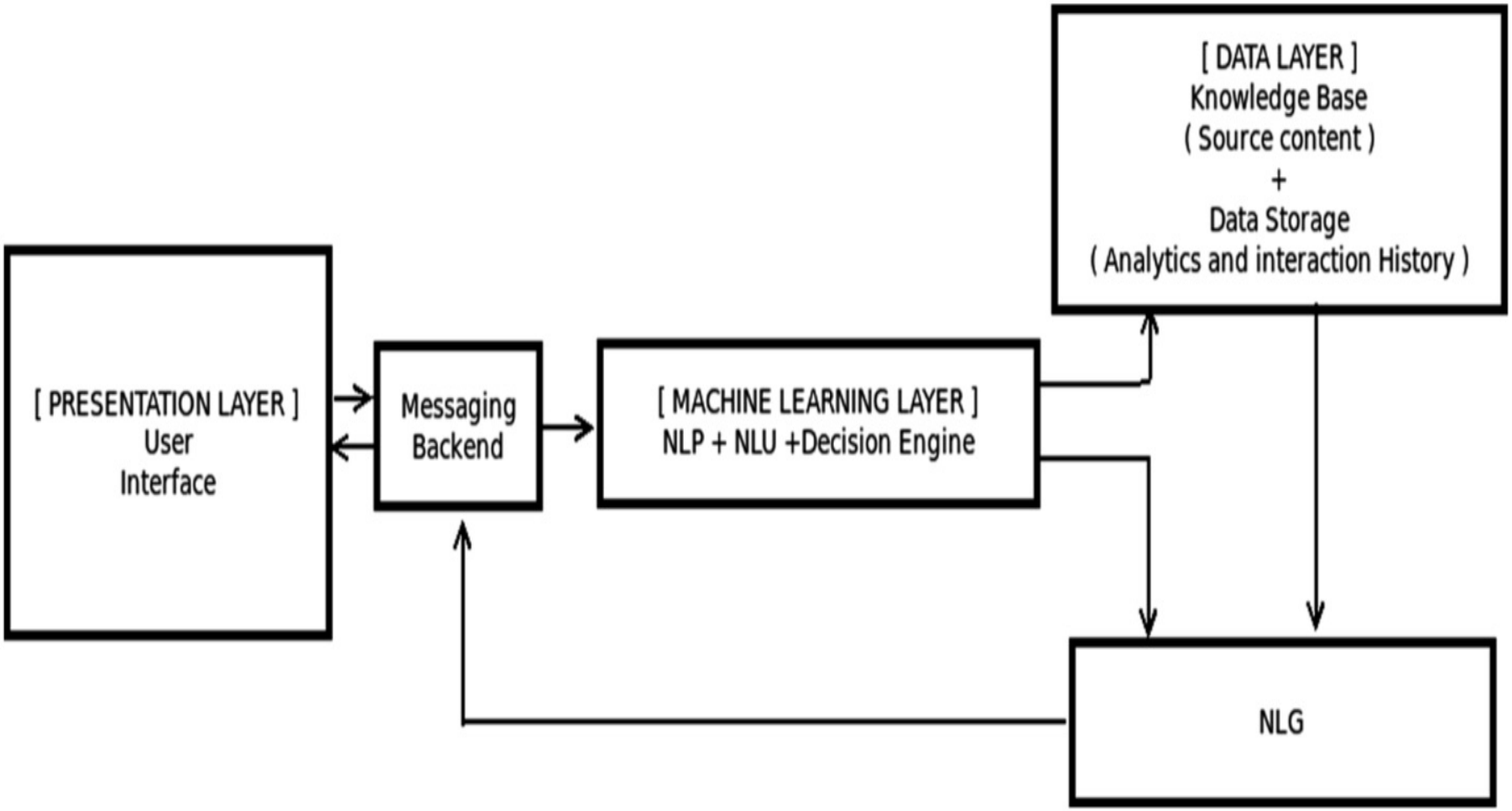
Source: https://www.mdsdecoded.com/blog/the-rise-of-chatbots/

Dialogue System



Source: Serban, I. V., Lowe, R., Charlin, L., & Pineau, J. (2015). A survey of available corpora for building data-driven dialogue systems. *arXiv preprint arXiv:1512.05742*.

Overall Architecture of Intelligent Chatbot



Source: Borah, Bhriguraj, Dhrubajyoti Pathak, Priyankoo Sarmah, Bidisha Som, and Sukumar Nandi. "Survey of Textbased Chatbot in Perspective of Recent Technologies." In International Conference on Computational Intelligence, Communications, and Business Analytics, pp. 84-96. Springer, Singapore, 2018.

Can machines think?

(Alan Turing ,1950)

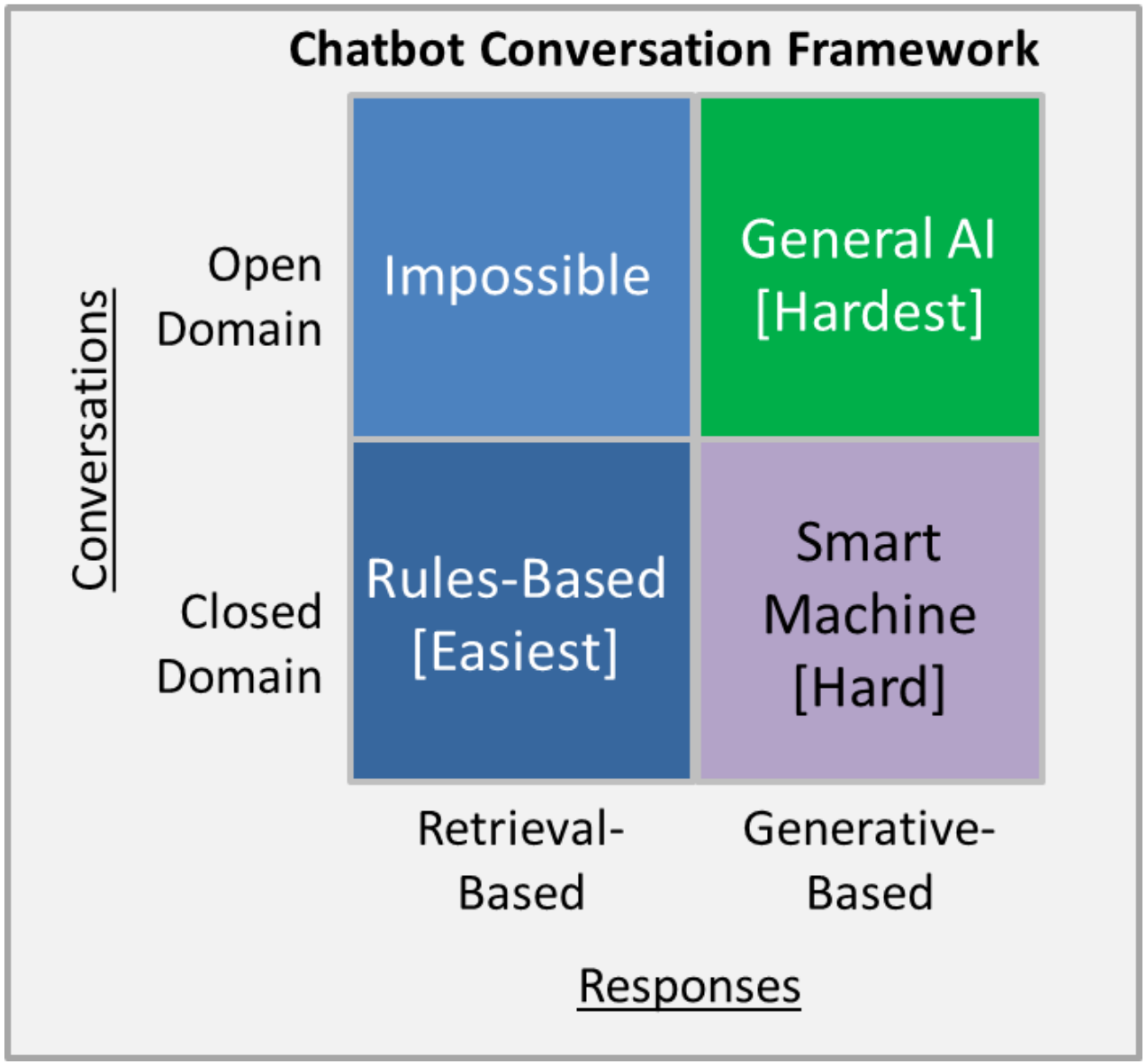
Source: Cahn, Jack. "CHATBOT: Architecture, Design, & Development." PhD diss., University of Pennsylvania, 2017.

Chatbot

"online human-computer dialog system with natural language."

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

Chatbot Conversation Framework

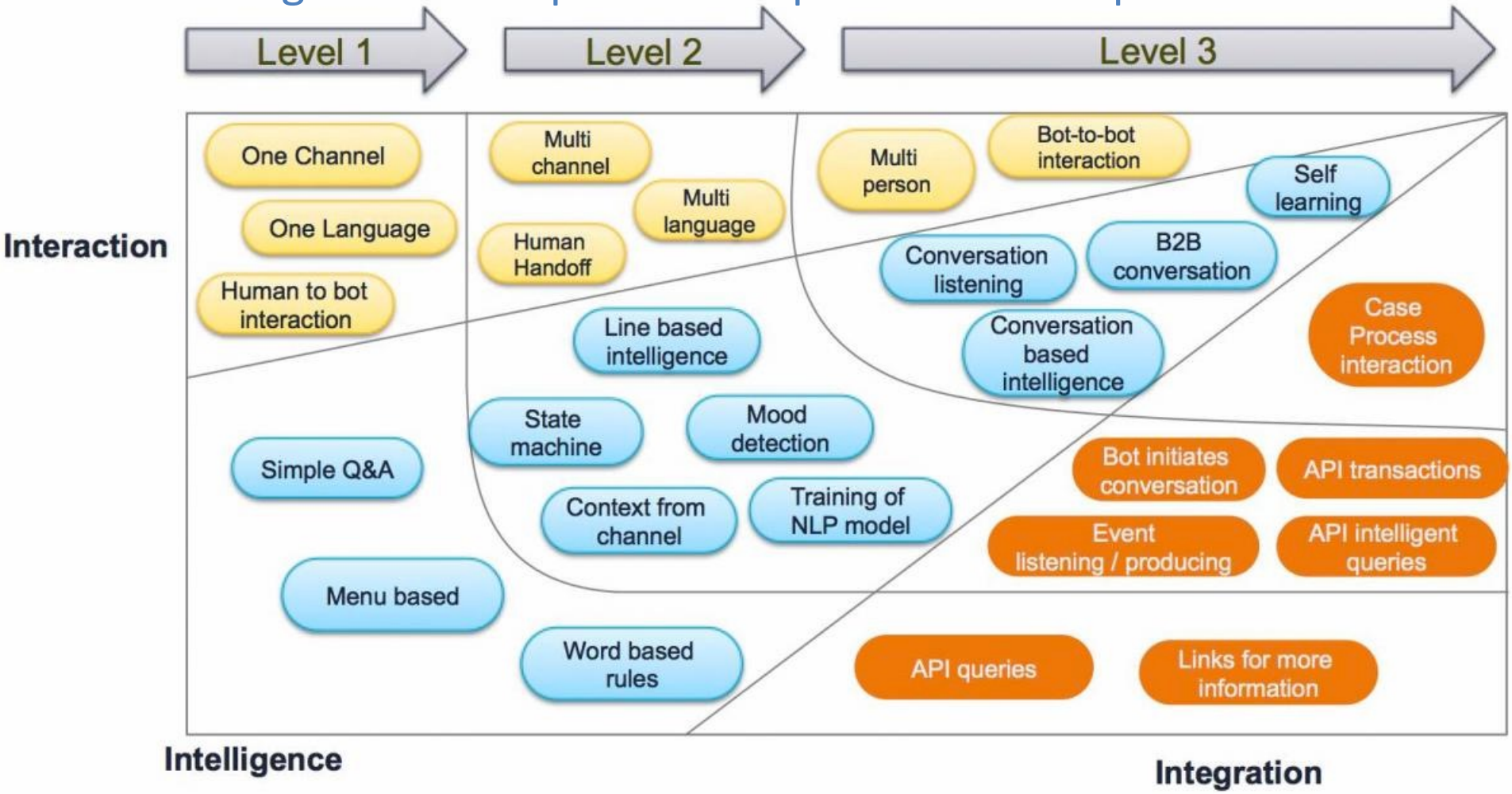


Source: https://chatbotslife.com/ultimate-guide-to-leveraging-nlp-machine-learning-for-you-chatbot-531ff2dd870c

Chatbots

Bot Maturity Model

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



Source: https://www.capgemini.com/2017/04/how-can-chatbots-meet-expectations-introducing-the-bot-maturity/

Task-Oriented Dialogue System

Dialogue Subtasks

Browse SoTA > Natural Language Processing > Dialogue

Dialogue subtasks

Dialogue Generation

Dialogue Generation

9 benchmarks

78 papers with code

Dialogue State Tracking

2 benchmarks

51 papers with code

Task-Oriented Dialogue Systems

Task-Oriented Dialogue Systems

2 benchmarks

48 papers with code

Visual Dialog

8 benchmarks

37 papers with code

Goal-Oriented Dialog

1 benchmark

20 papers with code

Dialogue Management

12 papers with code

Dialogue Understanding

11 benchmarks

8 papers with code

Dialogue Act Classification

2 benchmarks

8 papers with code

Short-Text Conversation

Short-Text Conversation

7 papers with code

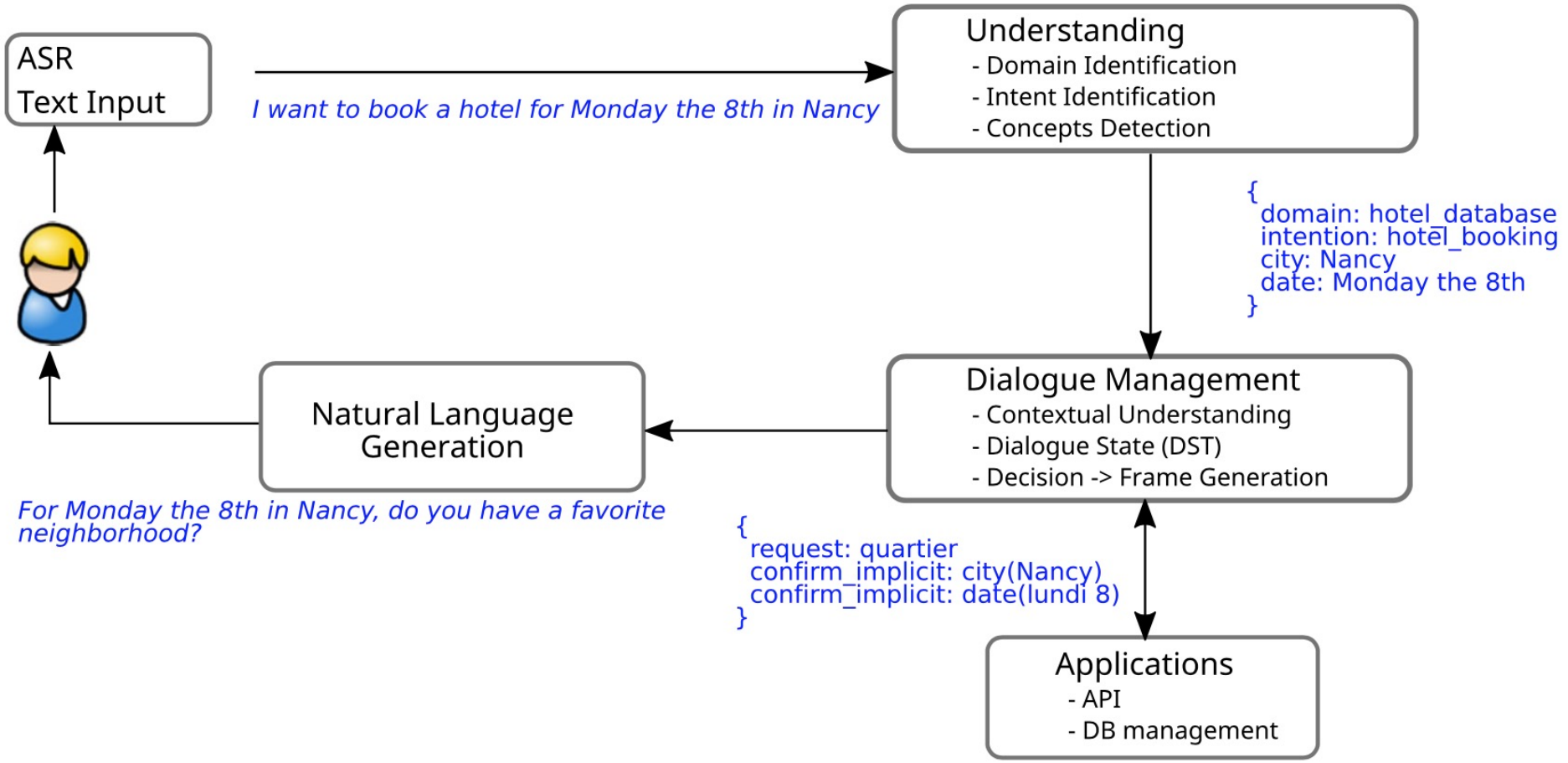
Goal-Oriented Dialogue Systems

7 papers with code

Source: https://paperswithcode.com/area/natural-language-processing/dialogue

Task-Oriented Dialogue System

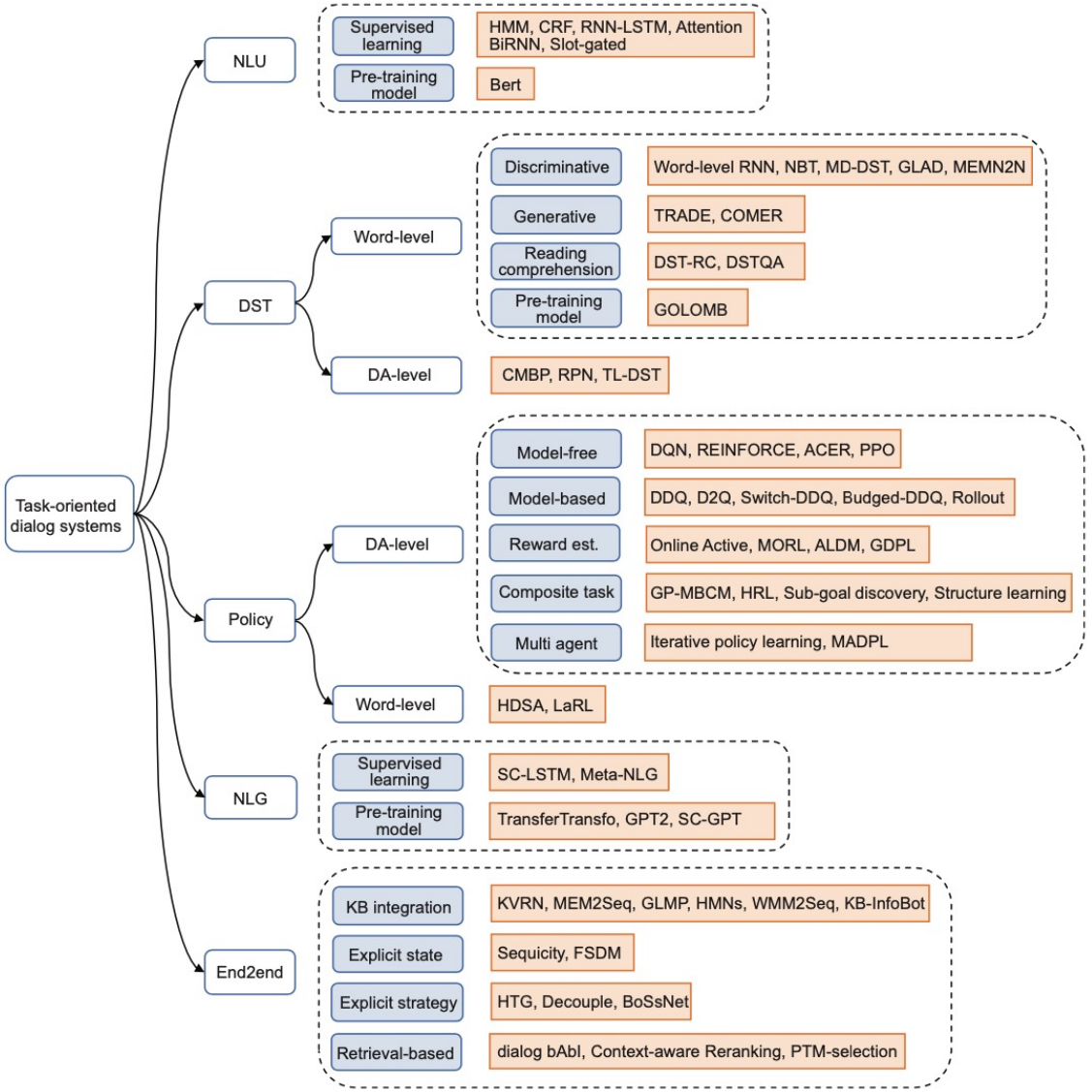
(Deriu et al., 2021)



Source: Deriu, Jan, Alvaro Rodrigo, Arantxa Otegi, Guillermo Echegoyen, Sophie Rosset, Eneko Agirre, and Mark Cieliebak (2021). "Survey on evaluation methods for dialogue systems." Artificial Intelligence Review 54, no. 1 (2021): 755-810.

Task-Oriented Dialogue Systems

(Zhang et al., 2020)



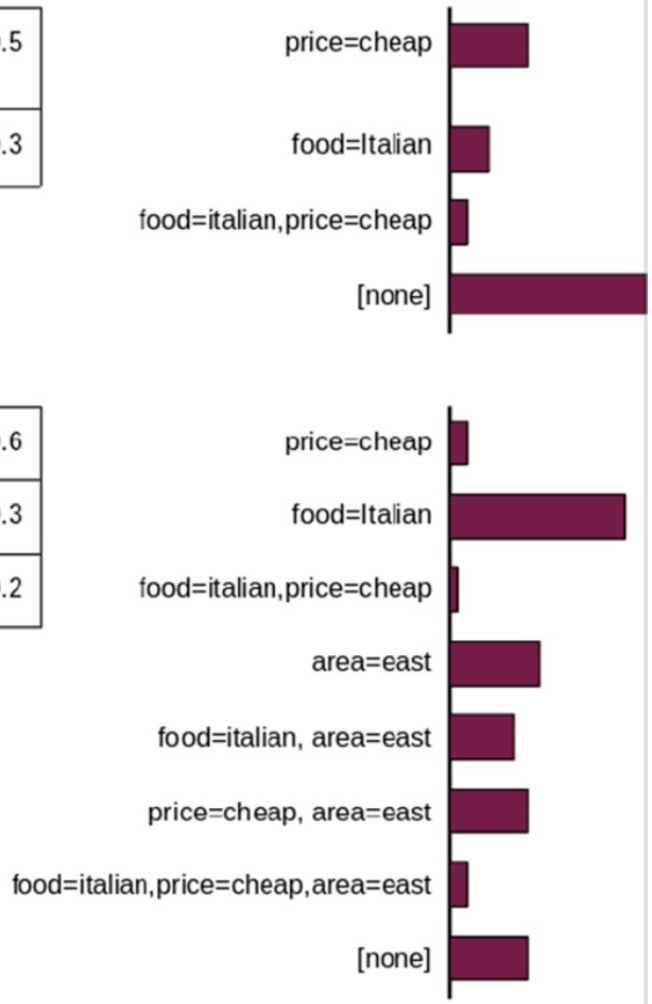
Source: Zhang, Zheng, Ryuichi Takanobu, Qi Zhu, Minlie Huang, and Xiaoyan Zhu (2020). "Recent advances and challenges in task-oriented dialog systems." Science China Technological Sciences (2020): 1-17.

Dialog State Tracker (DST)

Dialog state tracker inputs

System action/ user response	ASR output		SLU output	
How can I help you? *welcome()*	Cheap restaurant	0.6	inform(price=cheap)	0.5
	Restaurant	0.2	inform(food=italian)	0.3
An Italian restaurant	Italian	0.1		
What price did you want?	East Area	0.5	inform(area=east)	0.6
request(price)	Italian	0.3	inform(food=italian)	0.3
Uh, Italian	Yeah	0.1	affirm()	0.2

Dialog state tracker outputs



Source: Deriu, Jan, Alvaro Rodrigo, Arantxa Otegi, Guillermo Echegoyen, Sophie Rosset, Eneko Agirre, and Mark Cieliebak (2021). "Survey on evaluation methods for dialogue systems." Artificial Intelligence Review 54, no. 1 (2021): 755-810.

Dialogue Acts

(Young et al., 2010)

Dialogue act	Description
hello($a = x, b = y, \ldots$)	Open a dialogue and give info $a = x, b = y, \ldots$
inform($a = x, b = y, \ldots$)	Give information $a = x, b = y, \ldots$
request($a, b = x, \ldots$)	Request value for a given $b = x, \ldots$
reqalts($a = x, \ldots$)	Request alternative with $a = x, \ldots$
confirm($a = x, b = y, \ldots$)	Explicitly confirm $a = x, b = y, \ldots$
confreq($a = x, \ldots, d$)	Implicitly confirm $a = x, \ldots$ and request value of d
select($a = x, a = y$)	Select either $a = x$ or $a = y$
affirm($a = x, b = y$)	Affirm and give further info $a = x, b = y, \ldots$
negate($a = x$)	Negate and give corrected value $a = x$
deny($a = x$)	Deny that $a = x$
bye()	Close a dialogue

Source: Deriu, Jan, Alvaro Rodrigo, Arantxa Otegi, Guillermo Echegoyen, Sophie Rosset, Eneko Agirre, and Mark Cieliebak (2021). "Survey on evaluation methods for dialogue systems." Artificial Intelligence Review 54, no. 1 (2021): 755-810.

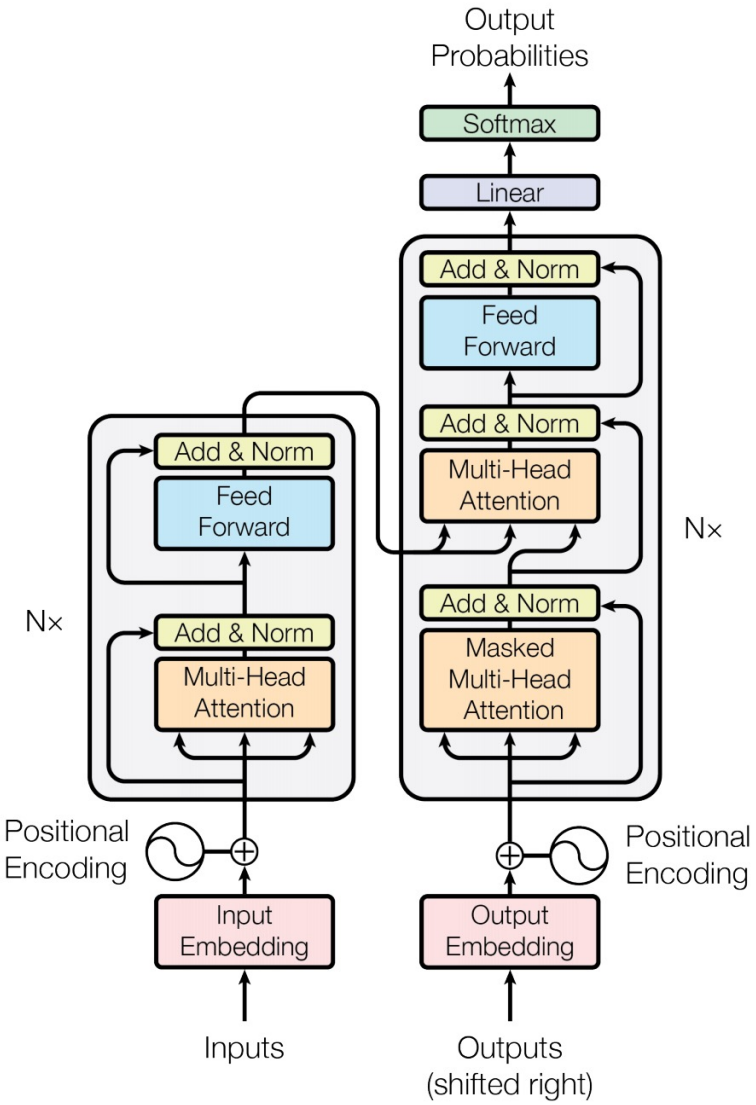
Sample Dialogue Acts

Utterance	Dialogue Act
U: Hi, I am looking for somewhere to eat	hello(task = find,type=restaurant)
S: You are looking for a restaurant. What type of food?	confreq(type = restaurant,food)
U: I'd like an Italian somewhere near the museum.	inform(food = Italian,near=museum)
S: Roma is a nice Italian restaurant near the museum.	inform(name = "Roma", type = restaurant, food = Italian, near = museum)
U: Is it reasonably priced?	confirm(pricerange = moderate)
S: Yes, Roma is in the moderate price range.	affirm(name = "Roma", pricerange = moderate)
U: What is the phone number?	request(phone)
S: The number of Roma is 385456.	inform(name = "Roma", phone = "385456")
U: Ok, thank you goodbye.	bye()

Source: Deriu, Jan, Alvaro Rodrigo, Arantxa Otegi, Guillermo Echegoyen, Sophie Rosset, Eneko Agirre, and Mark Cieliebak (2021). "Survey on evaluation methods for dialogue systems." Artificial Intelligence Review 54, no. 1 (2021): 755-810.

Transformer (Attention is All You Need)

(Vaswani et al., 2017)

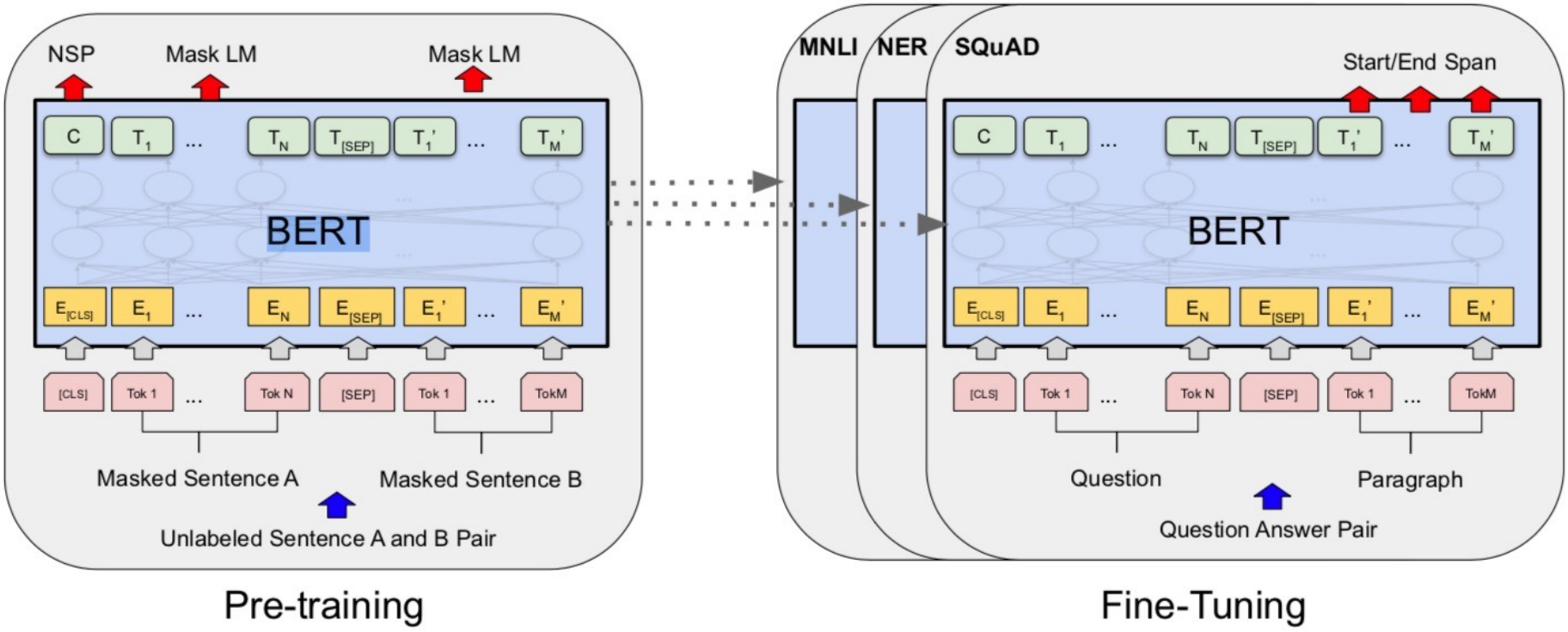


Source: Vaswani, Ashish, Noam Shazeer, Niki Parmar, Jakob Uszkoreit, Llion Jones, Aidan N. Gomez, Łukasz Kaiser, and Illia Polosukhin. "Attention is all you need." In *Advances in neural information processing systems*, pp. 5998-6008. 2017.

BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding

BERT (Bidirectional Encoder Representations from Transformers)

Overall pre-training and fine-tuning procedures for BERT

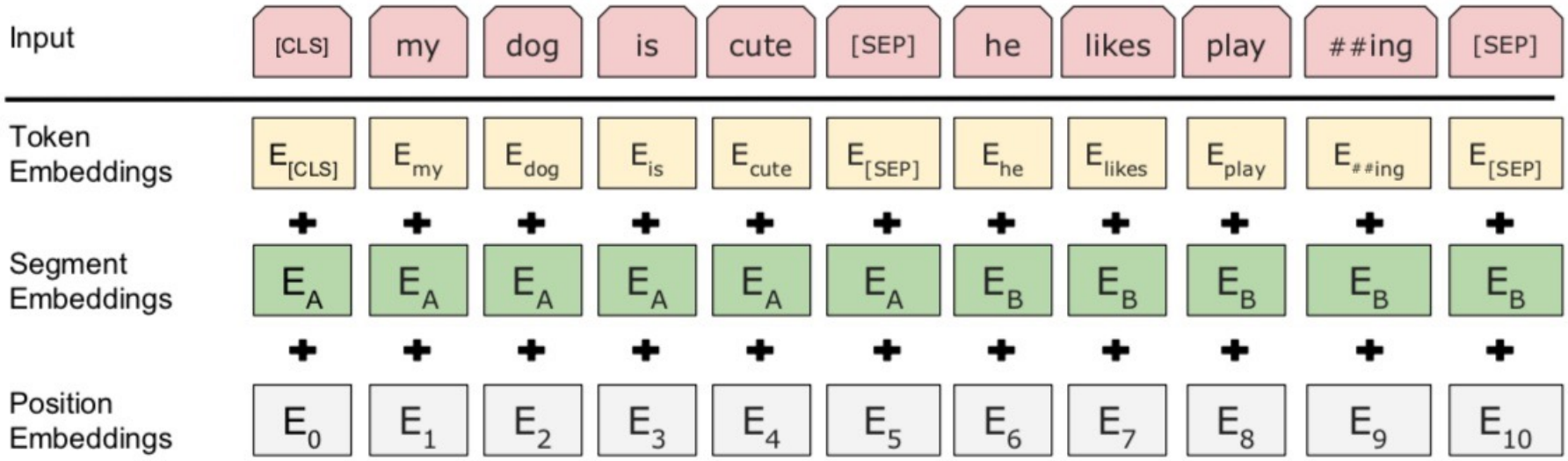


Source: Devlin, Jacob, Ming-Wei Chang, Kenton Lee, and Kristina Toutanova (2018).
"Bert: Pre-training of deep bidirectional transformers for language understanding." arXiv preprint arXiv:1810.04805.

BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding

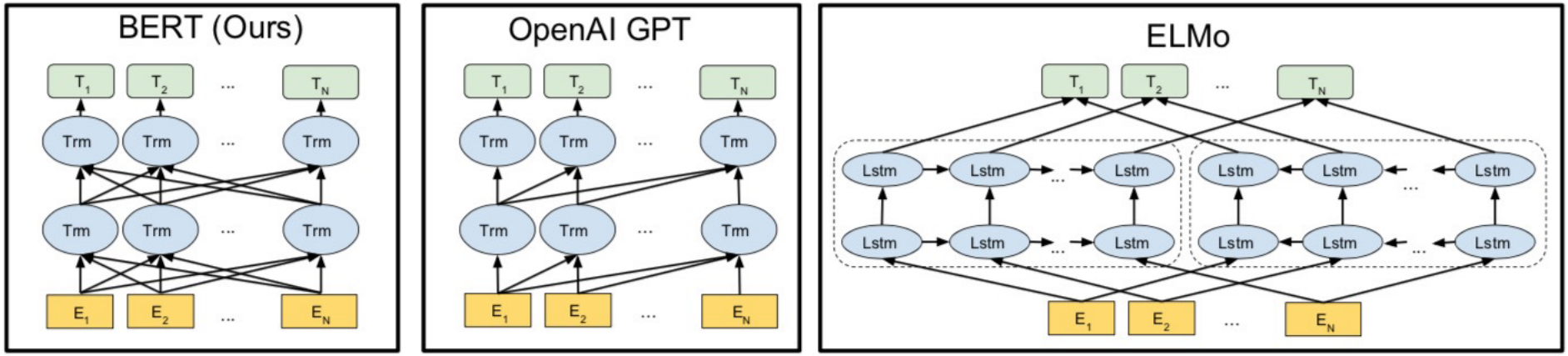
BERT (Bidirectional Encoder Representations from Transformers)

BERT input representation



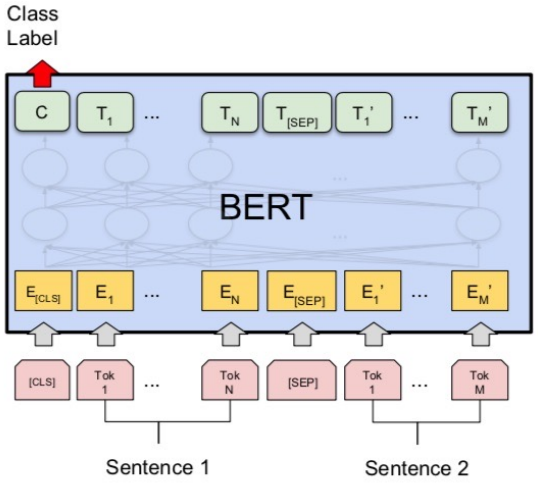
Source: Devlin, Jacob, Ming-Wei Chang, Kenton Lee, and Kristina Toutanova (2018).
"Bert: Pre-training of deep bidirectional transformers for language understanding." arXiv preprint arXiv:1810.04805.

BERT, OpenAI GPT, ELMo

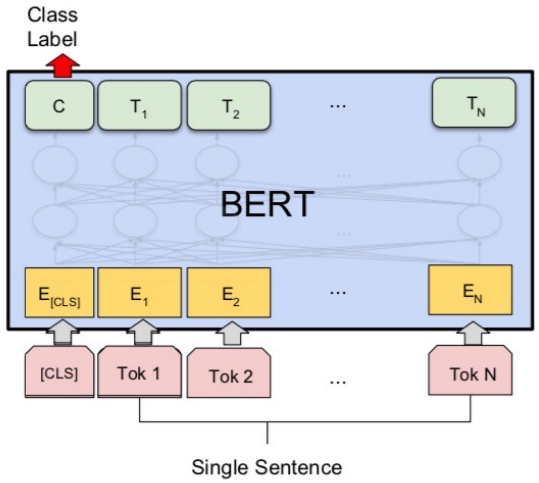


Source: Devlin, Jacob, Ming-Wei Chang, Kenton Lee, and Kristina Toutanova (2018).
"Bert: Pre-training of deep bidirectional transformers for language understanding." arXiv preprint arXiv:1810.04805.

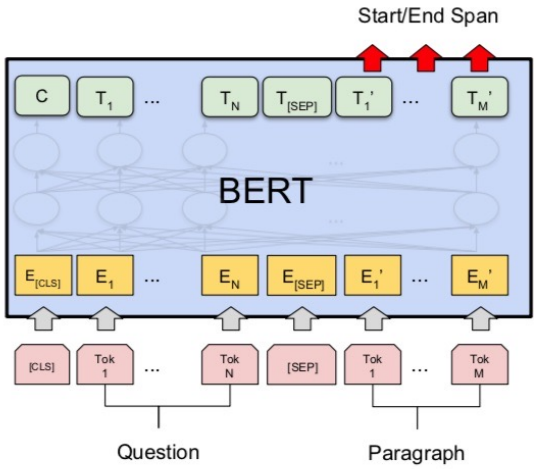
Fine-tuning BERT on Different Tasks



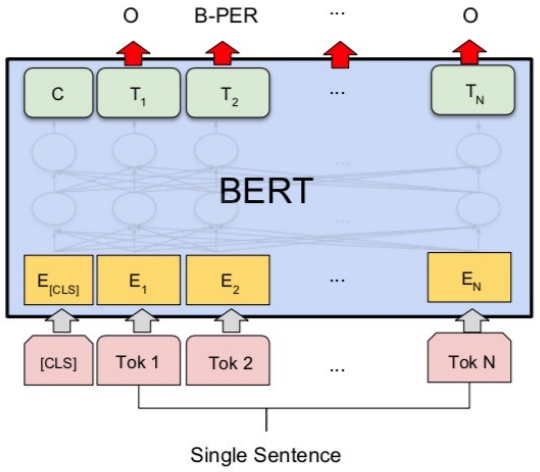
(a) Sentence Pair Classification Tasks: MNLI, QQP, QNLI, STS-B, MRPC, RTE, SWAG



(b) Single Sentence Classification Tasks: SST-2, CoLA



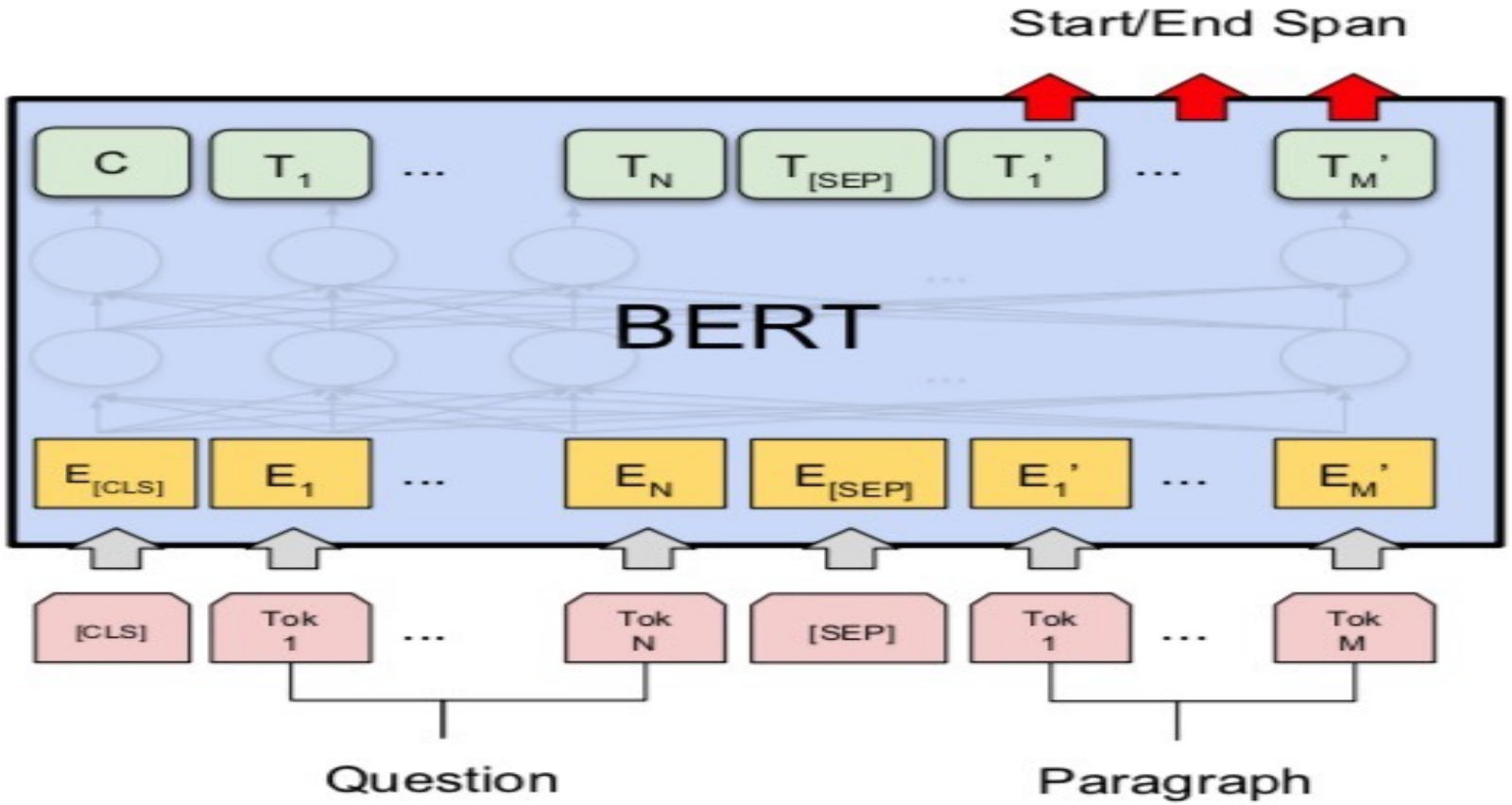
(c) Question Answering Tasks: SQuAD v1.1



(d) Single Sentence Tagging Tasks: CoNLL-2003 NER

Source: Devlin, Jacob, Ming-Wei Chang, Kenton Lee, and Kristina Toutanova (2018). "Bert: Pre-training of deep bidirectional transformers for language understanding." arXiv preprint arXiv:1810.04805.

Fine-tuning BERT on Question Answering (QA)

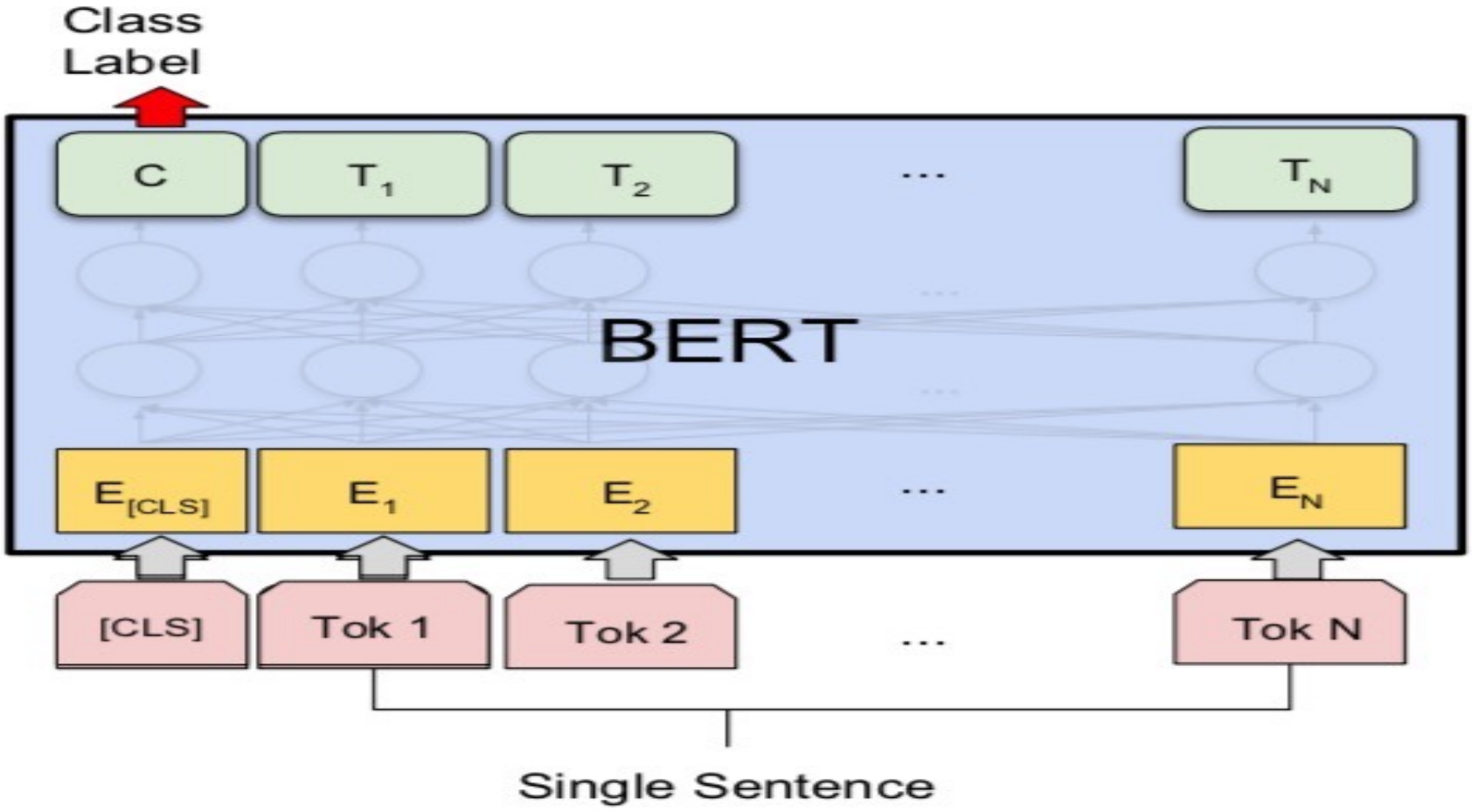


(c) Question Answering Tasks: SQuAD v1.1

Source: Devlin, Jacob, Ming-Wei Chang, Kenton Lee, and Kristina Toutanova (2018). "Bert: Pre-training of deep bidirectional transformers for language understanding." arXiv preprint arXiv:1810.04805.

Fine-tuning BERT on Dialogue

Intent Detection (ID; Classification)



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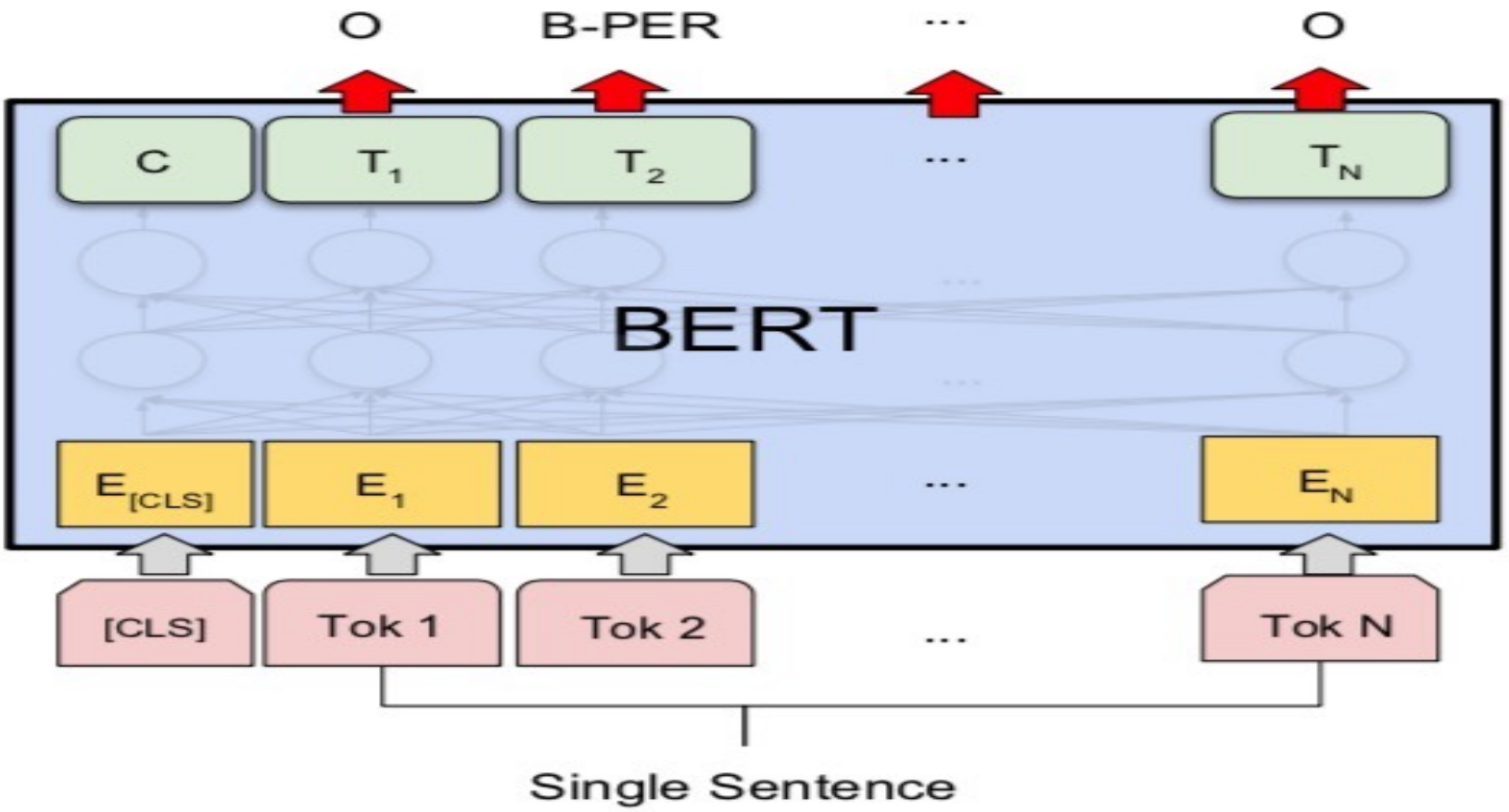
Source: Devlin, Jacob, Ming-Wei Chang, Kenton Lee, and Kristina Toutanova (2018). "Bert: Pre-training of deep bidirectional transformers for language understanding." arXiv preprint arXiv:1810.04805.

Fine-tuning BERT on Dialogue

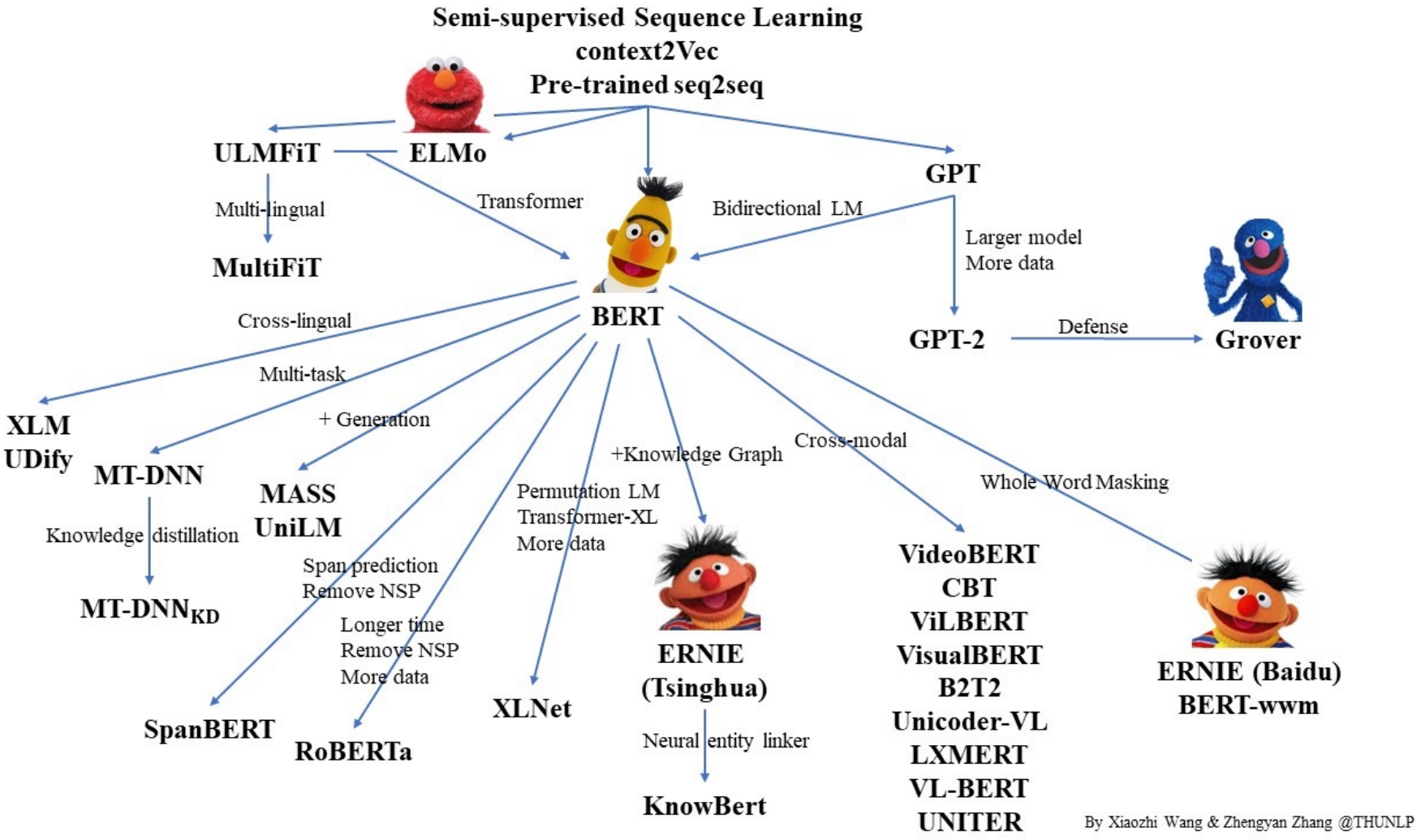
Slot Filling (SF)



(d) Single Sentence Tagging Tasks: CoNLL-2003 NER

Source: Devlin, Jacob, Ming-Wei Chang, Kenton Lee, and Kristina Toutanova (2018). "Bert: Pre-training of deep bidirectional transformers for language understanding." arXiv preprint arXiv:1810.04805.

Pre-trained Language Model (PLM)



Source: https://github.com/thunlp/PLMpapers

Transformers

State-of-the-art Natural Language Processing for TensorFlow 2.0 and PyTorch

- Transformers
  - pytorch-transformers
  - pytorch-pretrained-bert
- provides state-of-the-art general-purpose architectures
  - (BERT, GPT-2, RoBERTa, XLM, DistilBert, XLNet, CTRL...)
  - for Natural Language Understanding (NLU) and Natural Language Generation (NLG) with over 32+ pretrained models in 100+ languages and deep interoperability between TensorFlow 2.0 and PyTorch.

Source: https://github.com/huggingface/transformers

Dialogue on Airline Travel Information System (ATIS)

The ATIS (Airline Travel Information System) Dataset

https://www.kaggle.com/siddhadev/atis-dataset-from-ms-cntk

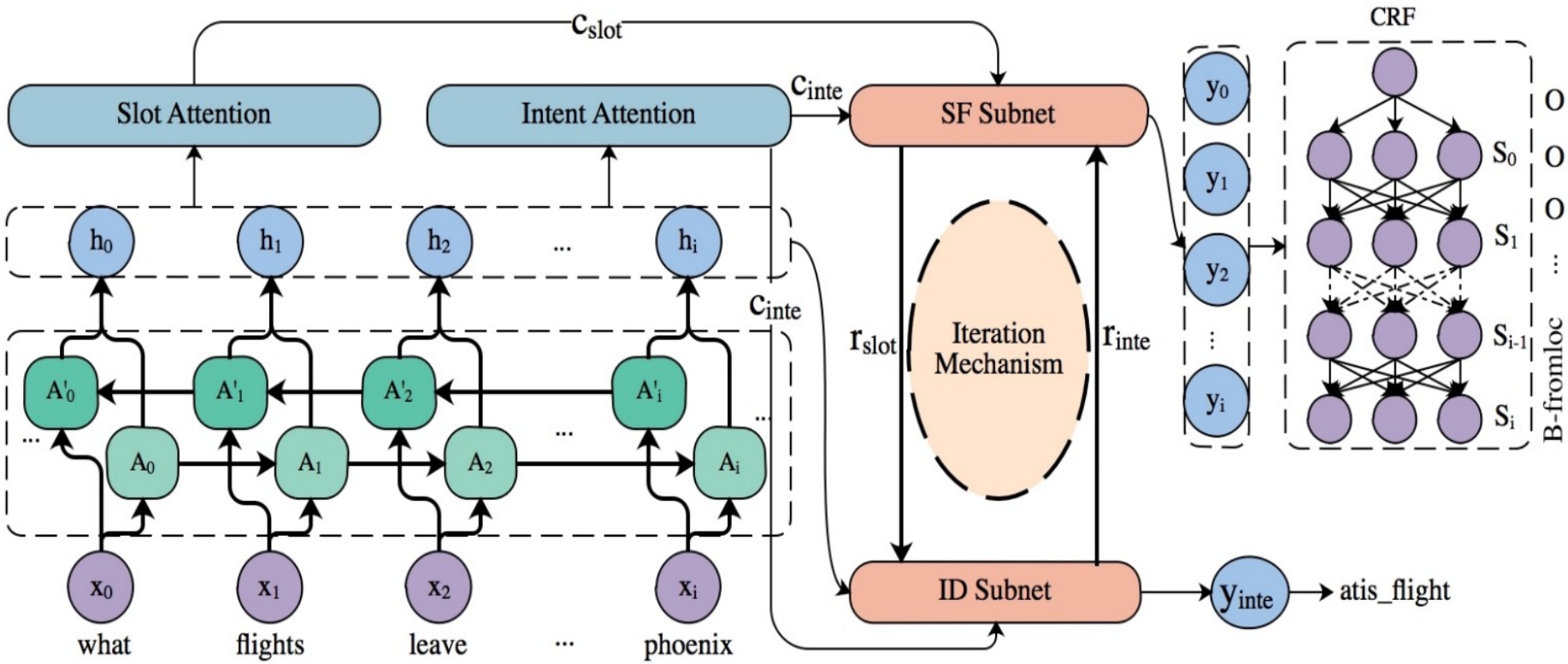
Sentence	what	flights	leave	from	phoenix
Slots	O	O	O	O	B-fromloc
Intent	atis_flight				

Training samples: 4978
Testing samples: 893
Vocab size: 943
Slot count: 129
Intent count: 26

Source: Haihong, E., Peiqing Niu, Zhongfu Chen, and Meina Song. "A novel bi-directional interrelated model for joint intent detection and slot filling." In Proceedings of the 57th Annual Meeting of the Association for Computational Linguistics, pp. 5467-5471. 2019.

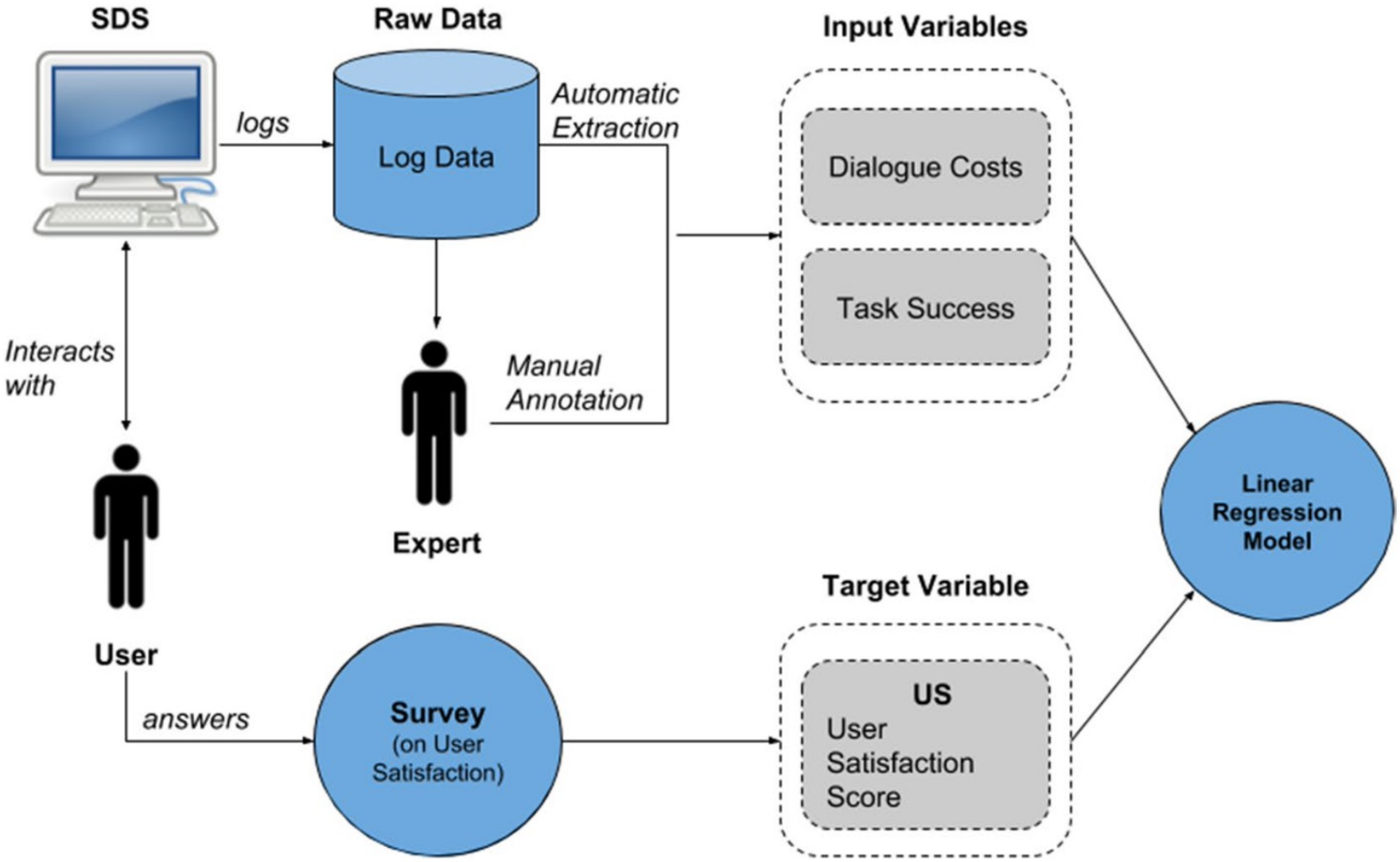
SF-ID Network (E et al., 2019)
Slot Filling (SF)
Intent Detection (ID)

A Novel Bi-directional Interrelated Model for Joint Intent Detection and Slot Filling



Source: Haihong, E., Peiqing Niu, Zhongfu Chen, and Meina Song. "A novel bi-directional interrelated model for joint intent detection and slot filling." In Proceedings of the 57th Annual Meeting of the Association for Computational Linguistics, pp. 5467-5471. 2019.

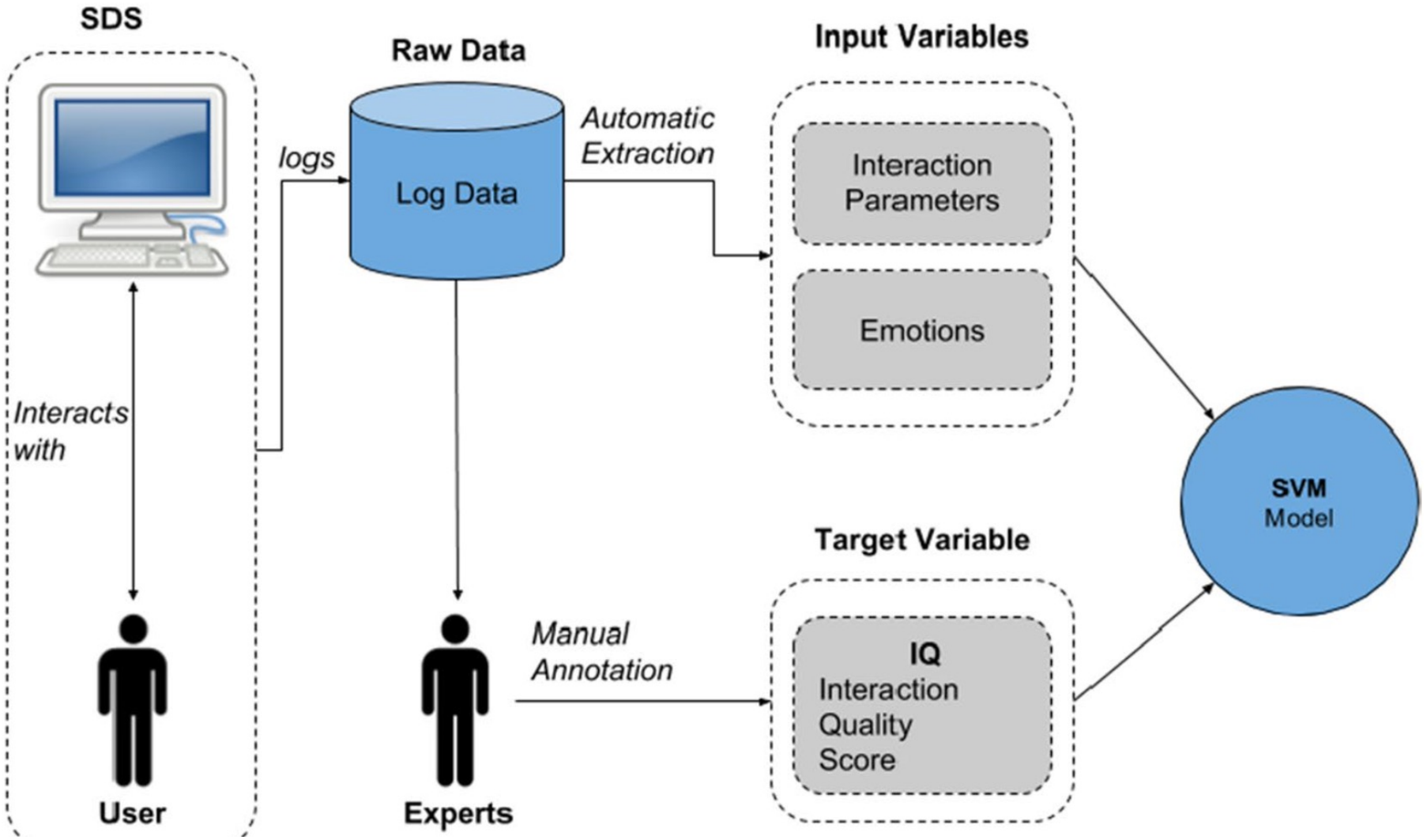
PARAdigm for DIalog System Evaluation
PARADISE Framework (Walker et al. 1997)



Source: Deriu, Jan, Alvaro Rodrigo, Arantxa Otegi, Guillermo Echegoyen, Sophie Rosset, Eneko Agirre, and Mark Cieliebak (2021). "Survey on evaluation methods for dialogue systems." Artificial Intelligence Review 54, no. 1 (2021): 755-810.

Interaction Quality procedure

(Schmitt and Ultes, 2015)



Source: Deriu, Jan, Alvaro Rodrigo, Arantxa Otegi, Guillermo Echegoyen, Sophie Rosset, Eneko Agirre, and Mark Cieliebak (2021). "Survey on evaluation methods for dialogue systems." Artificial Intelligence Review 54, no. 1 (2021): 755-810.

Datasets for task-oriented dialogue systems

Name	Topics	# dialogues	Reference
DSTC1	Bus schedules	15,000	(Williams et al. 2013)
DSTC2	Restaurants	3000	(Henderson et al. 2014)
DSTC3	Tourist information	2265	(Henderson et al. 2013a)
DSTC4 & DSTC5	Tourist information	35	(Kim et al. 2016)
DSTC6	Restaurant reservation	–	(Perez et al. 2017)
DSTC7 (Flex Data)	Student guiding	500	(Gunasekara et al. 2019)
DSTC8 (MetaLWOz)	47 domains	37,884	(Lee et al. 2019)
DSTC8 (Schema-Guided)	20 domains	22,825	(Rastogi et al. 2019)
MultiWOZ	Tourist information	10,438	(Budzianowski et al. 2018)
Taskmaster-1	6 domains	13,215	(Byrne et al. 2019)
MultiDoGo	6 domains	86,698	(Peskov et al. 2019)

Source: Deriu, Jan, Alvaro Rodrigo, Arantxa Otegi, Guillermo Echegoyen, Sophie Rosset, Eneko Agirre, and Mark Cieliebak (2021). "Survey on evaluation methods for dialogue systems." Artificial Intelligence Review 54, no. 1 (2021): 755-810.

Restaurants Dialogue Datasets

- MIT Restaurant Corpus
  - https://groups.csail.mit.edu/sls/downloads/restaurant/
- CamRest676
  (Cambridge restaurant dialogue domain dataset)
  - https://www.repository.cam.ac.uk/handle/1810/260970
- DSTC2 (Dialog State Tracking Challenge 2 & 3)
  - http://camdial.org/~mh521/dstc/

CrossWOZ:
A Large-Scale Chinese Cross-Domain Task-Oriented Dialogue Dataset

MultiWOZ	CrossWOZ
usr: I'm looking for a college type attraction. ... usr: I would like to visit in town centre please. ... usr: Can you find an Indian restaurant for me that is **also in the town centre**?	usr: 你好，可以帮我推荐一个评分是4.5分以上的景点吗? Hello, could you recommend an attraction with a rating of 4.5 or higher? sys: 天安门城楼，簋街小吃和北京欢乐谷都是很不错的地方呢。 Tiananmen, Gui Street, and Beijing Happy Valley are very nice places. usr: 我喜欢北京欢乐谷，你知道这个景点周边的酒店都是什么吗? I like Beijing Happy Valley. What hotels are around this attraction? sys: 那可多了，有A酒店, B酒店, C酒店。 There are many, such as hotel A, hotel B, and hotel C. usr: 太好了，我正打算在**景点附近**找个酒店住宿呢，知道哪家评分是4分以上，提供叫醒服务的不? Great! I am planning to find a hotel to stay **near the attraction**. Which one has a rating of 4 or higher and offers wake-up call service?
Schema	
usr: I want a hotel in San Diego and I want to check out on Thursday next week. ... usr: I need a one way flight to **go there**.	

Source: Zhu, Qi, Kaili Huang, Zheng Zhang, Xiaoyan Zhu, and Minlie Huang. "Crosswoz: A large-scale chinese cross-domain task-oriented dialogue dataset." arXiv preprint arXiv:2002.11893 (2020).

CrossWOZ:
A Large-Scale Chinese Cross-Domain Task-Oriented Dialogue Dataset

Type	Single-domain goal					Multi-domain goal		
Dataset	DSTC2	WOZ 2.0	Frames	KVRET	M2M	MultiWOZ	Schema	**CrossWOZ**
Language	EN	EN	EN	EN	EN	EN	EN	**CN**
Speakers	H2M	H2H	H2H	H2H	M2M	H2H	M2M	**H2H**
# Domains	1	1	1	3	2	7	16	**5**
# Dialogues	1,612	600	1,369	2,425	1,500	8,438	16,142	**5,012**
# Turns	23,354	4,472	19,986	12,732	14,796	115,424	329,964	**84,692**
Avg. domains	1	1	1	1	1	1.80	1.84	**3.24**
Avg. turns	14.5	7.5	14.6	5.3	9.9	13.7	20.4	**16.9**
# Slots	8	4	61	13	14	25	214	**72**
# Values	212	99	3,871	1363	138	4,510	14,139	**7,871**

Source: Zhu, Qi, Kaili Huang, Zheng Zhang, Xiaoyan Zhu, and Minlie Huang. "Crosswoz: A large-scale chinese cross-domain task-oriented dialogue dataset." arXiv preprint arXiv:2002.11893 (2020).

Task-Oriented Dialogue

Initial user state (=user goal)

id=1(Attraction): fee=free,
name=?, nearby hotels=?

id=2(Hotel): **name=near (id=1)**,
wake-up call=yes, rating=?

id=3(Taxi): **from=(id=1)**, **to=(id=2)**,
car type=? plate number=?

. . .

Final user state

id=1 (Attraction): name=Tiananmen Square,
fee=free, nearby hotels=[Beijing Capital
Hotel, Guidu Hotel Beijing]

id=2 (Hotel): **name=Beijing Capital Hotel**,
wake-up call=yes, rating=4.6

id=3 (Taxi): **from=Tiananmen Square**,
to=Beijing Capital Hotel,
car type=#CX, plate number=#CP

Source: Zhu, Qi, Kaili Huang, Zheng Zhang, Xiaoyan Zhu, and Minlie Huang. "Crosswoz: A large-scale chinese cross-domain task-oriented dialogue dataset." arXiv preprint arXiv:2002.11893 (2020).

任務型對話系統

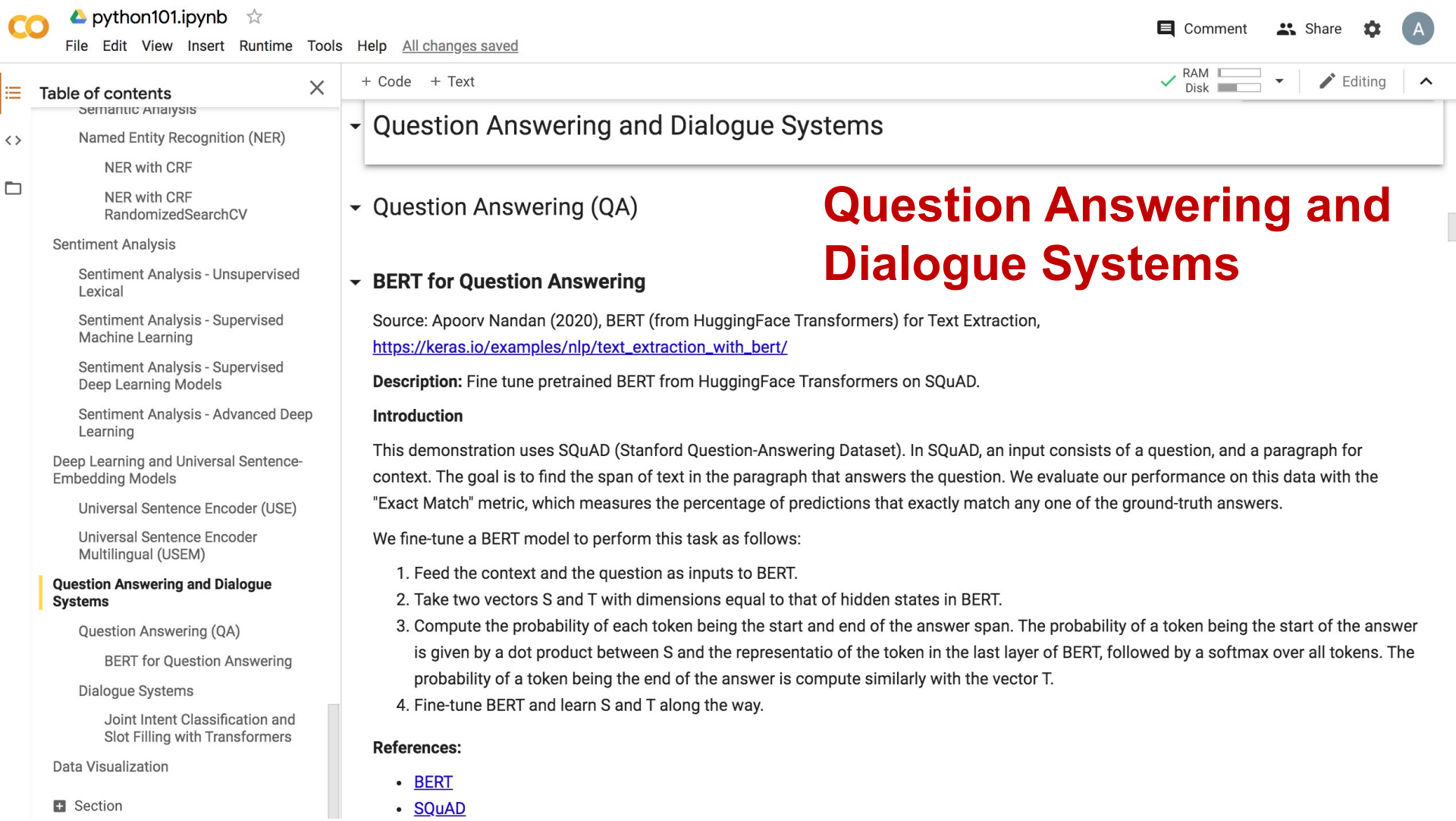
The Evaluation of Chinese Human-Computer Dialogue Technology, SMP2019-ECDT

- 自然語言理解
  Natural Language Understanding (NLU)
- 對話管理
  Dialog Management (DM)
- 自然語言生成
  Natural Language Generation (NLG)

Source: http://conference.cipsc.org.cn/smp2019/evaluation.html
https://github.com/OnionWang/SMP2019-ECDT-NLU

Python in Google Colab (Python101)

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

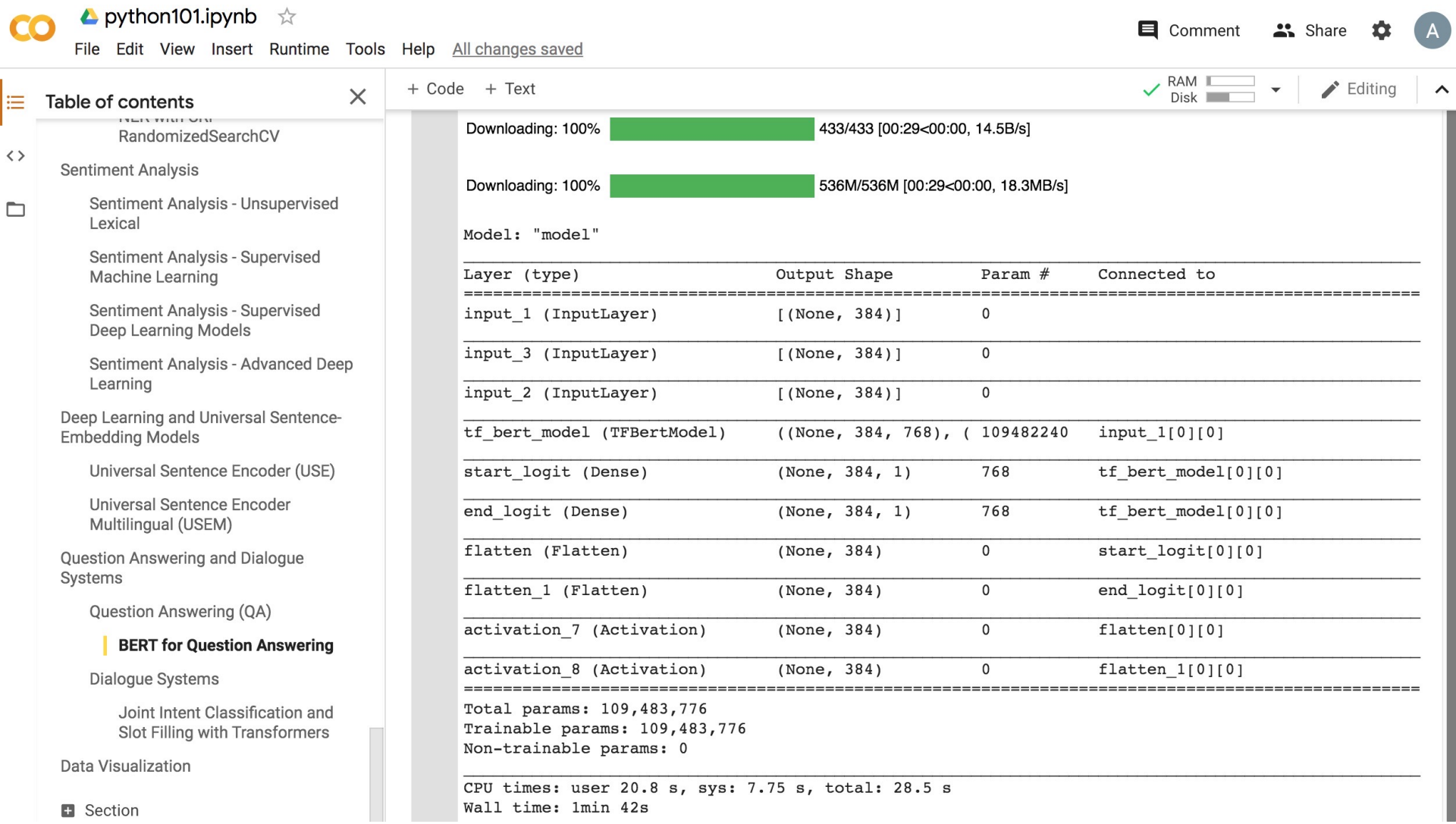


Question Answering and Dialogue Systems

https://tinyurl.com/aintpupython101

Python in Google Colab (Python101)

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



https://tinyurl.com/aintpupython101

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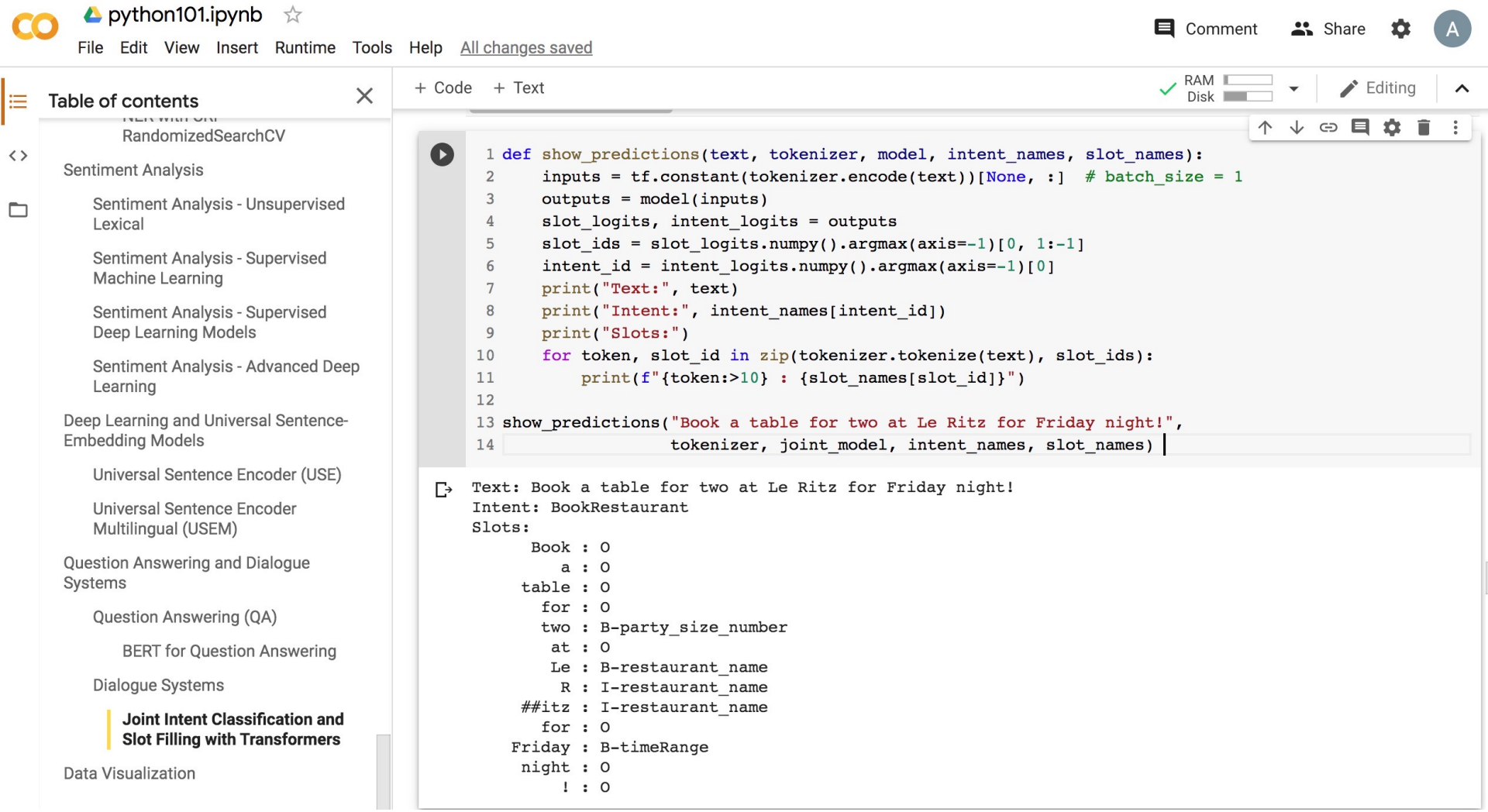

https://tinyurl.com/aintpupython101

Summary

- Artificial Intelligence
- FinTech
- Conversational Commerce
- Task Oriented Dialogue System

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Q & A

NTPU
國立臺北大學
National Taipei University

AI Task-Oriented Dialogue System for Conversational Commerce in FinTech

Host: Prof. Kuan-Yu Menphis Chen

Computer Science and Information Engineering, National Taiwan University of Science and Technology

Time: 14:00-15:00, May 10, 2021 (Monday)

Place: CSIE, NTUST

Address: No.43, Keelung Rd., Sec.4, Da'an Dist., Taipei, Taiwan

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