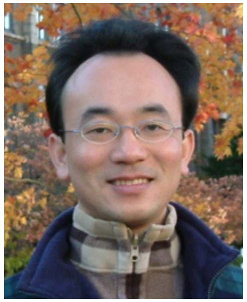
人工智慧文本分析
(Artificial Intelligence for Text Analytics)

Tamkang Universit
淡江大學

問答系統與對話系統
(Question Answering and Dialogue Systems)

1082AITA12
MBA, IMTKU (M2455) (8410) (Spring 2020)
Wed 8, 9 (15:10-17:00) (B605)



Min-Yuh Day
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Associate Professor
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淡江大學 資訊管理學系
http://mail. tku.edu.tw/myday/

2020-06-10

課程大綱 (Syllabus)

週次 (Week)	日期 (Date)	內容 (Subject/Topics)
1	2020/03/04	人工智慧文本分析課程介紹 (Course Orientation on Artificial Intelligence for Text Analytics)
2	2020/03/11	文本分析的基礎：自然語言處理 (Foundations of Text Analytics: Natural Language Processing; NLP)
3	2020/03/18	Python自然語言處理 (Python for Natural Language Processing)
4	2020/03/25	處理和理解文本 (Processing and Understanding Text)
5	2020/04/01	文本表達特徵工程 (Feature Engineering for Text Representation)
6	2020/04/08	人工智慧文本分析個案研究 I (Case Study on Artificial Intelligence for Text Analytics I)

課程大綱 (Syllabus)

週次 (Week)　日期 (Date)　內容 (Subject/Topics)

7　2020/04/15　文本分類 (Text Classification)

8　2020/04/22　文本摘要和主題模型
(Text Summarization and Topic Models)

9　2020/04/29　期中報告 (Midterm Project Report)

10　2020/05/06　文本相似度和分群 (Text Similarity and Clustering)

11　2020/05/13　語意分析和命名實體識別
(Semantic Analysis and Named Entity Recognition; NER)

12　2020/05/20　情感分析 (Sentiment Analysis)

課程大綱 (Syllabus)

週次 (Week)	日期 (Date)	內容 (Subject/Topics)
13	2020/05/27	人工智慧文本分析個案研究 II (Case Study on Artificial Intelligence for Text Analytics II)
14	2020/06/03	深度學習和通用句子嵌入模型 (Deep Learning and Universal Sentence-Embedding Models)
15	2020/06/10	問答系統與對話系統 (Question Answering and Dialogue Systems)
16	2020/06/17	期末報告 I (Final Project Presentation I)
17	2020/06/24	期末報告 II (Final Project Presentation II)
18	2020/07/01	教師彈性補充教學

Question Answering and Dialogue Systems

Outline

- Question Answering
- Dialogue Systems

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)

InnoServe Awards

- 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

IMTKU

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

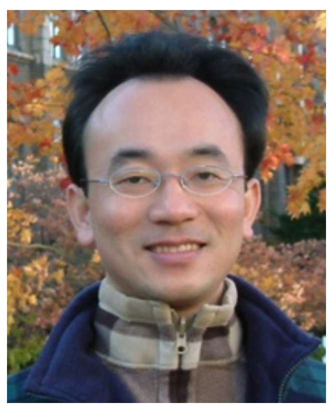
Tamkang University
淡江大學

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

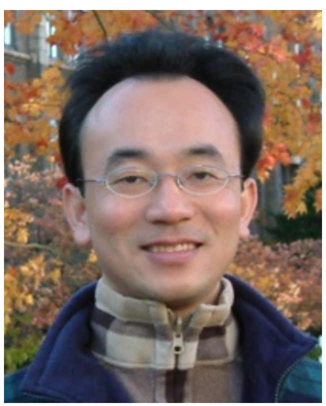
Tamkang University
淡江大學

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

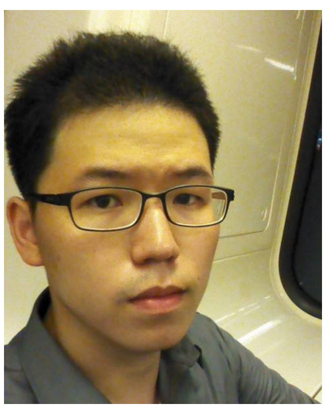
Tamkang University
淡江大學

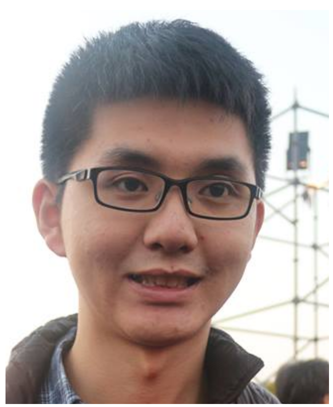

Min-Yuh Day

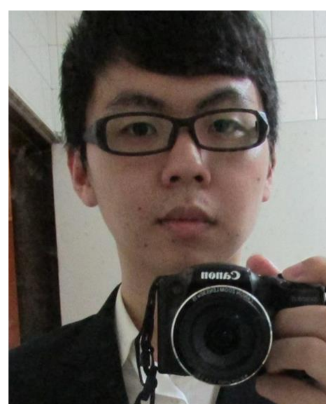

Ya-Jung Wang


Che-Wei Hsu


En-Chun Tu


Huai-Wen Hsu


Yu-An Lin


Shang-Yu Wu


Yu-Hsuan Tai


Cheng-Chia Tsai

NTCIR

Tamkang University

淡江大學

2016

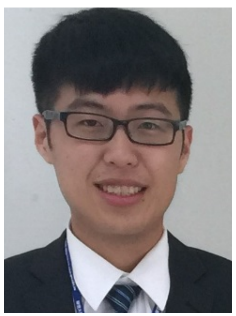
IMTKU Question Answering System for World History Exams at NTCIR-12 QA Lab2

Department of Information Management

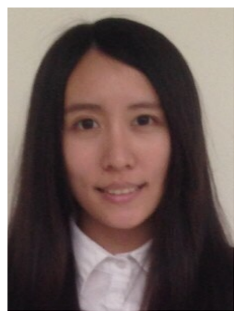
Tamkang University, Taiwan

Sagacity Technolog


Min-Yuh Day

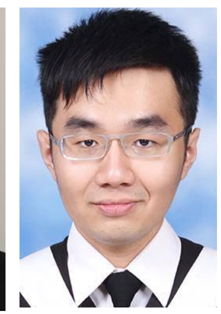

Cheng-Chia Tsai

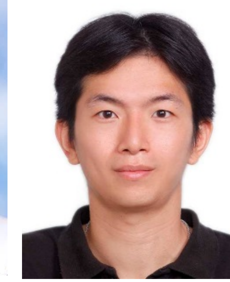

Wei-Chun Chung


Hsiu-Yuan Chang


Tzu-Jui Sun


Yuan-Jie Tsai

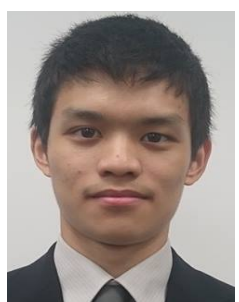

Jin-Kun Lin


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

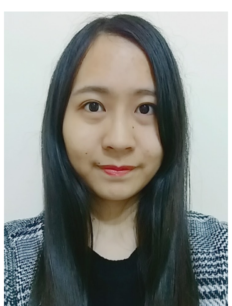
IMTKU Question Answering System for World History Exams at NTCIR-13 QALab-3

Department of Information Management
Tamkang University, Taiwan

Min-Yuh Day

Chao-Yu Chen

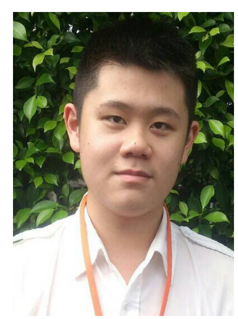
Wanchu Huang



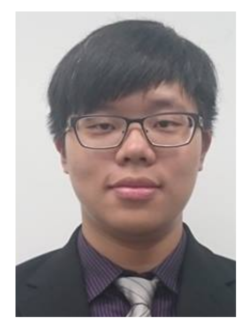
Shi-Ya Zheng

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

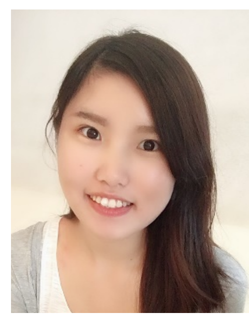
IMTKU Emotional Dialogue System for Short Text Conversation at NTCIR-14 STC-3 (CECG) Task

Department of Information Management
Tamkang University, Taiwan


Min-Yuh Day


Chi-Sheng Hung


Yi-Jun Xie


Jhih-Yi Chen

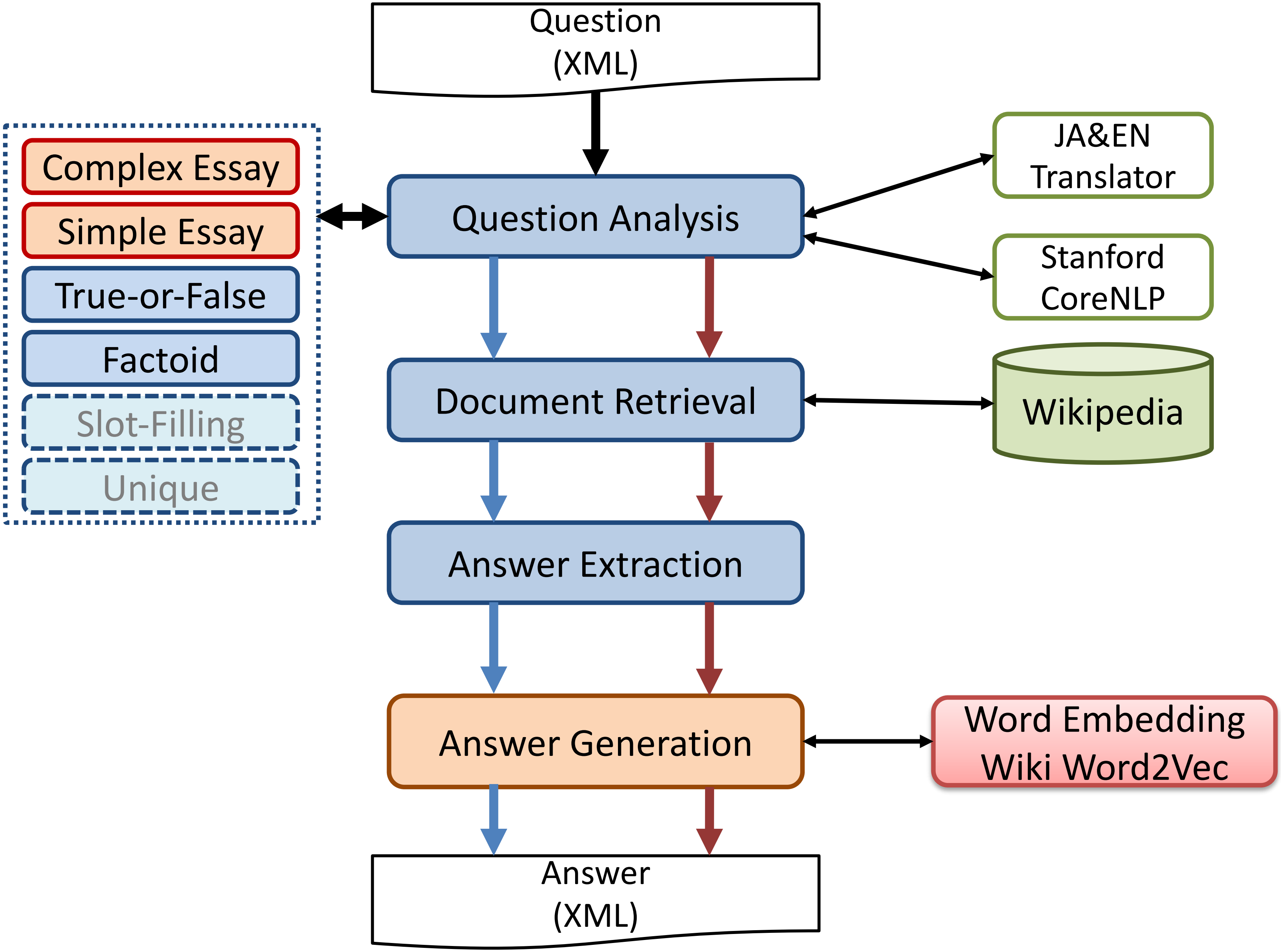

Yu-Ling Kuo


Jian-Ting Lin

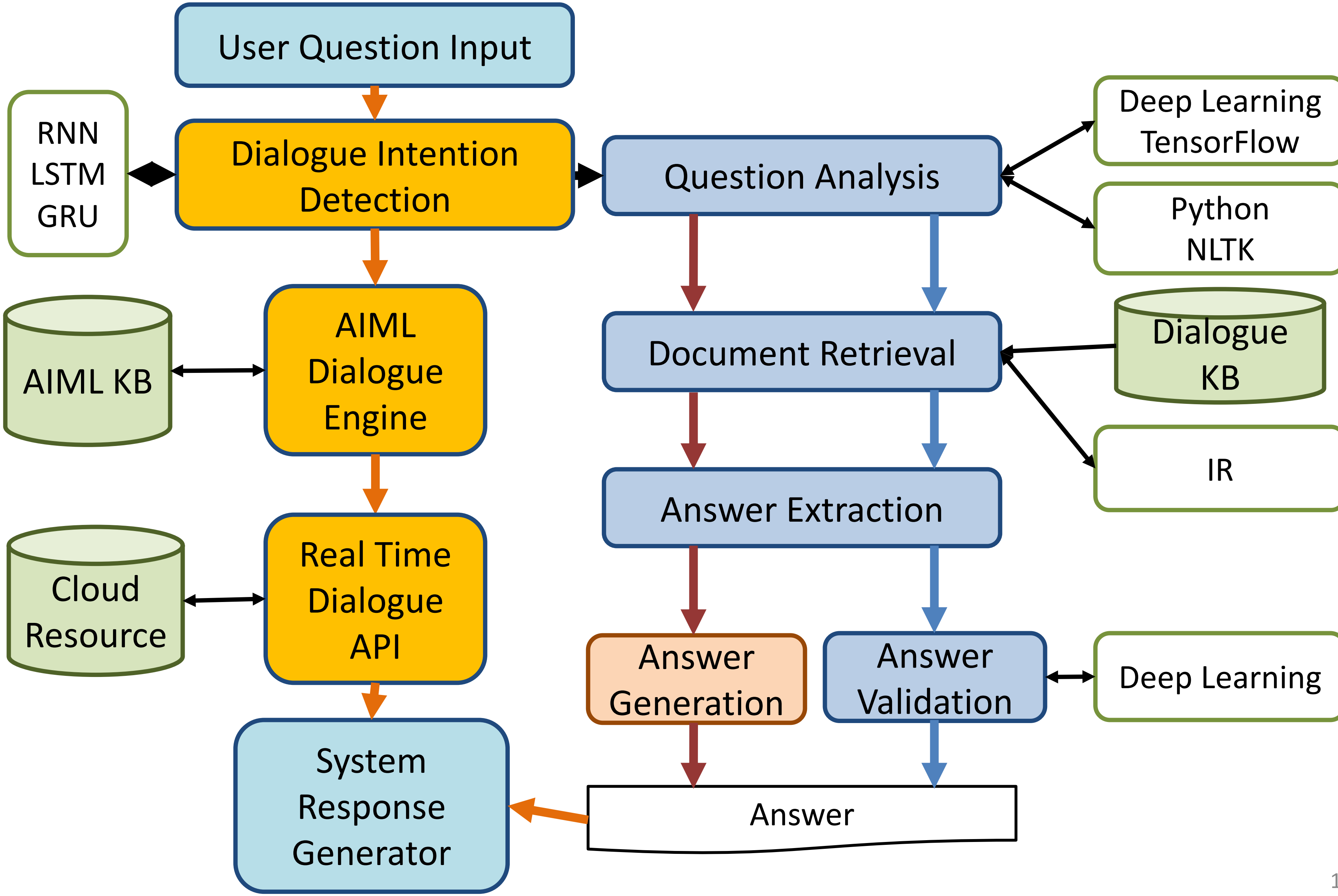
myday@mail.tku.edu.tw

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

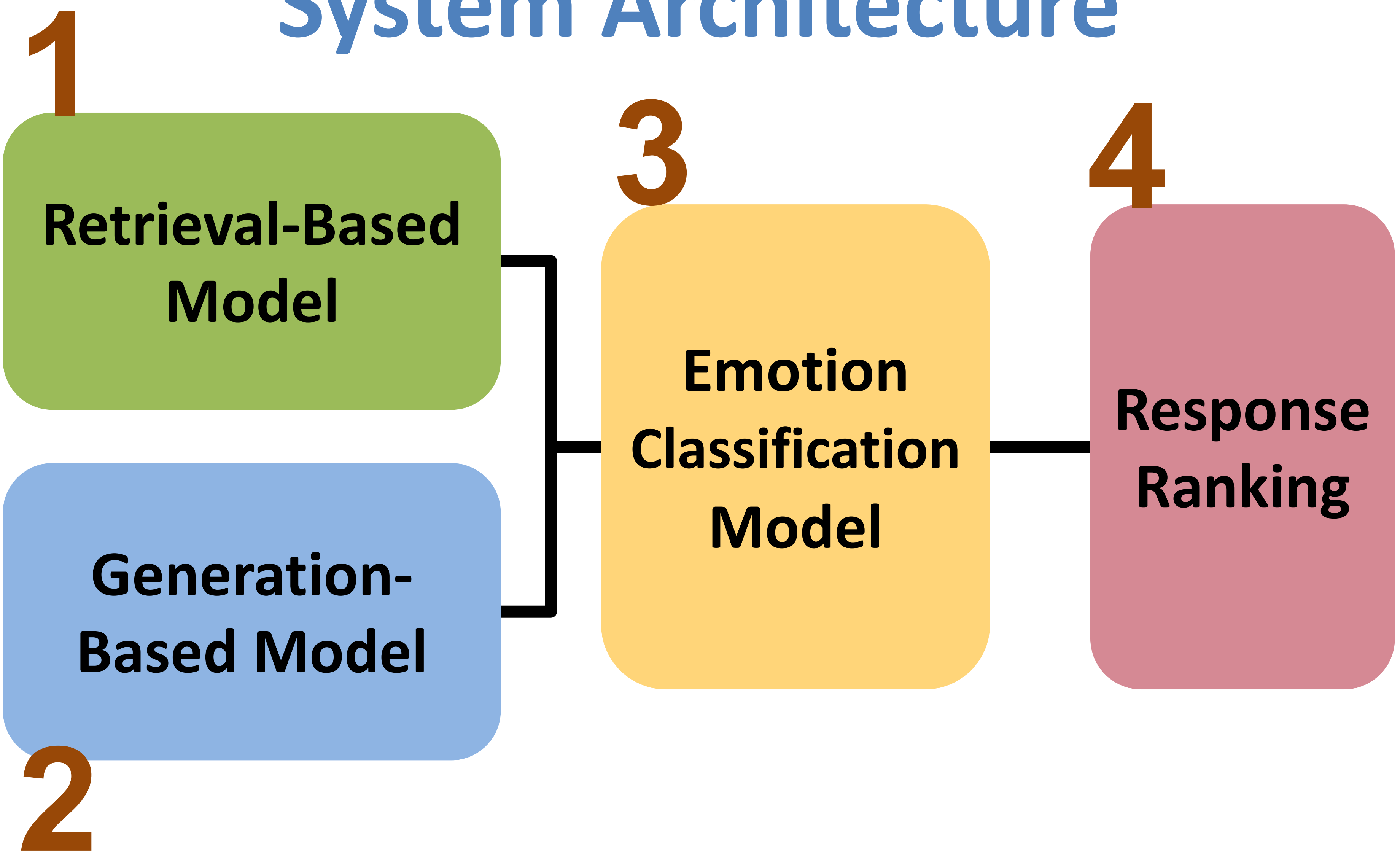
IMTKU System Architecture for NTCIR-13 QALab-3



System Architecture of Intelligent Dialogue and Question Answering System

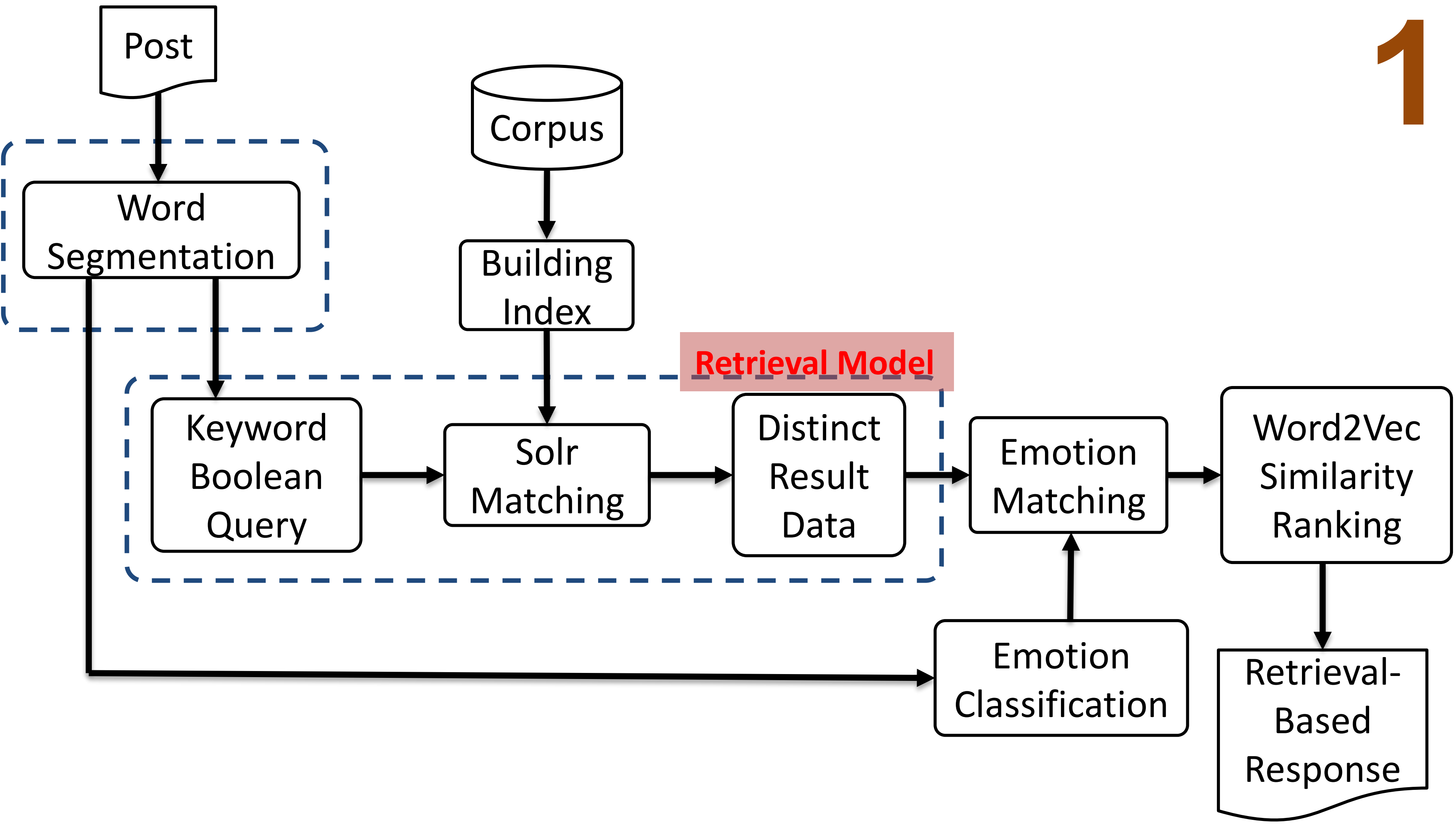


IMTKU Emotional Dialogue System Architecture



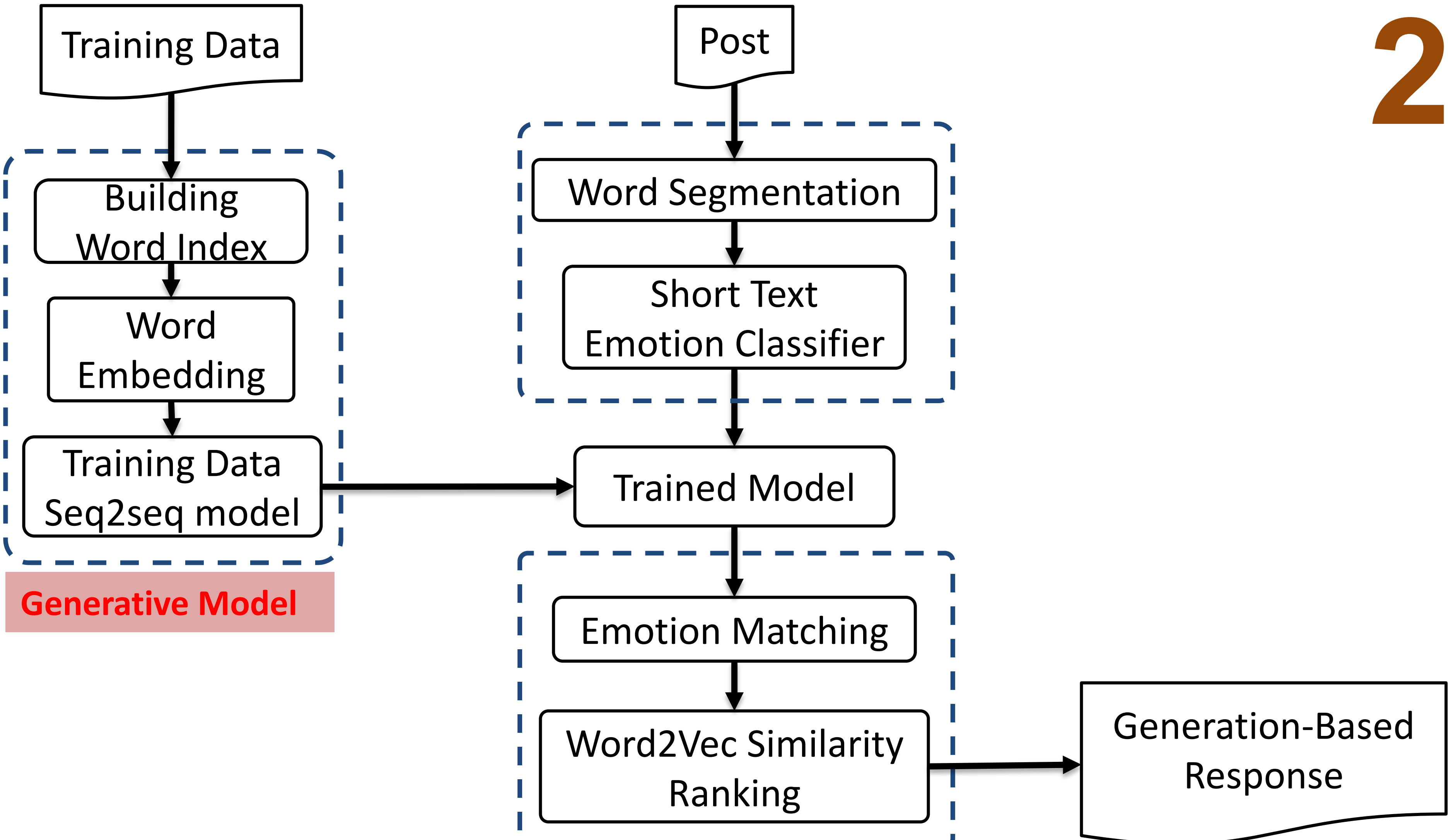
The system architecture of IMTKU retrieval-based model for NTCIR-14 STC-3

Retrieval-Based Model



The system architecture of IMTKU generation-based model for NTCIR-14 STC-3

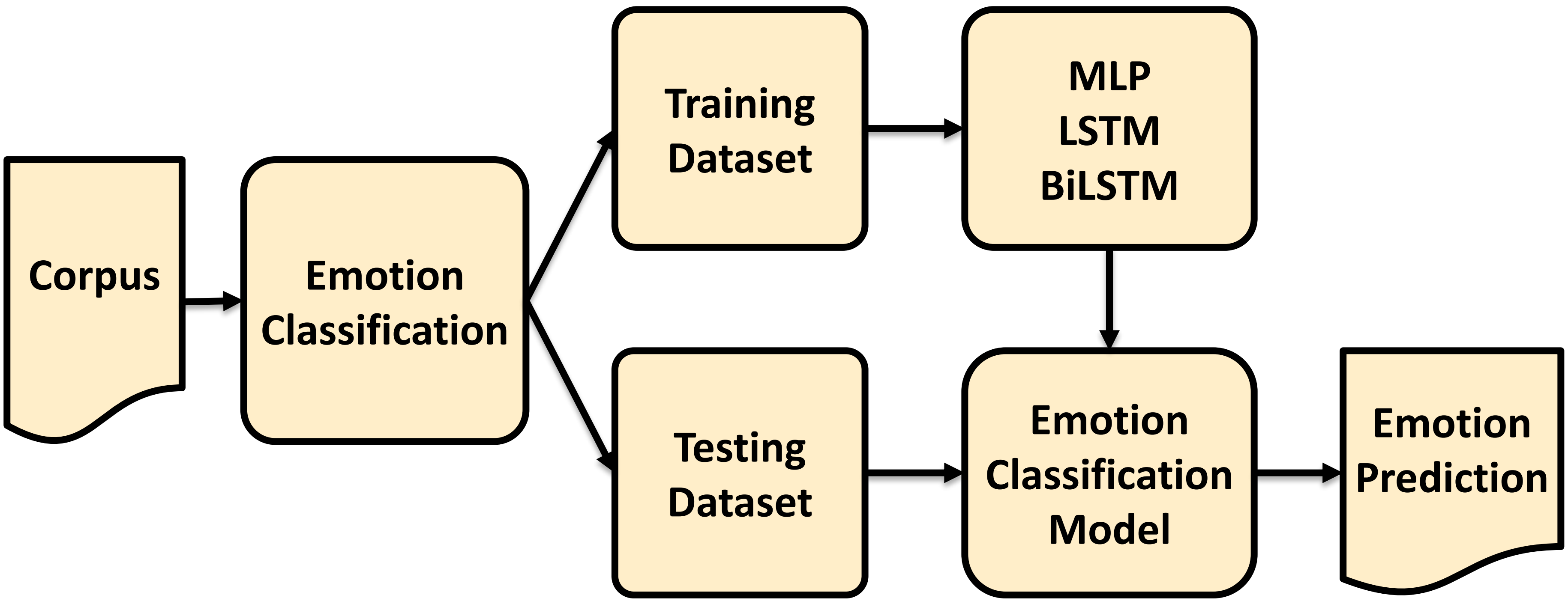
Generation-Based Model



The system architecture of IMTKU emotion classification model for NTCIR-14 STC-3

Emotion Classification Model

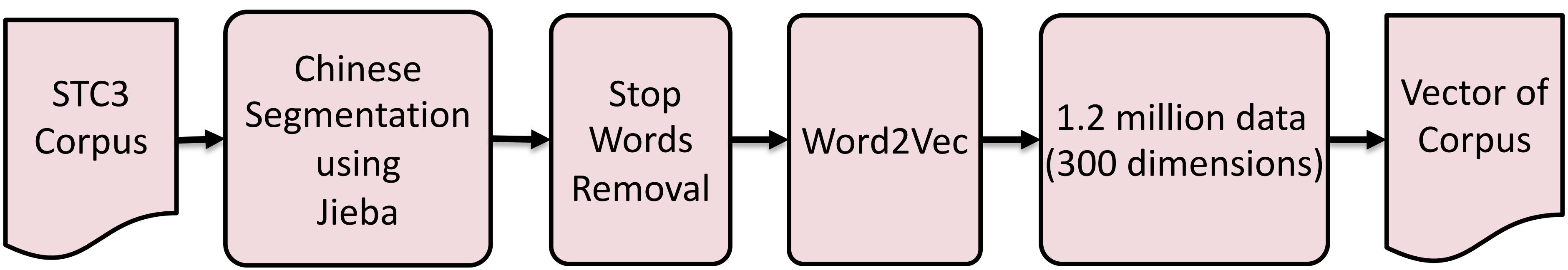
3



The system architecture of IMTKU Response Ranking for NTCIR-14 STC-3

Response Ranking

4



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

	Japanese	Chinese	English
NTCIR-12 STC-1 (22 active participants)	Twitter, Retrieval	Weibo, Retrieval	
NTCIR-13 STC-2 (27 active participants)	Yahoo! News, Retrieval+ Generation	Weibo, Retrieval+ Generation	
NTCIR-14 STC-3		Weibo, Generation for given emotion categories	
		Weibo+English translations, distribution estimation for subjective annotations	

Single-turn, Non task-oriented

Multi-turn, task-oriented (helpdesk)

Chinese Emotional Conversation Generation (CECG) subtask

Dialogue Quality (DQ) and Nugget Detection (ND) subtasks

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

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

AI Dialogue System

Dialogue Subtasks

Browse > Natural Language Processing > Dialogue

Dialogue subtasks

Dialogue Generation

Dialogue Generation
9 leaderboards
35 papers with code

Dialogue State Tracking
2 leaderboards
30 papers with code

Visual Dialog
3 leaderboards
28 papers with code

Task-Oriented Dialogue Systems

Task-Oriented Dialogue Systems
20 papers with code

Goal-Oriented Dialog
15 papers with code

Dialogue Management
10 papers with code

Dialogue Understanding
6 papers with code

Short-Text Conversation

Short-Text Conversation
5 papers with code

Goal-Oriented Dialogue Systems
3 papers with code

Task-Completion Dialogue Policy Learning
2 papers with code

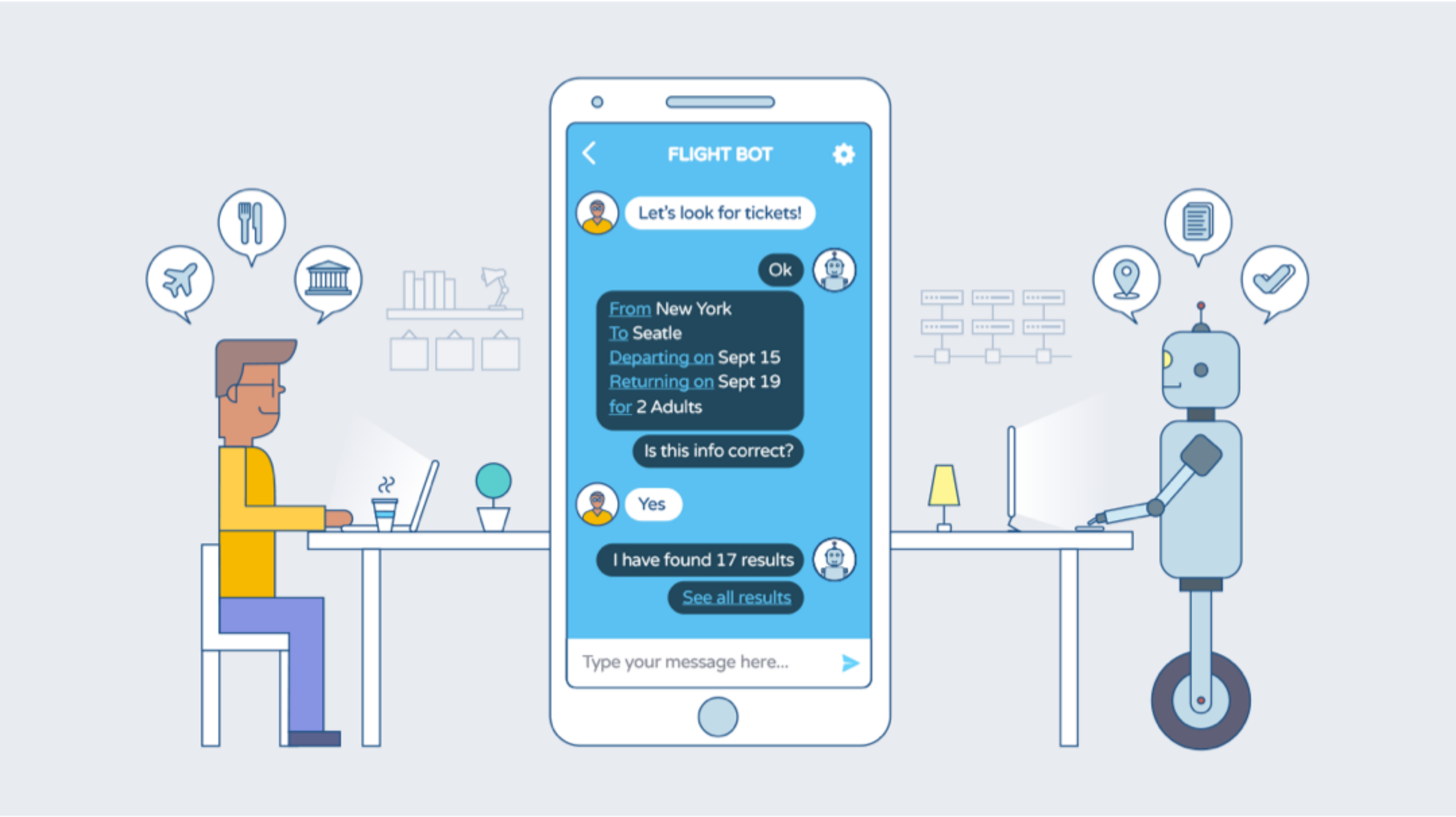
Source: https://paperswithcode.com/area/natural-language-processing/dialogue

Chatbot

Dialogue System

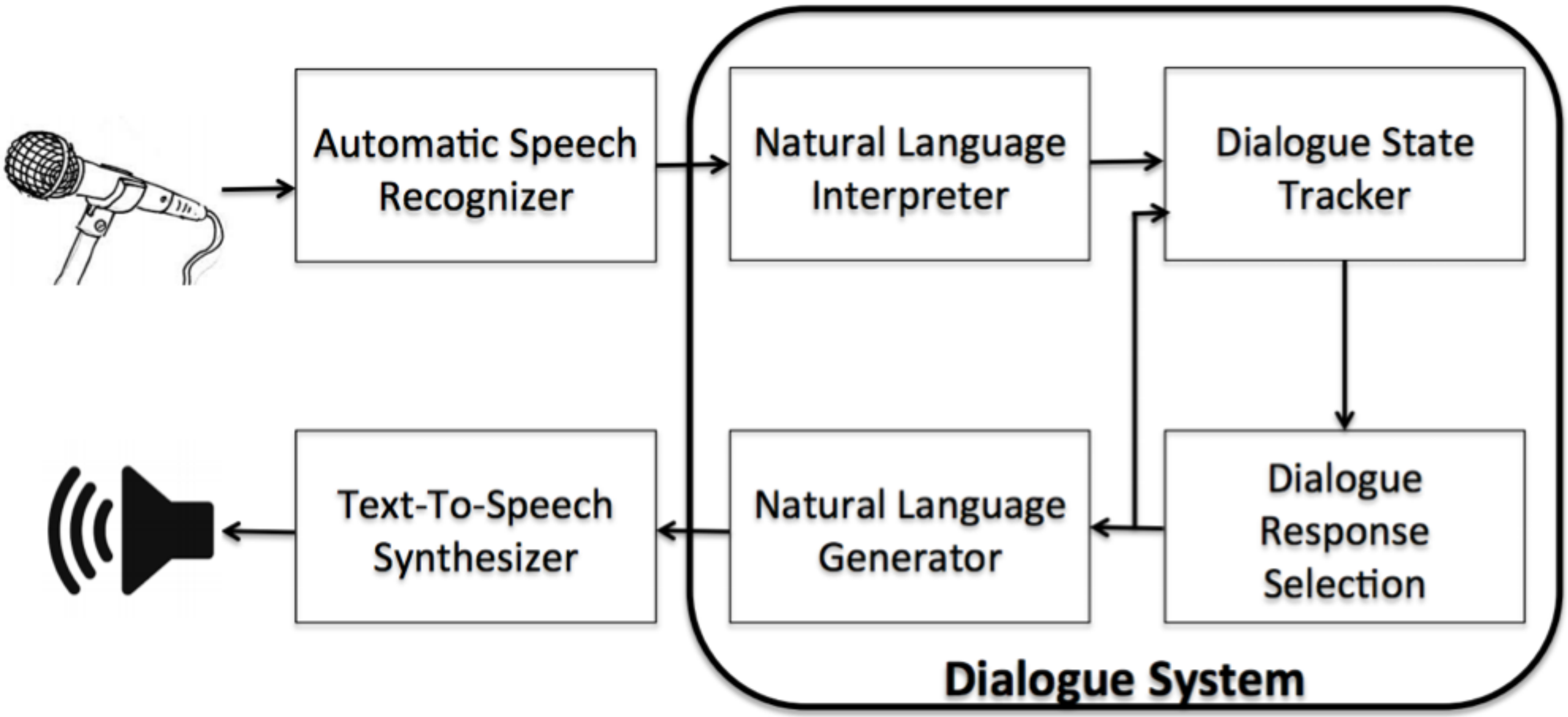
Intelligent Agent

Chatbot



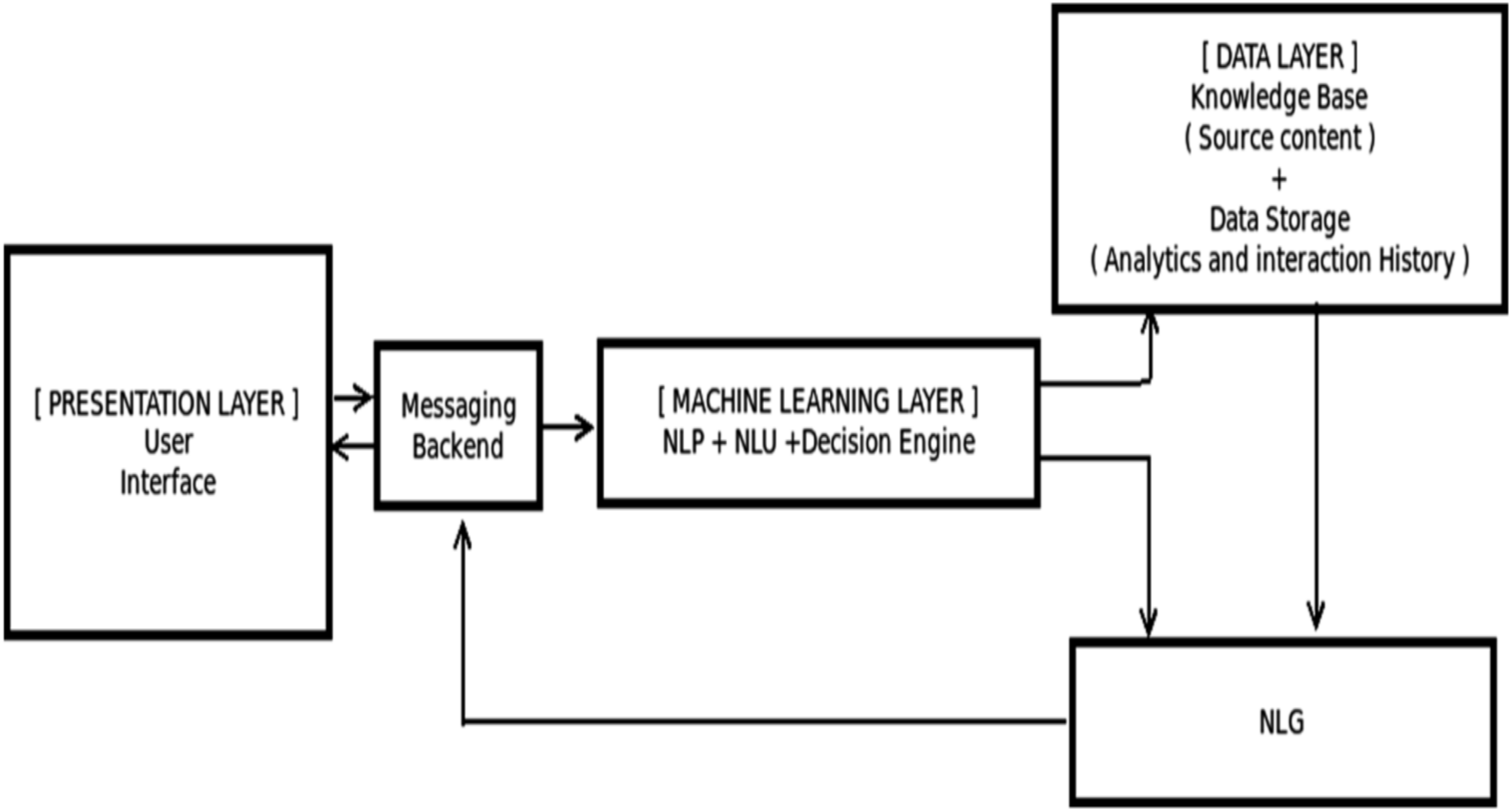
Source: https://www.mdsdecoded.com/blog/the-rise-of-chatbots/

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)

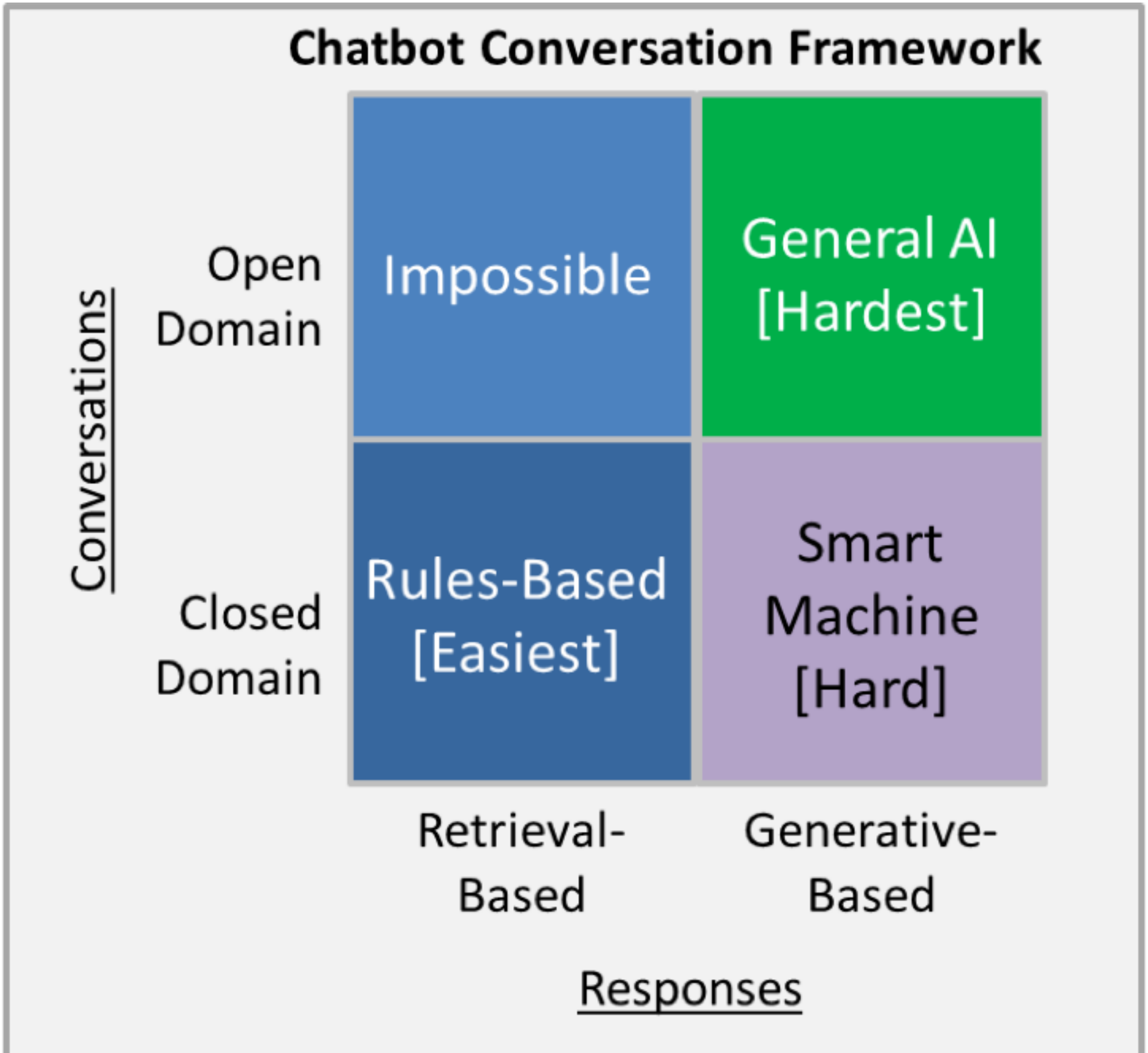
Source: Cahn, Jack. "CHATBOT: Architecture, Design, & Development." PhD diss., University of Pennsylvania, 2017.

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

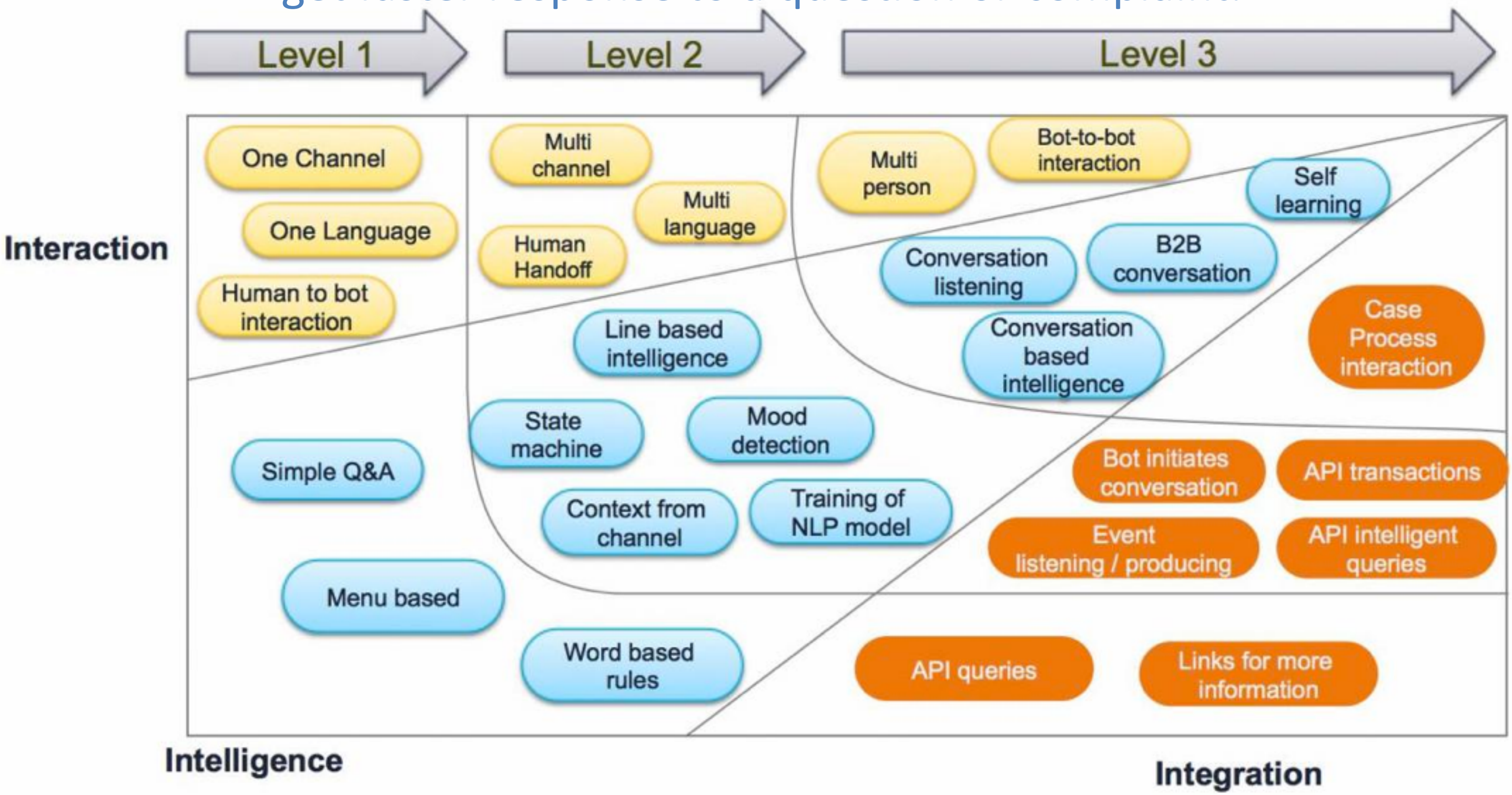


Source: https://chatbotslife.com/ultimate-guide-to-leveraging-nlp-machine-learning-for-you-chatbot-531ff2dd870c

Chatbots

Bot Maturity Model

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

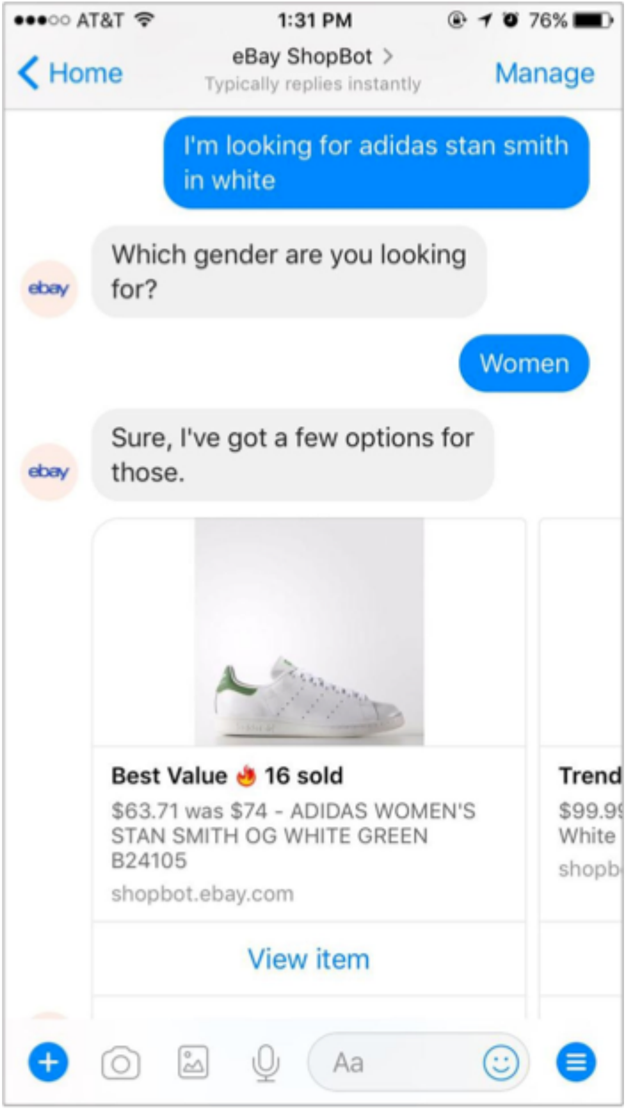


Source: https://www.capgemini.com/2017/04/how-can-chatbots-meet-expectations-introducing-the-bot-maturity/

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

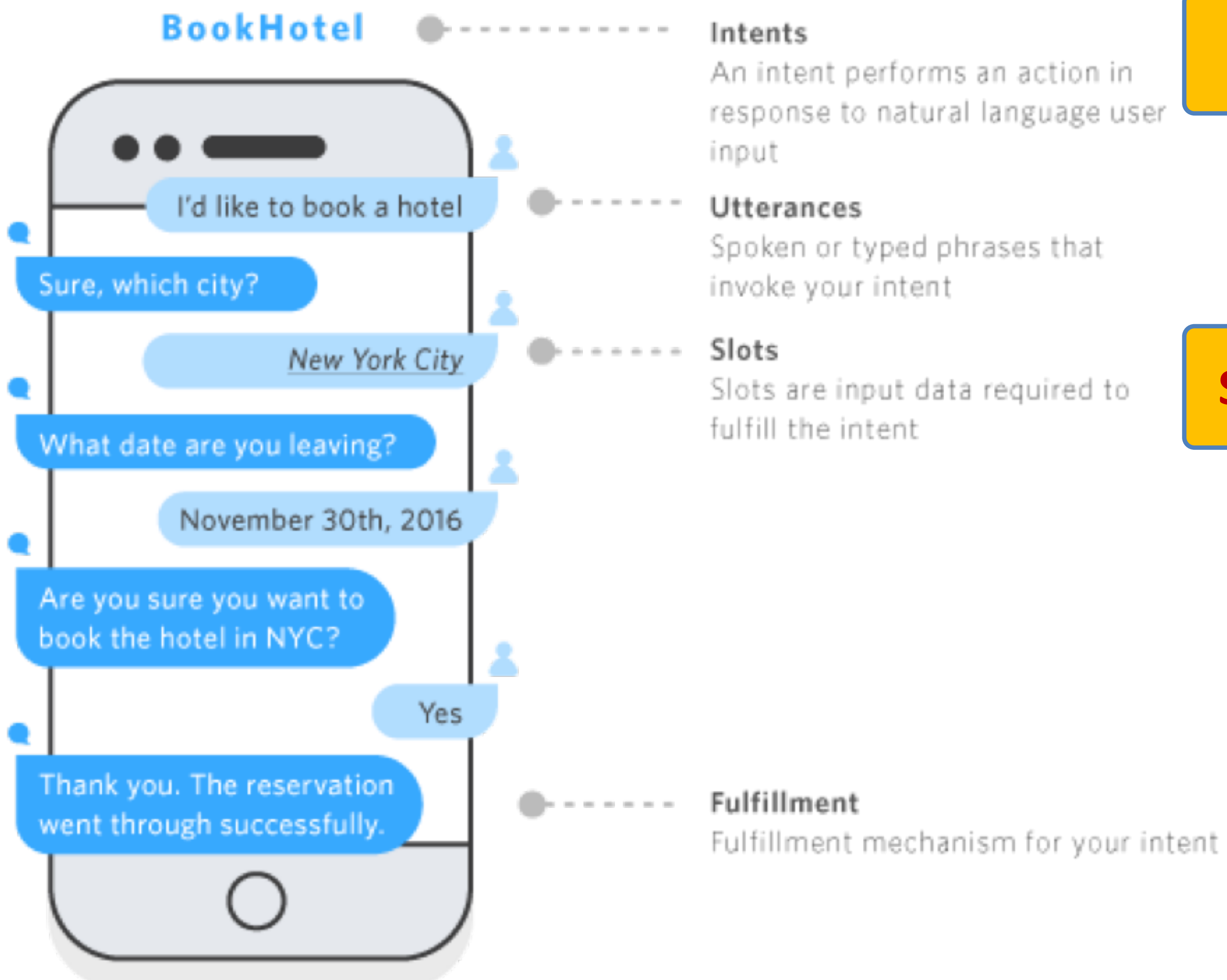
Source: http://www.guided-selling.org/from-e-commerce-to-conversational-commerce/

Conversational Commerce: eBay AI Chatbots



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

Hotel Chatbot

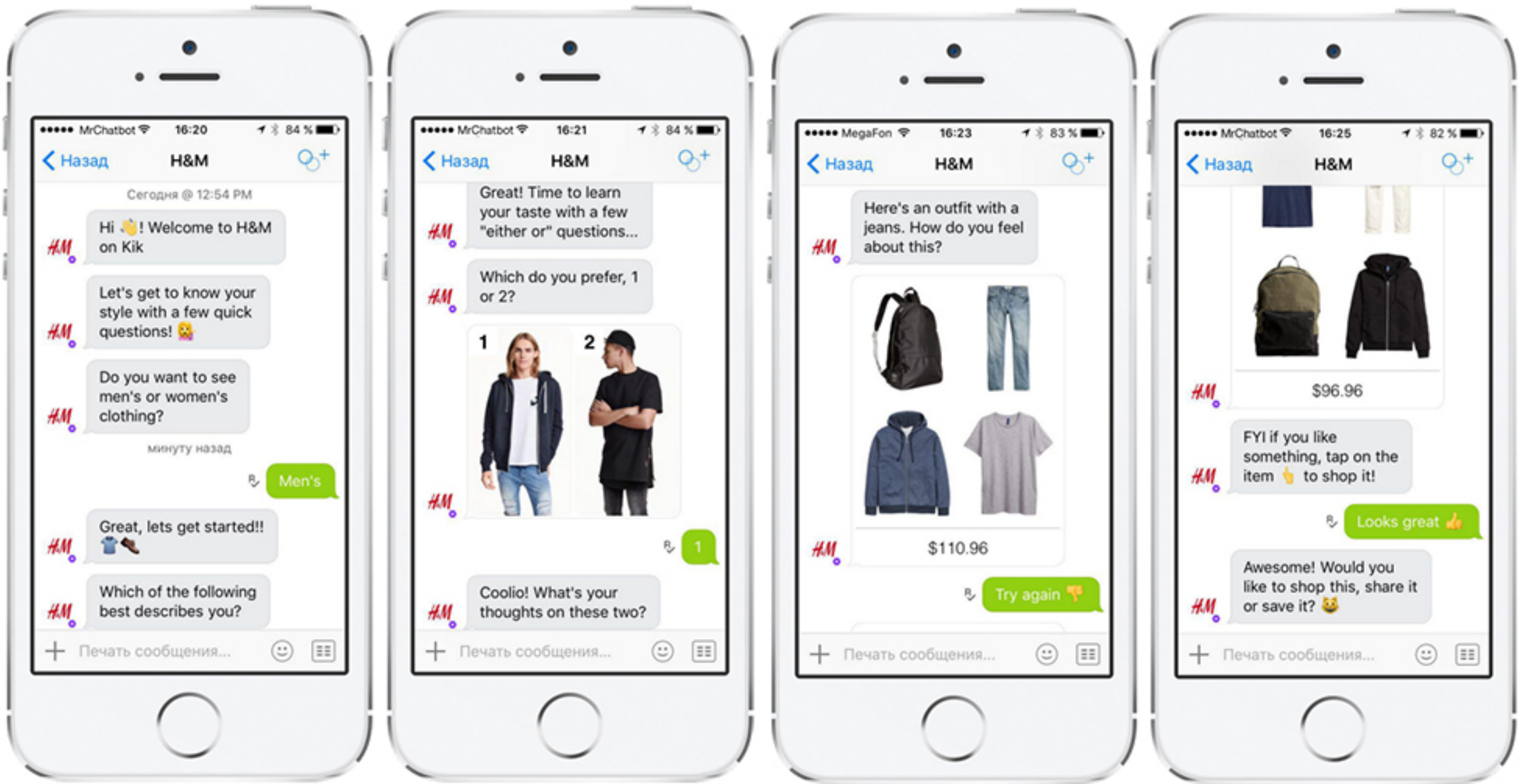


Intent Detection

Slot Filling

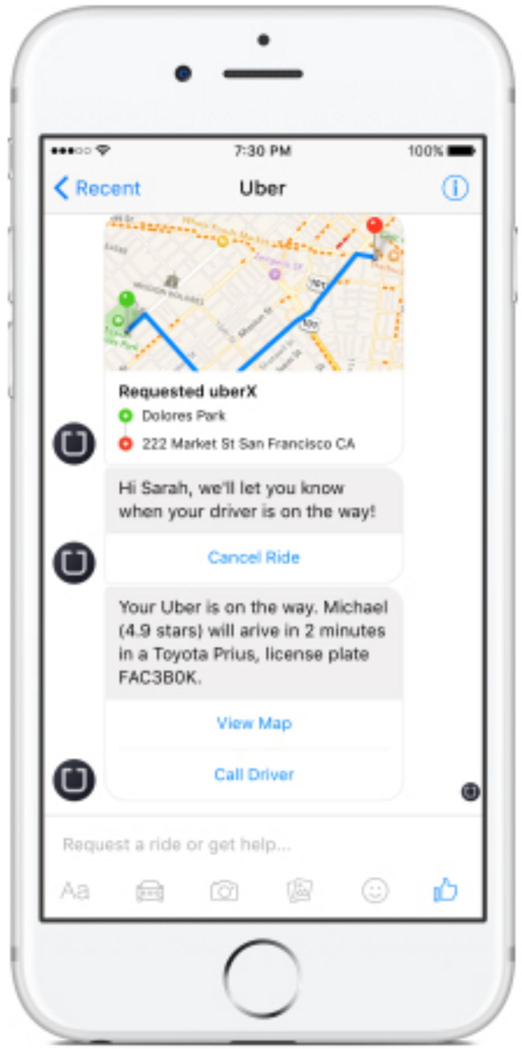
Source: https://sdtimes.com/amazon/guest-view-capitalize-amazon-lex-available-general-public/

H&M's Chatbot on Kik



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

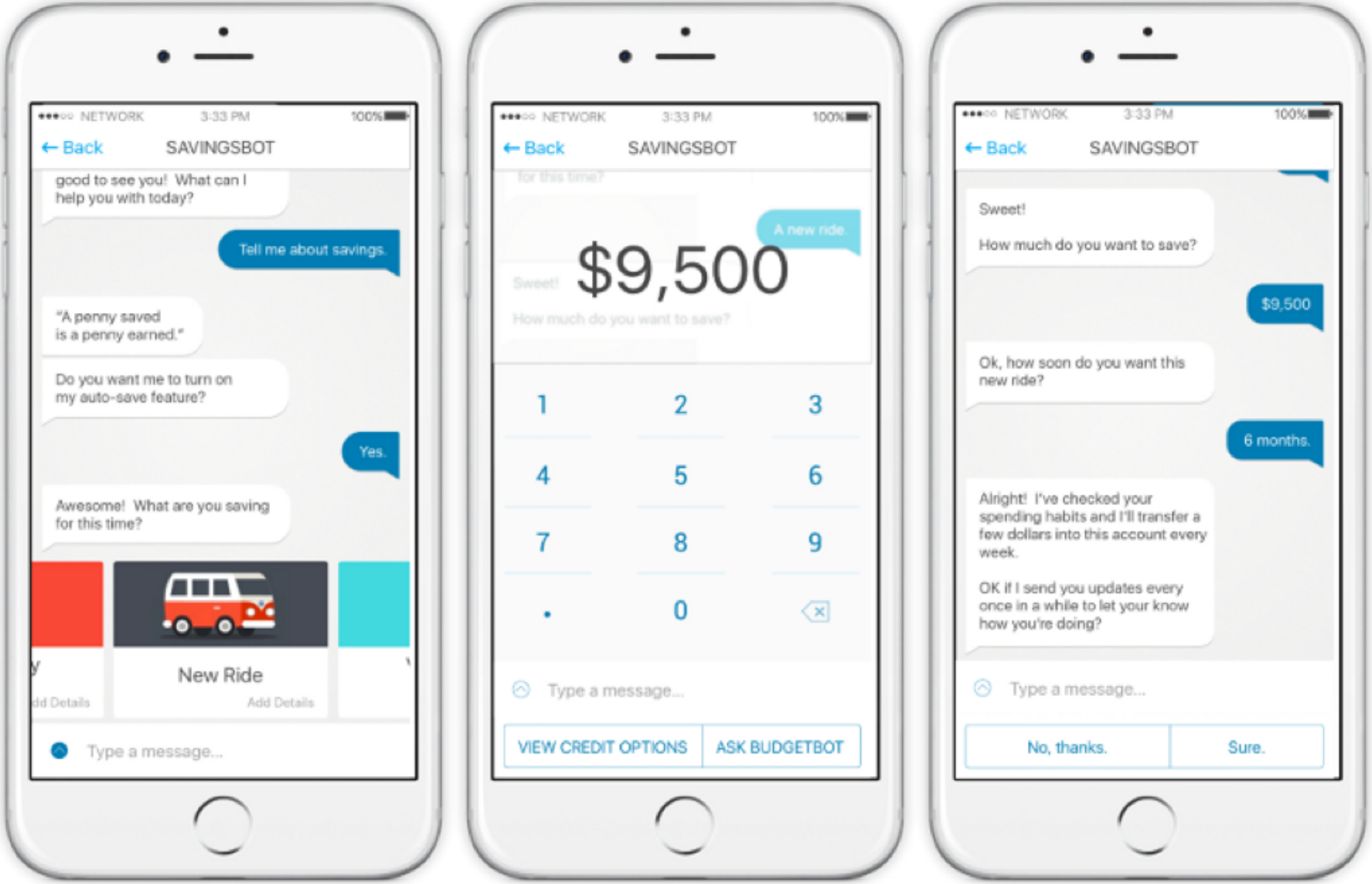
Uber's Chatbot on Facebook's Messenger



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/

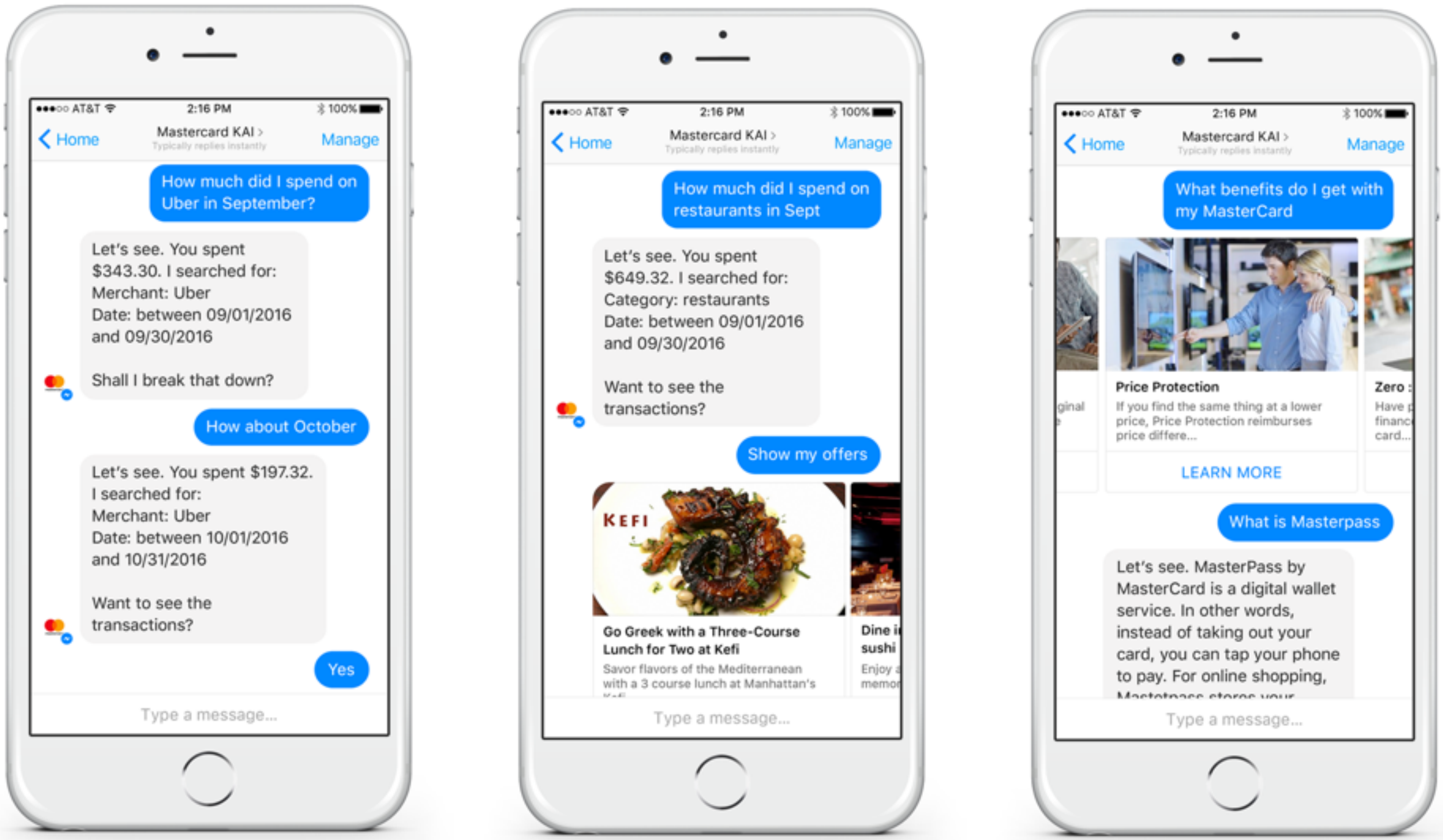
Savings Bot



Source: https://chatbotsmagazine.com/artificial-intelligence-ai-and-fintech-part-1-7cae1e67dc13

Mastercard Makes Commerce More Conversational

mastercard



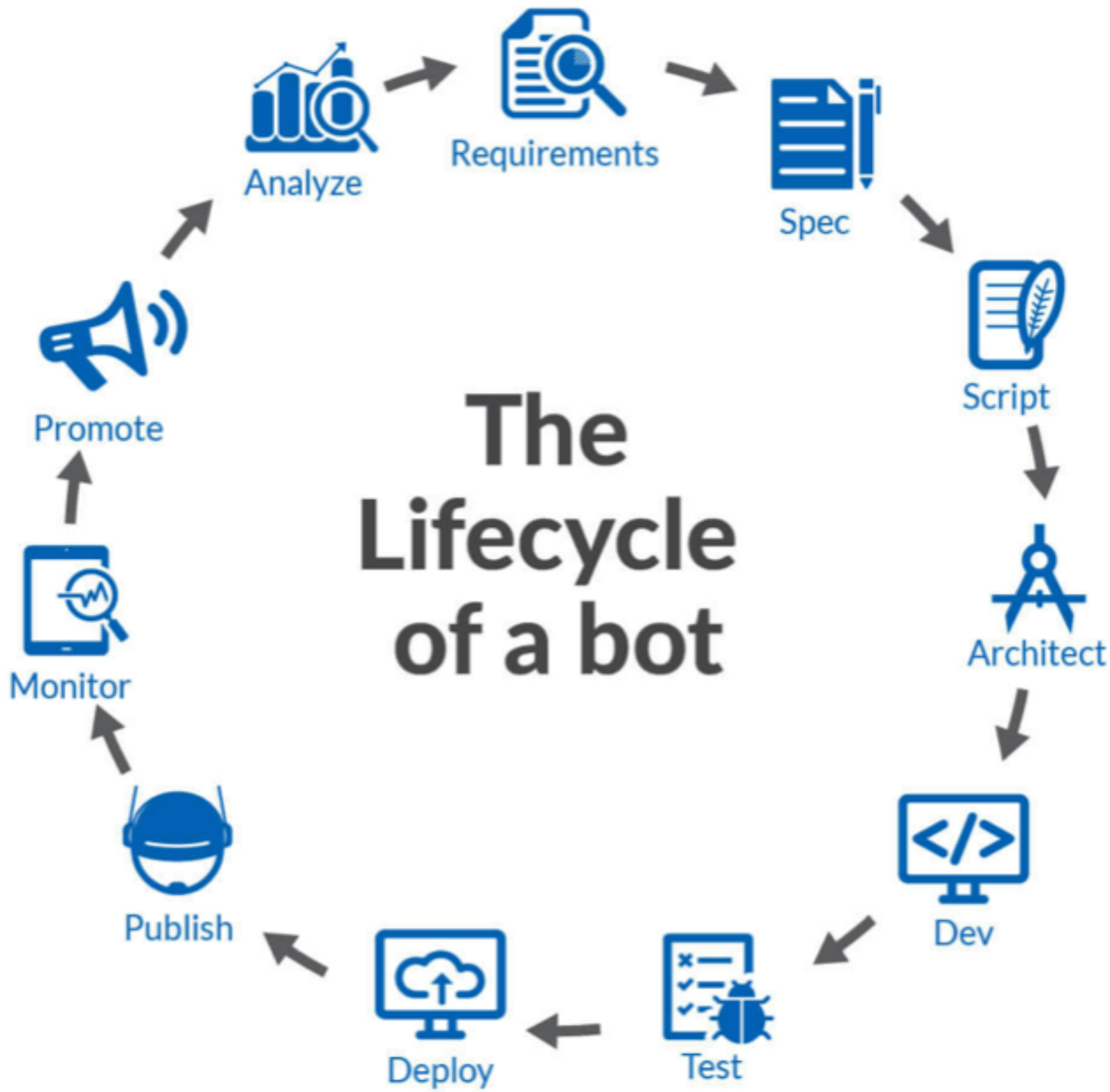
POWERED BY

kasisto

Source: https://newsroom.mastercard.com/press-releases/mastercard-makes-commerce-more-conversational-with-launch-of-chatbots-for-banks-and-merchants/

Bot Life Cycle and Platform Ecosystem

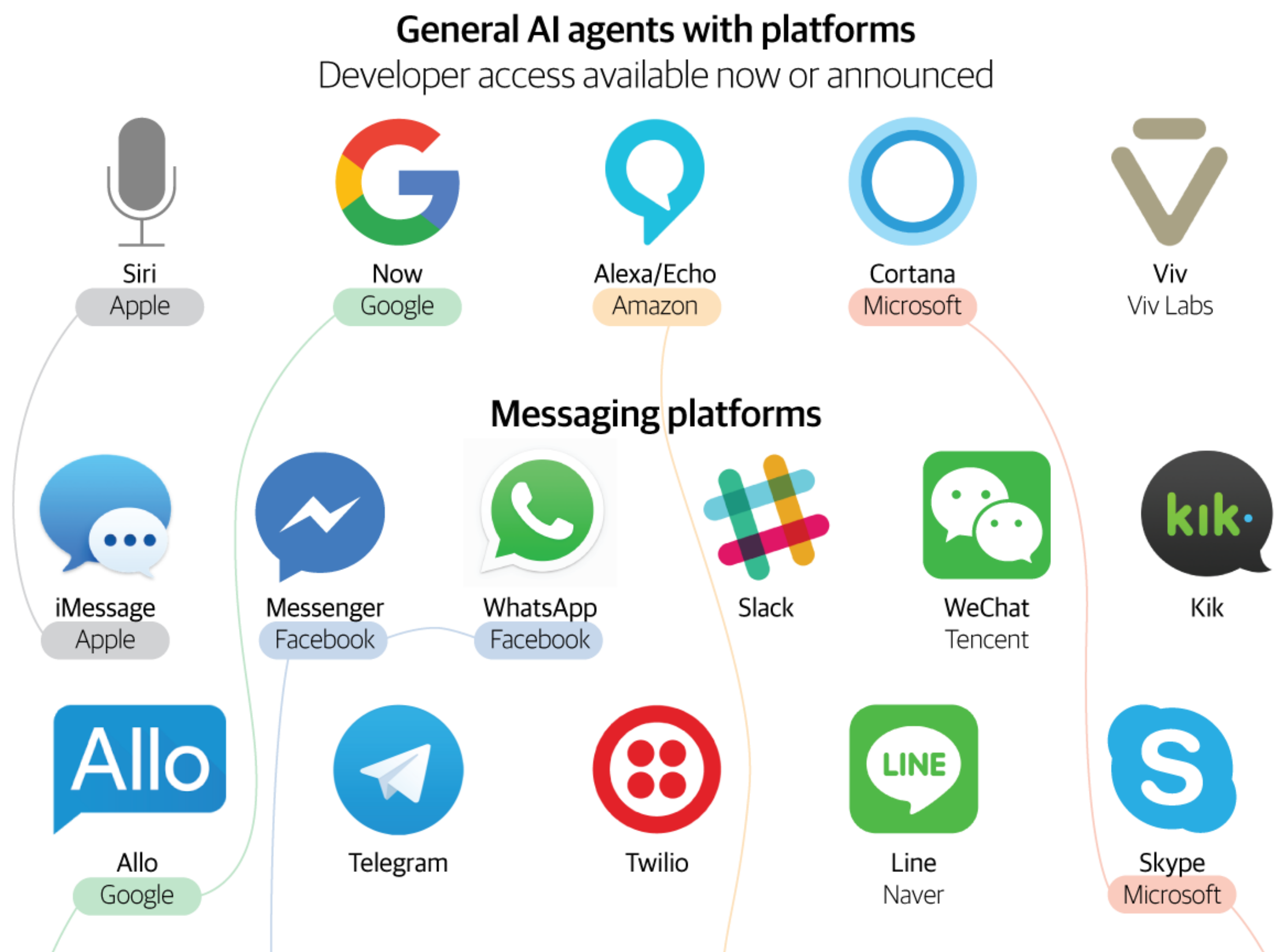
The Bot Lifecycle



Source: https://chatbotsmagazine.com/the-bot-lifecycle-1ff357430db7

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.



Source: https://www.oreilly.com/ideas/infographic-the-bot-platform-ecosystem

Bot frameworks and deployment platforms

Wit.ai
Facebook

BotKit
Howdy

Chatfuel

Automat

Bot Framework
Microsoft

Api.ai
Google

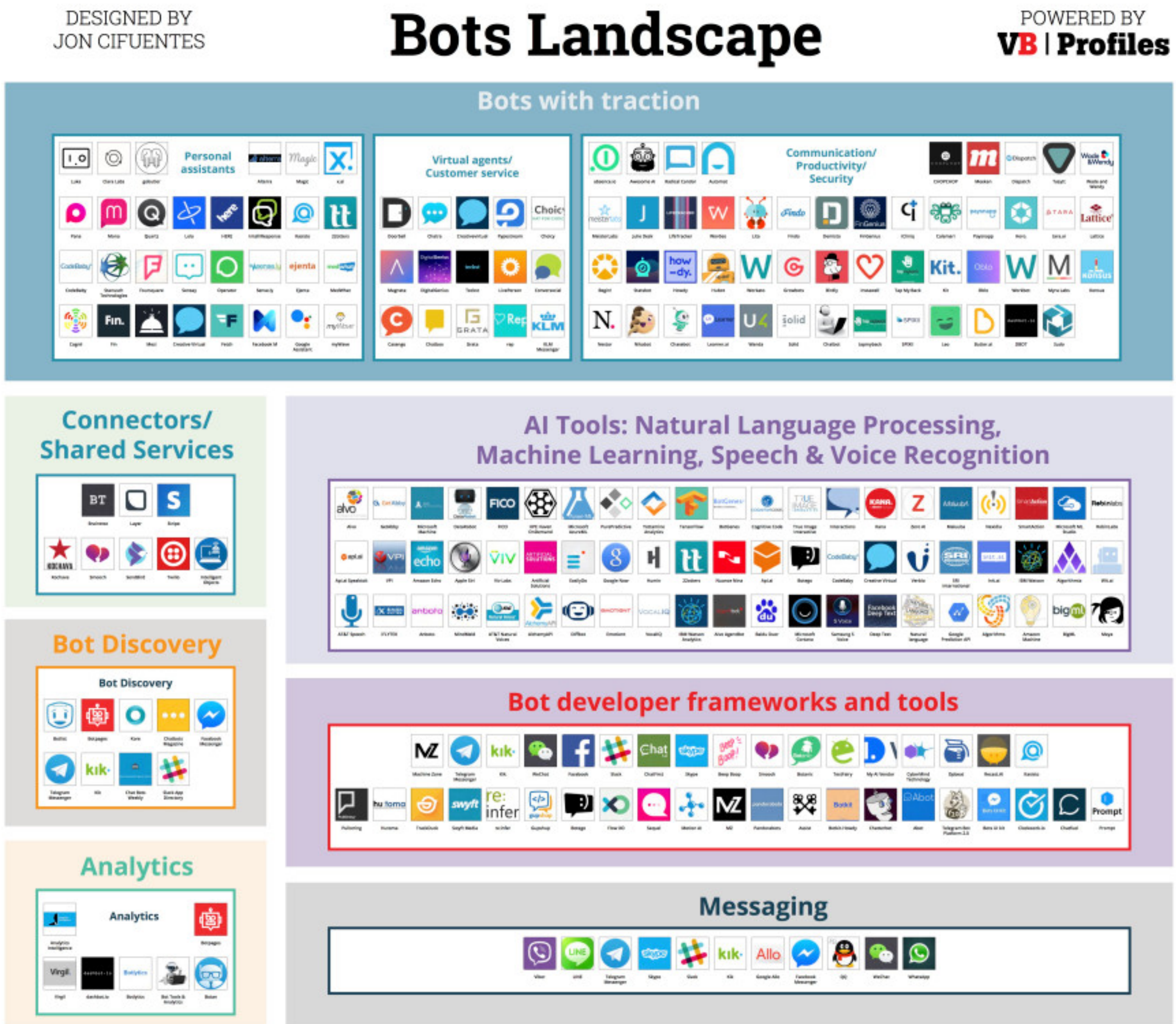
Pandorabots

MindMeld

Gupshup

Sequel

Source: https://www.oreilly.com/ideas/infographic-the-bot-platform-ecosystem



Source: https://venturebeat.com/2016/08/11/introducing-the-bots-landscape-170-companies-4-billion-in-funding-thousands-of-bots/

RECAST.AI

Messenger Bot Landscape

May 2017

Food

The Wine Pairer, Plum, Pescetarian Kitchen, Hungry, Foodie, Fitmeal, Entrée, Chatobook, Make My Sushi, Voome

Communication

Tangowork, Typeform, Anony, Tarjimly, Refugio, Rescue, Messenger Match, Sensay, LangLearnBot, Chat Club, Lingio Translate, Decodemoji, U-Report Global, Twiggo

Utilities

Poncho, Calcbot, Smokey, DotCom, Server Monitoring, English Dictionary, Youtube Search, Idea Bot, QRobot, Instant Translator

Personal

M, Assist, Operator, Uber, Swelly, AskVoila, Ikea Build, Selectionnist, Bud Light Bot, Ask Gary Vee, Gidi, Visabot

Design

ColoretoBot, Connie Digital, AWWWARDS, Mr. Norman, Graphic Design, SnapBot

Analytics

SISENSE, Stockflare, PageInsights, DAM, BuzzLogger, Trading Bot

News

CNN, TIA, Digg, WSJ, Reddit Bot, Al Jazeera, Hacker News, Wired, The Guardian, France Info, Chatbots Mag, VentureBeat

Travel

Grindbase, KLM, British Airways, Space Explorer, AustrianAirlines, SnapTravel, Skyscanner, Kayak, Ticketbot, Rapido

Entertainment

Spotify, Kim Kardashian, La Bringue, 50 Cent, L'oquillo Fiel, Lindsay Lohan, Maroon 5, MTV News, Axwell Λ Ingrosso, RedBull TV, SantaBot, Star Wars Bot, Citron, Pokébot

Developer Tools

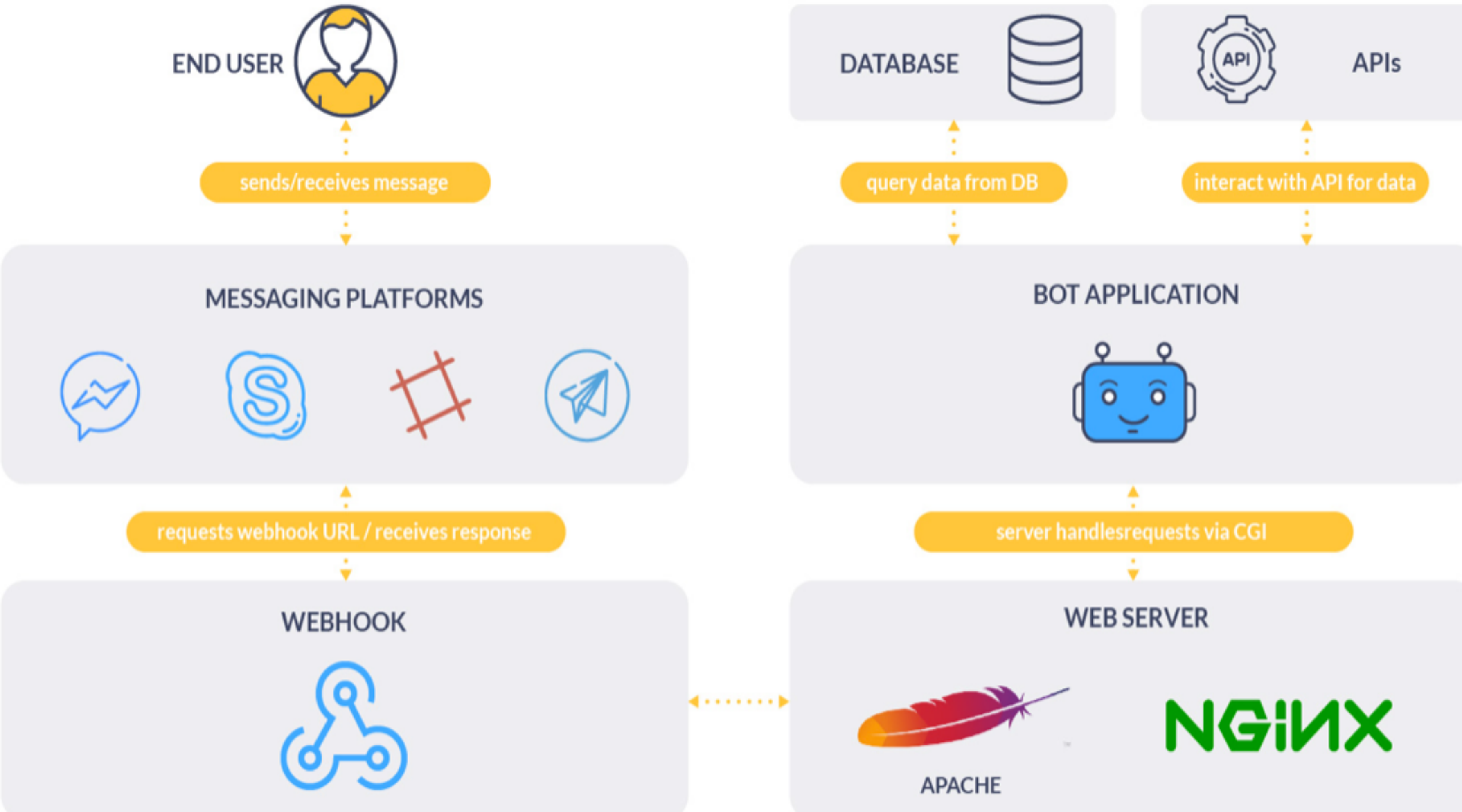
HackerOne, Wiredelta, Robbie, Zilly

Education

Genius, Kimchi, MemoryzerBot, Ainstein

Source: https://medium.com/@RecastAI/2017-messenger-bot-landscape-a-public-spreadsheet-gathering-1000-messenger-bots-f017fdb1448a /

How to Build Chatbots



Source: Igor Bobriakov (2018), https://activewizards.com/blog/a-comparative-analysis-of-chatbots-apis/

Chatbot Frameworks and AI Services

- Bot Frameworks
  - Botkit
  - Microsoft Bot Framework
  - Rasa NLU
- AI Services
  - Wit.ai
  - api.ai
  - LUIS.ai
  - IBM Watson

Source: Igor Bobriakov (2018), https://activewizards.com/blog/a-comparative-analysis-of-chatbots-apis/

Chatbot Frameworks

Comparison Table of Most Prominent Bot Frameworks

	Botkit	Microsoft Bot Framework	RASA NLU
Built-in integration with messaging platforms	✓	✓	✗
NLP support	✗ but possible to integrate with middlewares	✗ but have close bonds with LUIS.ai	✓
Out-of-box bots ready to be deployed	✓	✗	✗
Programming Language	JavaScript (Node)	JavaScript (Node), C#	Python

Created by ActiveWizards

Source: Igor Bobriakov (2018), https://activewizards.com/blog/a-comparative-analysis-of-chatbots-apis/

Comparison of Most Prominent AI Services

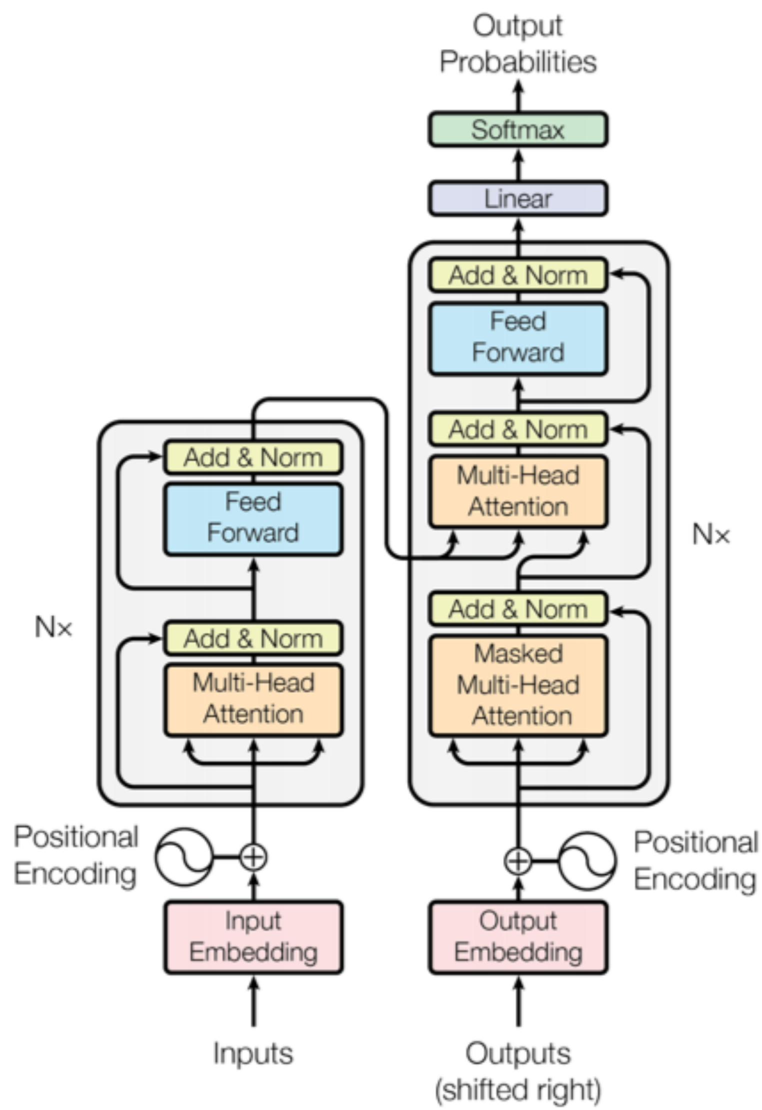
	wit.ai	api.ai	LUIS.ai	IBM Watson
Free of charge	✓	✓ but has paid enterprise version	✓ it is in beta and has transaction limits	**30 days trial** then priced for enterprise use
Text and Speech processing	✓	✓	✓ with use of Cortana	✓
Machine Learning Modeling	✓	✓	✓	✓
Support for Intents, Entities, Actions	✓ Intents used as trait entities, actions are combined operations	✓ Intents is the main prediction mechanism. Domains of entities, intents and actions	✓	✓
Pre-build entities for easy parsing of numbers, temperature, date, etc.	✓	✓	✓	✓
Integration to messaging platforms	✗ web service API	✓ also has facility for deploying to heroku. Paid environment	✓ integrated to Azure	✓ possible via API
Support of SDKs	✓ includes SDKs for Python, Node.js, Rust, C, Ruby, iOS, Android, Windows Phone	✓ C#, Xamarin, Python, Node.js, iOS, Android, Windows Phone	✓ enables building with Web Service API, Microsoft Bot Framework integration	Proprietary language "AlchemyLanguage"

Created by ActiveWizards

Source: Igor Bobriakov (2018), https://activewizards.com/blog/a-comparative-analysis-of-chatbots-apis/

Transformer (Attention is All You Need)

(Vaswani et al., 2017)

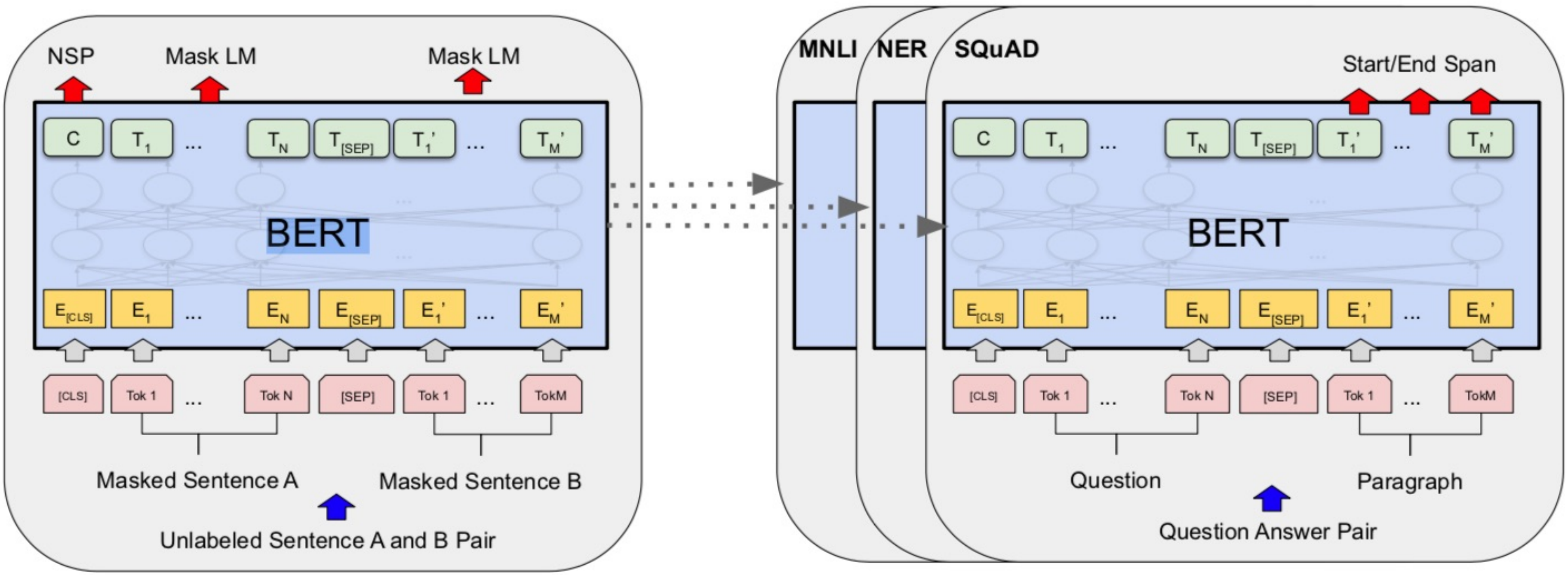


Source: Vaswani, Ashish, Noam Shazeer, Niki Parmar, Jakob Uszkoreit, Llion Jones, Aidan N. Gomez, Łukasz Kaiser, and Illia Polosukhin. "Attention is all you need." In *Advances in neural information processing systems*, pp. 5998-6008. 2017.

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



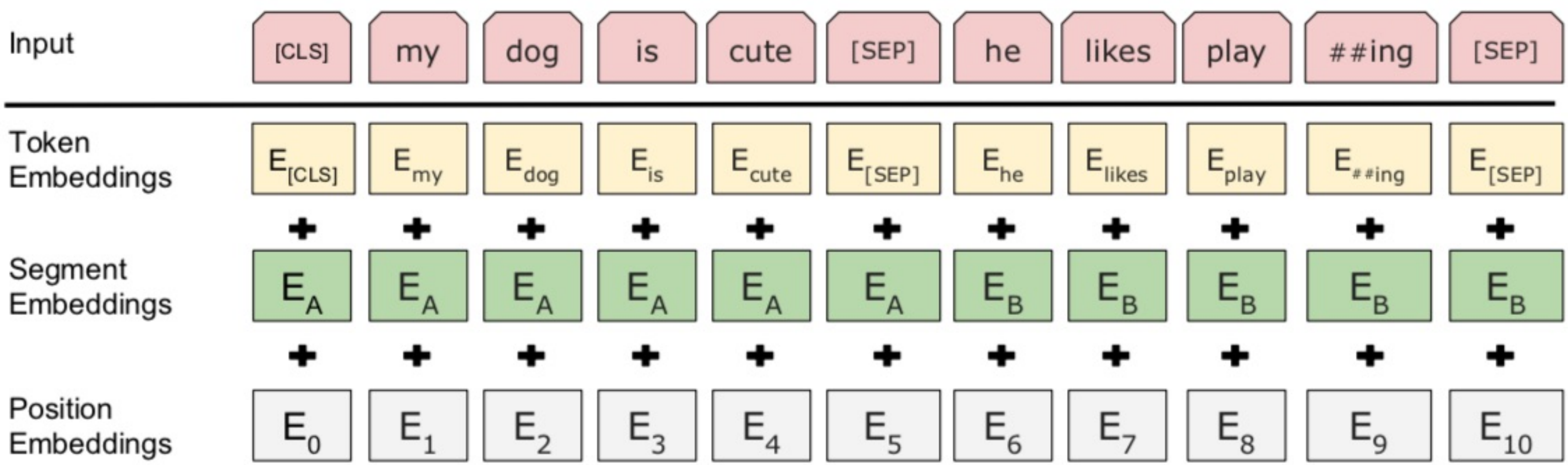
Pre-training Fine-Tuning

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

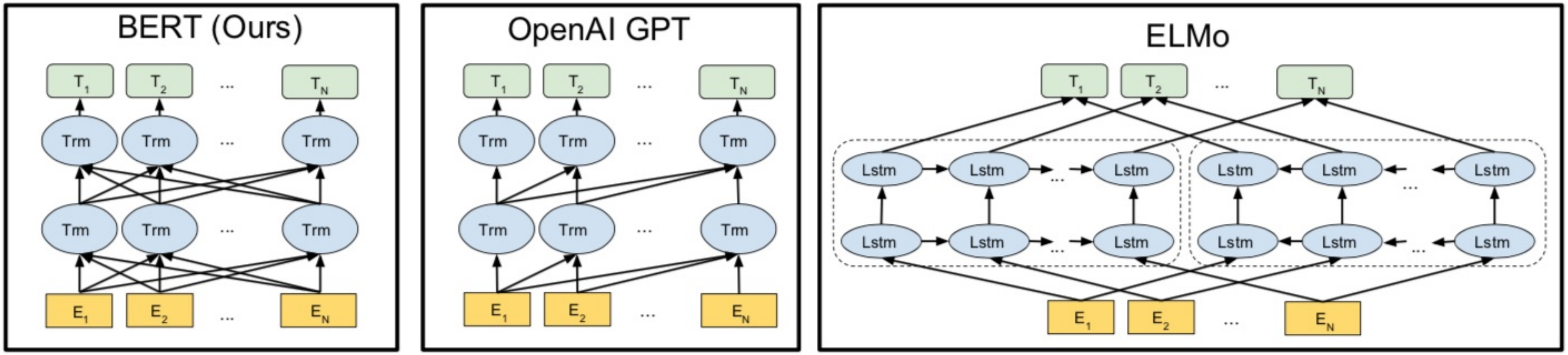
BERT (Bidirectional Encoder Representations from Transformers)

BERT input representation



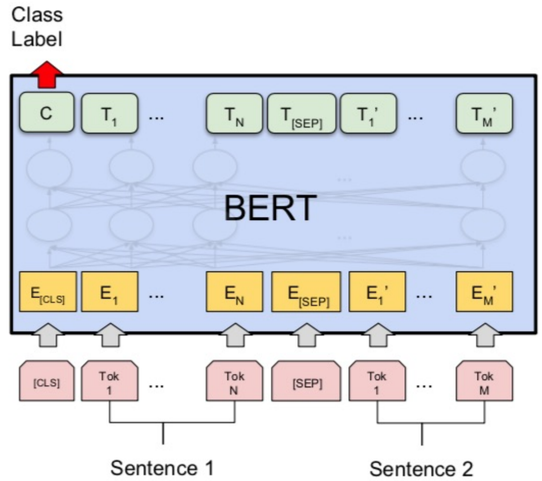
Source: Devlin, Jacob, Ming-Wei Chang, Kenton Lee, and Kristina Toutanova (2018).
"Bert: Pre-training of deep bidirectional transformers for language understanding." arXiv preprint arXiv:1810.04805.

BERT, OpenAI GPT, ELMo

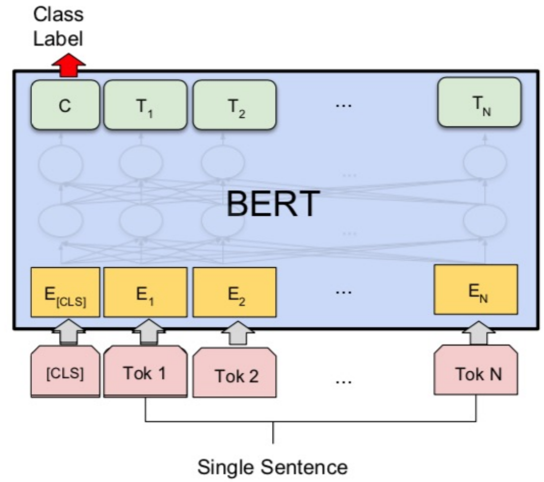


Source: Devlin, Jacob, Ming-Wei Chang, Kenton Lee, and Kristina Toutanova (2018).
"Bert: Pre-training of deep bidirectional transformers for language understanding." arXiv preprint arXiv:1810.04805.

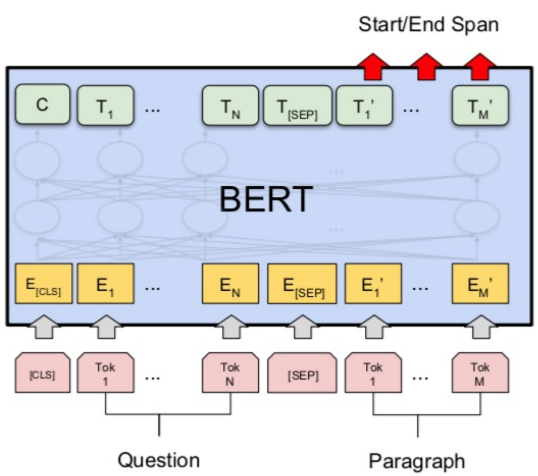
Fine-tuning BERT on Different Tasks



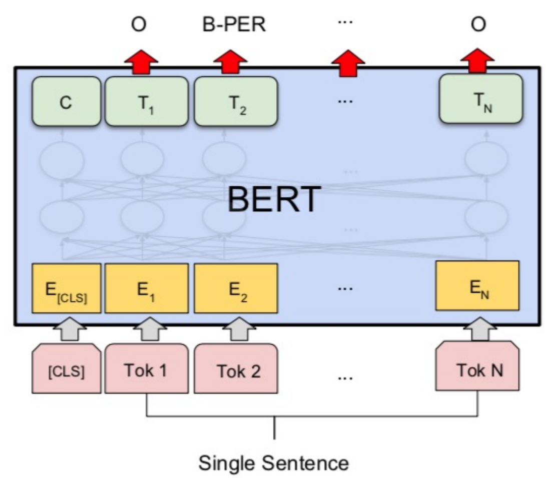
(a) Sentence Pair Classification Tasks: MNLI, QQP, QNLI, STS-B, MRPC, RTE, SWAG



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



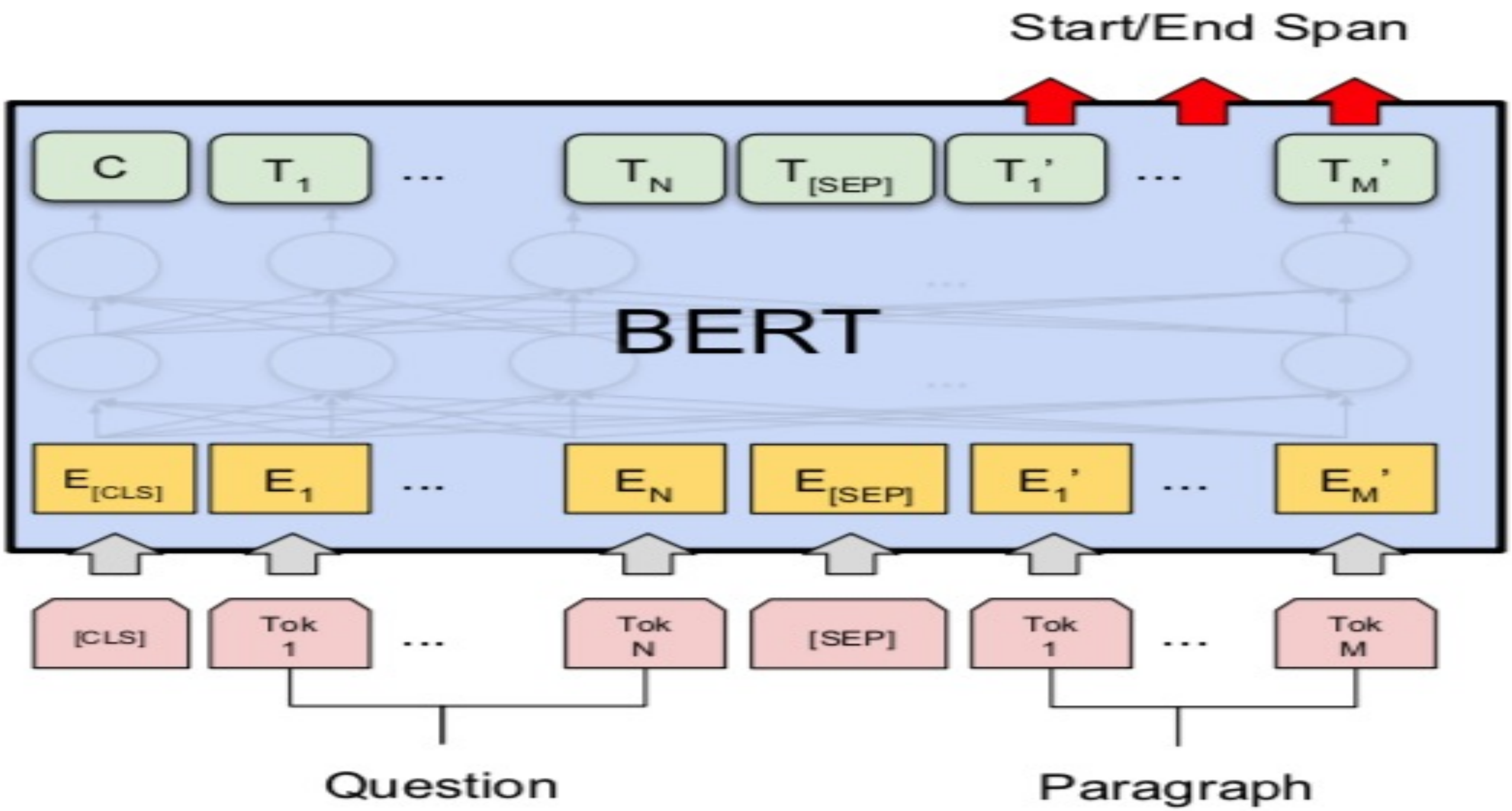
(c) Question Answering Tasks: SQuAD v1.1



(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)

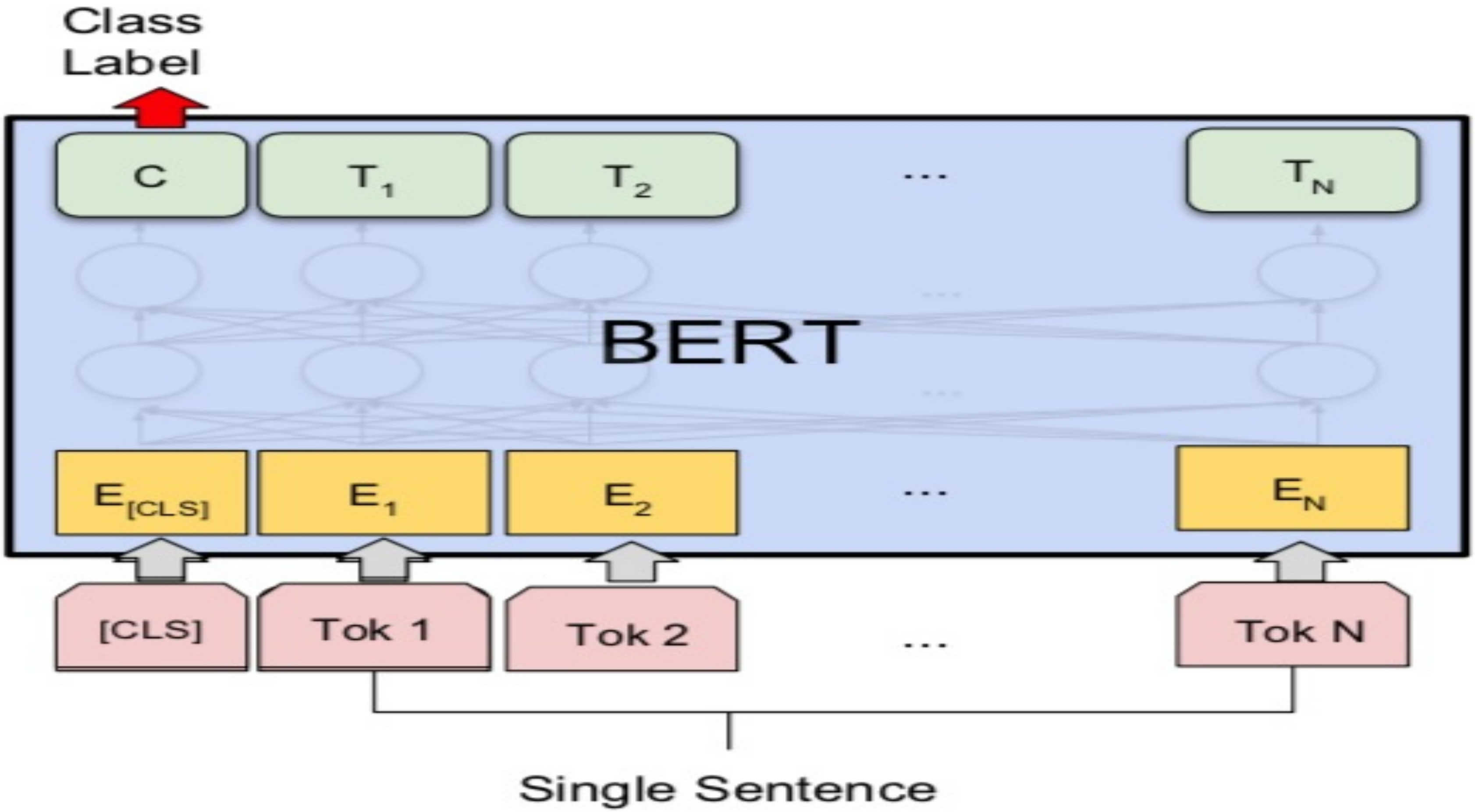


(c) Question Answering Tasks: SQuAD v1.1

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)

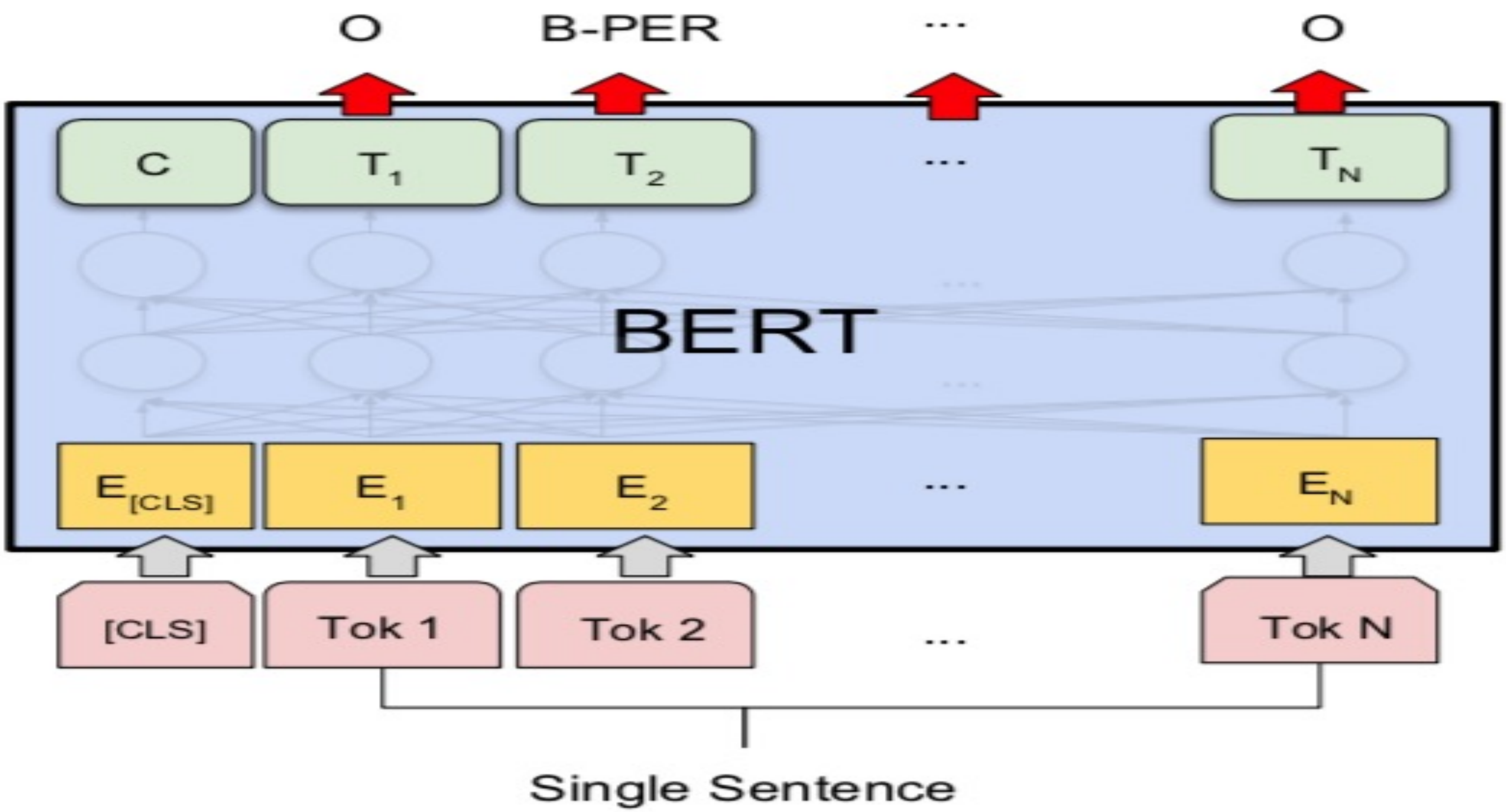


(b) Single Sentence Classification Tasks: SST-2, CoLA

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

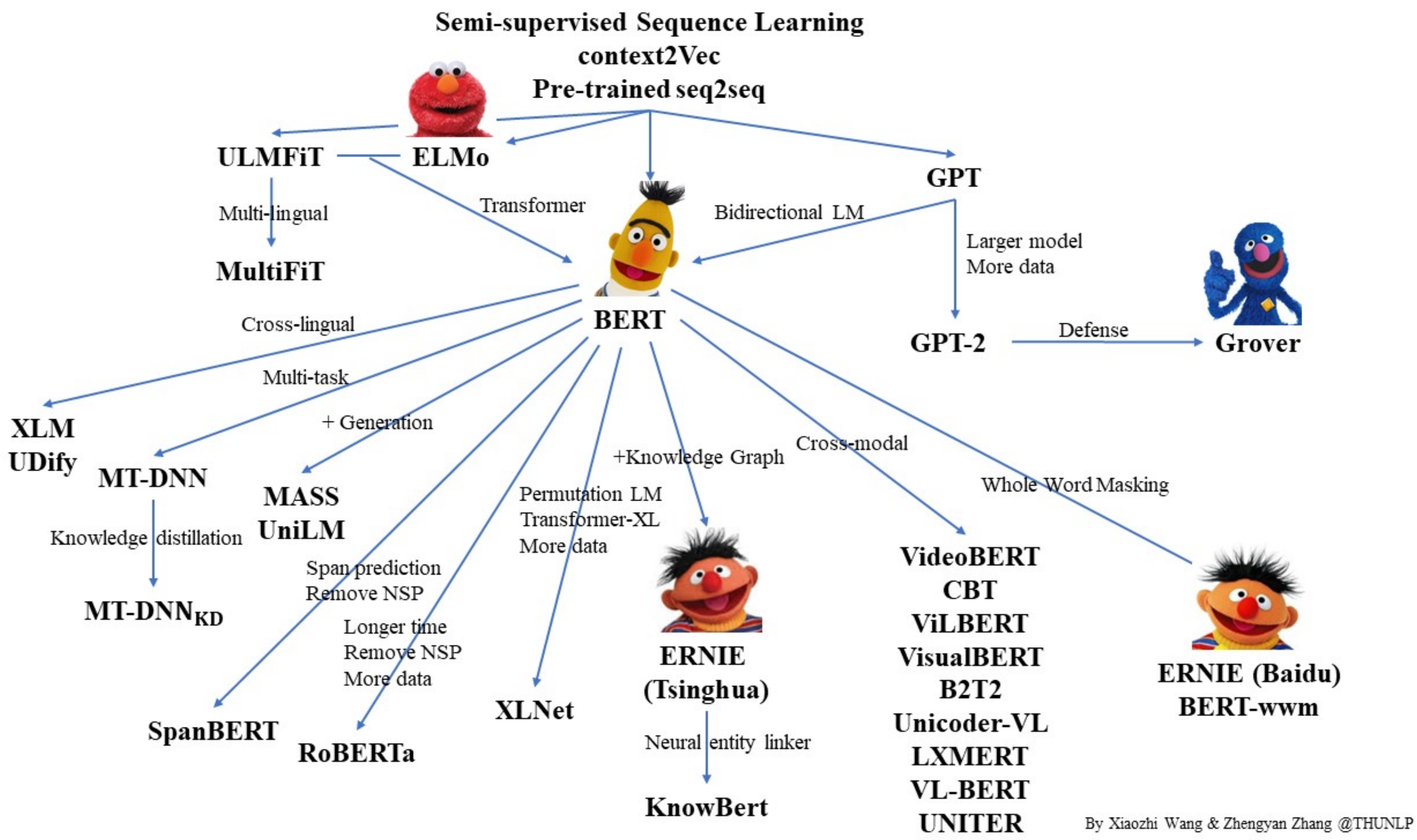
Slot Filling (SF)



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

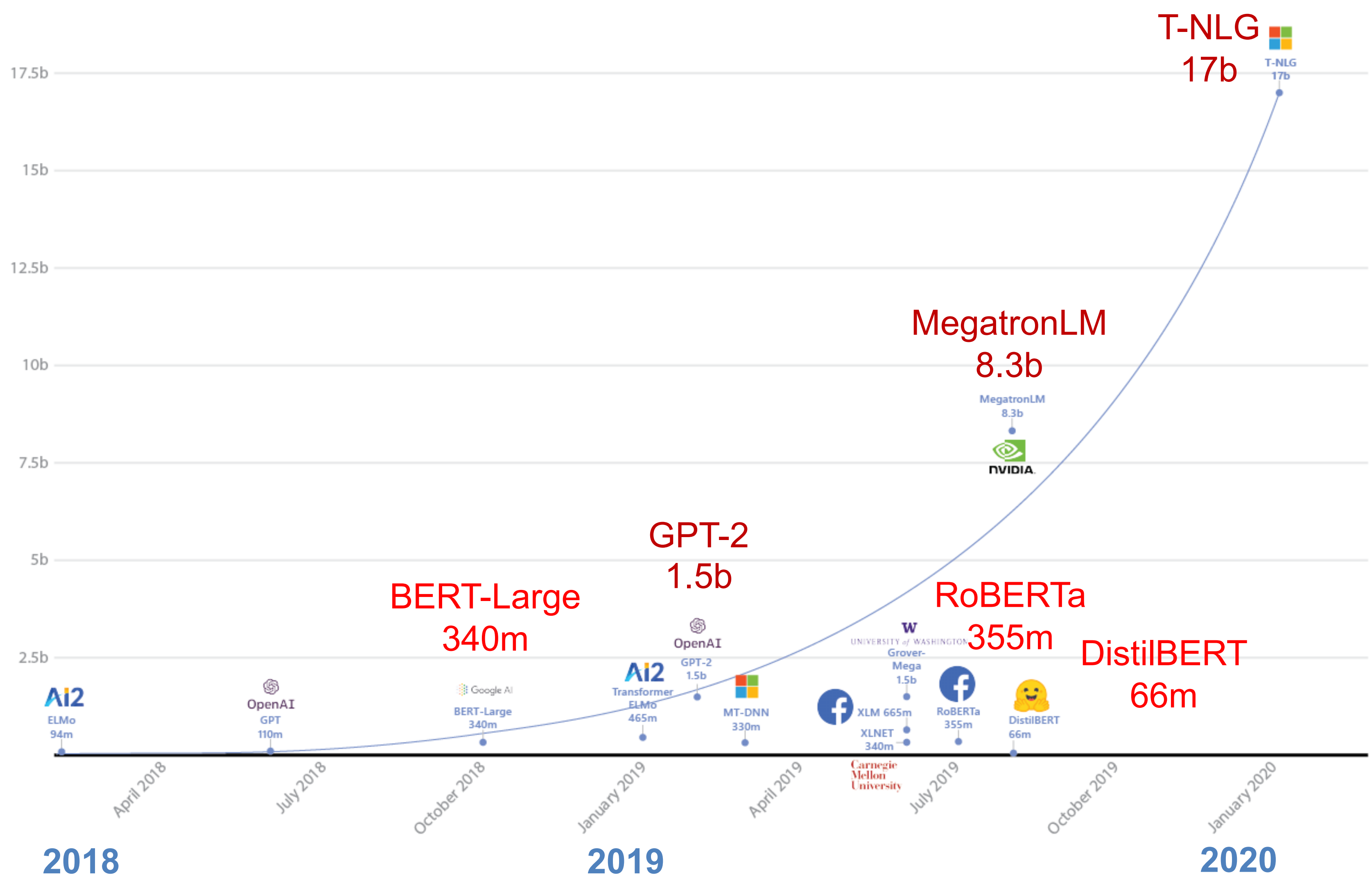
Source: Devlin, Jacob, Ming-Wei Chang, Kenton Lee, and Kristina Toutanova (2018). "Bert: Pre-training of deep bidirectional transformers for language understanding." arXiv preprint arXiv:1810.04805.

Pre-trained Language Model (PLM)



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

Turing Natural Language Generation (T-NLG)



Source: https://www.microsoft.com/en-us/research/blog/turing-nlg-a-17-billion-parameter-language-model-by-microsoft/

🤗 Transformers

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

Transfer Learning in Natural Language Processing

Source: Sebastian Ruder, Matthew E. Peters, Swabha Swayamdipta, and Thomas Wolf (2019), "Transfer learning in natural language processing." In Proceedings of the 2019 Conference of the North American Chapter of the Association for Computational Linguistics: Tutorials, pp. 15-18.

NLP Benchmark Datasets

Task	Dataset	Link
Machine Translation	WMT 2014 EN-DE WMT 2014 EN-FR	http://www-lium.univ-lemans.fr/~schwenk/cslm_joint_paper/
Text Summarization	CNN/DM Newsroom DUC Gigaword	https://cs.nyu.edu/~kcho/DMQA/ https://summari.es/ https://www-nlpir.nist.gov/projects/duc/data.html https://catalog.ldc.upenn.edu/LDC2012T21
Reading Comprehension Question Answering Question Generation	ARC CliCR CNN/DM NewsQA RACE SQuAD Story Cloze Test NarativeQA Quasar SearchQA	http://data.allenai.org/arc/ http://aclweb.org/anthology/N18-1140 https://cs.nyu.edu/~kcho/DMQA/ https://datasets.maluuba.com/NewsQA http://www.qizhexie.com/data/RACE_leaderboard https://rajpurkar.github.io/SQuAD-explorer/ http://aclweb.org/anthology/W17-0906.pdf https://github.com/deepmind/narrativeqa https://github.com/bdhingra/quasar https://github.com/nyu-dl/SearchQA
Semantic Parsing	AMR parsing ATIS (SQL Parsing) WikiSQL (SQL Parsing)	https://amr.isi.edu/index.html https://github.com/jkkummerfeld/text2sql-data/tree/master/data https://github.com/salesforce/WikiSQL
Sentiment Analysis	IMDB Reviews SST Yelp Reviews Subjectivity Dataset	http://ai.stanford.edu/~amaas/data/sentiment/ https://nlp.stanford.edu/sentiment/index.html https://www.yelp.com/dataset/challenge http://www.cs.cornell.edu/people/pabo/movie-review-data/
Text Classification	AG News DBpedia TREC 20 NewsGroup	http://www.di.unipi.it/~gulli/AG_corpus_of_news_articles.html https://wiki.dbpedia.org/Datasets https://trec.nist.gov/data.html http://qwone.com/~jason/20Newsgroups/
Natural Language Inference	SNLI Corpus MultiNLI SciTail	https://nlp.stanford.edu/projects/snli/ https://www.nyu.edu/projects/bowman/multinli/ http://data.allenai.org/scitail/
Semantic Role Labeling	Proposition Bank OneNotes	http://propbank.github.io/ https://catalog.ldc.upenn.edu/LDC2013T19

Source: Amirsina Torfi, Rouzbeh A. Shirvani, Yaser Keneshloo, Nader Tavvaf, and Edward A. Fox (2020). "Natural Language Processing Advancements By Deep Learning: A Survey." arXiv preprint arXiv:2003.01200.

Dialogue on Airline Travel Information System (ATIS)

The ATIS (Airline Travel Information System) Dataset

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

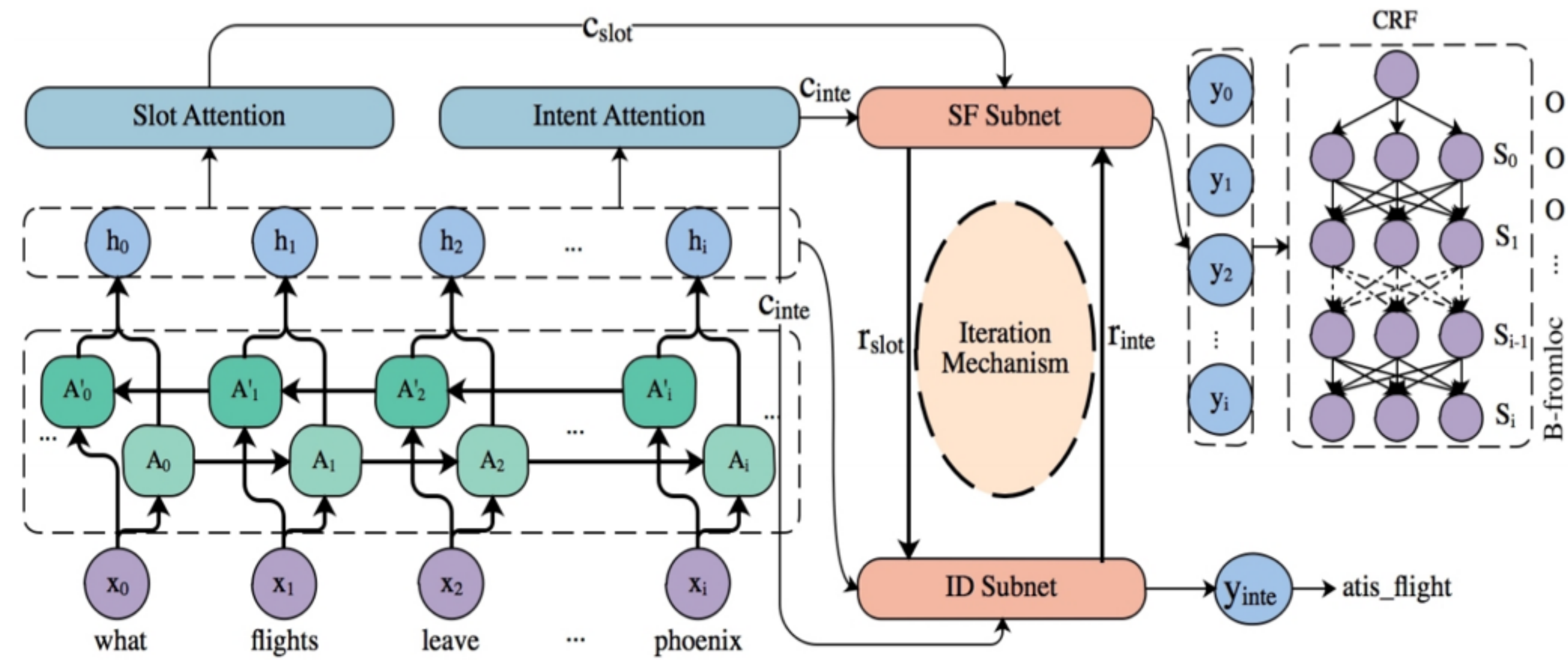
Sentence	what	flights	leave	from	phoenix
Slots	O	O	O	O	B-fromloc
Intent	atis_flight				

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)

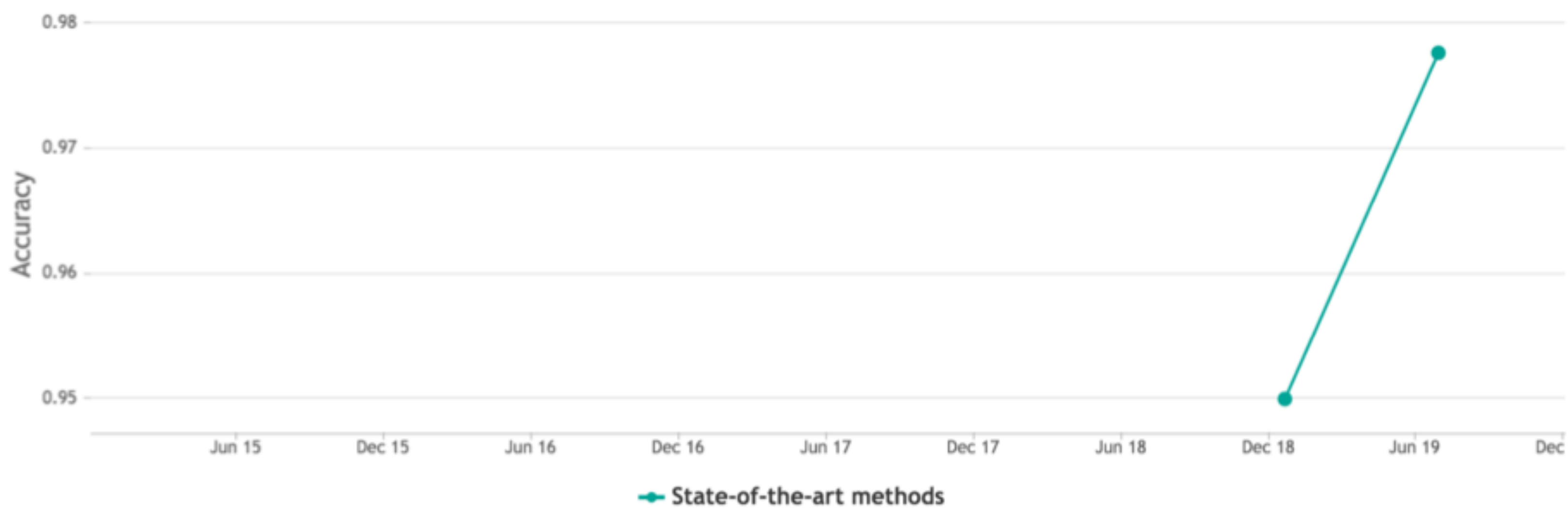
A Novel Bi-directional Interrelated Model for Joint Intent Detection and Slot Filling



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.

Intent Detection on ATIS State-of-the-art

Intent Detection on ATIS

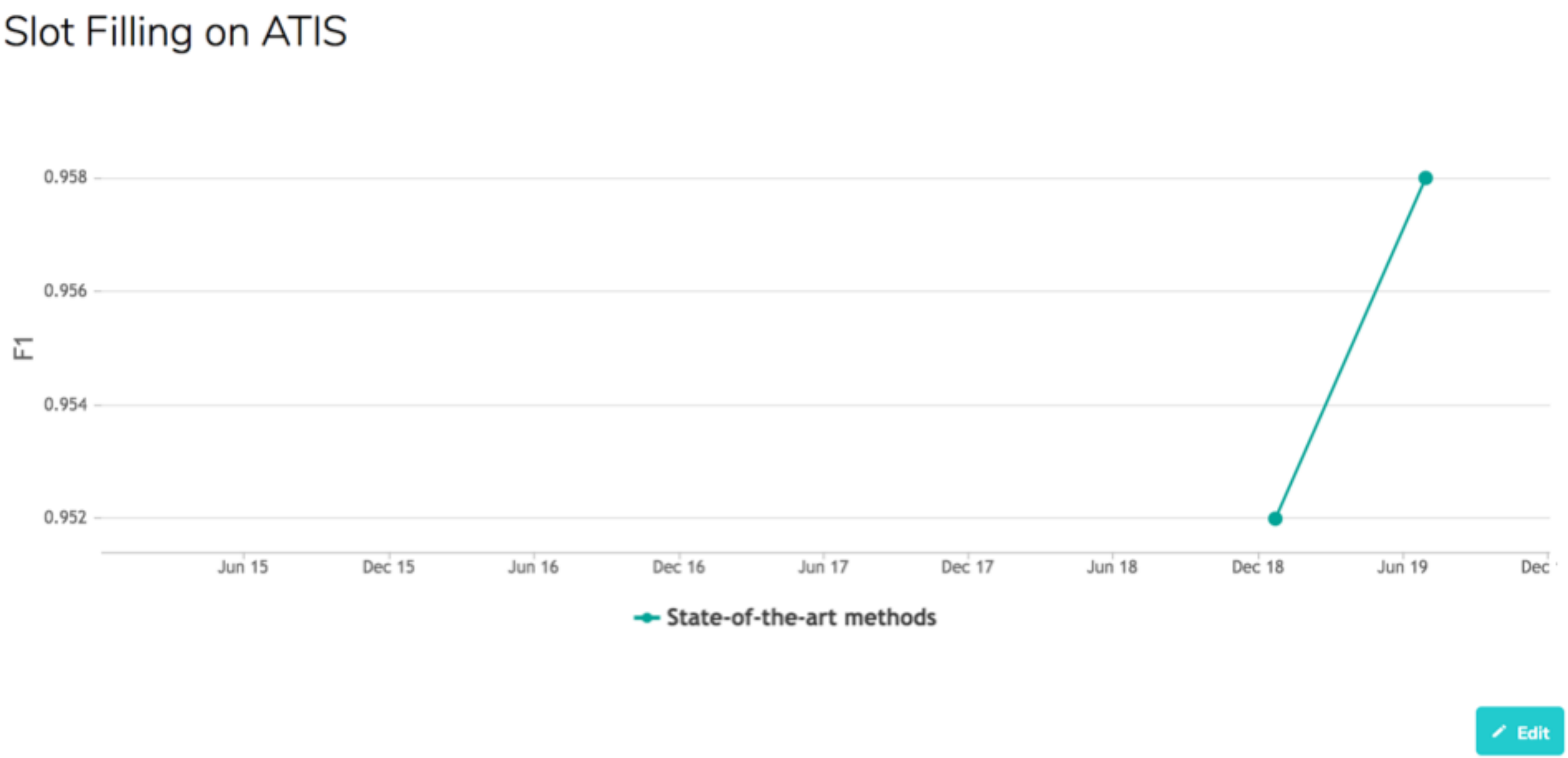


Edit

RANK	METHOD	ACCURACY	PAPER TITLE	YEAR	PAPER	CODE
1	SF-ID	0.9776	A Novel Bi-directional Interrelated Model for Joint Intent Detection and Slot Filling	2019		
2	Capsule-NLU	0.950	Joint Slot Filling and Intent Detection via Capsule Neural Networks	2018		

Source: https://paperswithcode.com/sota/intent-detection-on-atis

Slot Filling on ATIS State-of-the-art



RANK	METHOD	F1	PAPER TITLE	YEAR	PAPER	CODE
1	SF-ID	0.958	A Novel Bi-directional Interrelated Model for Joint Intent Detection and Slot Filling	2019		
2	Capsule-NLU	0.952	Joint Slot Filling and Intent Detection via Capsule Neural Networks	2018		

Source: https://paperswithcode.com/sota/slot-filling-on-atis

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

<table>
<tr><th>MultiWOZ</th><th>CrossWOZ</th></tr>
<tr><td>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?</td><td rowspan="3">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?</td></tr>
<tr><th>Schema</th></tr>
<tr><td>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.</td></tr>
</table>

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

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

1 你好，帮我找一个免费的景点。
Hello, find me a free attraction please.

Attraction: fee=free

天安门广场怎么样?
How about Tiananmen Square?

. . .

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

5 多谢。我还想在天安门广场旁边找一家有叫醒服务的酒店住宿。
Thanks. I'm also looking for a place to stay near Tiananmen Square. It must have wake-up call.

Hotel: nearby=Tiananmen Square,
facilities=[wake-up call]

向您推荐北京首都宾馆。
I recommend you Beijing Capital Hotel.

. . .

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

7 帮我叫一辆从天安门广场到酒店的出租车吧，告诉我车型和车牌。
Book a taxi from Tiananmen Square to the hotel. Tell me the car type and plate number.

Taxi: from=Tiananmen Square,
to=Beijing Capital Hotel

好的。车型是 #CX, 车牌是 #CP。
Ok. Car type is #CX. Plate number is #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

python101.ipynb
File Edit View Insert Runtime Tools Help All changes saved
Comment Share
+ Code + Text RAM Disk Editing

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Section

Question Answering and Dialogue Systems

Question Answering (QA)

BERT for Question Answering

Source: Apoorv Nandan (2020), BERT (from HuggingFace Transformers) for Text Extraction, https://keras.io/examples/nlp/text_extraction_with_bert/

Description: Fine tune pretrained BERT from HuggingFace Transformers on SQuAD.

Introduction

This demonstration uses SQuAD (Stanford Question-Answering Dataset). In SQuAD, an input consists of a question, and a paragraph for context. The goal is to find the span of text in the paragraph that answers the question. We evaluate our performance on this data with the "Exact Match" metric, which measures the percentage of predictions that exactly match any one of the ground-truth answers.

We fine-tune a BERT model to perform this task as follows:

1. Feed the context and the question as inputs to BERT.
2. Take two vectors S and T with dimensions equal to that of hidden states in BERT.
3. Compute the probability of each token being the start and end of the answer span. The probability of a token being the start of the answer is given by a dot product between S and the representatio of the token in the last layer of BERT, followed by a softmax over all tokens. The probability of a token being the end of the answer is compute similarly with the vector T.
4. Fine-tune BERT and learn S and T along the way.

References:

- BERT
- SQuAD

https://tinyurl.com/imtkupython101

Python in Google Colab (Python101)

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

python101.ipynb

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Downloading: 100% 536M/536M [00:29<00:00, 18.3MB/s]

```
Model: "model"
__________________________________________________________________________________________________
Layer (type)                    Output Shape         Param #     Connected to
==================================================================================================
input_1 (InputLayer)            [(None, 384)]        0
__________________________________________________________________________________________________
input_3 (InputLayer)            [(None, 384)]        0
__________________________________________________________________________________________________
input_2 (InputLayer)            [(None, 384)]        0
__________________________________________________________________________________________________
tf_bert_model (TFBertModel)     ((None, 384, 768), ( 109482240   input_1[0][0]
__________________________________________________________________________________________________
start_logit (Dense)             (None, 384, 1)       768         tf_bert_model[0][0]
__________________________________________________________________________________________________
end_logit (Dense)               (None, 384, 1)       768         tf_bert_model[0][0]
__________________________________________________________________________________________________
flatten (Flatten)               (None, 384)          0           start_logit[0][0]
__________________________________________________________________________________________________
flatten_1 (Flatten)             (None, 384)          0           end_logit[0][0]
__________________________________________________________________________________________________
activation_7 (Activation)       (None, 384)          0           flatten[0][0]
__________________________________________________________________________________________________
activation_8 (Activation)       (None, 384)          0           flatten_1[0][0]
==================================================================================================
Total params: 109,483,776
Trainable params: 109,483,776
Non-trainable params: 0
__________________________________________________________________________________________________
CPU times: user 20.8 s, sys: 7.75 s, total: 28.5 s
Wall time: 1min 42s
```

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Dialogue Systems

```
[ ] #Source: Olivier Grisel (2020), Transformers (BERT fine-tuning): Joint Intent Classification and S
    #https://github.com/m2dsupsdlclass/lectures-labs/blob/master/labs/06_deep_nlp/Transformers_Joint_I
```

Joint Intent Classification and Slot Filling with Transformers

The goal of this notebook is to fine-tune a pretrained transformer-based neural network model to convert a user query expressed in English into a representation that is structured enough to be processed by an automated service.

Here is an example of interpretation computed by such a Natural Language Understanding system:

```
>>> nlu("Book a table for two at Le Ritz for Friday night",
        tokenizer, joint_model, intent_names, slot_names)
```

```
{
    'intent': 'BookRestaurant',
    'slots': {
        'party_size_number': 'two',
        'restaurant_name': 'Le Ritz',
        'timeRange': 'Friday night'
    }
}
```

Intent classification is a simple sequence classification problem. The trick is to treat the structured knowledge extraction part ("Slot Filling") as token-level classification problem using BIO-annotations:

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```python
def show_predictions(text, tokenizer, model, intent_names, slot_names):
    inputs = tf.constant(tokenizer.encode(text))[None, :]  # batch_size = 1
    outputs = model(inputs)
    slot_logits, intent_logits = outputs
    slot_ids = slot_logits.numpy().argmax(axis=-1)[0, 1:-1]
    intent_id = intent_logits.numpy().argmax(axis=-1)[0]
    print("Text:", text)
    print("Intent:", intent_names[intent_id])
    print("Slots:")
    for token, slot_id in zip(tokenizer.tokenize(text), slot_ids):
        print(f"{token:>10} : {slot_names[slot_id]}")

show_predictions("Book a table for two at Le Ritz for Friday night!",
                 tokenizer, joint_model, intent_names, slot_names)
```

```
Text: Book a table for two at Le Ritz for Friday night!
Intent: BookRestaurant
Slots:
      Book : O
         a : O
     table : O
       for : O
       two : B-party_size_number
        at : O
        Le : B-restaurant_name
         R : I-restaurant_name
     ##itz : I-restaurant_name
       for : O
    Friday : B-timeRange
     night : O
         ! : O
```

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```python
            # Naive BIO: handling: treat B- and I- the same...
            new_slot_name = current_word_slot_name[2:]
            if active_slot_name is None:
                active_slot_words.append(word)
                active_slot_name = new_slot_name
            elif new_slot_name == active_slot_name:
                active_slot_words.append(word)
            else:
                collected_slots[active_slot_name] = " ".join(active_slot_words)
                active_slot_words = [word]
                active_slot_name = new_slot_name
    if active_slot_name:
        collected_slots[active_slot_name] = " ".join(active_slot_words)
    info["slots"] = collected_slots
    return info

def nlu(text, tokenizer, model, intent_names, slot_names):
    inputs = tf.constant(tokenizer.encode(text))[None, :]  # batch_size = 1
    outputs = model(inputs)
    slot_logits, intent_logits = outputs
    slot_ids = slot_logits.numpy().argmax(axis=-1)[0, 1:-1]
    intent_id = intent_logits.numpy().argmax(axis=-1)[0]

    return decode_predictions(text, tokenizer, intent_names, slot_names,
                              intent_id, slot_ids)

nlu("Book a table for two at Le Ritz for Friday night",
    tokenizer, joint_model, intent_names, slot_names)
```

```
{'intent': 'BookRestaurant',
 'slots': {'party_size_number': 'two',
  'restaurant_name': 'Le Ritz',
  'timeRange': 'Friday night'}}
```

https://tinyurl.com/imtkupython101

NLP Benchmark Datasets

Task	Dataset	Link
Machine Translation	WMT 2014 EN-DE WMT 2014 EN-FR	http://www-lium.univ-lemans.fr/~schwenk/cslm_joint_paper/
Text Summarization	CNN/DM Newsroom DUC Gigaword	https://cs.nyu.edu/~kcho/DMQA/ https://summari.es/ https://www-nlpir.nist.gov/projects/duc/data.html https://catalog.ldc.upenn.edu/LDC2012T21
Reading Comprehension Question Answering Question Generation	ARC CliCR CNN/DM NewsQA RACE SQuAD Story Cloze Test NarativeQA Quasar SearchQA	http://data.allenai.org/arc/ http://aclweb.org/anthology/N18-1140 https://cs.nyu.edu/~kcho/DMQA/ https://datasets.maluuba.com/NewsQA http://www.qizhexie.com/data/RACE_leaderboard https://rajpurkar.github.io/SQuAD-explorer/ http://aclweb.org/anthology/W17-0906.pdf https://github.com/deepmind/narrativeqa https://github.com/bdhingra/quasar https://github.com/nyu-dl/SearchQA
Semantic Parsing	AMR parsing ATIS (SQL Parsing) WikiSQL (SQL Parsing)	https://amr.isi.edu/index.html https://github.com/jkkummerfeld/text2sql-data/tree/master/data https://github.com/salesforce/WikiSQL
Sentiment Analysis	IMDB Reviews SST Yelp Reviews Subjectivity Dataset	http://ai.stanford.edu/~amaas/data/sentiment/ https://nlp.stanford.edu/sentiment/index.html https://www.yelp.com/dataset/challenge http://www.cs.cornell.edu/people/pabo/movie-review-data/
Text Classification	AG News DBpedia TREC 20 NewsGroup	http://www.di.unipi.it/~gulli/AG_corpus_of_news_articles.html https://wiki.dbpedia.org/Datasets https://trec.nist.gov/data.html http://qwone.com/~jason/20Newsgroups/
Natural Language Inference	SNLI Corpus MultiNLI SciTail	https://nlp.stanford.edu/projects/snli/ https://www.nyu.edu/projects/bowman/multinli/ http://data.allenai.org/scitail/
Semantic Role Labeling	Proposition Bank OneNotes	http://propbank.github.io/ https://catalog.ldc.upenn.edu/LDC2013T19

Source: Amirsina Torfi, Rouzbeh A. Shirvani, Yaser Keneshloo, Nader Tavvaf, and Edward A. Fox (2020). "Natural Language Processing Advancements By Deep Learning: A Survey." arXiv preprint arXiv:2003.01200.

Summary

- Question Answering
- Dialogue Systems

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