

Artificial Intelligence

Introduction to Artificial Intelligence

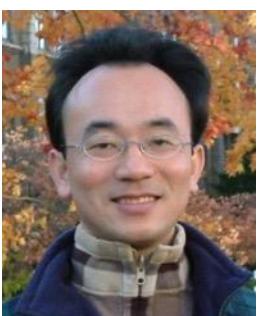
1141AI01

MBA, IM, NTPU (M5276) (Fall 2025)

Tue 2, 3, 4 (9:10-12:00) (B3F17)



<https://meet.google.com/paj-zhhj-mya>



Min-Yuh Day, Ph.D,
Professor and Director

Institute of Information Management, National Taipei University

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





國立臺北大學
National Taipei University



Prof. Min-Yuh Day

NVIDIA.
University Ambassador
Certified Instructor

Director, Information Management, NTPU

Director, Intelligent Financial Innovation Technology, IFIT Lab, IM, NTPU

Director, Fintech and Green Finance Center (FGFC), NTPU

Division Director, Sustainable Development, Sustainability Office, NTPU

Visiting Scholar, IIS, Academia Sinica

Ph.D., Information Management, NTU

**Artificial Intelligence, Agentic AI, ESG and Green Financial Technology,
Big Data Analytics, Electronic Commerce**

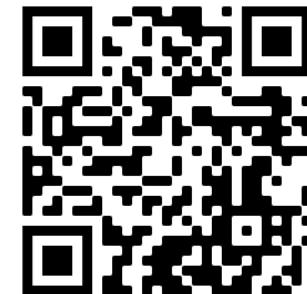


Course Syllabus

National Taipei University

Academic Year 114, 1st Semester (Fall 2025)

- Course Title: **Artificial Intelligence**
- Instructor: Min-Yuh Day
- Course Class: MBA, IM, NTPU (3 Credits, Elective)
- Details
 - In-Class and Distance Learning EMI Course (3 Credits, Elective, One Semester) (M5276)
- Time & Place: Tue, 2, 3, 4, (9:10-12:00) (B3F17)
- Google Meet: <https://meet.google.com/paj-zhhj-mya>



<https://meet.google.com/paj-zhhj-mya>



Course Objectives

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

Course Outline

- This course introduces the **fundamental concepts, research issues, and hands-on practices of Artificial Intelligence**.
- Topics include:
 1. Introduction to Artificial Intelligence
 2. Artificial Intelligence and Intelligent Agents; Problem Solving
 3. Knowledge, Reasoning and Knowledge Representation
 4. Uncertain Knowledge and Reasoning
 5. Machine Learning: Supervised and Unsupervised Learning
 6. The Theory of Learning and Ensemble Learning
 7. NVIDIA Fundamentals of Deep Learning
 8. Natural Language Processing
 9. Computer Vision and Robotics
 10. Generative AI, Agentic AI, and Physical AI
 11. Philosophy and Ethics of AI and the Future of AI
 12. Case Study on AI

Core Competence

- Exploring new knowledge in information technology, system development and application 80 %
- Internet marketing planning ability 10 %
- Thesis writing and independent research skills 10 %

Four Fundamental Qualities

- Professionalism
 - Creative thinking and Problem-solving 40 %
 - Comprehensive Integration 40 %
- Interpersonal Relationship
 - Communication and Coordination 10 %
 - Teamwork 5 %
- Ethics
 - Honesty and Integrity 0 %
 - Self-Esteem and Self-reflection 0 %
- International Vision
 - Caring for Diversity 0 %
 - Interdisciplinary Vision 5 %

College Learning Goals

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

Department Learning Goals

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

Syllabus

Week Date Subject/Topics

1 2025/09/09 Introduction to Artificial Intelligence

**2 2025/09/16 Artificial Intelligence and Intelligent Agents;
Problem Solving**

**3 2025/09/23 Knowledge, Reasoning and Knowledge Representation;
Uncertain Knowledge and Reasoning**

4 2025/09/30 Case Study on Artificial Intelligence I

**5 2025/10/07 Machine Learning: Supervised and Unsupervised Learning;
The Theory of Learning and Ensemble Learning**

Syllabus

Week Date Subject/Topics

6 2025/10/14 NVIDIA Fundamentals of Deep Learning I:
Deep Learning; Neural Networks

7 2025/10/21 NVIDIA Fundamentals of Deep Learning II:
Convolutional Neural Networks;
Data Augmentation and Deployment

8 2025/10/28 Self-Learning

9 2025/11/04 Midterm Project Report

10 2025/11/11 NVIDIA Fundamentals of Deep Learning III:
Pre-trained Models; Natural Language Processing

Syllabus

Week Date Subject/Topics

11 2025/11/18 Case Study on Artificial Intelligence II

12 2025/11/25 Computer Vision and Robotics

13 2025/12/02 Generative AI, Agentic AI, and Physical AI

14 2025/12/09 Philosophy and Ethics of AI and the Future of AI

15 2025/12/16 Final Project Report I

16 2025/12/23 Final Project Report II

Teaching Methods and Activities

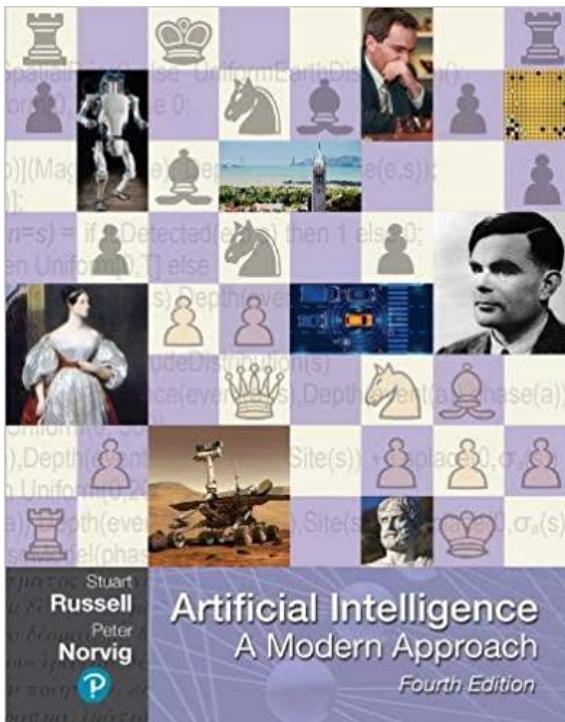
- Lecture
- Discussion
- Practicum

Evaluation Methods

- Individual Presentation 60 %
- Group Presentation 10 %
- Case Report 10 %
- Class Participation 10 %
- Assignment 10 %

Required Texts

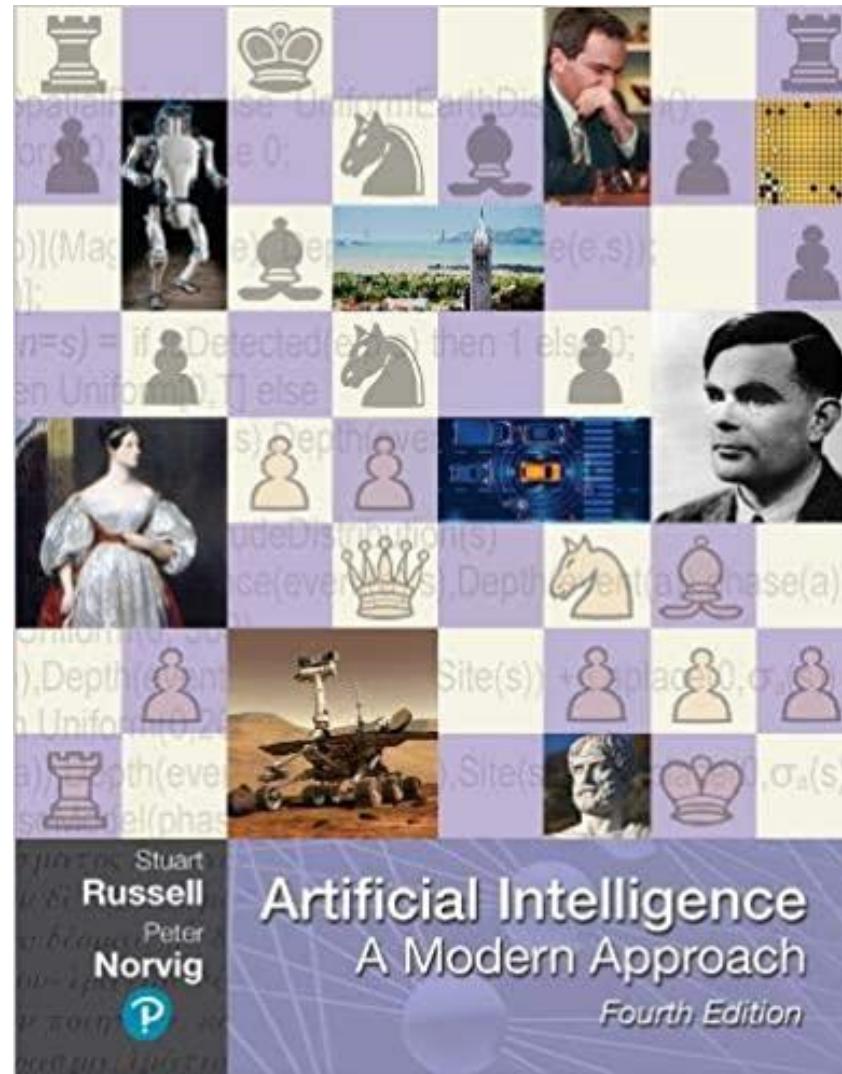
Stuart Russell and Peter Norvig (2020),
Artificial Intelligence: A Modern Approach,
4th Edition, Pearson.



Reference Books

- Thomas R. Caldwell (2025), The Agentic AI Bible: The Complete and Up-to-Date Guide to Design, Build, and Scale Goal-Driven, LLM-Powered Agents that Think, Execute and Evolve, Independently published
- Numa Dhamani and Maggie Engler (2024), Introduction to Generative AI, Manning
- Denis Rothman (2024), Transformers for Natural Language Processing and Computer Vision - Third Edition: Explore Generative AI and Large Language Models with Hugging Face, ChatGPT, GPT-4V, and DALL-E 3, 3rd ed. Edition, Packt Publishing
- Ben Auffarth (2023), Generative AI with LangChain: Build large language model (LLM) apps with Python, ChatGPT and other LLMs, Packt Publishing.
- Aurélien Géron (2022), Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, 3rd Edition, O'Reilly Media.
- Steven D'Ascoli (2022), Artificial Intelligence and Deep Learning with Python: Every Line of Code Explained For Readers New to AI and New to Python, Independently published.
- Nithin Buduma, Nikhil Buduma, Joe Papa (2022), Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms, 2nd Edition, O'Reilly Media.

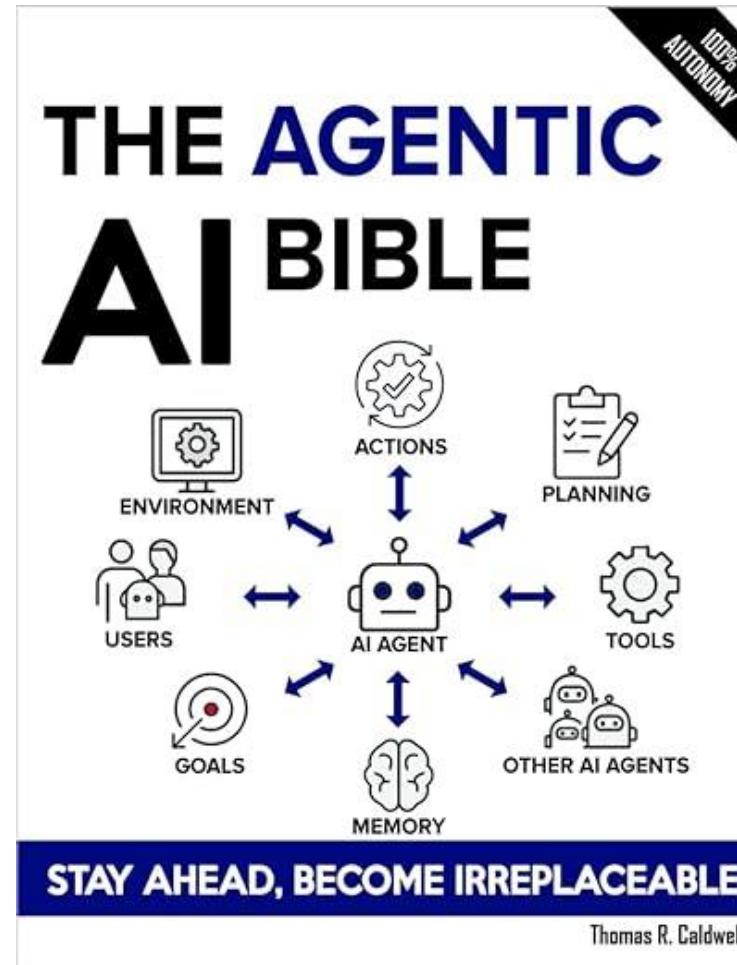
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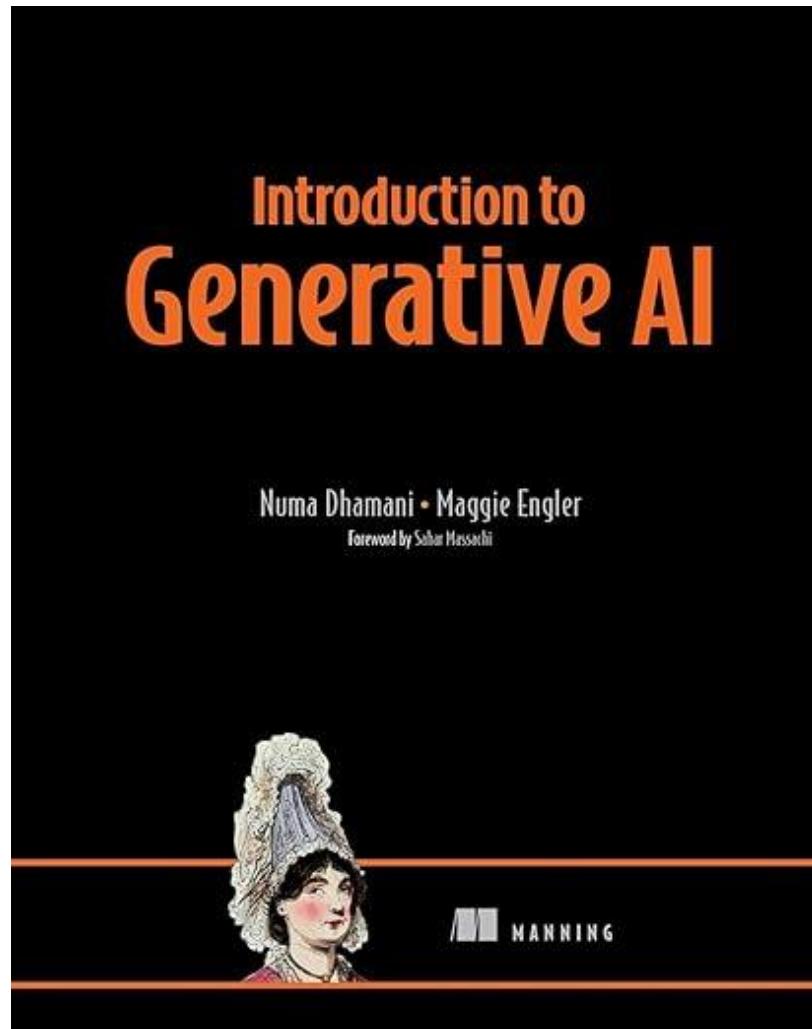
Source: Stuart Russell and Peter Norvig (2020), Artificial Intelligence: A Modern Approach, 4th Edition, Pearson

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Numa Dhamani and Maggie Engler (2024),
Introduction to Generative AI,
Manning



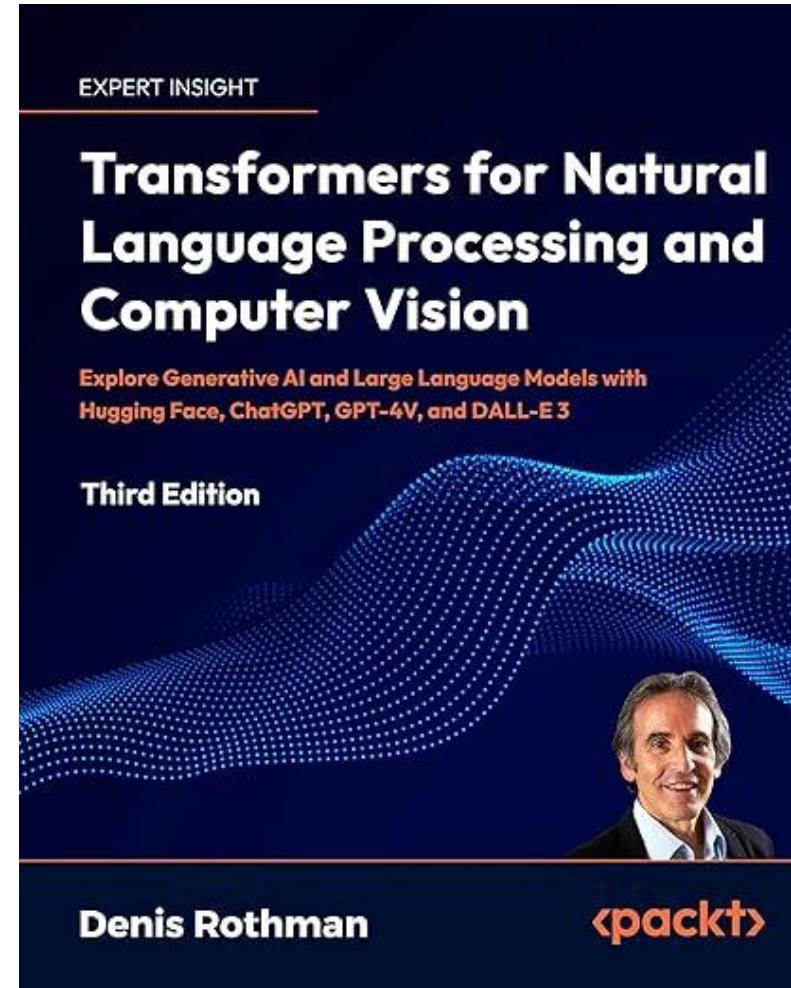
Source: Numa Dhamani and Maggie Engler (2024), Introduction to Generative AI, Manning
<https://www.amazon.com/Introduction-Generative-AI-Numa-Dhamani/dp/1633437191/>

Denis Rothman (2024),

Transformers for Natural Language Processing and Computer Vision:

Explore Generative AI and Large Language Models with Hugging Face, ChatGPT, GPT-4V, and DALL-E 3,

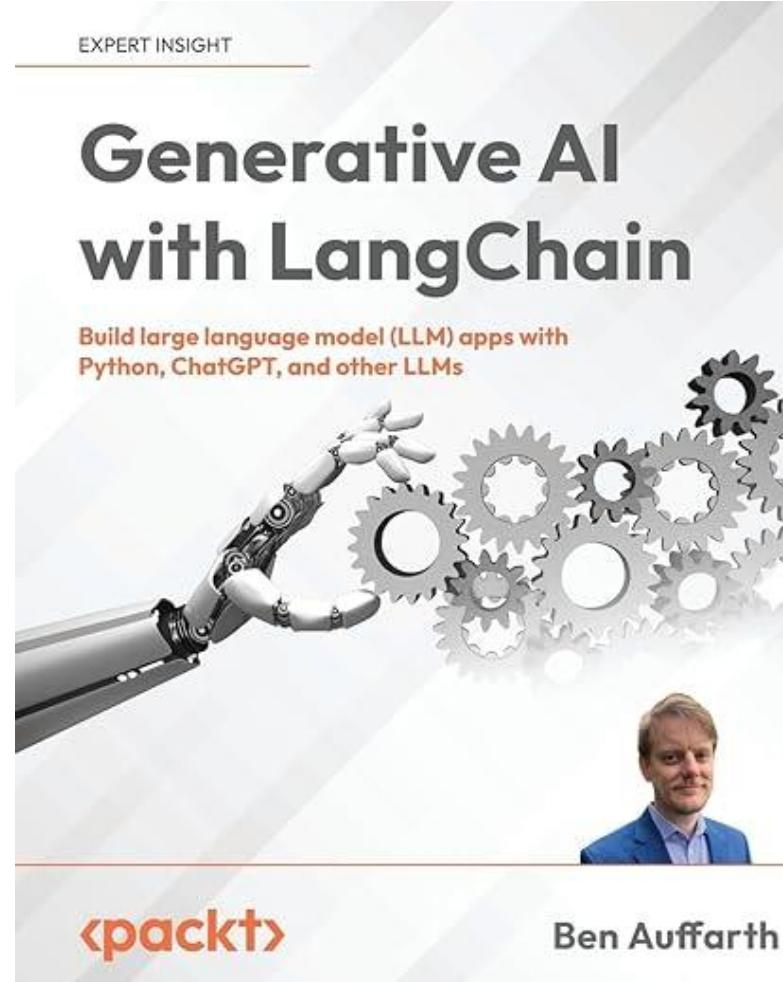
3rd Edition, Packt Publishing



Ben Auffarth (2023),

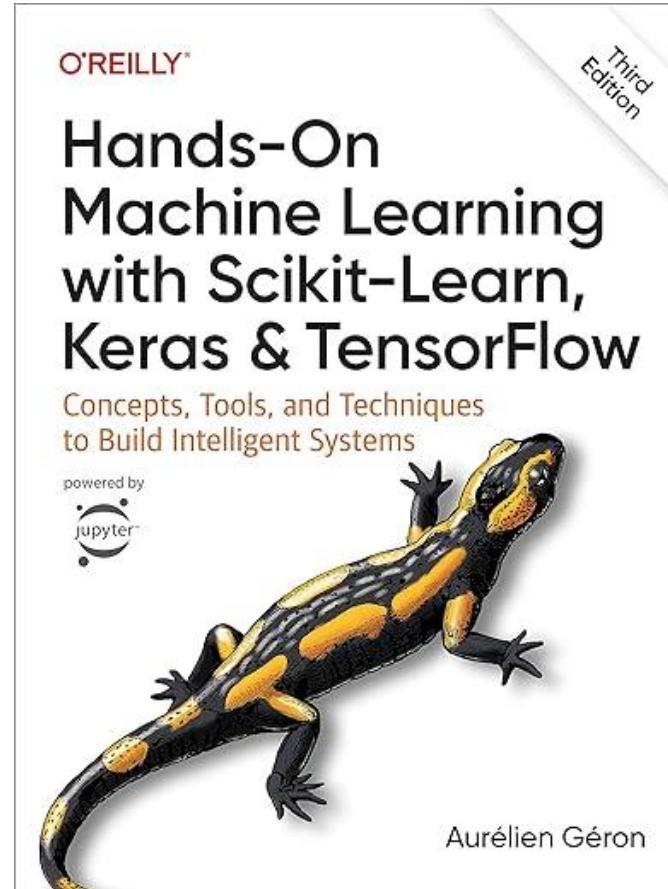
Generative AI with LangChain:

Build large language model (LLM) apps with Python, ChatGPT and other LLMs,
Packt Publishing.



Aurélien Géron (2022),

Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, 3rd Edition, O'Reilly Media

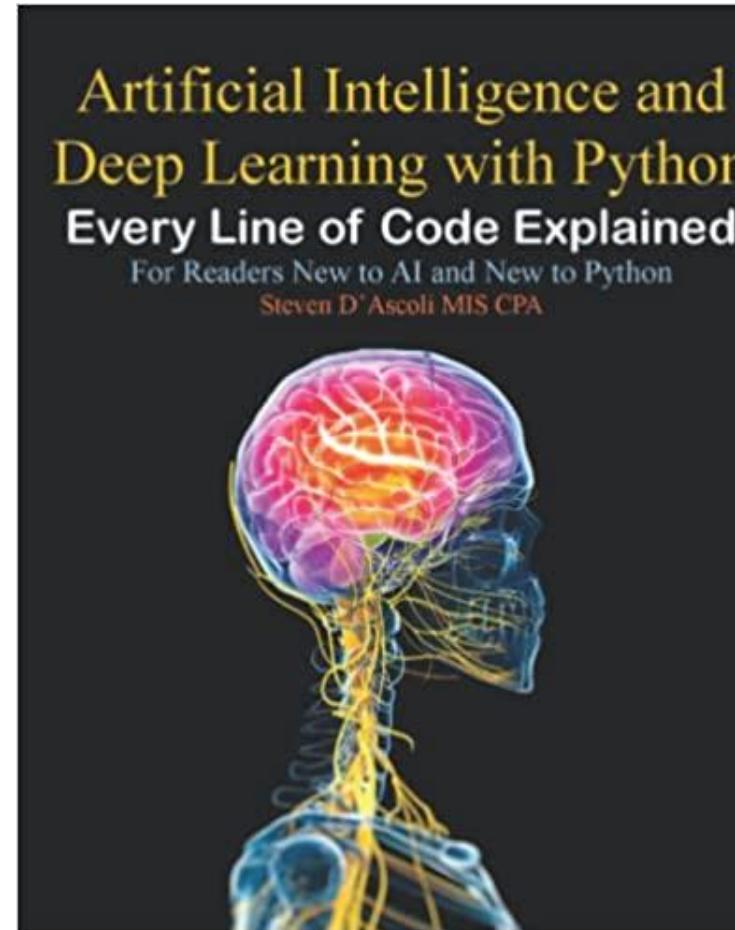


<https://github.com/ageron/handson-ml3>

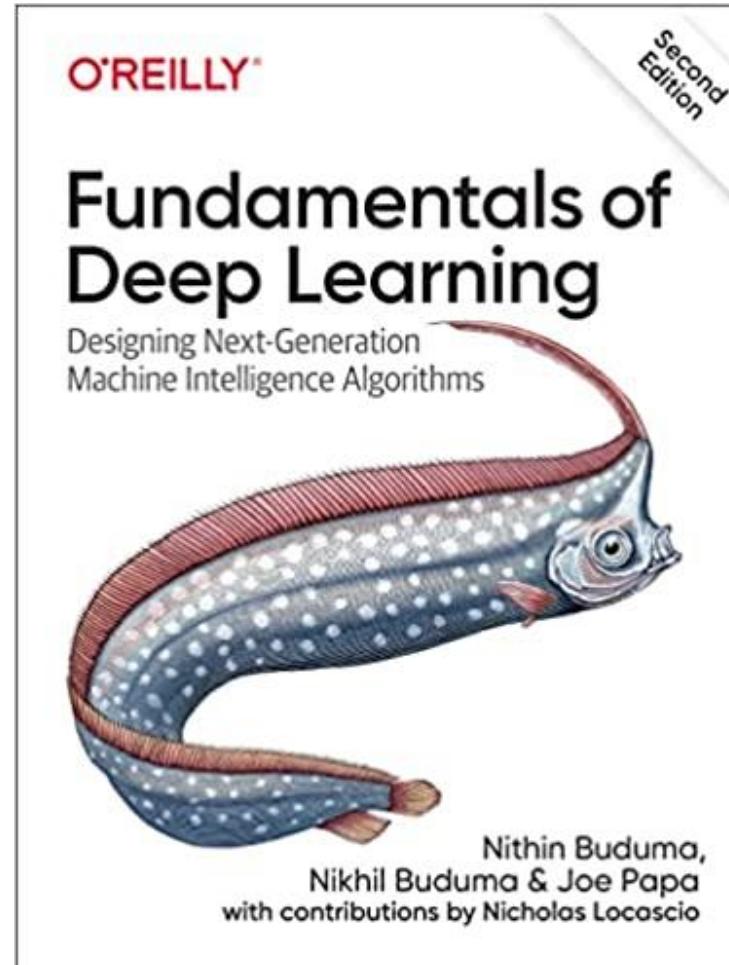
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Nithin Buduma, Nikhil Buduma, Joe Papa (2022),
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2nd Edition, O'Reilly Media.



NVIDIA Developer Program

<https://developer.nvidia.com/join-nvidia-developer-program>

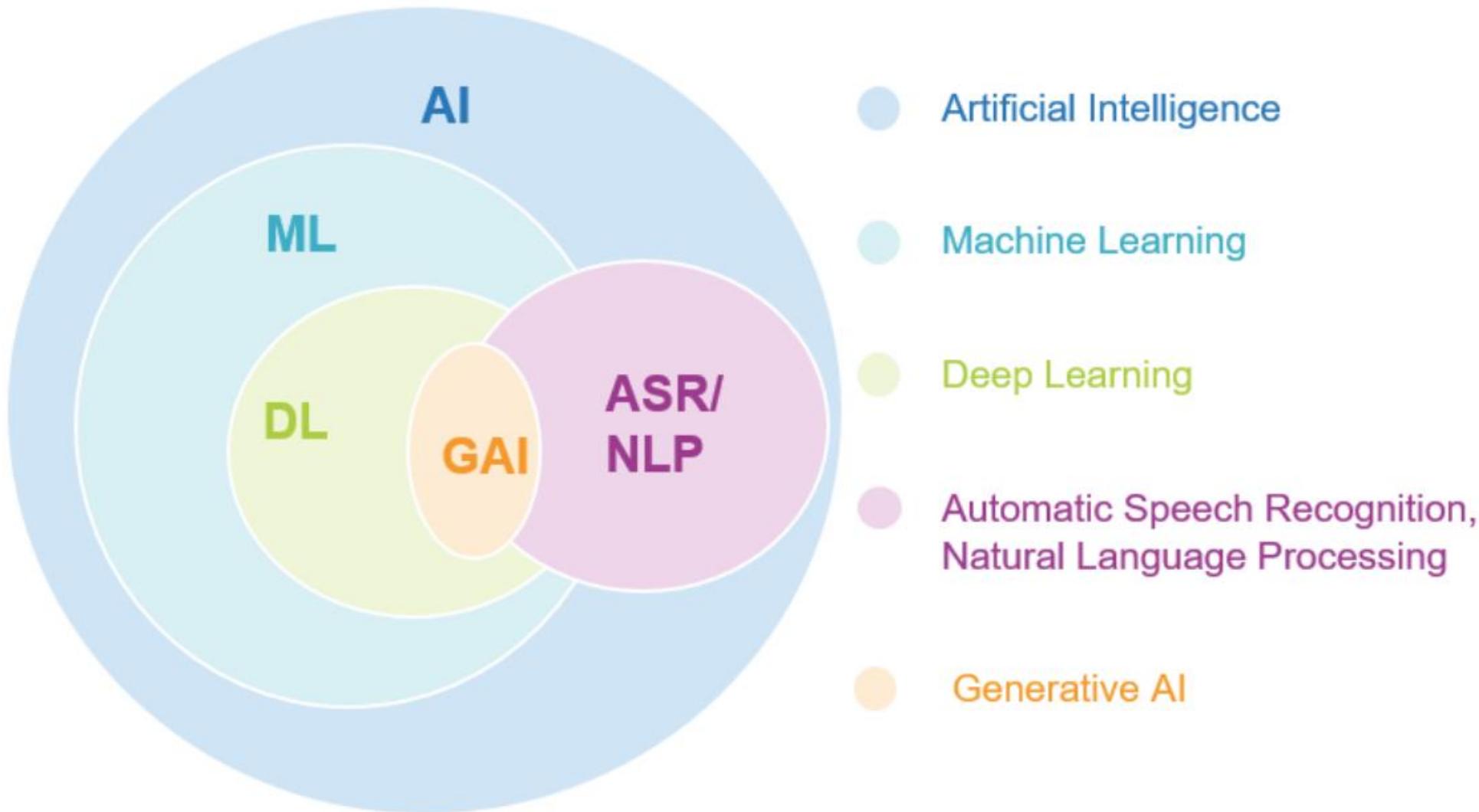
NVIDIA

Deep Learning Institute (DLI)

<https://learn.nvidia.com/>

Artificial Intelligence (AI)

AI, ML, DL, Generative AI



Generative AI, Agentic AI, Physical AI



Physical AI

Self-driving cars
General robotics



Agentic AI

Coding assistants
Customer service
Patient care



Generative AI

Digital marketing
Content creation



Perception AI

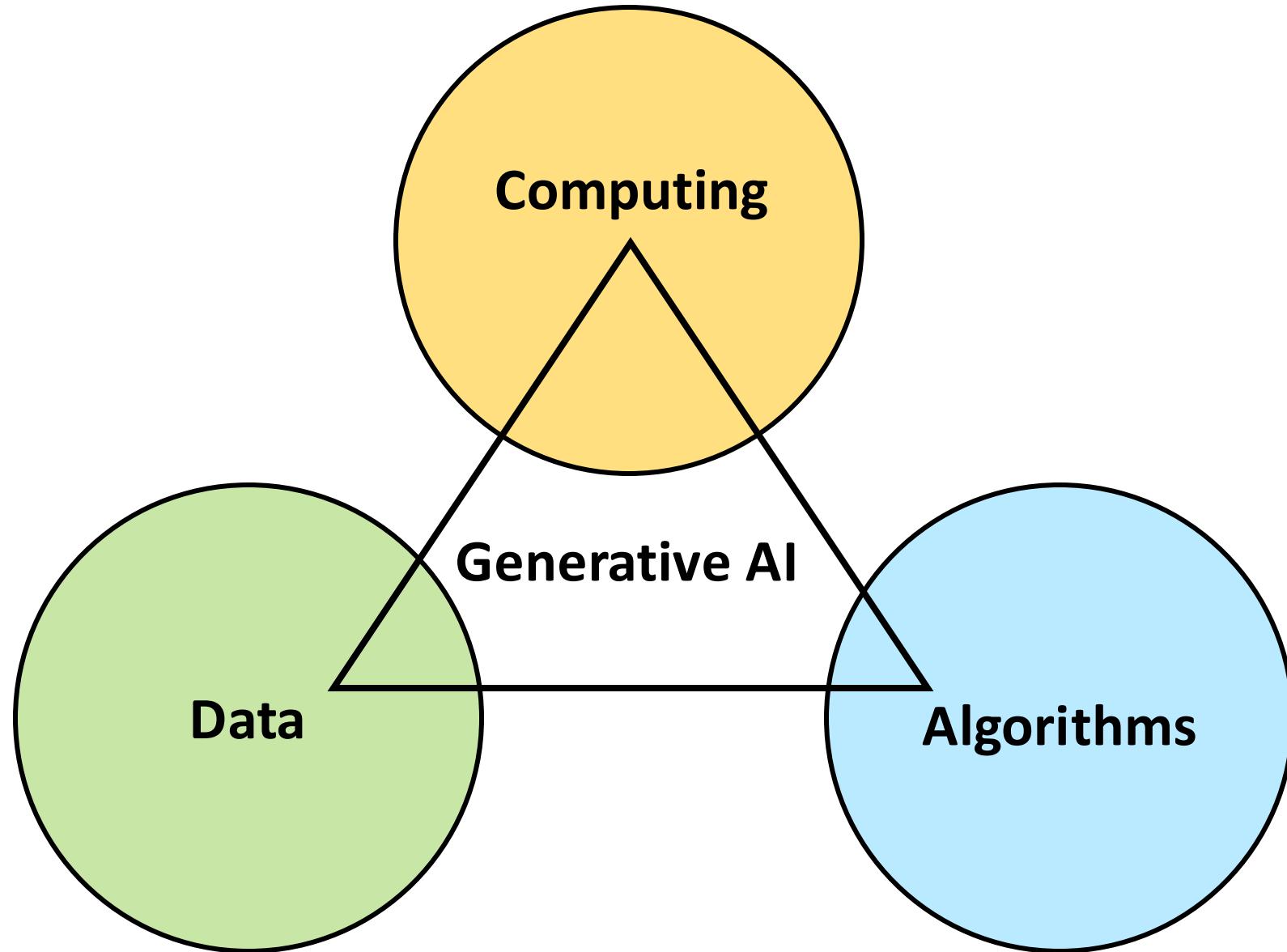
Speech recognition
Deep recommender systems
Medical imaging

2012 AlexNet

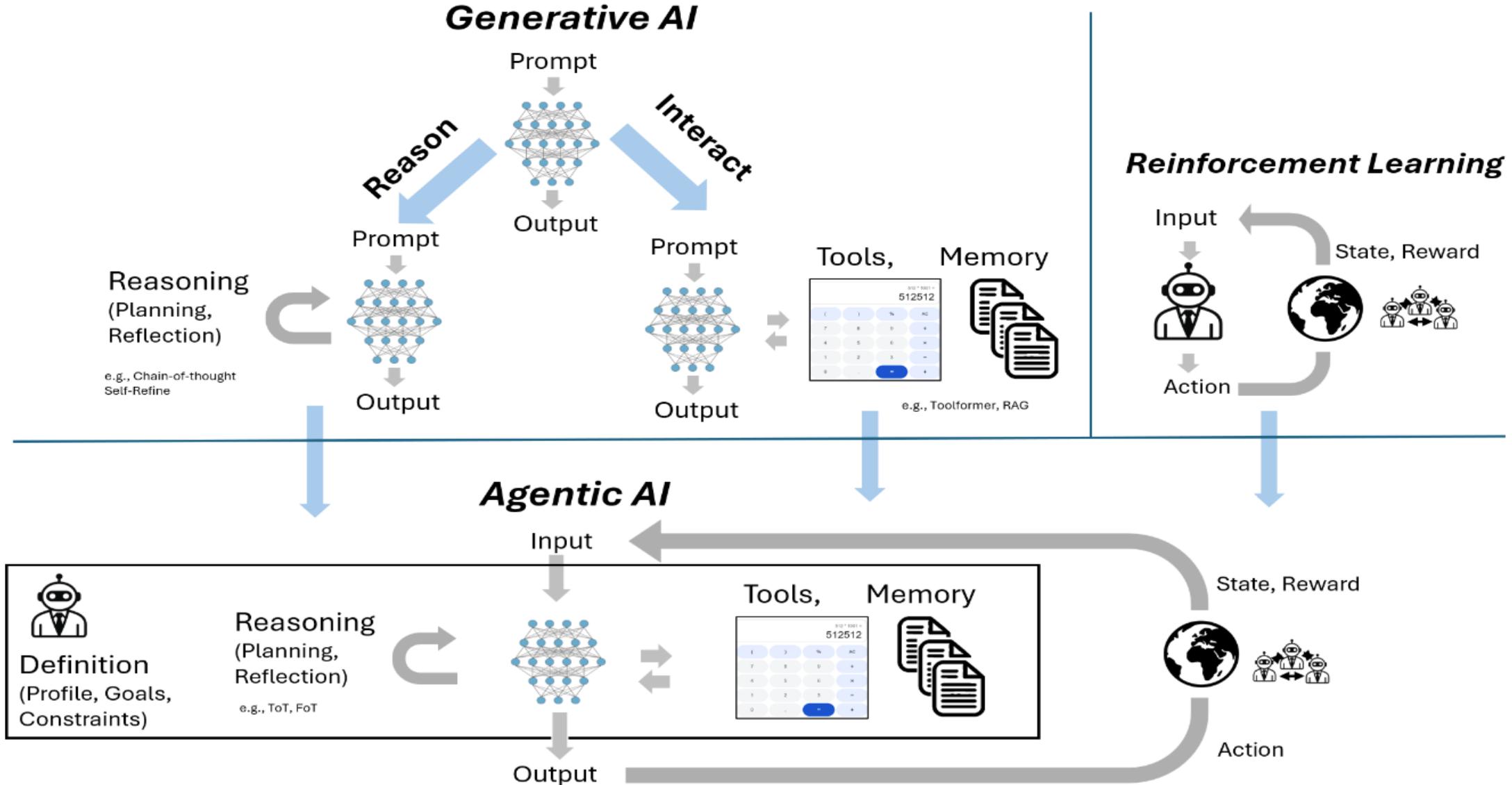


Deep learning breakthrough

Generative AI



From Generative AI to Agentic AI

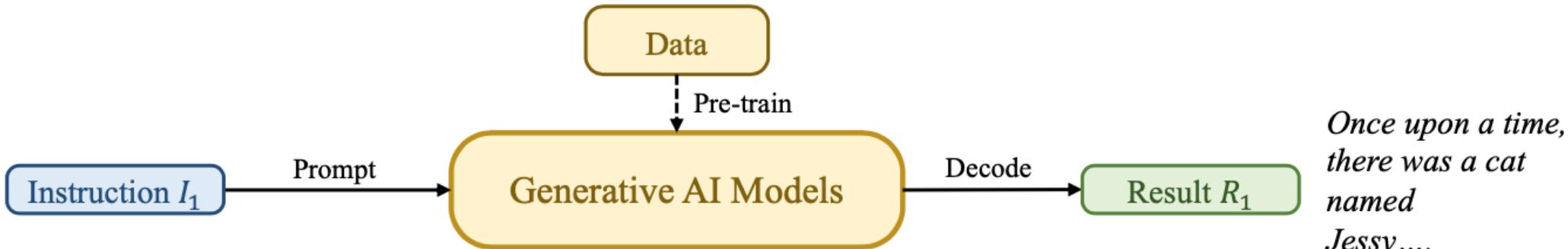


Generative AI (Gen AI)

AI Generated Content (AIGC)

Unimodal

Please write a story about a cat.



Multimodal



Describe this picture.

Instruction I_2

Prompt

Draw a picture of a cat.

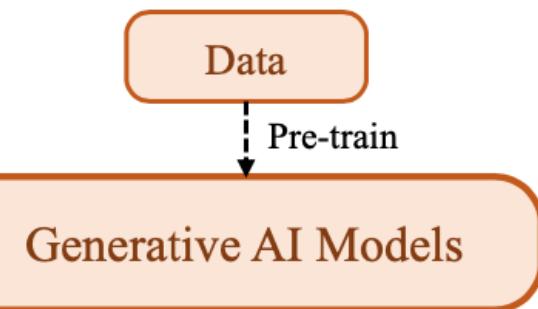
Instruction I_3

Prompt

Write a song about a cat.

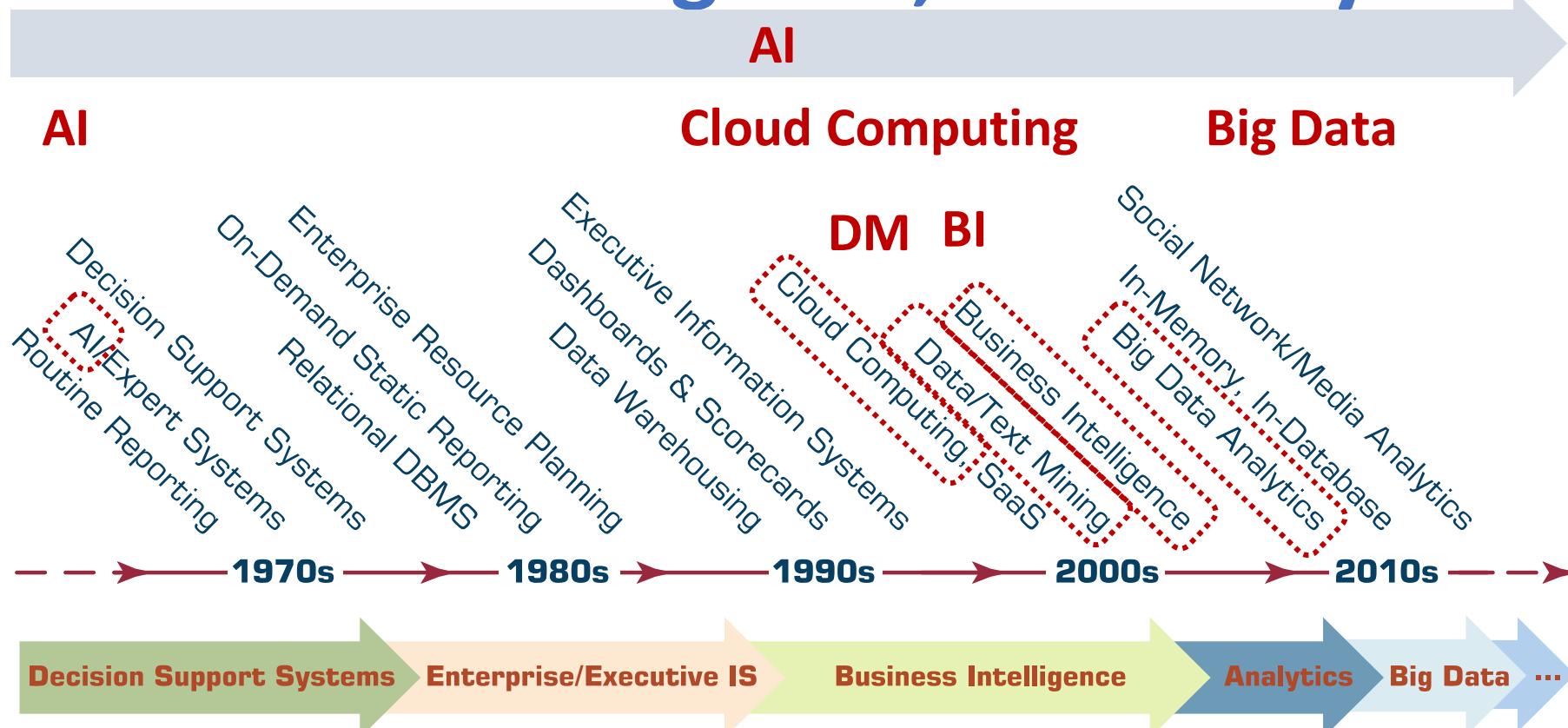
Instruction I_4

Prompt

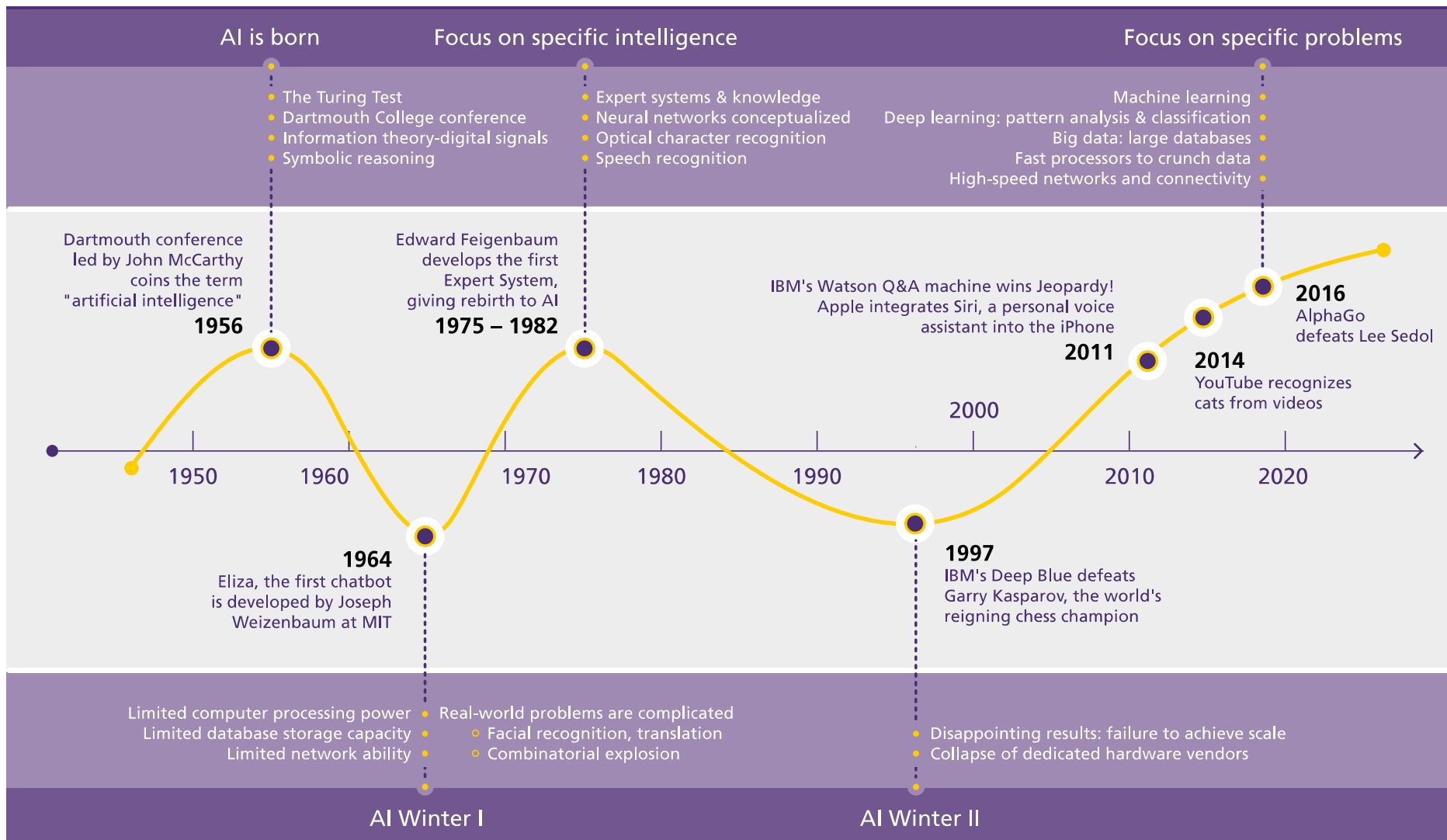


AI, Big Data, Cloud Computing

Evolution of Decision Support, Business Intelligence, and Analytics



The Rise of AI



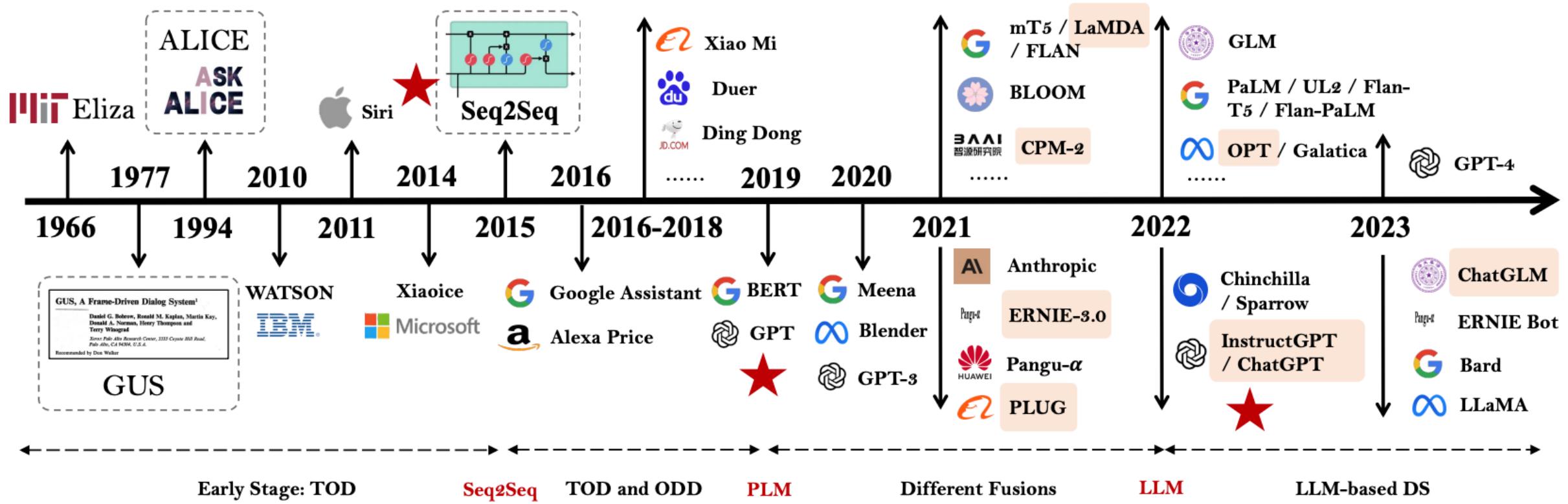
The Development of LM-based Dialogue Systems

1) Early Stage (1966 - 2015)

2) The Independent Development of TOD and ODD (2015 - 2019)

3) Fusions of Dialogue Systems (2019 - 2022)

4) LLM-based DS (2022 - Now)



Definition of Artificial Intelligence (A.I.)

Artificial Intelligence

**“... the science and
engineering
of
making
intelligent machines”**

(John McCarthy, 1955)

Artificial Intelligence

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

Artificial Intelligence

“... intelligence
exhibited by machines
or software”

4 Approaches of AI

Thinking Humanly	Thinking Rationally
Acting Humanly	Acting Rationally

4 Approaches of AI

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

AI Acting Humanly: The Turing Test Approach

(Alan Turing, 1950)

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

Artificial Intelligence: A Modern Approach

- 1. Artificial Intelligence**
- 2. Problem Solving**
- 3. Knowledge and Reasoning**
- 4. Uncertain Knowledge and Reasoning**
- 5. Machine Learning**
- 6. Communicating, Perceiving, and Acting**
- 7. Philosophy and Ethics of AI**

Artificial Intelligence: Intelligent Agents

Artificial Intelligence:

2. Problem Solving

- Solving Problems by Searching**
- Search in Complex Environments**
- Adversarial Search and Games**
- Constraint Satisfaction Problems**

Artificial Intelligence:

3. Knowledge and Reasoning

- **Logical Agents**
- **First-Order Logic**
- **Inference in First-Order Logic**
- **Knowledge Representation**
- **Automated Planning**

Artificial Intelligence:

4. Uncertain Knowledge and Reasoning

- Quantifying Uncertainty
- Probabilistic Reasoning
- Probabilistic Reasoning over Time
- Probabilistic Programming
- Making Simple Decisions
- Making Complex Decisions
- Multiagent Decision Making

Artificial Intelligence:

5. Machine Learning

- **Learning from Examples**
- **Learning Probabilistic Models**
- **Deep Learning**
- **Reinforcement Learning**

Artificial Intelligence:

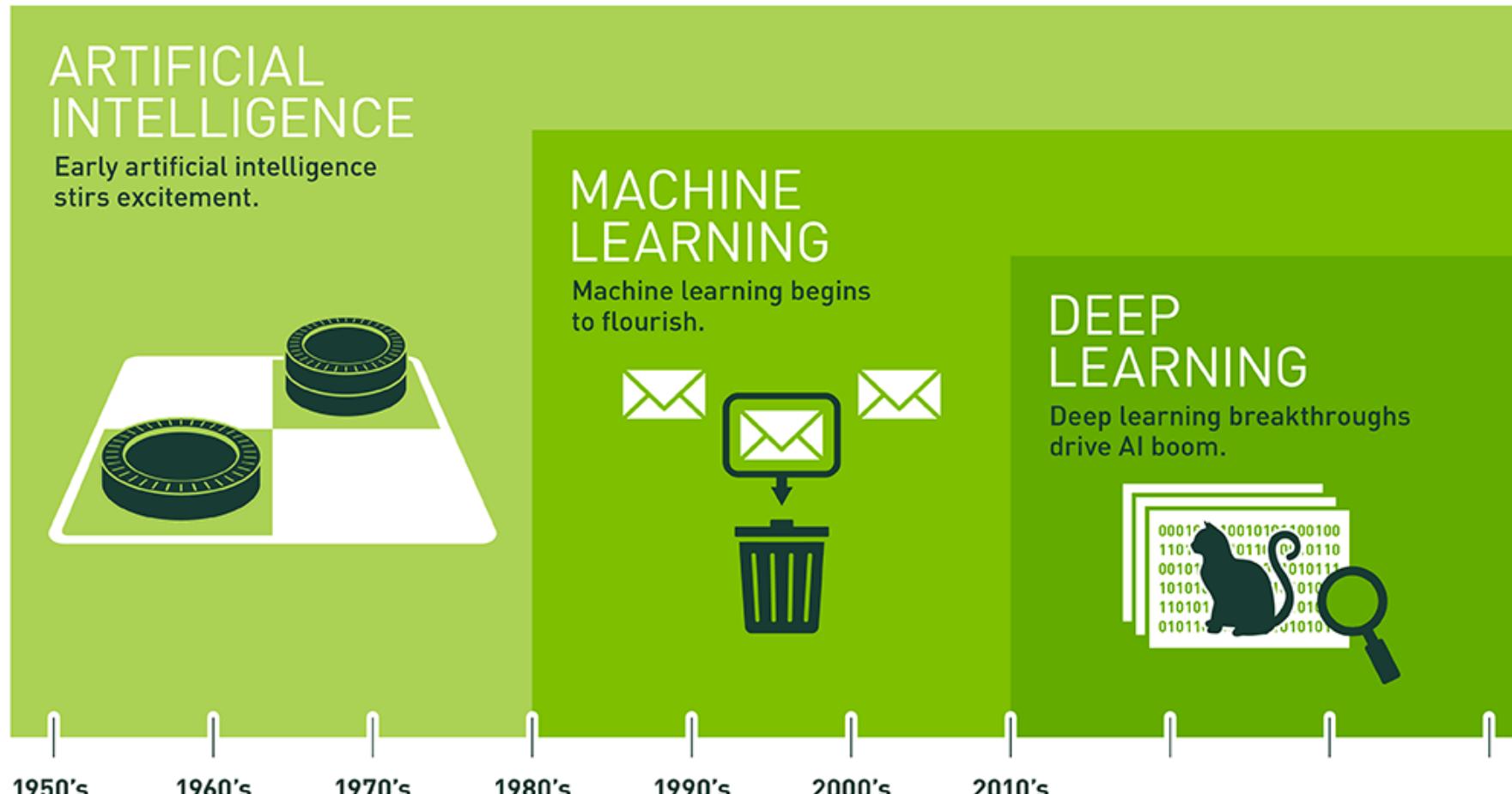
6. Communicating, Perceiving, and Acting

- **Natural Language Processing**
- **Deep Learning for Natural Language Processing**
- **Computer Vision**
- **Robotics**

Artificial Intelligence: Philosophy and Ethics of AI The Future of AI

Artificial Intelligence

Machine Learning & Deep Learning



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.

AI, ML, DL

Artificial Intelligence (AI)

Machine Learning (ML)

Supervised
Learning

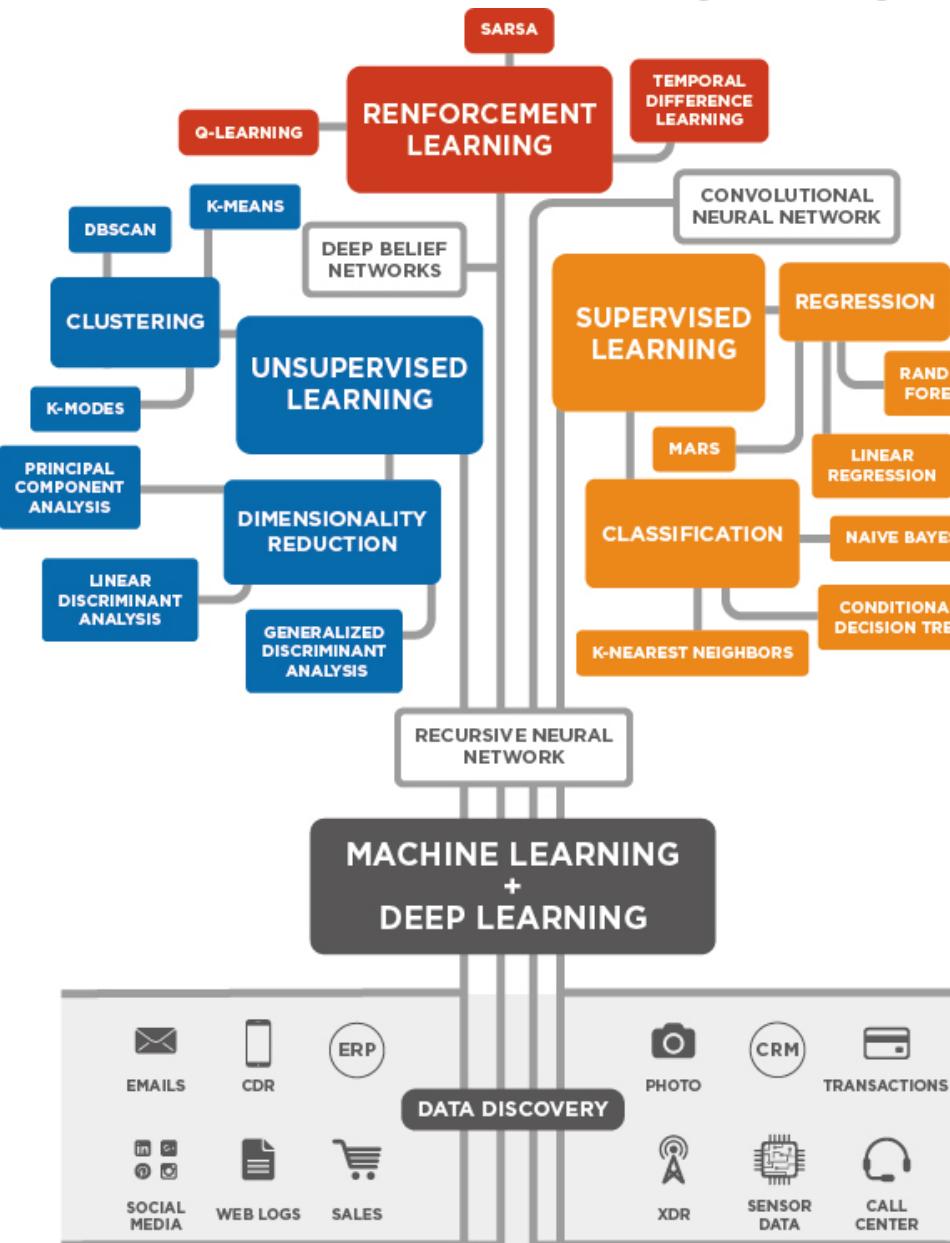
Unsupervised
Learning

Deep Learning (DL)
CNN
RNN LSTM GRU
GAN

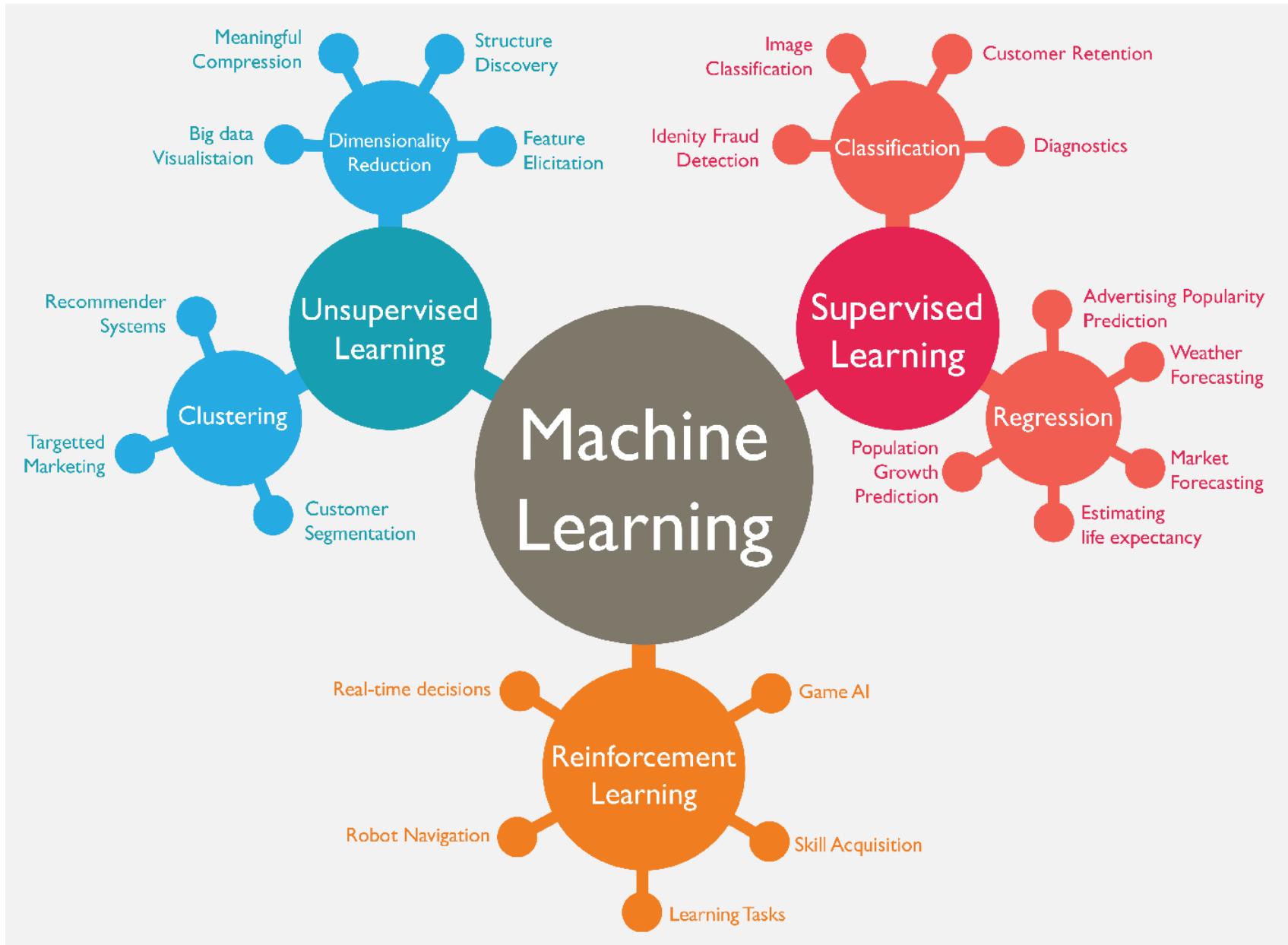
Semi-supervised
Learning

Reinforcement
Learning

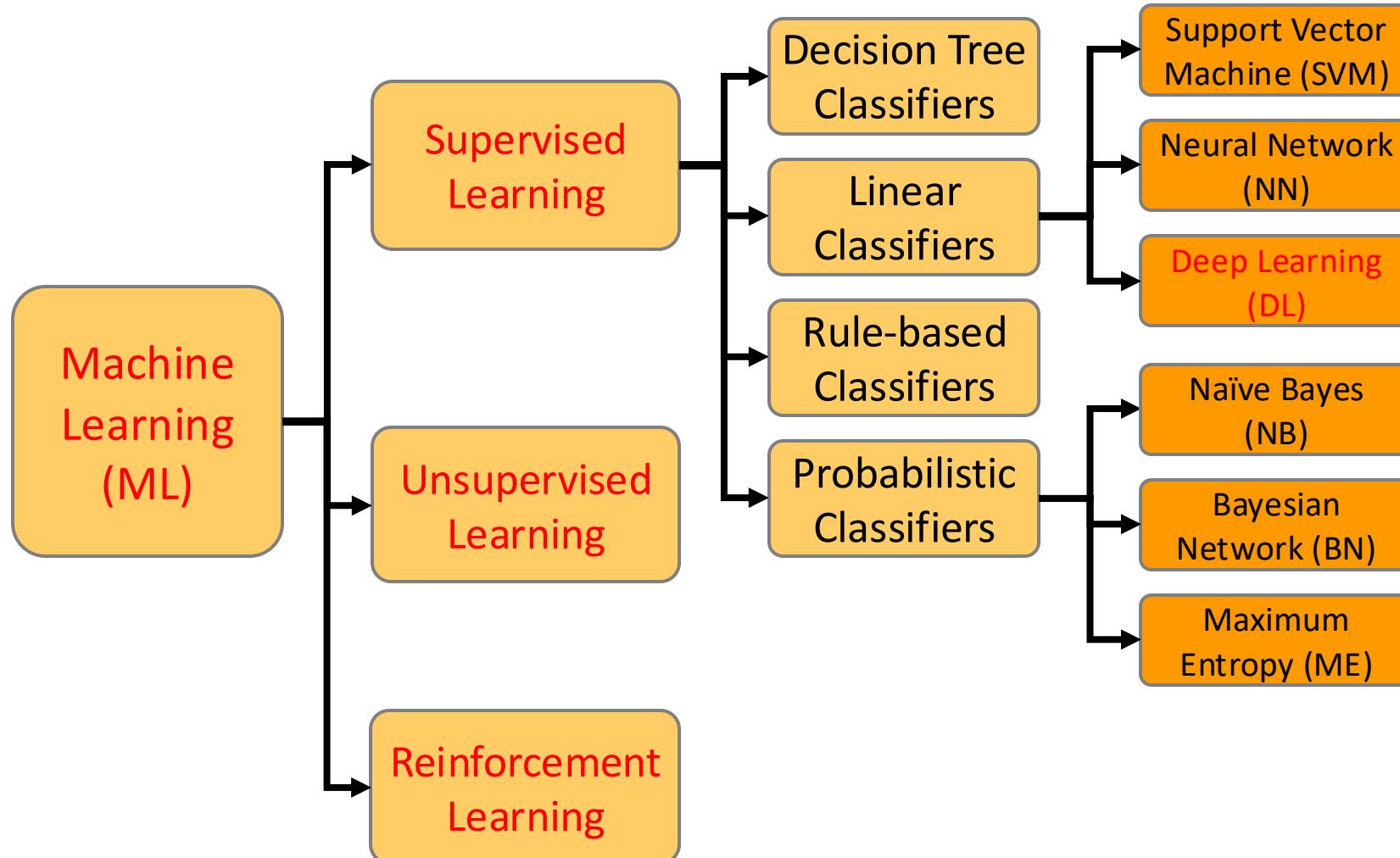
3 Machine Learning Algorithms



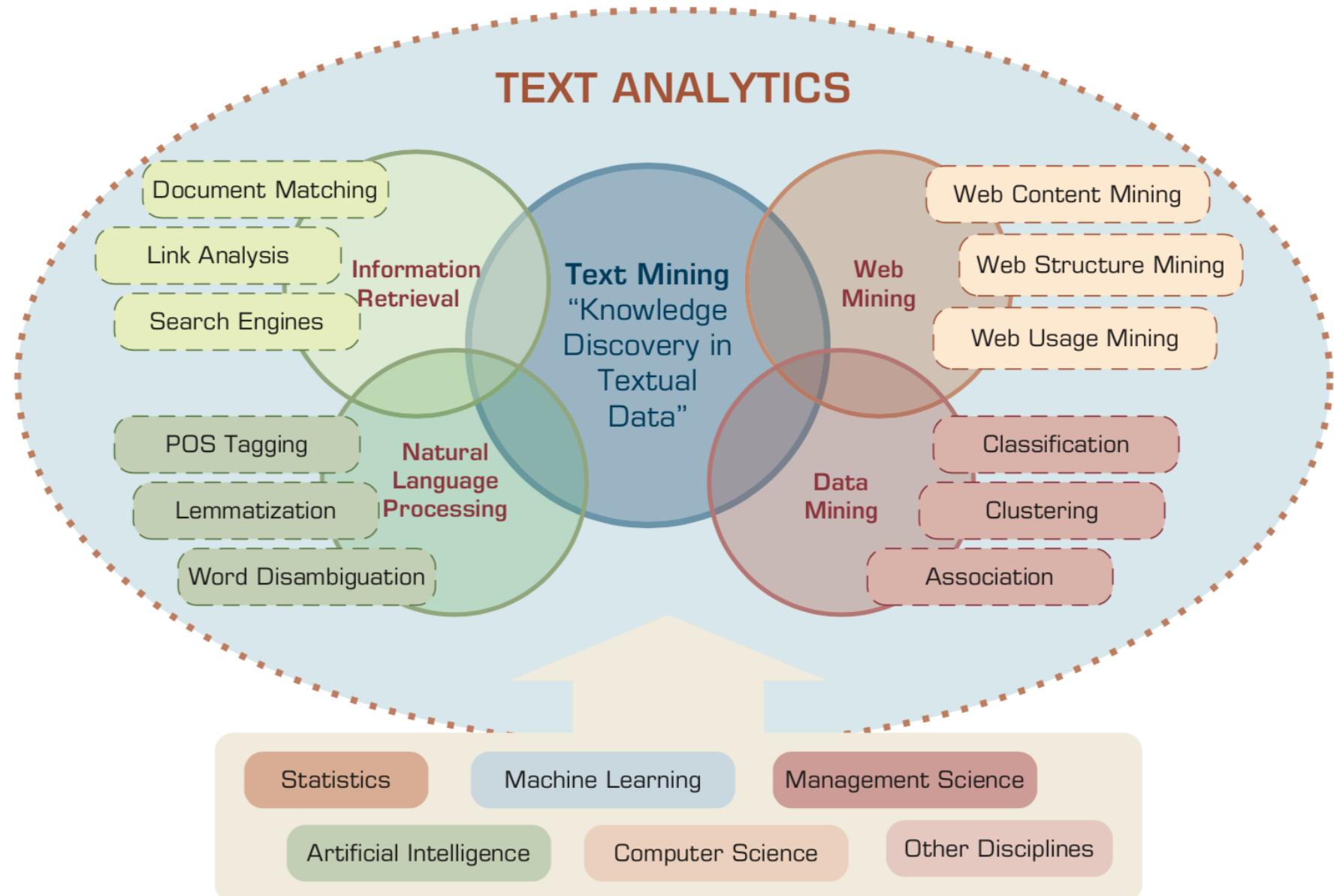
Machine Learning (ML)



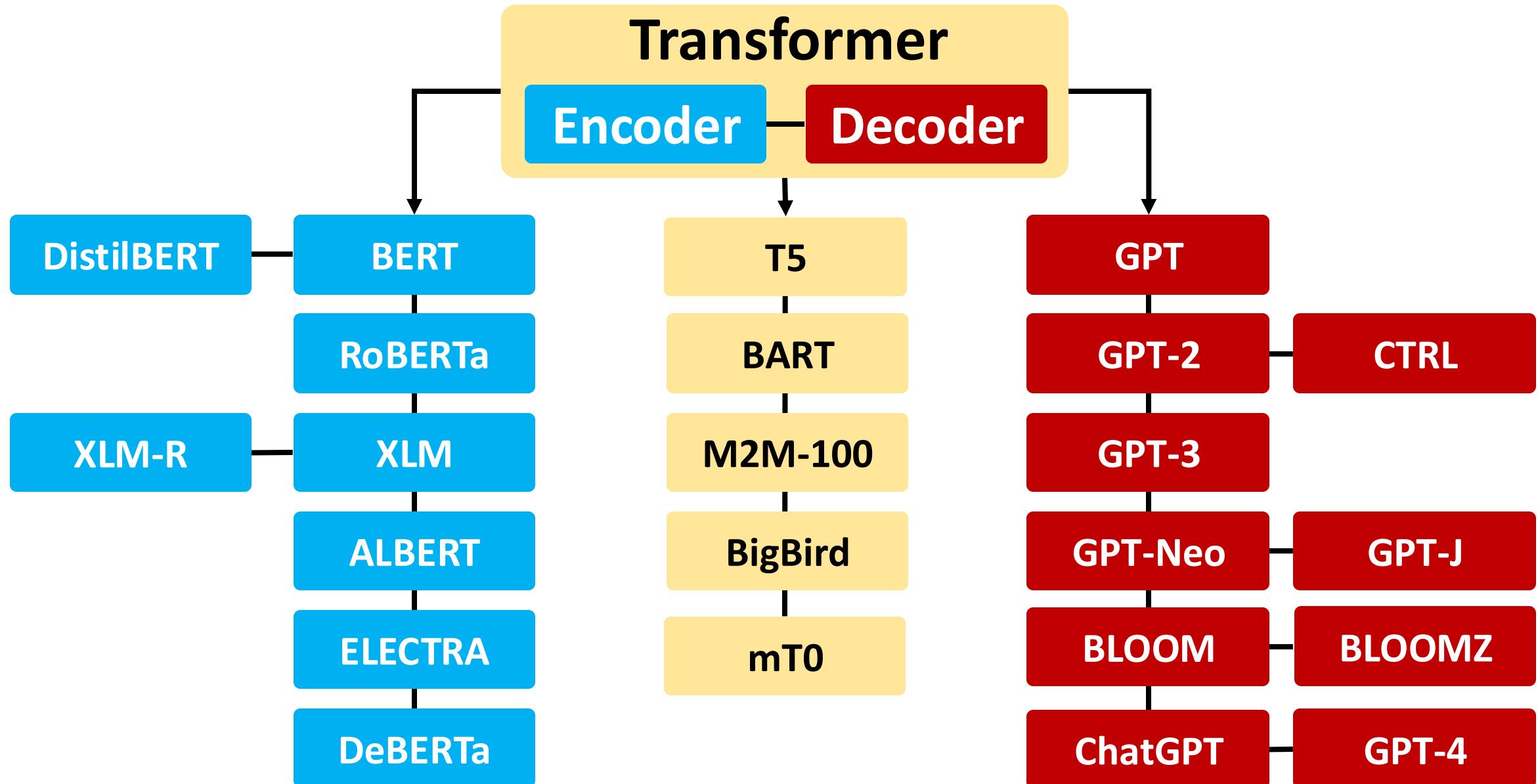
Machine Learning (ML) / Deep Learning (DL)



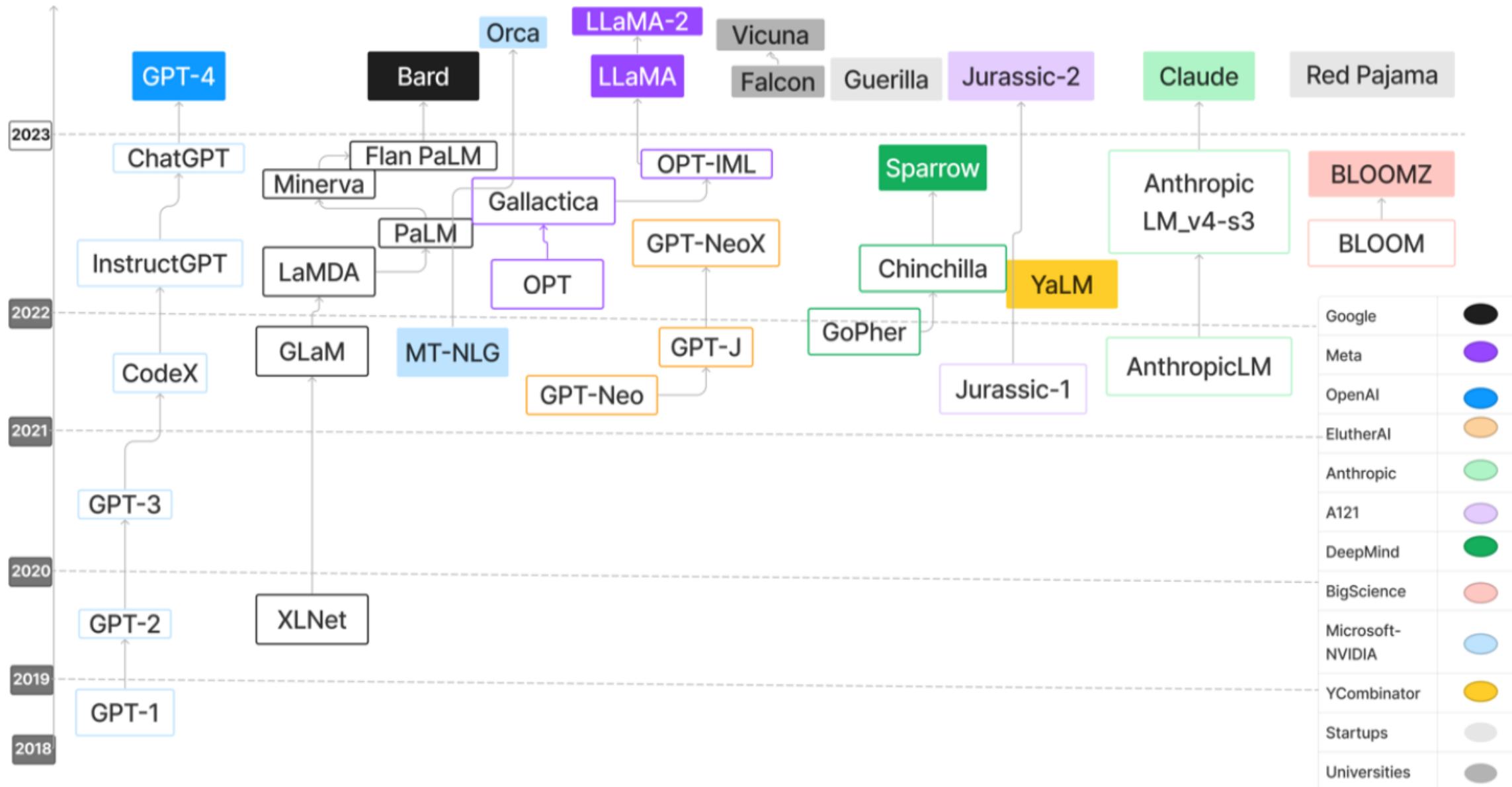
AI for Text Analytics



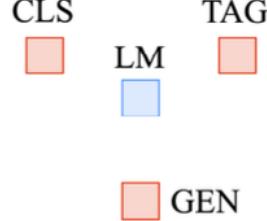
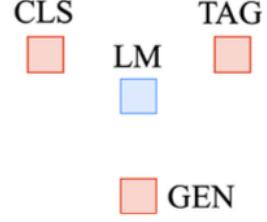
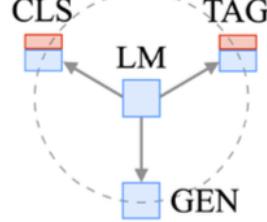
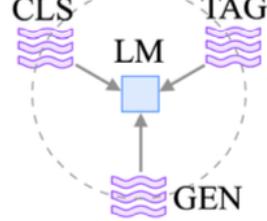
Transformer Models



Large Language Models (LLMs)



Four Paradigms in NLP (LM)

Paradigm	Engineering	Task Relation
a. Fully Supervised Learning (Non-Neural Network)	Feature (e.g. word identity, part-of-speech, sentence length)	
b. Fully Supervised Learning (Neural Network)	Architecture (e.g. convolutional, recurrent, self-attentional)	
c. Pre-train, Fine-tune	Objective (e.g. masked language modeling, next sentence prediction)	
Transfer Learning: Pre-training, Fine-Tuning (FT)		
d. Pre-train, Prompt, Predict	Prompt (e.g. cloze, prefix)	

Generative AI

Text, Image, Video, Audio

Applications

Comparison of Generative AI and Traditional AI

Feature	Generative AI	Traditional AI
Output type	New content	Classification/Prediction
Creativity	High	Low
Interactivity	Usually more natural	Limited

Generative AI

- **Generative AI: The Art of Creation**
- **Definition: AI systems capable of creating new content**
- **Characteristics: Creativity, interactivity**

LMArena Leaderboard

Rank (UB) ↑	Model ↓	Score ↑↓	95% CI (\pm) ↑↓	Votes ↑↓	Organization ↑↓	License ↑↓
1	 gemini-2.5-pro	1455	± 5	41,731	Google	Proprietary
1	 claude-opus-4-1-20250805-thinking-16k	1451	± 6	11,750	Anthropic	Proprietary
2	 o3-2025-04-16	1444	± 4	43,898	OpenAI	Proprietary
2	 gpt-5-high	1442	± 6	15,076	OpenAI	Proprietary
2	 chatgpt-4o-latest-20250326	1441	± 4	36,426	OpenAI	Proprietary
3	 gpt-4.5-preview-2025-02-27	1439	± 6	15,271	OpenAI	Proprietary
3	 claude-opus-4-1-20250805	1438	± 6	18,341	Anthropic	Proprietary
5	 gpt-5-chat	1430	± 6	11,808	OpenAI	Proprietary
6	 qwen3-max-preview	1428	± 7	8,781	Alibaba	Proprietary
8	 grok-4-0709	1422	± 5	21,446	xAI	Proprietary

LMArena Leaderboard

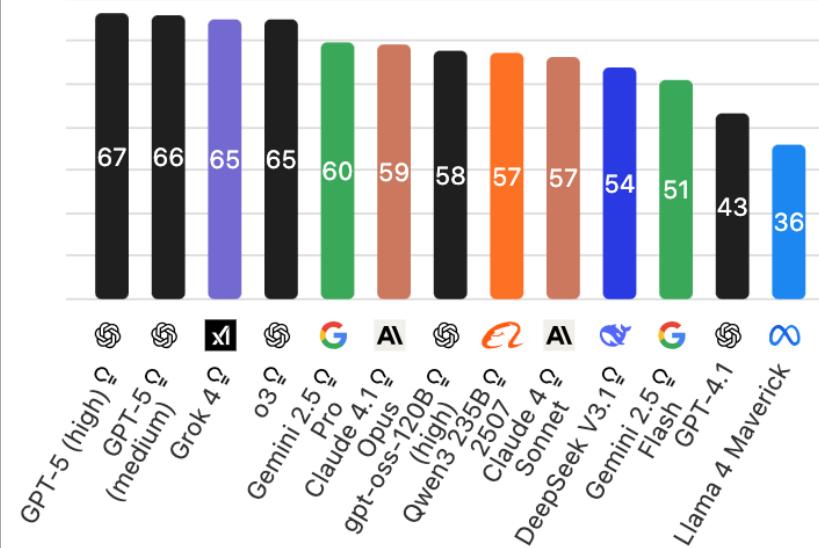
Q Model	239 / 239	Overall ↑↓	Hard Prompts ↑↓	Coding ↑↓	Math ↑↓	Creative Writing ↑↓	Instruction Following	Longer Query ↑↓	Multi-Turn ↑↓
AI claude-opus-4-1...	1	1	1	1	1	1	1	1	1
Google gemini-2.5-pro	1	2	3	1	1	1	1	1	1
Swing chatgpt-4o-lates...	2	4	3	13	2	5	4	1	1
Swing gpt-5-high	2	2	3	1	7	5	11	6	
Swing o3-2025-04-16	2	4	3	1	8	6	13	7	
AI claude-opus-4-1...	3	2	1	1	1	1	1	1	1
Swing gpt-4.5-preview...	3	5	4	8	1	4	3	1	
Swing gpt-5-chat	5	3	3	8	3	5	3	1	
Swing qwen3-max-preview	6	4	2	1	7	4	4	3	
AI claude-opus-4-20...	8	4	3	6	2	2	2	7	
Swing deepseek-r1-0528	8	8	4	10	8	15	13	14	
Swing deepseek-v3.1	8	6	4	1	7	6	5	9	
Swing deepseek-v3.1-th...	8	4	3	1	2	4	1	7	
XL grok-4-0709	8	10	12	1	4	6	8	7	
Swing kimi-k2-0711-pre...	8	10	7	13	16	24	22	7	
Swing kimi-k2-0905-pre...	8	5	3	-	6	16	12	7	
Swing qwen3-235b-a22b...	8	4	3	2	9	6	4	7	
Z glm-4.5	10	7	4	7	14	7	8	10	

Artificial Analysis Intelligence Index

Intelligence, Speed, Price

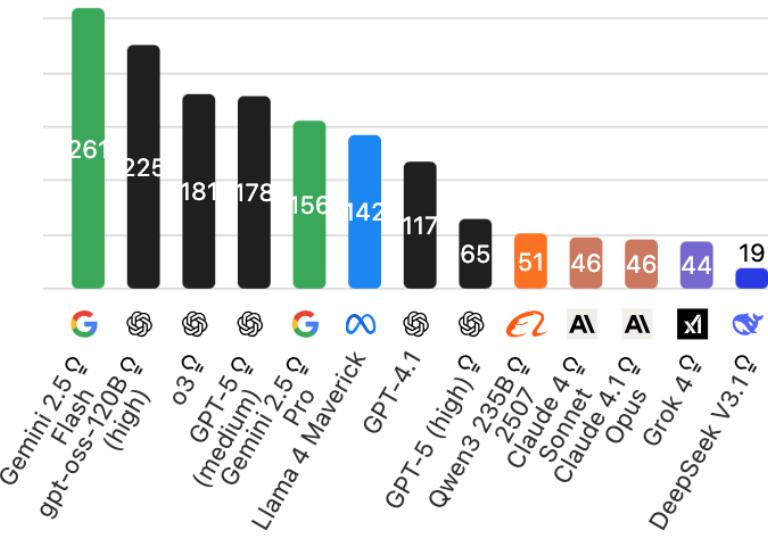
INTELLIGENCE

Artificial Analysis Intelligence Index; Higher is better



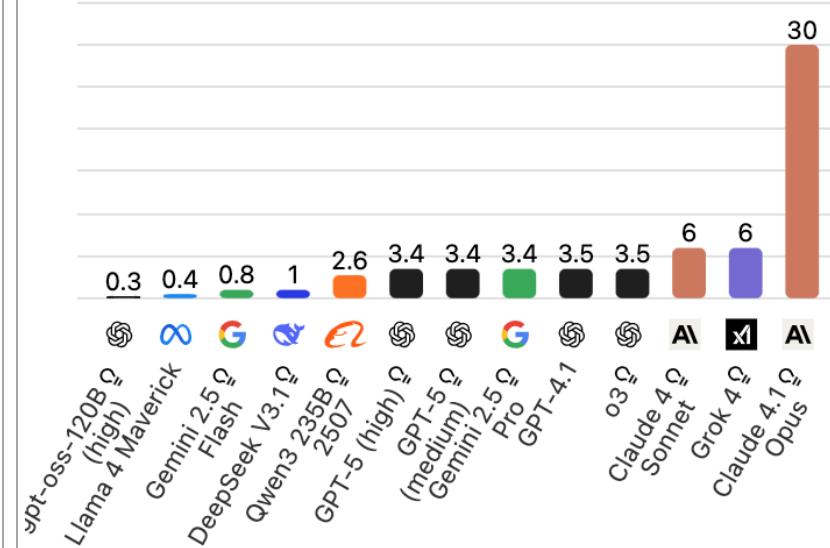
SPEED

Output Tokens per Second; Higher is better



PRICE

USD per 1M Tokens; Lower is better



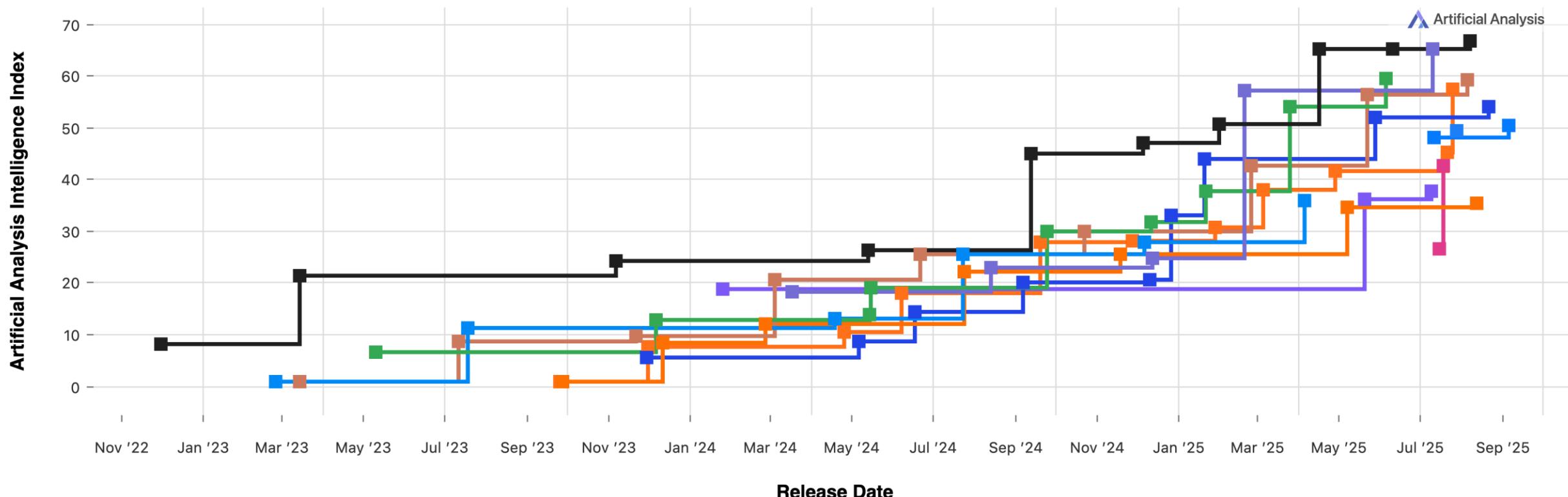
Artificial Analysis Intelligence Index

2022-2025

Frontier Language Model Intelligence, Over Time

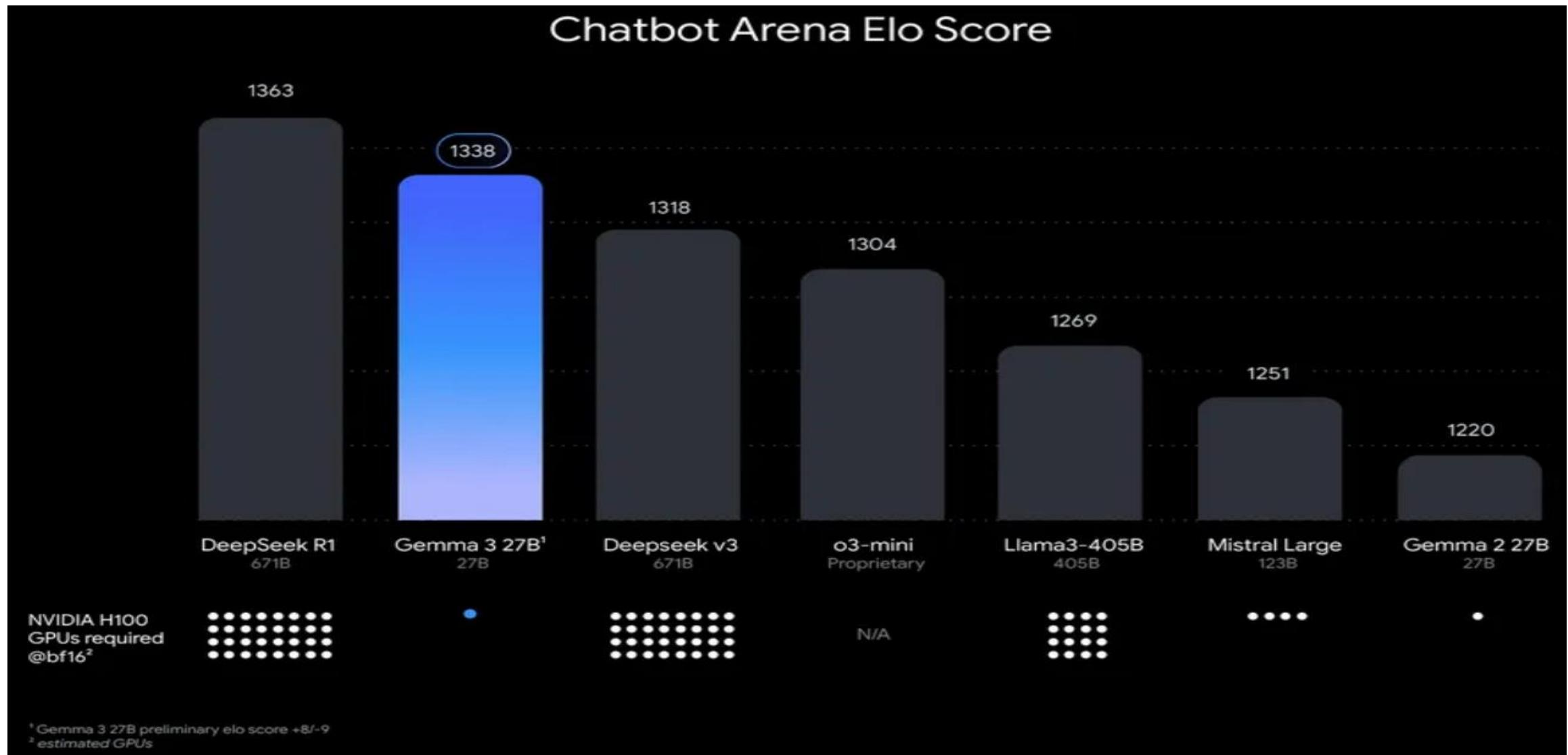
Artificial Analysis Intelligence Index v3.0 incorporates 10 evaluations: MMLU-Pro, GPQA Diamond, Humanity's Last Exam, LiveCodeBench, SciCode, AIME 2025, IFFBench, AA-LCR, Terminal-Bench Hard, τ^2 -Bench Telecom

Alibaba Anthropic DeepSeek Google LG AI Research Meta Mistral Moonshot AI OpenAI Upstage xAI Z AI



Google Gemma 3 27B

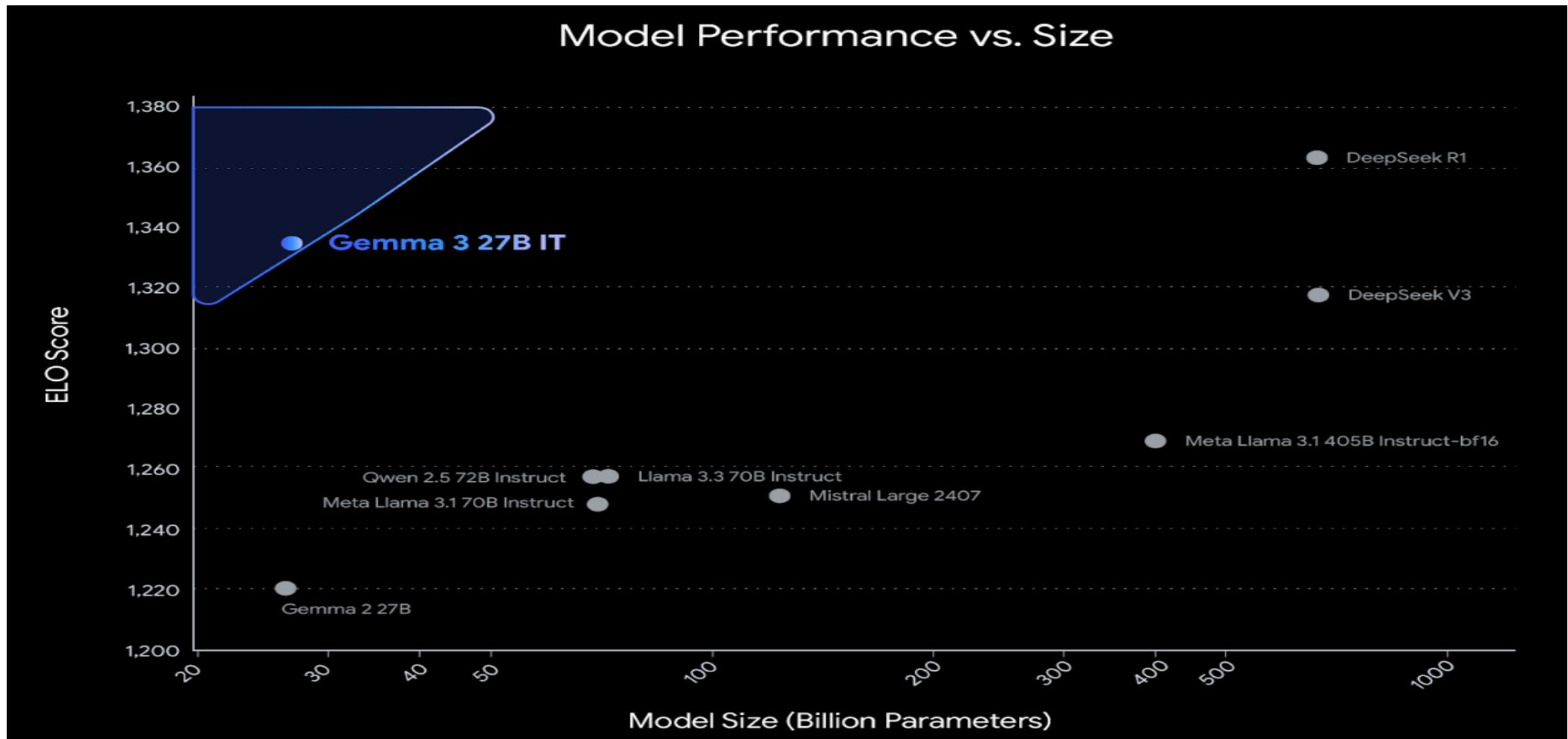
The most capable model you can run on a single GPU or TPU



Google Gemma 3 Multimodality (vision-language input and text outputs)

MODEL	SIZE (in billion parameter)	CONTEXT LENGTH	LANGUAGES	INPUT MODALITIES
Gemma 3 1B (IT)	1B	32k	English	Input: Text Output: Text
Gemma 3 4B (IT)	4B	128k	+140 Languages	Input: Text, Image Output: Text
Gemma 3 12B (IT)	12B	128k	+140 Languages	Input: Text, Image Output: Text
Gemma 3 27B (IT)	27B	128k	+140 Languages	Input: Text, Image Output: Text
Shield Gemma 2	4B	8k	+140 Languages	Input: Text, Image Output: Text

Google Gemma 3: Pre-training and Post-training (distillation, reinforcement learning, and model merging)



Google AI Studio (Gemma 3 27B)

Google AI Studio Generative AI: A Comprehensive Over... Enable Autosave Compare Open in Kaggle Open in Vertex AI

Stream Realtime Tune a Model Developer documentation Changelog Gemma models may make mistakes, so double-check its response. Gemma is provided under and subject to the [Gemma Terms of Use](#). Settings

Generative AI

Generative AI: A Deep Dive

Generative AI is one of the most exciting and rapidly evolving fields in artificial intelligence right now. Here's a comprehensive overview, covering what it is, how it works, its types, applications, limitations, and future trends:

1. What is Generative AI?

Generative AI refers to a category of machine learning models that can **create new content** – text, images, audio, video, code, and more – that resembles the data they were trained on. Unlike traditional AI which **analyzes** or **acts** on existing data, generative AI **produces** new data. Think of it as AI that can "imagine" and then manifest those imaginations.

Key Characteristics:

- **Learns Patterns:** Generative AI models learn the underlying patterns and structures within a dataset.
- **Generates Novel Content:** They use this learned knowledge to create new, original content that wasn't explicitly present in the training data.
- **Probabilistic:** Generation isn't deterministic. The models predict probabilities, leading to variations in output even with the same input.
- **Requires Large Datasets:** Effective generative AI typically needs massive amounts of data for training.

Run settings

Get code

Model

Gemma 3 27B

Token count
1,760 / 131,072

Temperature
 1

Advanced settings

Safety settings
 Edit safety settings

Add stop sequence
 Add stop...

Output length
8192

Type something Run

Grok 3 Deep Search

The screenshot shows the Grok 3 Deep Search interface. At the top, there's a navigation bar with icons for refresh, upload, download, and a user profile. A button labeled "Generative AI" is also present. On the left, a sidebar lists several tasks:

- Q Completed
49s · 71 Sources
 - Thinking
 - Exploring user intent
 - Researching recent developments
 - Investigating healthcare applications

The main content area displays the results for the search term "Generative AI".

Exploring user intent

- The request is "Generative AI," which feels a bit unclear. It could be asking for a definition, recent updates, or use cases.

Q Searching for "**definition of generative AI**"

☰ 10 results found

- w Generative artificial intelligence - Wikipedia en.wikipedia.org
- ⦿ Generative AI – What is it and How Does it Work? | NVIDIA nvidia.com
- ☞ What is generative AI? - IBM Research research.ibm.com
- 📦 What is Generative AI? - Gen AI Explained - AWS aws.amazon.com
- ☰ Explained: Generative AI | MIT News | Massachusetts I... news.mit.edu

See more (5)

⊕ Browsing results

- Currently looking for a definition from the search results, including sources like Wikipedia and IBM. Generative AI creates...

How can Grok help?

DeepSearch Think Grok 3 ↑

Perplexity.ai Deep Research

perplexity ←

New Thread ⌂ K

Home Discover Spaces Library

Generative AI

Deep Research Images Sources 39 54 steps ▾

linkedin The Future of Generative AI: Key Trends and Opportunities in...

ciklum Top 10 GenAI Trends to Watch in Technology 2025 and Beyond

research.aimultiple Top 100+ Generative AI Applications with Real-Life... +36 sources

Generative AI: Current State, Applications, and Future Trends in 2025

Generative AI has rapidly evolved into a transformative technology, revolutionizing content creation, business operations, and digital interactions across industries. As of early 2025, this technology has moved beyond experimental phases into mainstream adoption, with McKinsey reporting that 65% of organizations now regularly use generative AI, demonstrating its growing significance in the business landscape ⁴.

Understanding Generative AI

Generative AI refers to a sophisticated branch of artificial intelligence that employs machine learning models to generate new content, such as text, images, and audio, based on patterns learned from large datasets.

Ask follow-up

Deep Research ▾

↑

Networks), which have enabled increasingly sophisticated applications ¹.

Token

Tiktokenizer

gpt-4o

System

You are a helpful assistant



User

Content



Add message

```
<|im_start|>system<|im_sep|>You are a helpful  
assistant<|im_end|><|im_start|>user<|im_sep|><|im_end|>  
<|im_start|>assistant<|im_sep|>
```

Token count

16

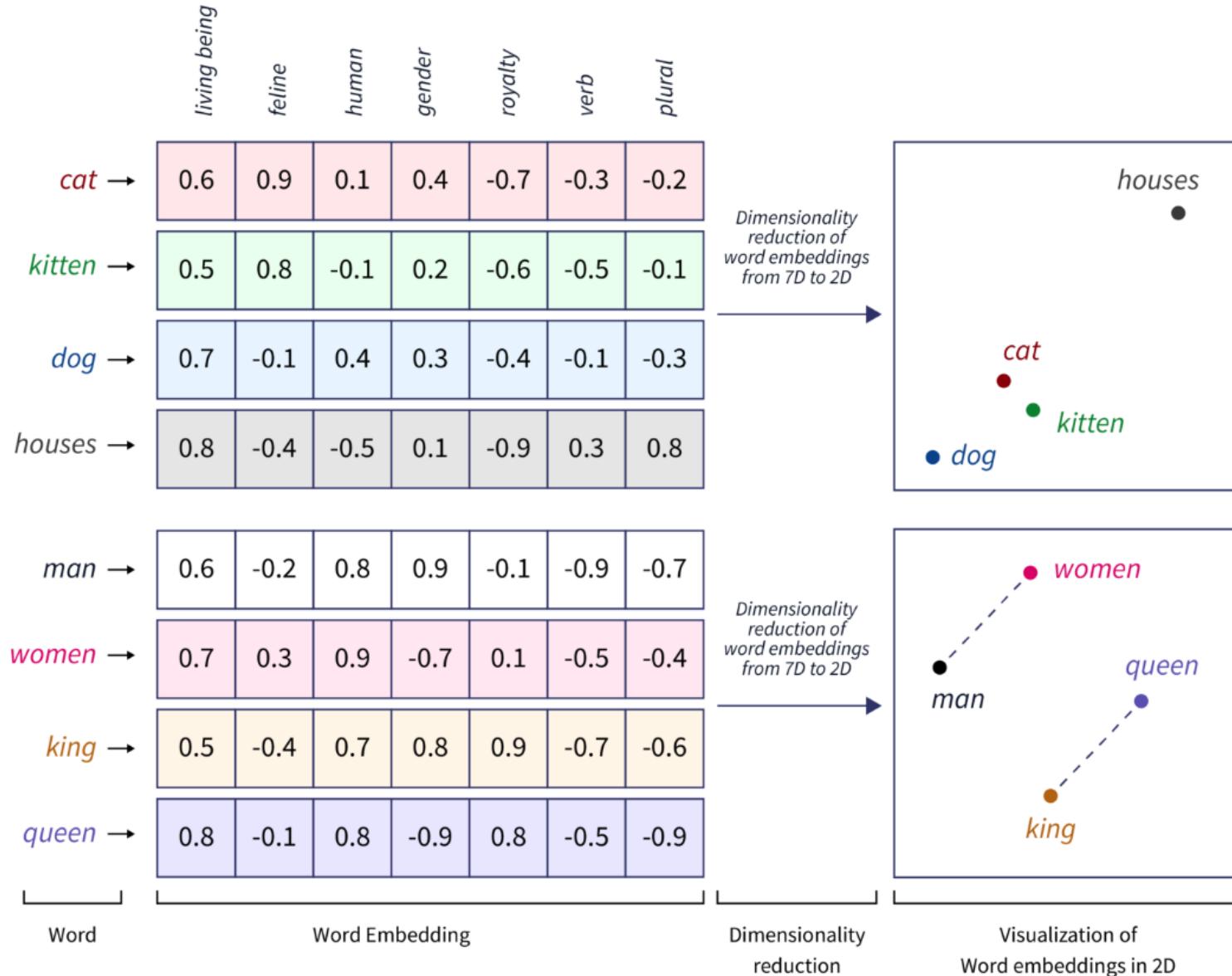
```
<|im_start|>system<|im_sep|>You are a helpful assistan  
t<|im_end|><|im_start|>user<|im_sep|><|im_end|><|im_st  
art|>assistant<|im_sep|>
```

```
200264, 17360, 200266, 3575, 553, 261, 10297, 29186, 2  
00265, 200264, 1428, 200266, 200265, 200264, 173781, 2  
00266
```

Show whitespace

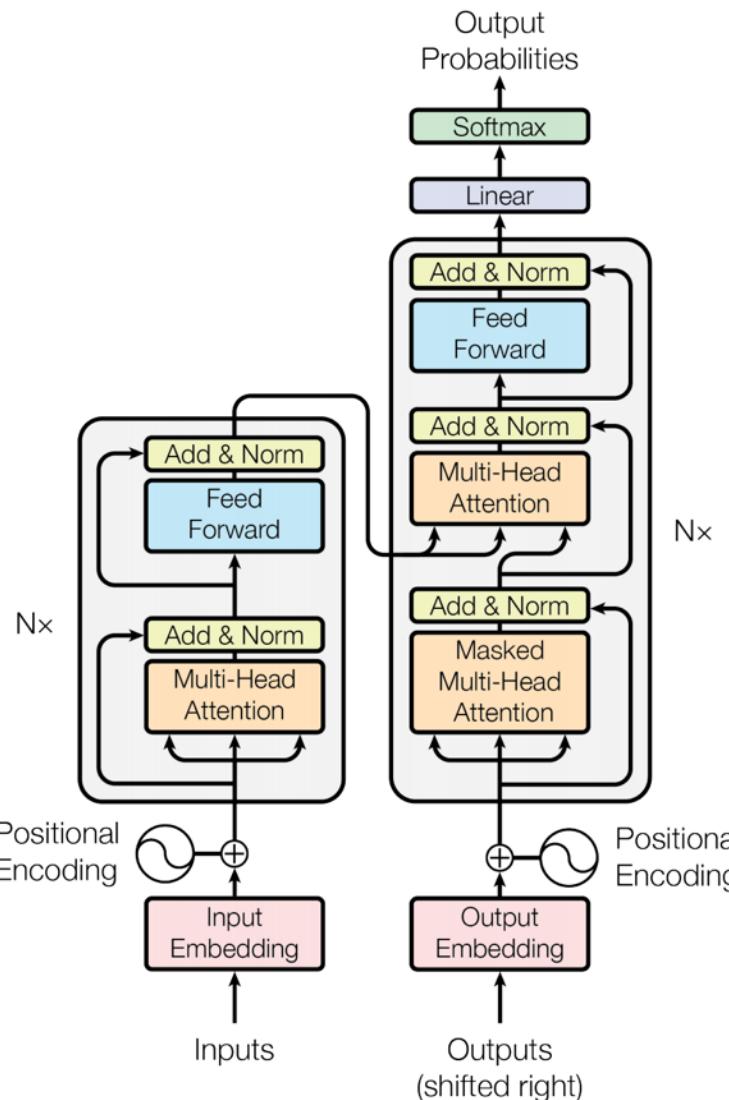
<https://tiktokenizer.vercel.app/>

Word Embeddings



Transformer (Attention is All You Need)

(Vaswani et al., 2017)

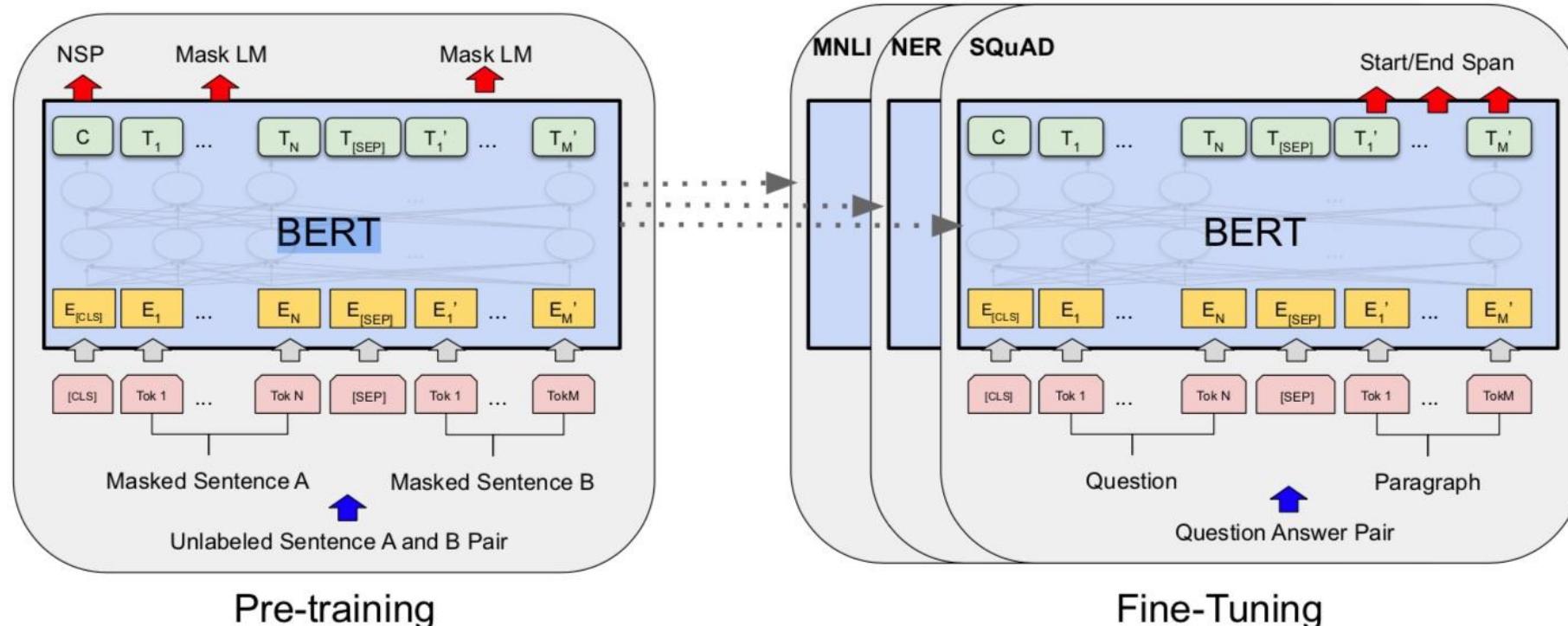


Source: Vaswani, Ashish, Noam Shazeer, Niki Parmar, Jakob Uszkoreit, Llion Jones, Aidan N. Gomez, Łukasz Kaiser, and Illia Polosukhin.
"Attention is all you need." In *Advances in neural information processing systems*, pp. 5998-6008. 2017.

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

BERT (Bidirectional Encoder Representations from Transformers)

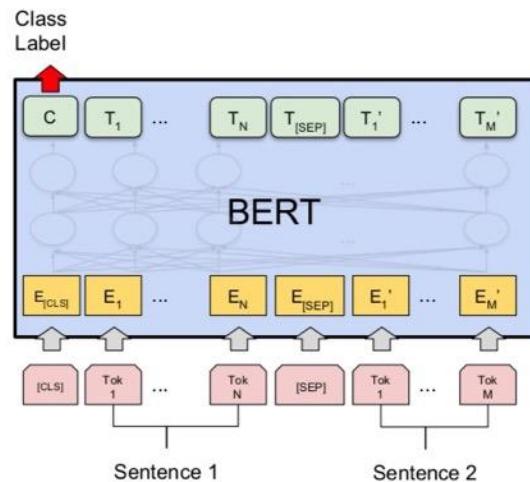
Overall pre-training and fine-tuning procedures for BERT



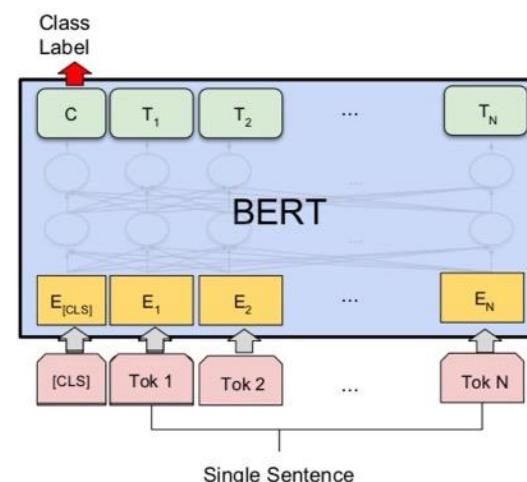
Source: Devlin, Jacob, Ming-Wei Chang, Kenton Lee, and Kristina Toutanova (2018).

"Bert: Pre-training of deep bidirectional transformers for language understanding." arXiv preprint arXiv:1810.04805.

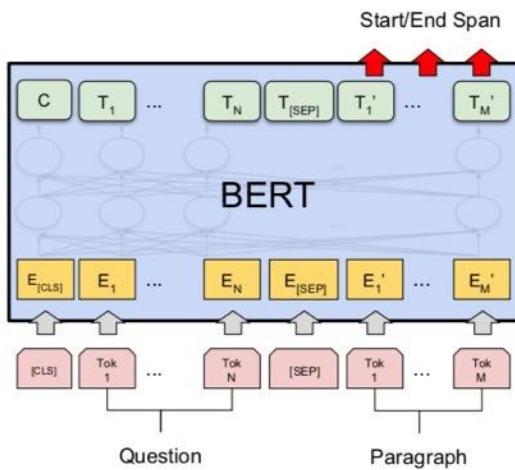
Fine-tuning BERT on Different Tasks



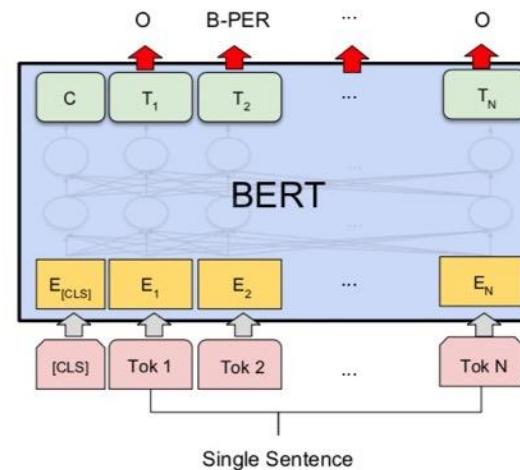
(a) Sentence Pair Classification Tasks:
MNLI, QQP, QNLI, STS-B, MRPC,
RTE, SWAG



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



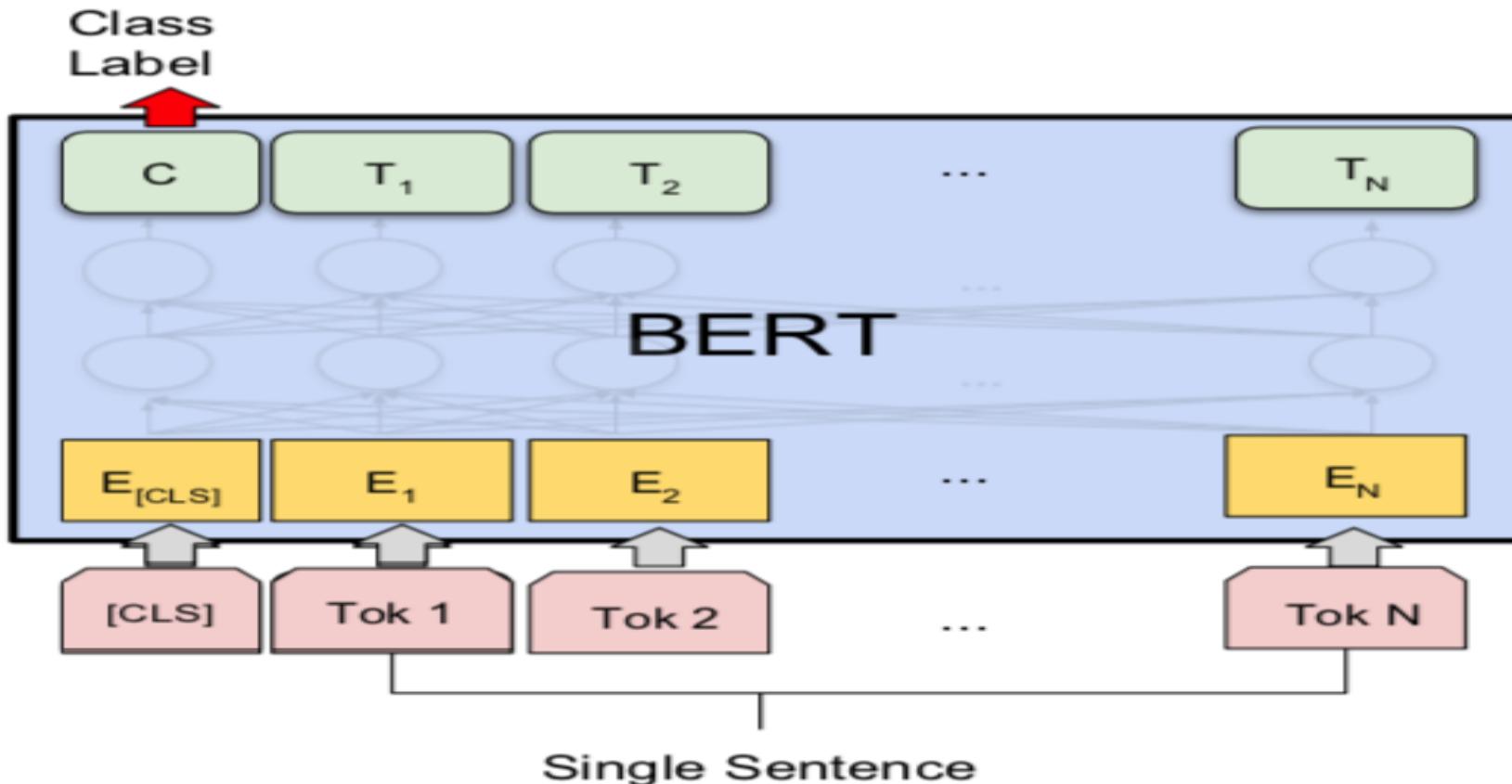
(c) Question Answering Tasks:
SQuAD v1.1



(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.

Sentiment Analysis: Single Sentence Classification

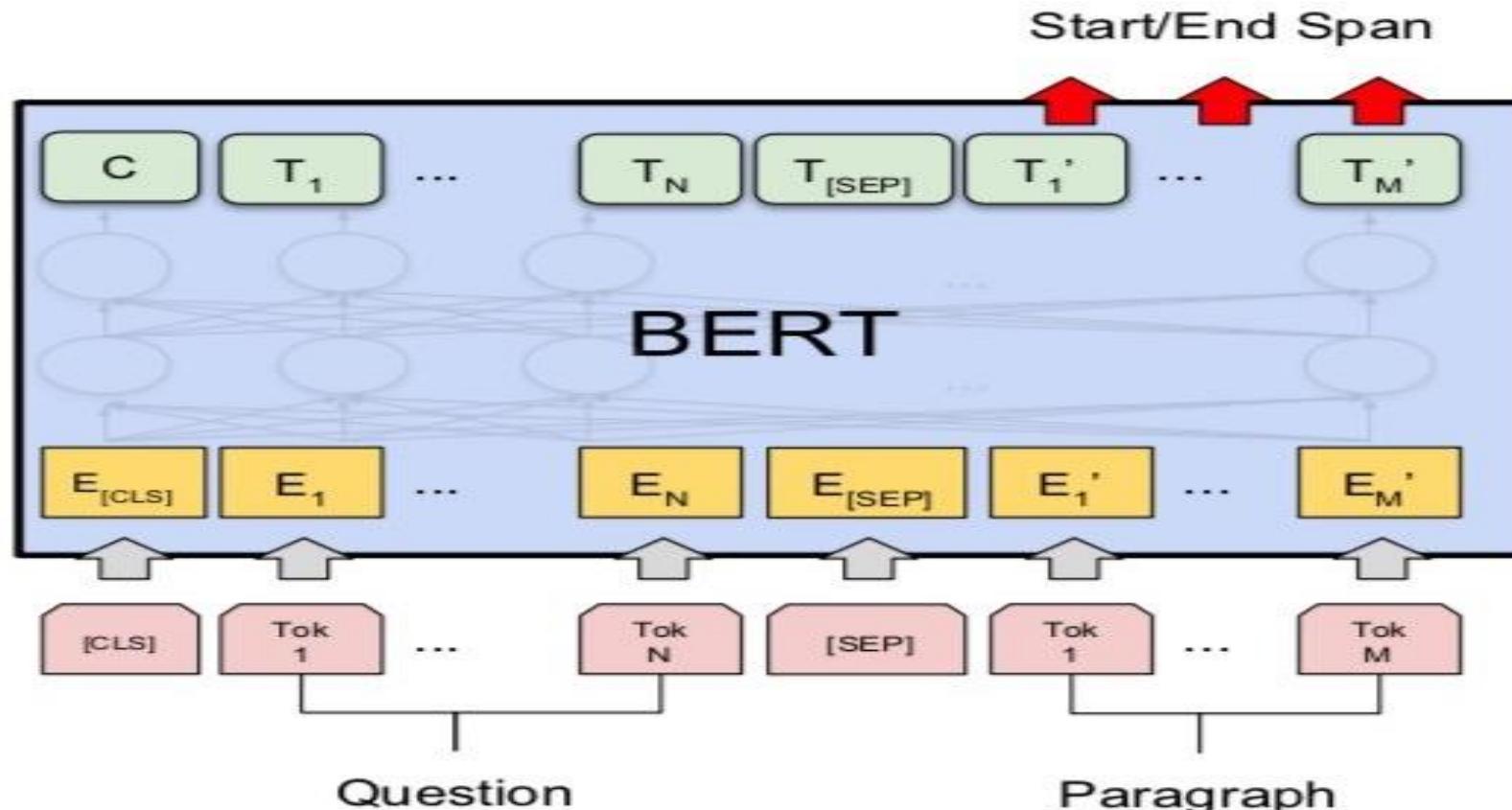


(b) Single Sentence Classification Tasks:
SST-2, CoLA

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 Question Answering (QA)

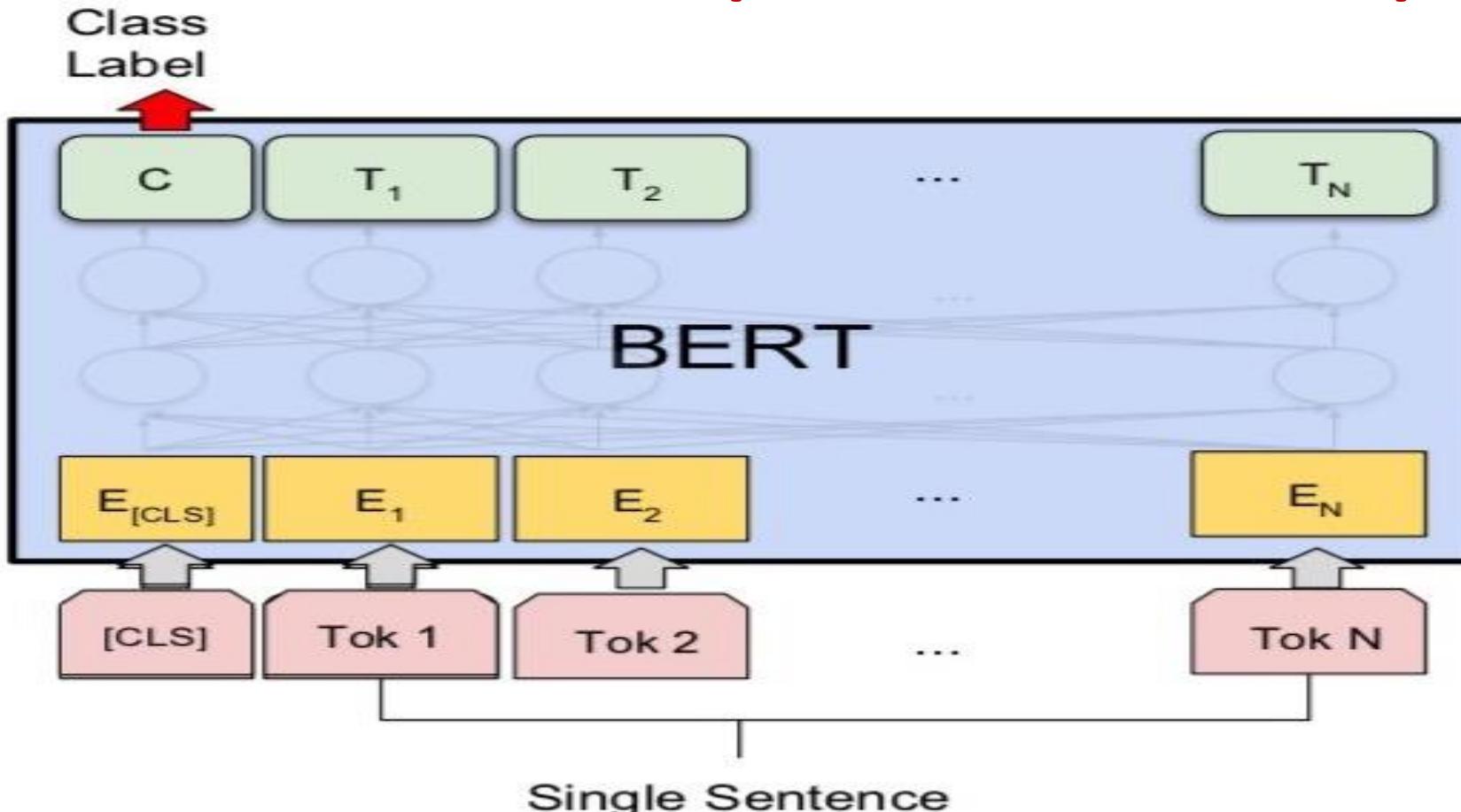


(c) Question Answering Tasks:
SQuAD v1.1

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)

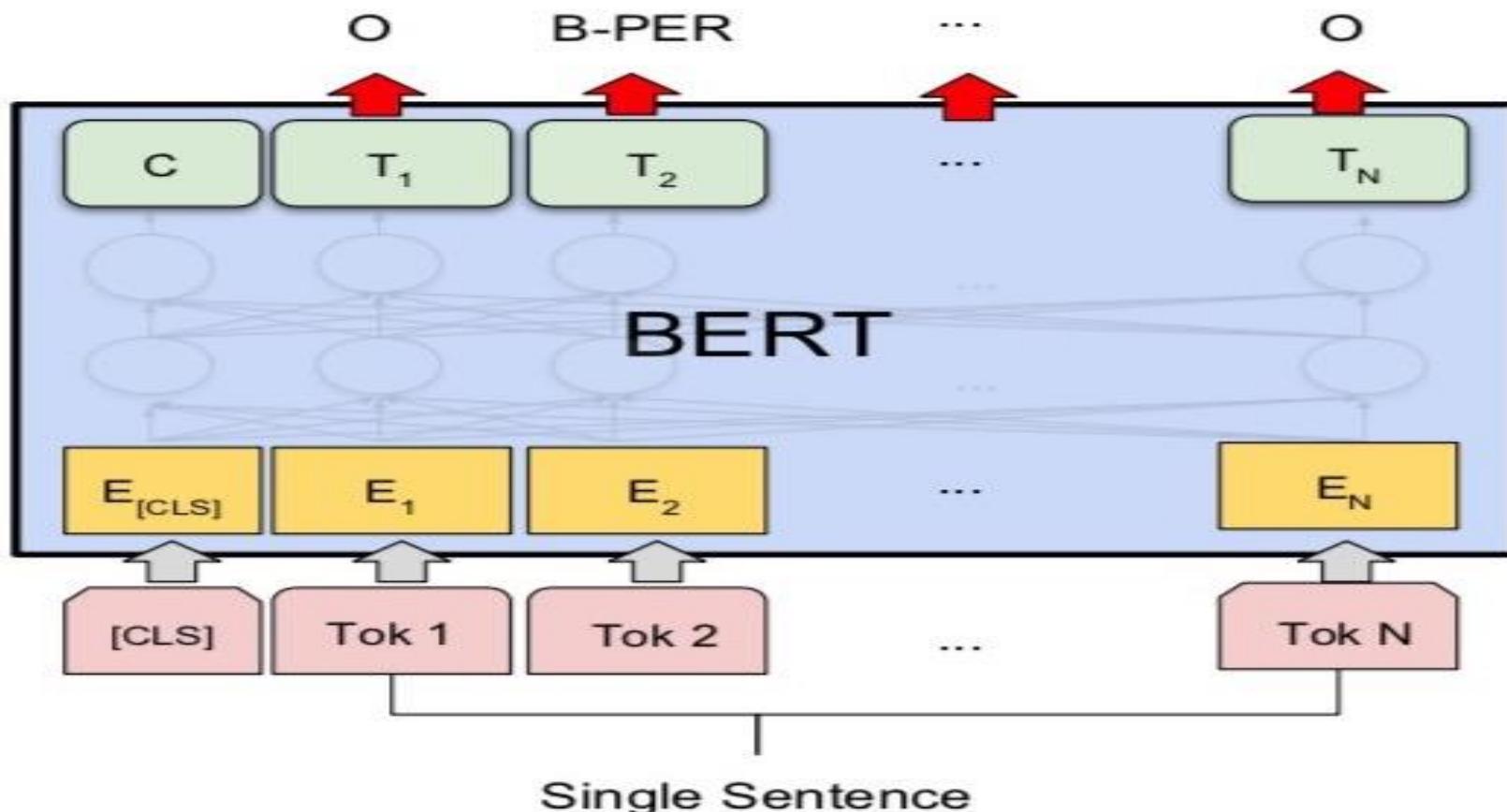


(b) Single Sentence Classification Tasks:
SST-2, CoLA

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)



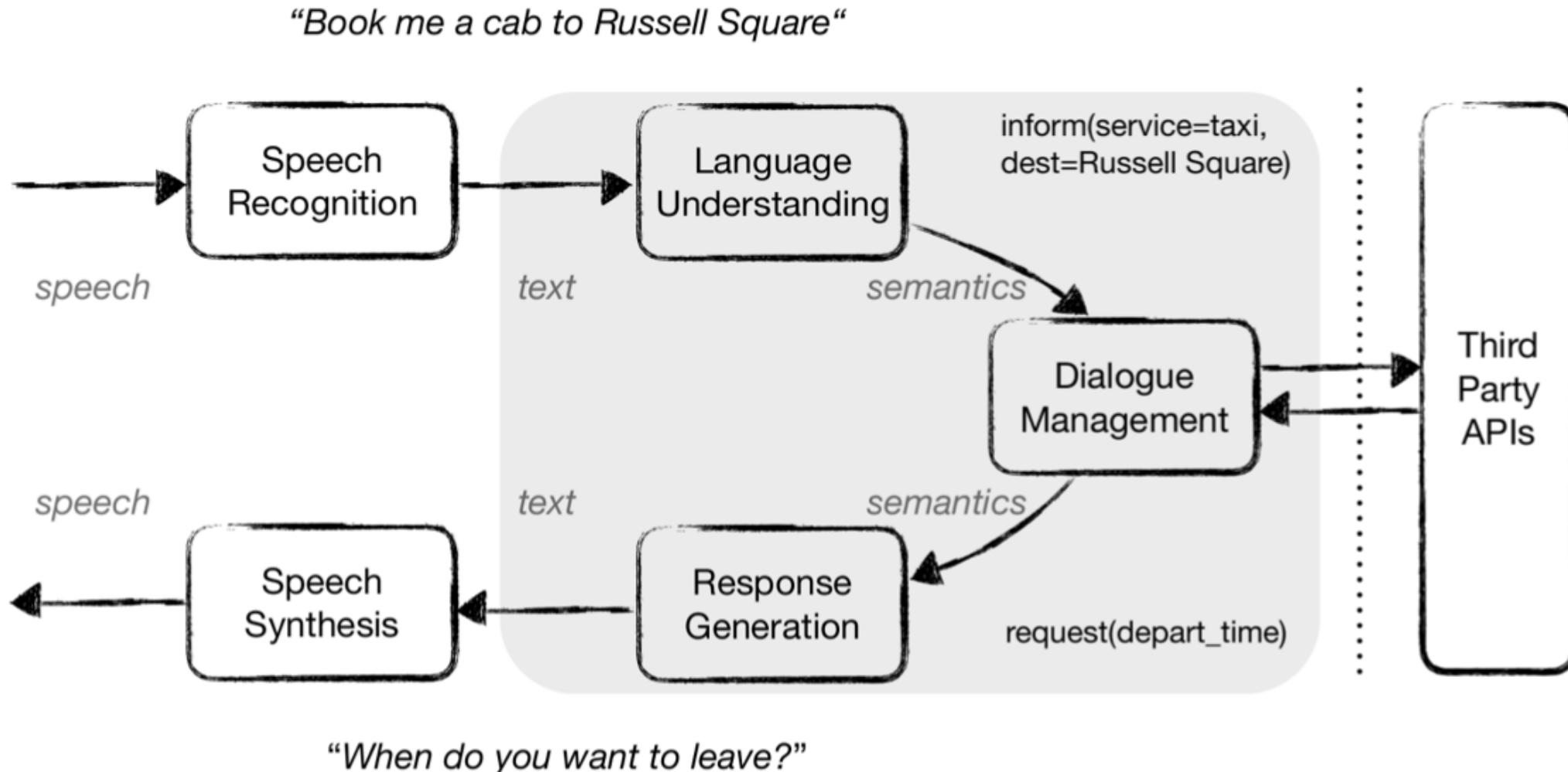
(d) Single Sentence Tagging Tasks:
CoNLL-2003 NER

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.

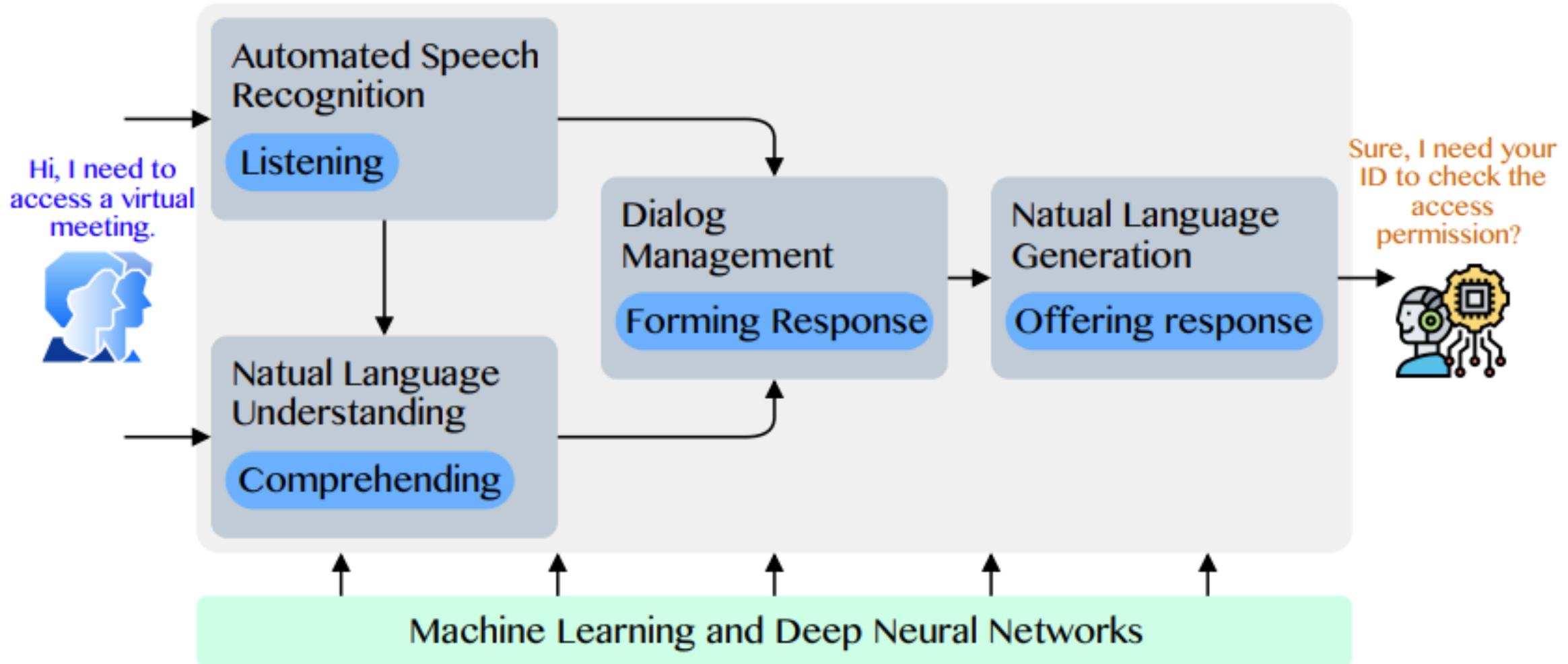
Task-Oriented Dialogue (ToD) System

Speech, Text, NLP

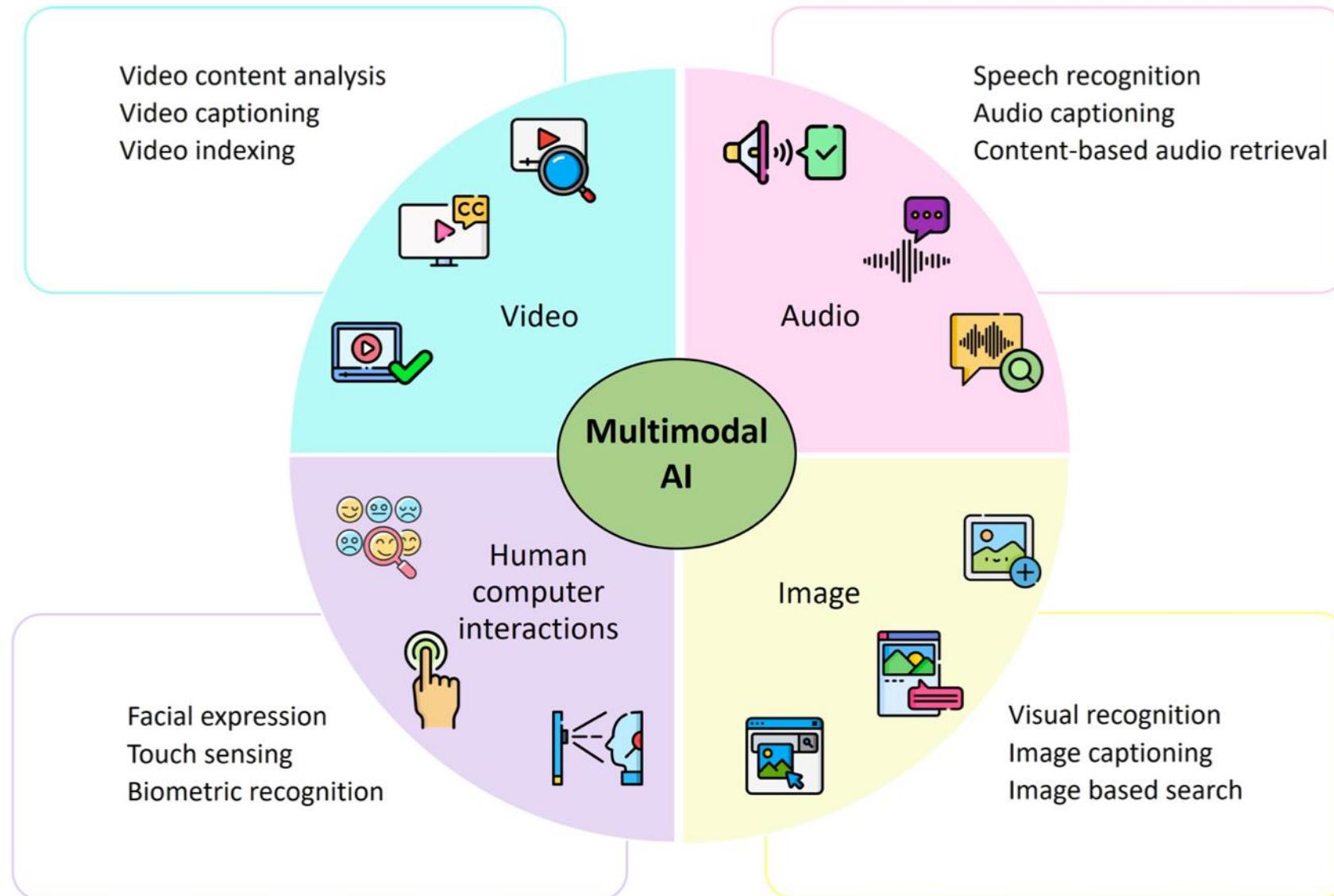


Conversational AI

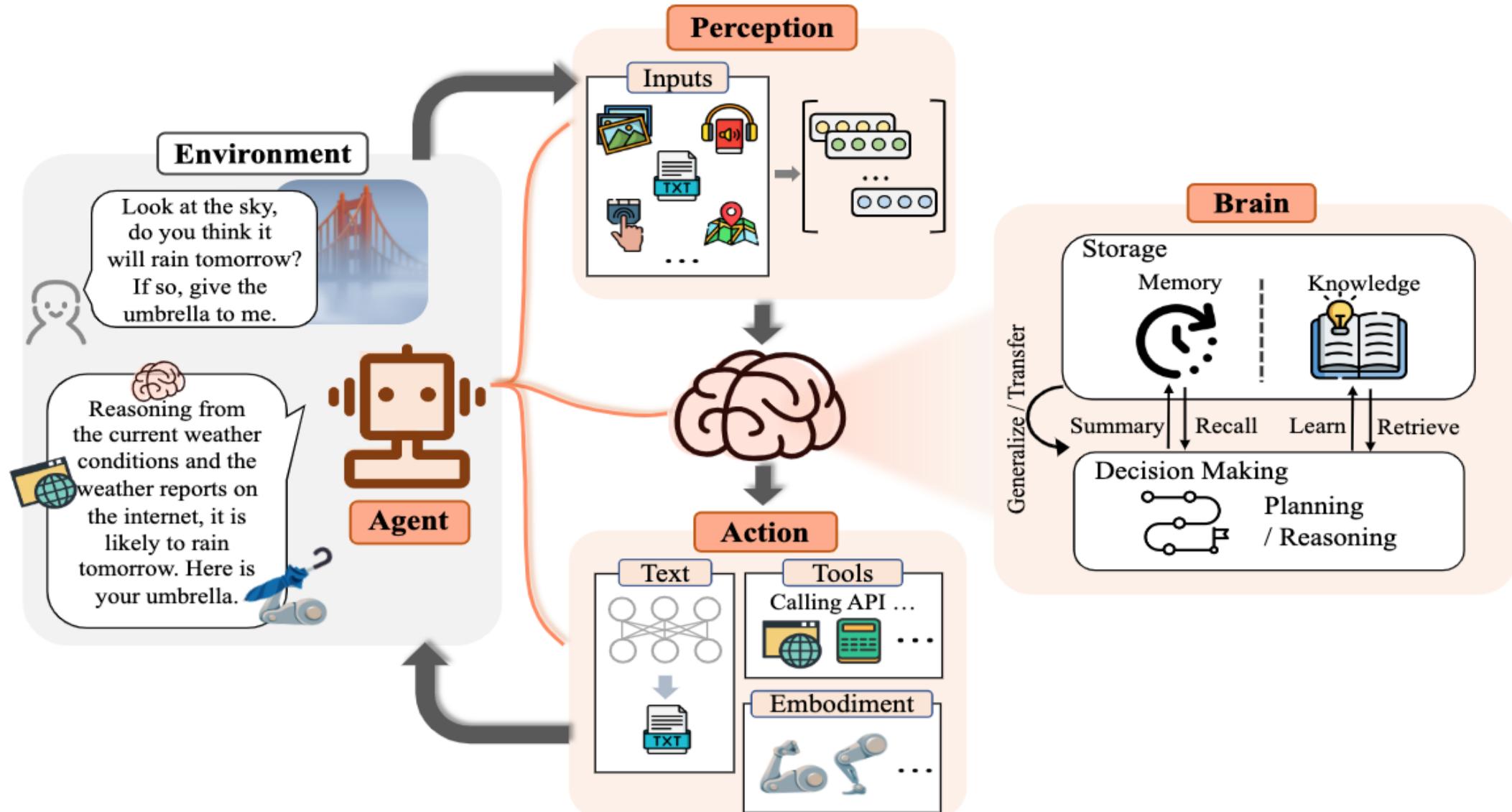
to deliver contextual and personal experience to users



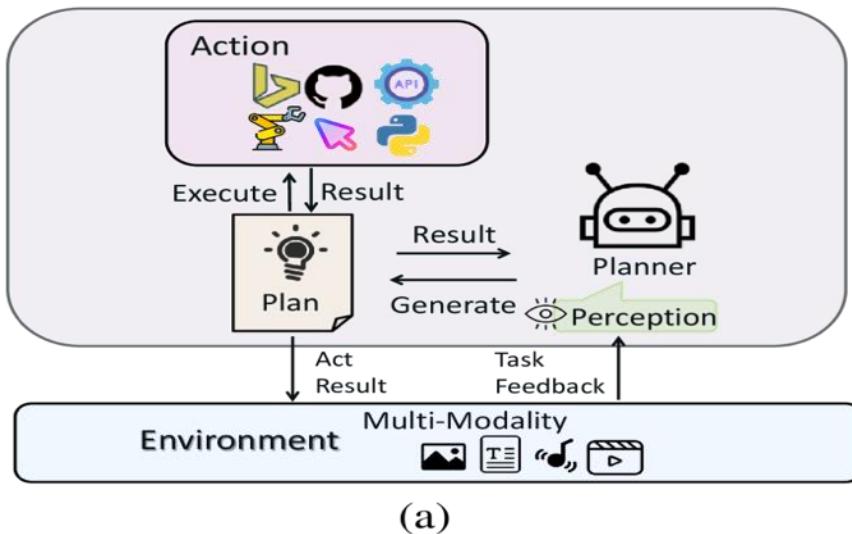
Technological Integration for Multimodal AI



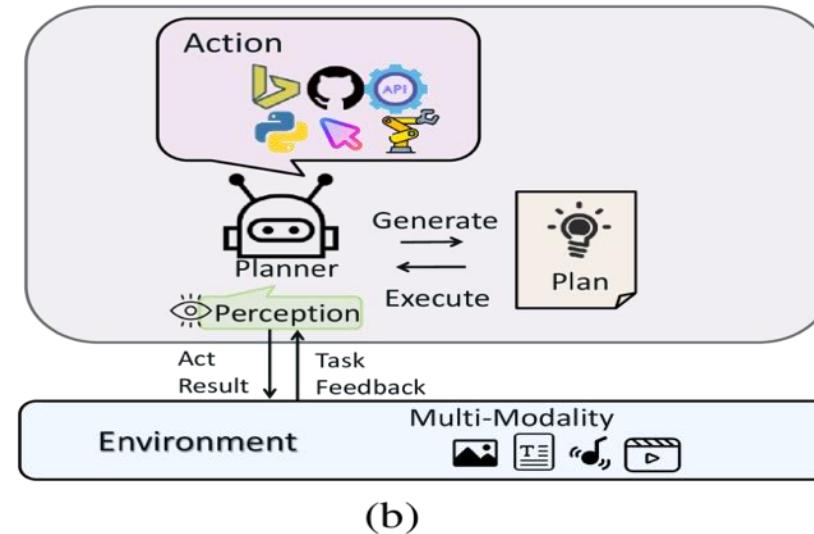
Large Language Model (LLM) based Agents



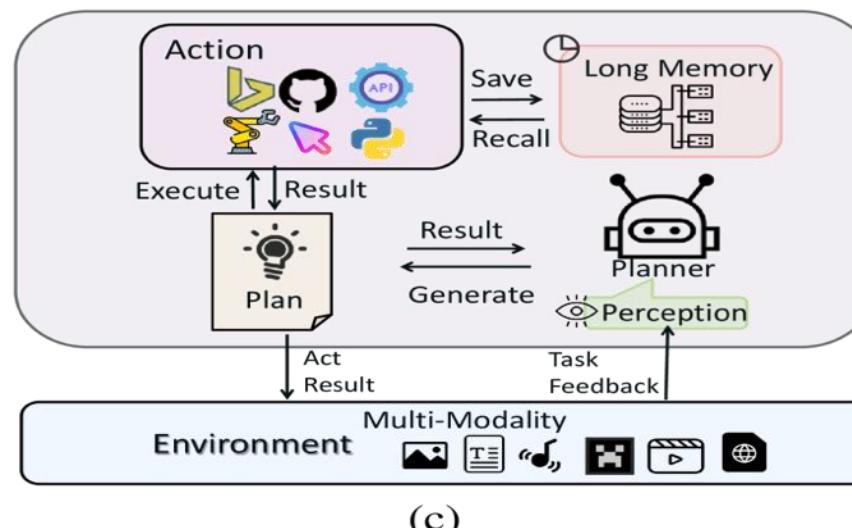
Large Multimodal Agents (LMA)



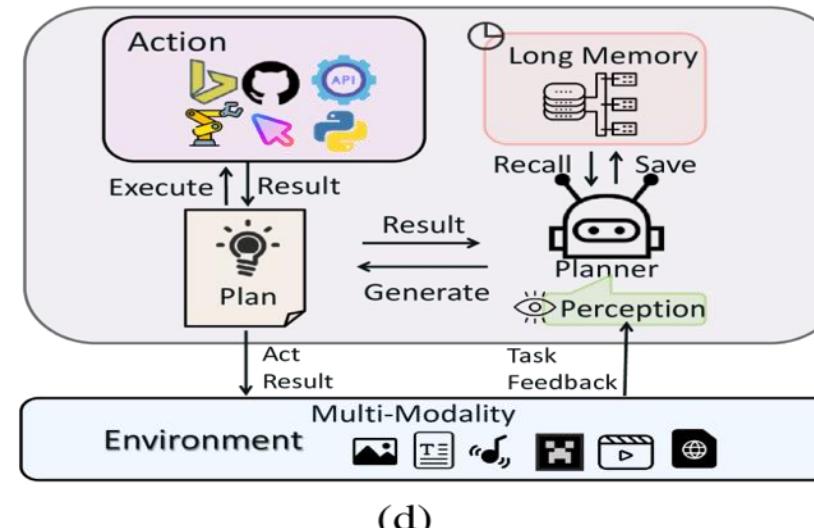
(a)



(b)

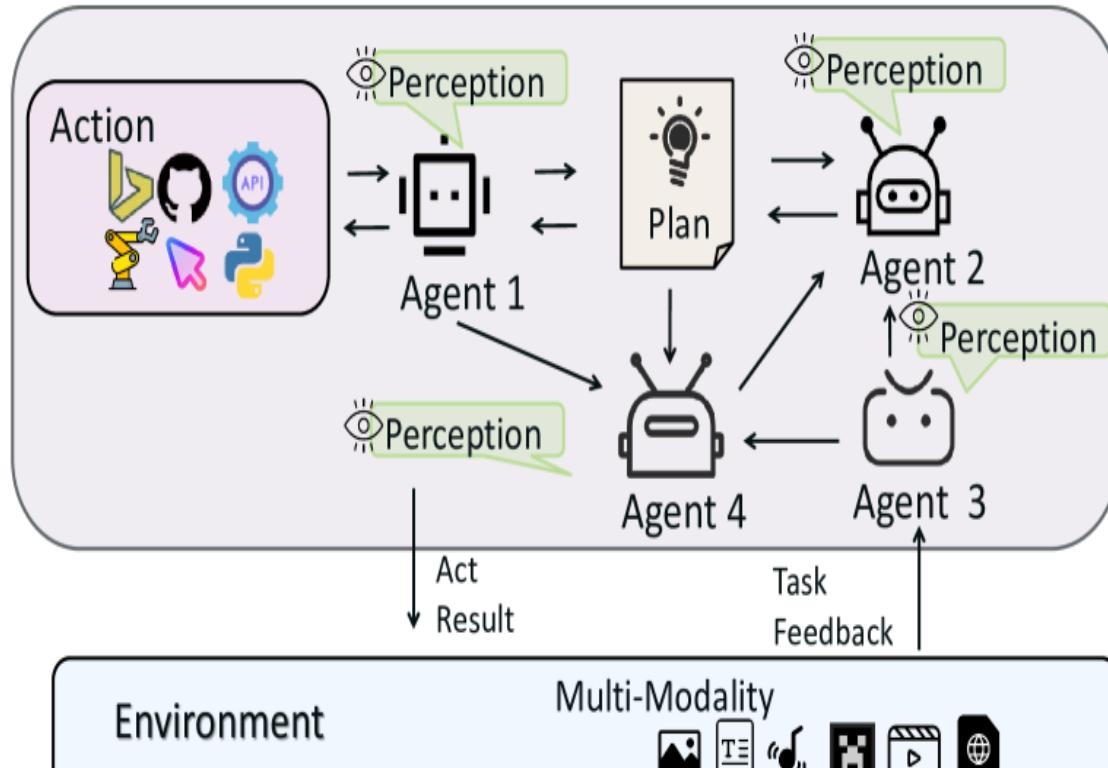


(c)

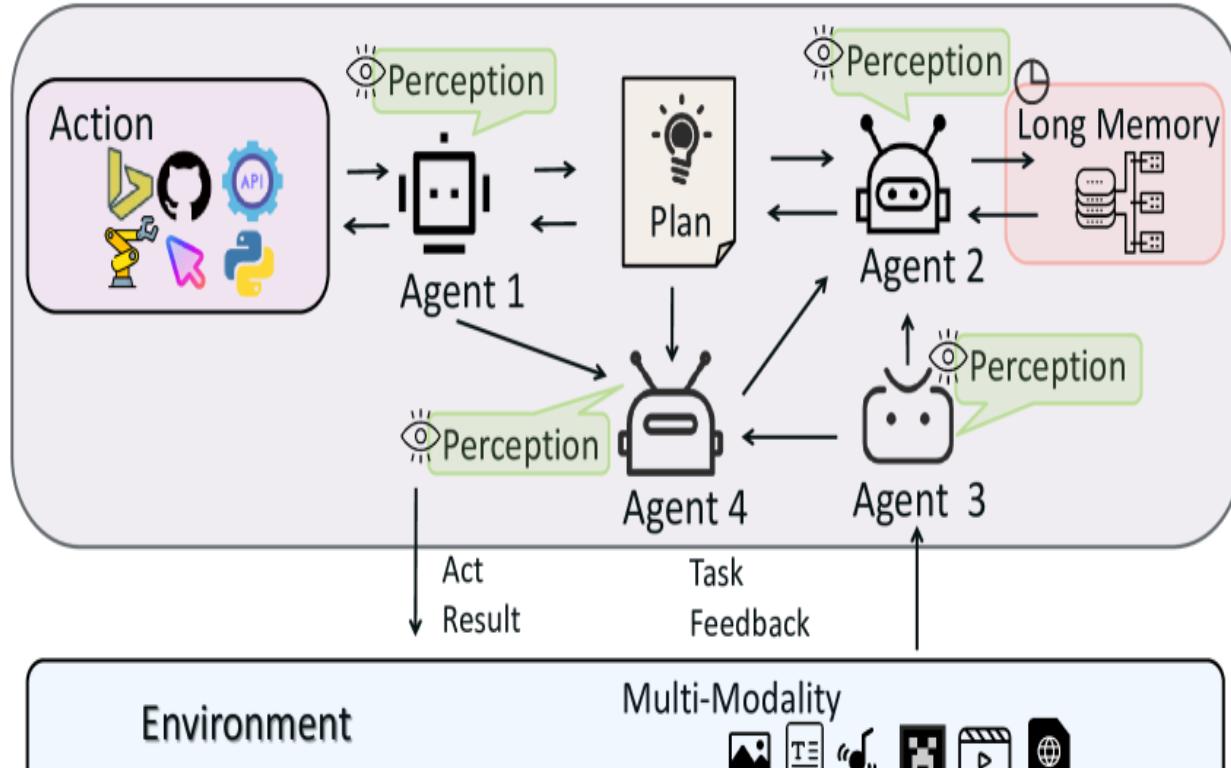


(d)

Large Multimodal Agents (LMA)



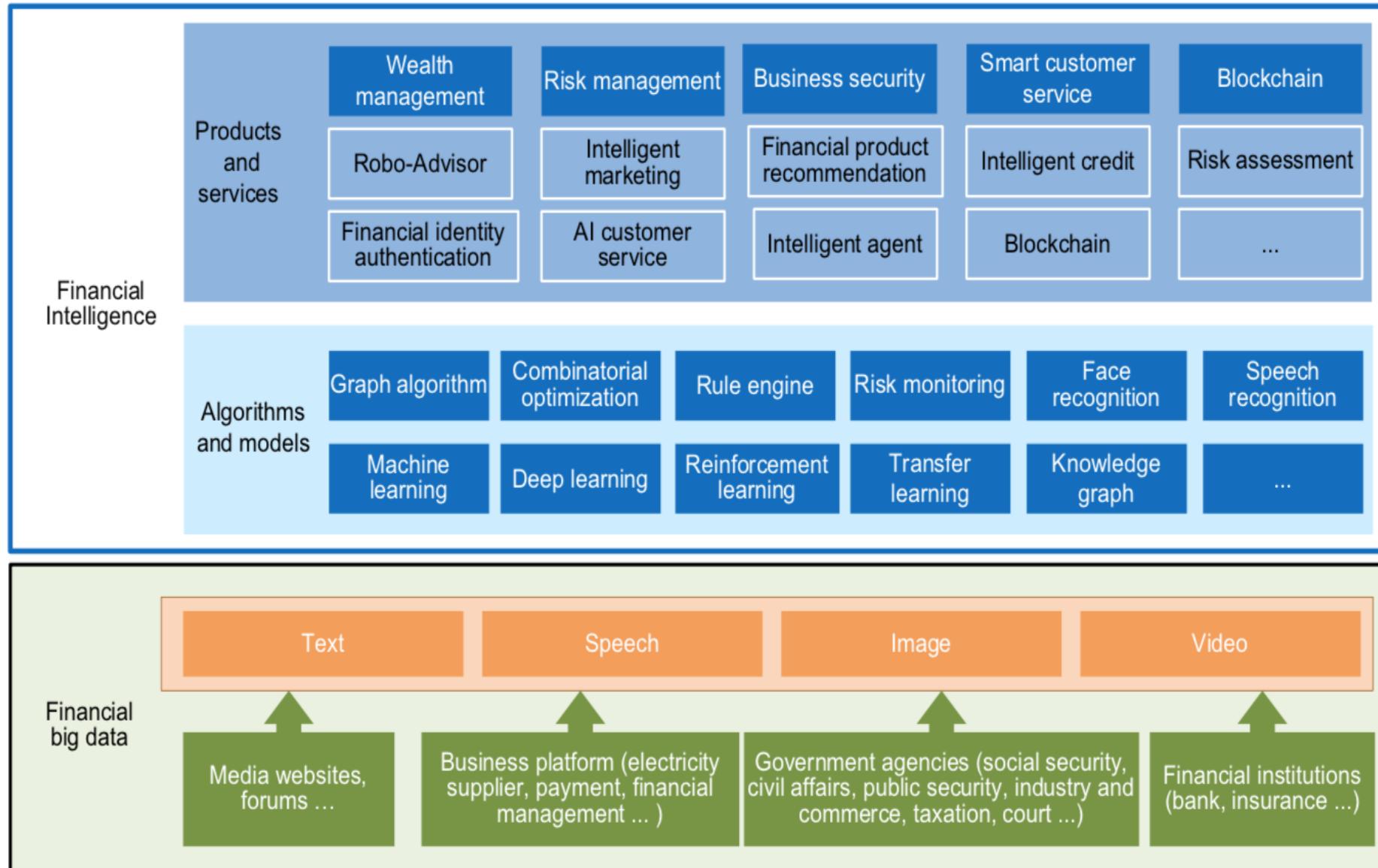
(a)



(b)

FinBrain: when Finance meets AI 2.0

(Zheng et al., 2019)



Source: Xiao-lin Zheng, Meng-ying Zhu, Qi-bing Li, Chao-chao Chen, and Yan-chao Tan (2019), "Finbrain: When finance meets AI 2.0."

Frontiers of Information Technology & Electronic Engineering 20, no. 7, pp. 914-924

Technology-driven Financial Industry Development

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

Source: Xiao-lin Zheng, Meng-ying Zhu, Qi-bing Li, Chao-chao Chen, and Yan-chao Tan (2019), "Finbrain: When finance meets AI 2.0."

Frontiers of Information Technology & Electronic Engineering 20, no. 7, pp. 914-924

Deep learning for financial applications: A survey

Applied Soft Computing (2020)

Source:

Ahmet Murat Ozbayoglu, Mehmet Ugur Gudelek, and Omer Berat Sezer (2020). "Deep learning for financial applications: A survey." Applied Soft Computing (2020): 106384.

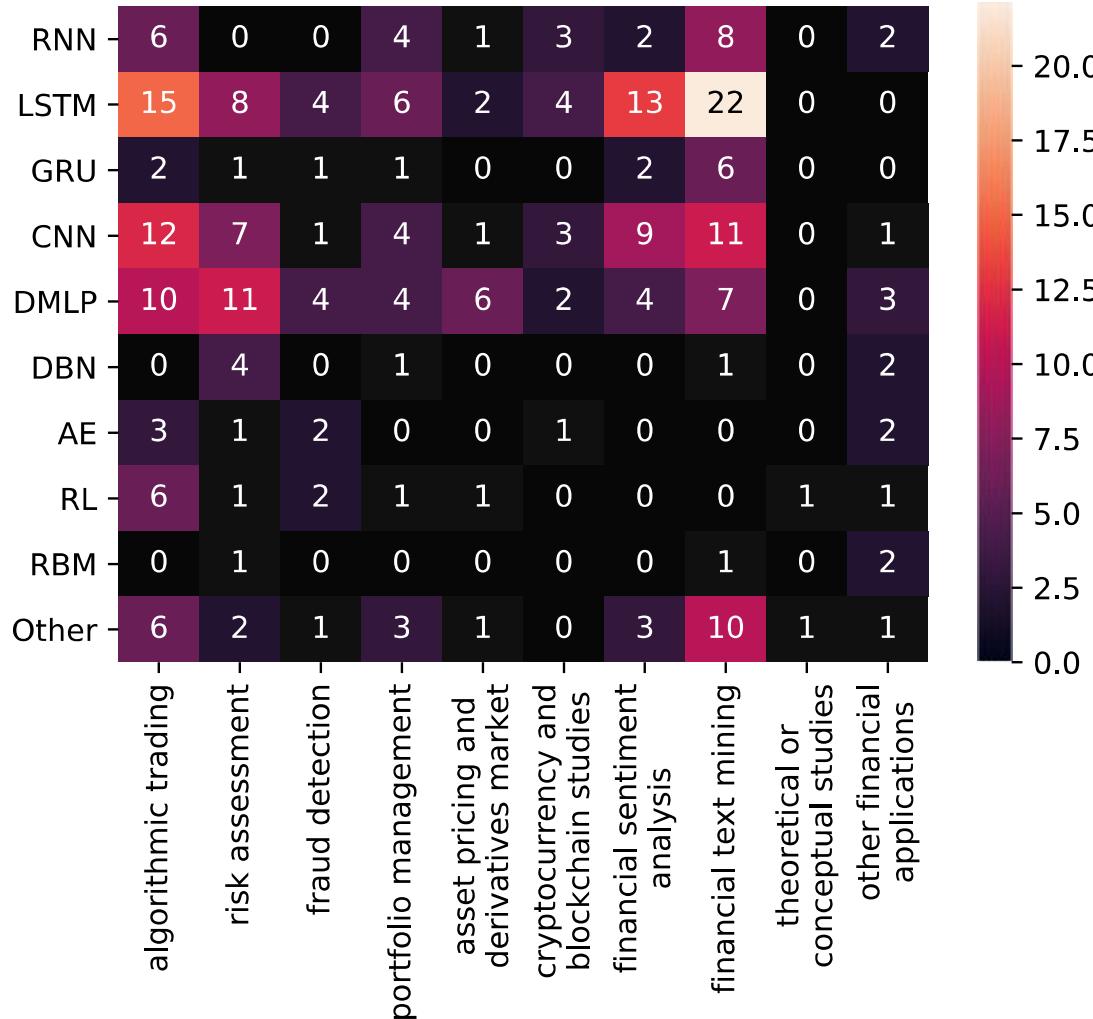
Financial time series forecasting with deep learning: A systematic literature review: 2005–2019

Applied Soft Computing (2020)

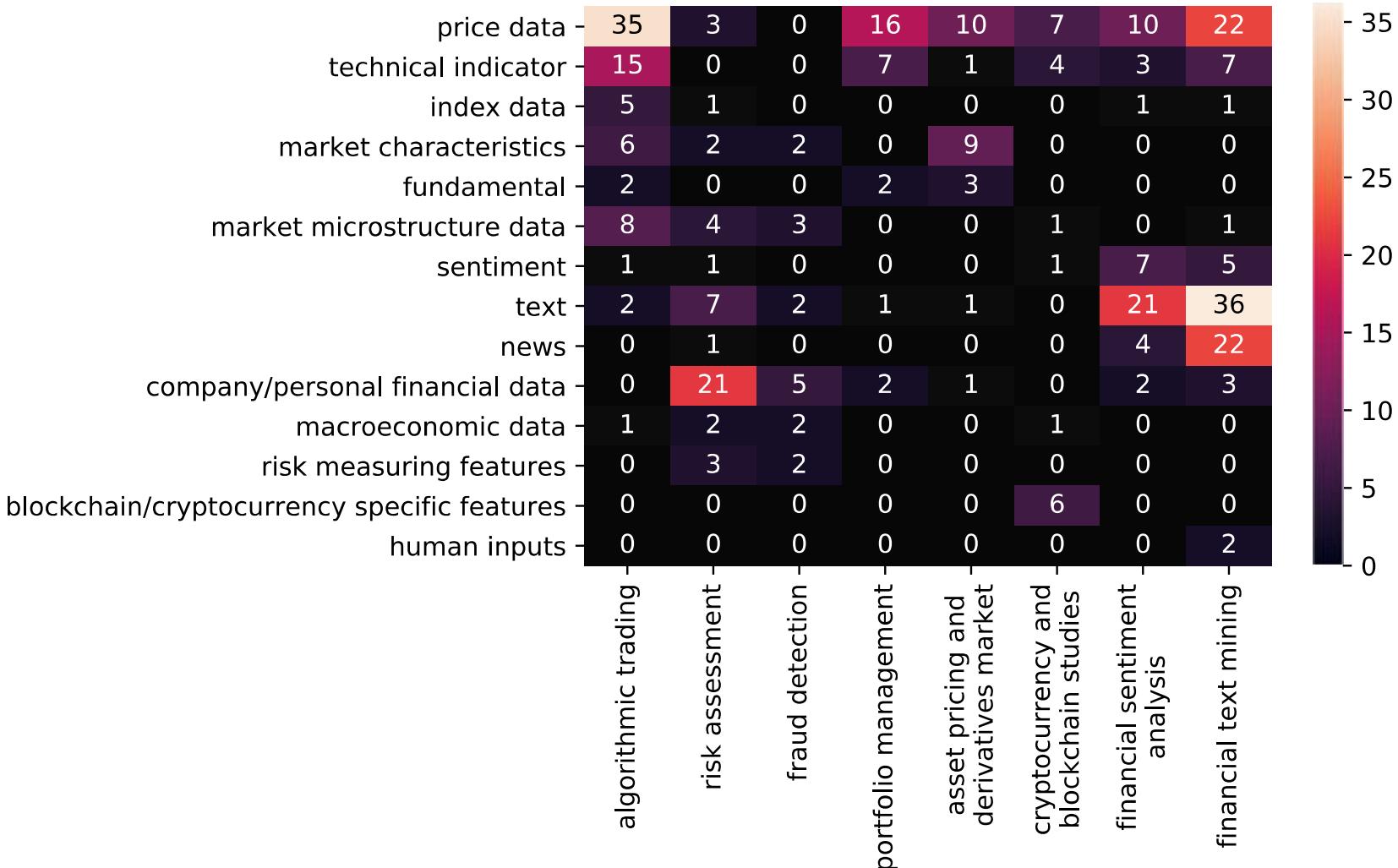
Source:

Omer Berat Sezer, Mehmet Ugur Gudelek, and Ahmet Murat Ozbayoglu (2020),
"Financial time series forecasting with deep learning: A systematic literature review:
2005–2019." Applied Soft Computing 90 (2020): 106181.

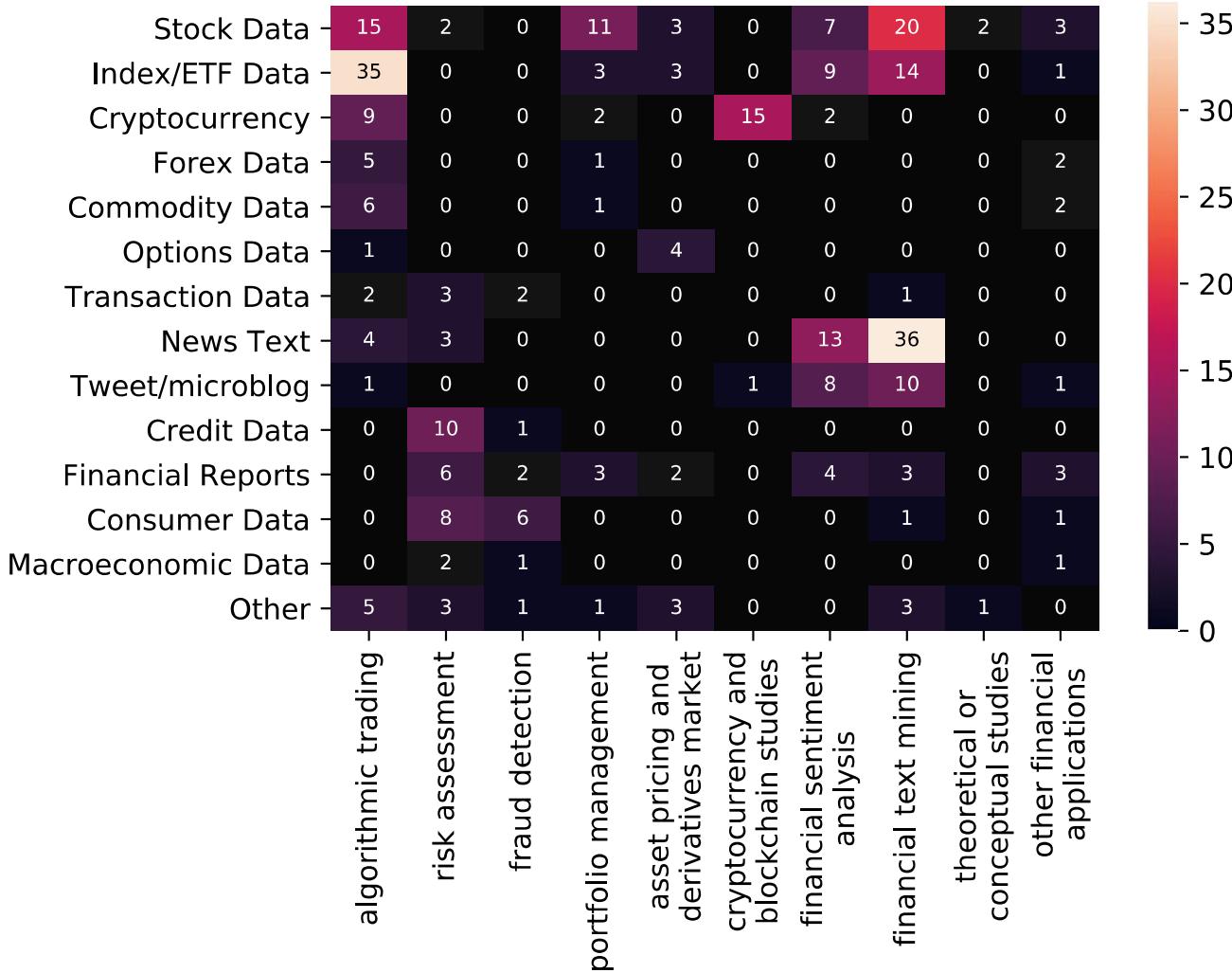
Deep learning for financial applications: Topic-Model Heatmap



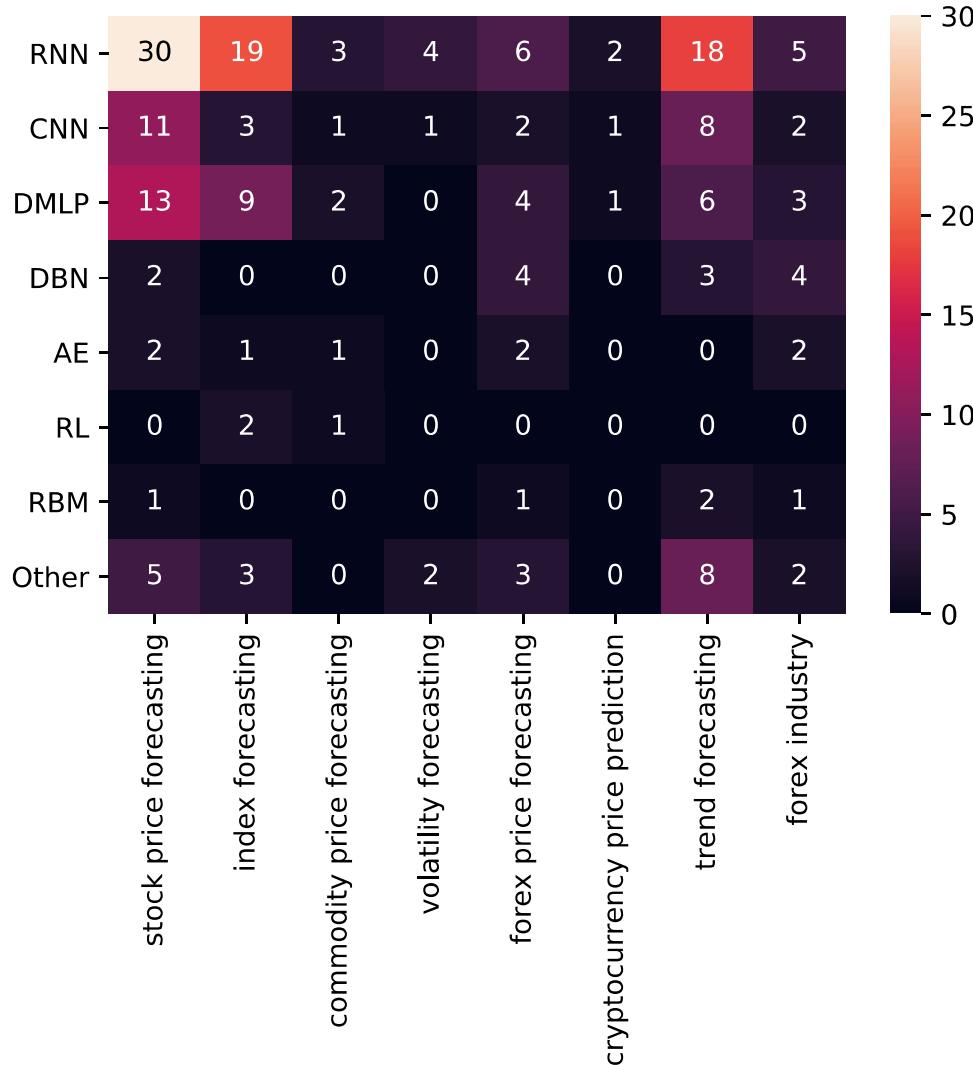
Deep learning for financial applications: Topic-Feature Heatmap



Deep learning for financial applications: Topic-Dataset Heatmap



Financial time series forecasting with deep learning: Topic-model heatmap



Source: Omer Berat Sezer, Mehmet Ugur Gudelek, and Ahmet Murat Ozbayoglu (2020), "Financial time series forecasting with deep learning: A systematic literature review: 2005–2019." Applied Soft Computing 90 (2020): 106181.

Papers with Code

State-of-the-Art (SOTA)



Search for papers, code and tasks



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Segmentation

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667 papers with code



Image
Classification

52 leaderboards

564 papers with code



Object
Detection

54 leaderboards

467 papers with code



Image
Generation

51 leaderboards

231 papers with code



Pose
Estimation

40 leaderboards

231 papers with code

▶ See all 707 tasks

Natural Language Processing



Machine
Translation



Language
Modelling



Question
Answering



Sentiment
Analysis



Text
Generation

Python in Google Colab (Python101)

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

python101.ipynb

File Edit View Insert Runtime Tools Help

CODE TEXT CELL CELL

CONNECTED EDITING

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

194.87
```

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

194.87
```

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

194.87
```

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

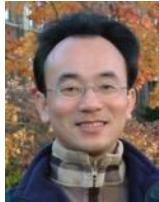
Pass
```

<https://tinyurl.com/aintpuppython101>



Teaching

- Artificial Intelligence
 - Spring 2021, Fall 2022, Fall 2024, Fall 2025
- Sustainability and ESG Data Analytics
 - Spring 2024, Fall 2024, Fall 2025
- Software Engineering
 - Fall 2020, Fall 2021, Spring 2022, Spring 2023, Spring 2024, Spring 2025
- Generative AI Innovative Applications
 - Spring 2025
- Artificial Intelligence in Finance and Quantitative
 - Fall 2021, Fall 2022, Fall 2023, Spring 2025
- Big Data Analytics
 - Fall 2020, Spring 2023, Spring 2024
- Artificial Intelligence for Text Analytics
 - Spring 2022, Fall 2023
- Python for Accounting Applications
 - Fall 2023, Fall 2024, Fall 2025
- Foundation of Business Cloud Computing
 - Spring 2021, Spring 2022, Spring 2023, Spring 2024

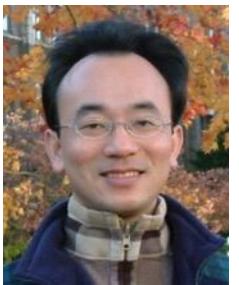


Research Projects

- 1. Generative AI Multi-Agent Systems with LLM-Based RAG for ESG Reporting Automation**
 - NSTC (E4104), NSTC 114-2221-E-305-002-, 2025/08/01~2026/07/31
- 2. Innovative Agentic AI Technology for Autonomous ESG Report Generation**
 - Industrial Technology Research Institute (ITRI), Fintech and Green Finance Center (FGFC, NTPU), NTPU-114A513E01, 2025/03/01~2025/12/31
- 3. Digital Support, Unimpeded Communication: The Development, Support and Promotion of AI-assisted Communication Assistive Devices for Speech Impairment(3/3), Sub-project 3: Multimodal Cross-lingual Task-Oriented Dialogue System for Inclusive Communication Support,**
 - NSTC (HZZ22), NSTC 114-2425-H-305-003-, 3 Years (2023/05/01-2026/04/30) Year 3: 2025/05/01~2026/04/30
- 4. Research on speech processing, synthesis, recognition, and sentence construction of people with language disabilities, Sub-project 3: Multimodal Cross-lingual Task-Oriented Dialogue System**
 - NTPU, 114-NTPU_ORDA-F-004, 3 Years (2023/01/01-2025/12/31) Year 3: 2025/01/01~2025/12/31
- 5. Development of a Deep Learning for Dental Implant Detection in Panoramic Radiographs,**
 - University System of Taipei Joint Research Program (NTPU, TMU), USTP-NTPU-TMU-114-02, 2025/01/01~2025/12/31

Summary

- This course introduces the **fundamental concepts, research issues, and hands-on practices of Artificial Intelligence**.
- Topics include:
 1. Introduction to Artificial Intelligence
 2. Artificial Intelligence and Intelligent Agents; Problem Solving
 3. Knowledge, Reasoning and Knowledge Representation
 4. Uncertain Knowledge and Reasoning
 5. Machine Learning: Supervised and Unsupervised Learning
 6. The Theory of Learning and Ensemble Learning
 7. NVIDIA Fundamentals of Deep Learning
 8. Natural Language Processing
 9. Computer Vision and Robotics
 10. Generative AI, Agentic AI, and Physical AI
 11. Philosophy and Ethics of AI and the Future of AI
 12. Case Study on AI



Artificial Intelligence

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Professor and Director

[Institute of Information Management, National Taipei University](#)

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Email: myday@gm.ntpu.edu.tw

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