

Artificial Intelligence

Introduction to Artificial Intelligence

1141AI01

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

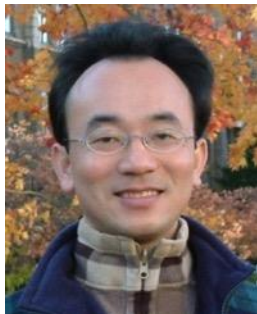
Tue 2, 3, 4 (9:10-12:00) (B3F17)



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

 **NVIDIA**
University Ambassador
Certified Instructor

 **aws** educate | Cloud
Ambassador
2020 Cohort



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

Institute of Information Management, National Taipei University

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

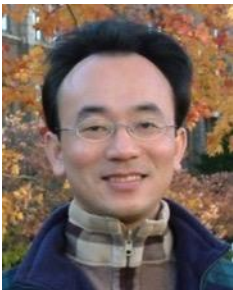




國立臺北大學
National Taipei University



2020 Cohort



Prof. Min-Yuh Day



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

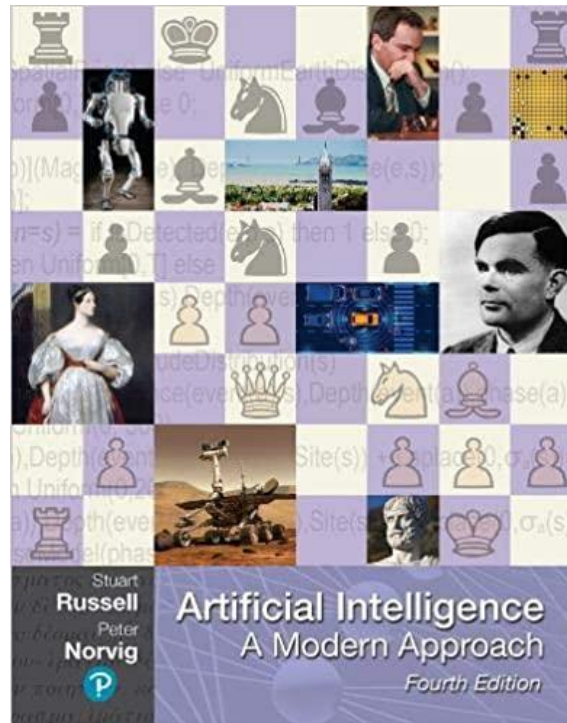
- **Lecture**
- **Discussion**
- **Practicum**

Evaluation Methods

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

Required Texts

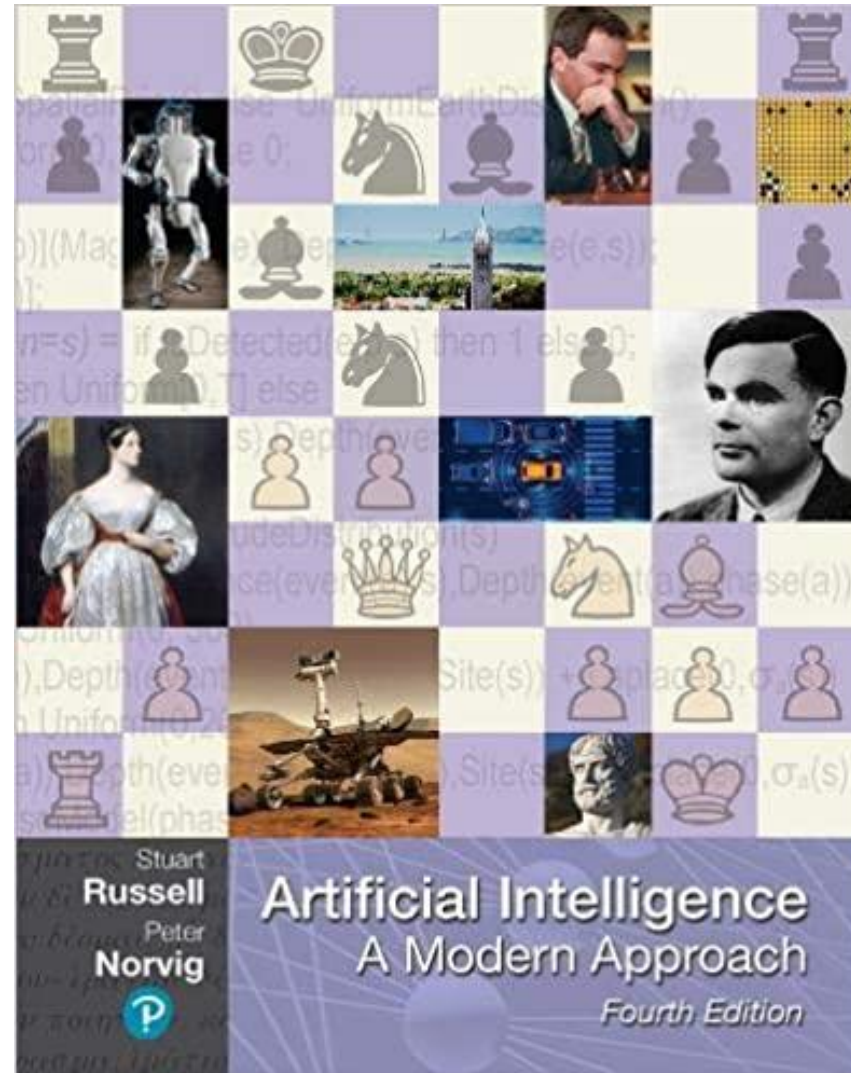
**Stuart Russell and Peter Norvig (2020),
Artificial Intelligence: A Modern Approach,
4th Edition, Pearson.**



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.

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



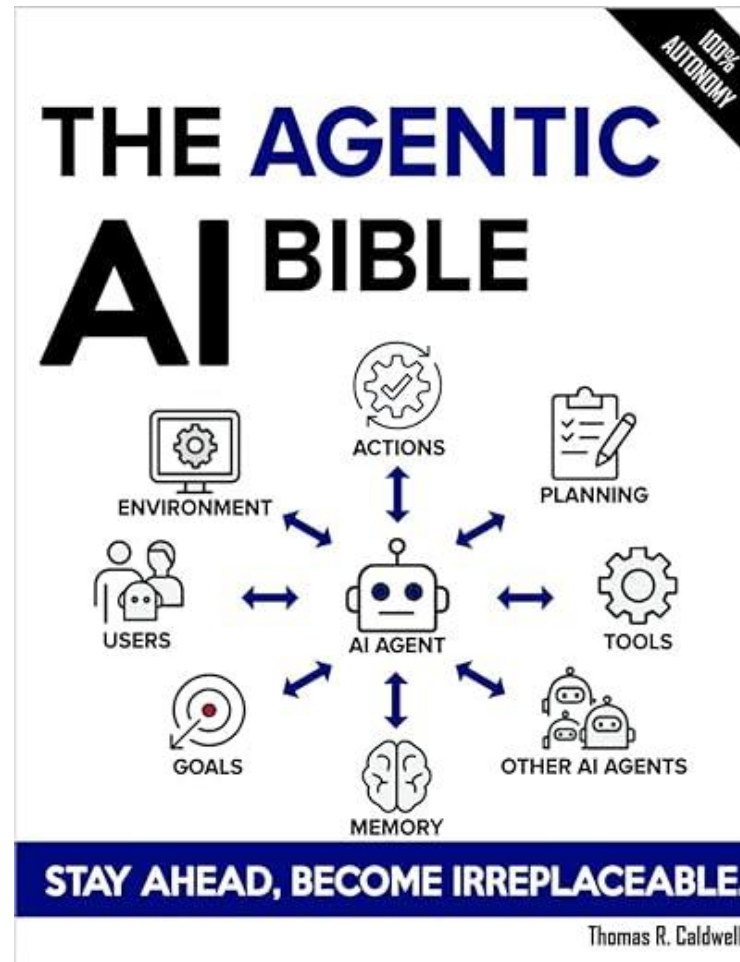
Source: Stuart Russell and Peter Norvig (2020), Artificial Intelligence: A Modern Approach, 4th Edition, Pearson

<https://www.amazon.com/Artificial-Intelligence-A-Modern-Approach/dp/0134610997/>

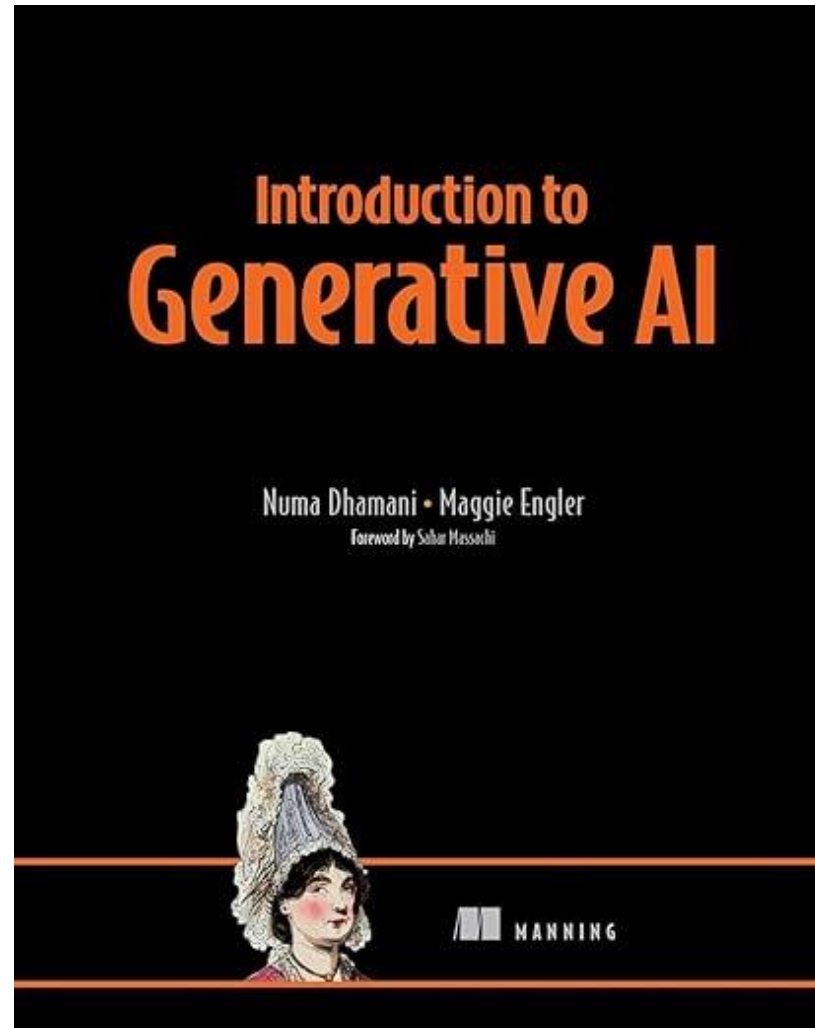
Thomas R. Caldwell (2025),

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



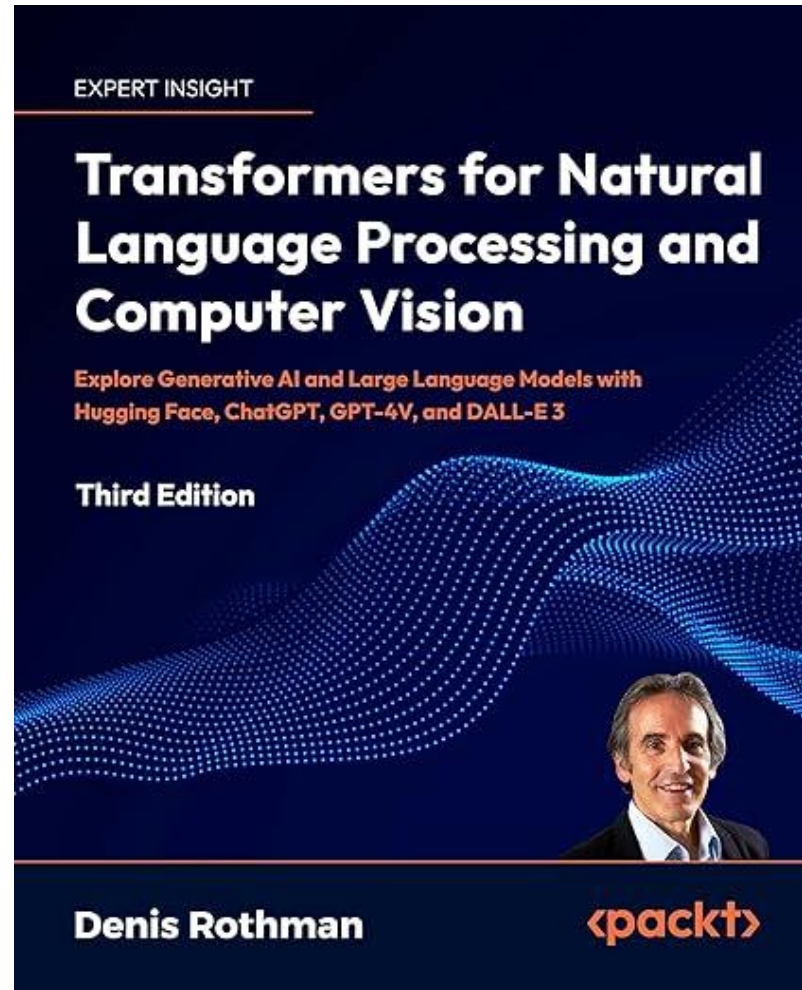
Numa Dhamani and Maggie Engler (2024),
Introduction to Generative AI,
Manning



Denis Rothman (2024),

Transformers for Natural Language Processing and Computer Vision:

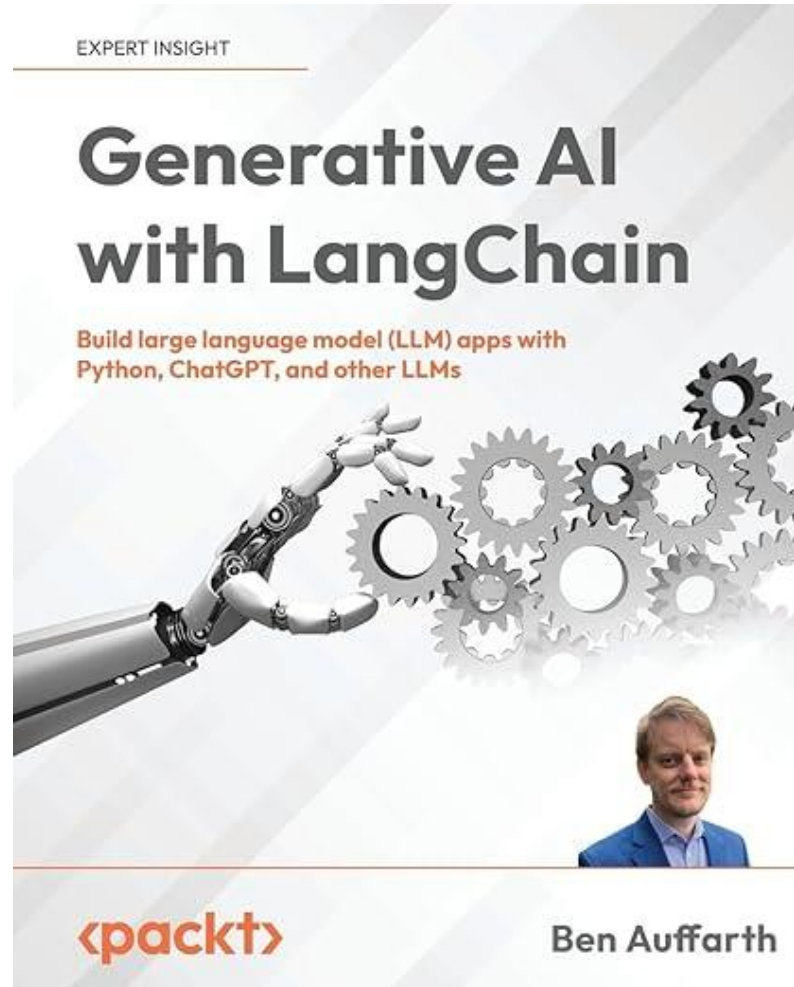
Explore Generative AI and Large Language Models with Hugging Face, ChatGPT, GPT-4V, and DALL-E 3,
3rd Edition, Packt Publishing



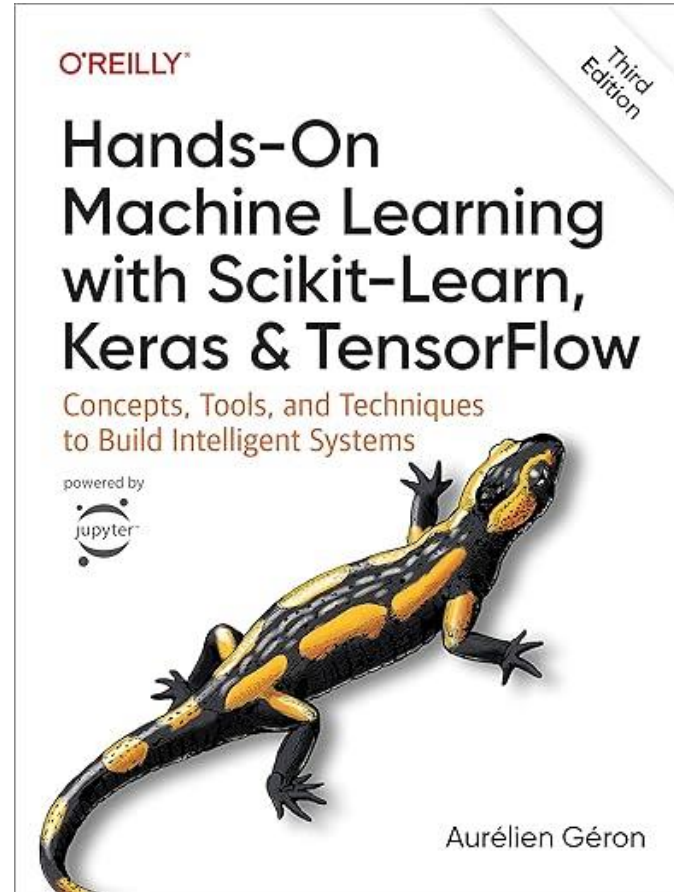
Ben Auffarth (2023),

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

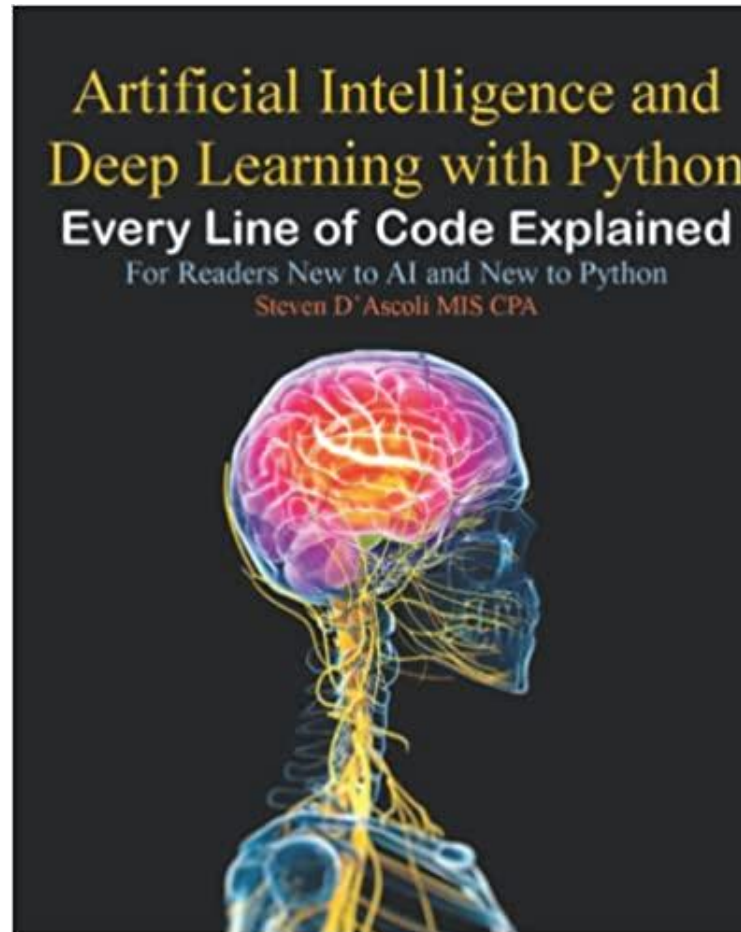


<https://github.com/ageron/handson-ml3>

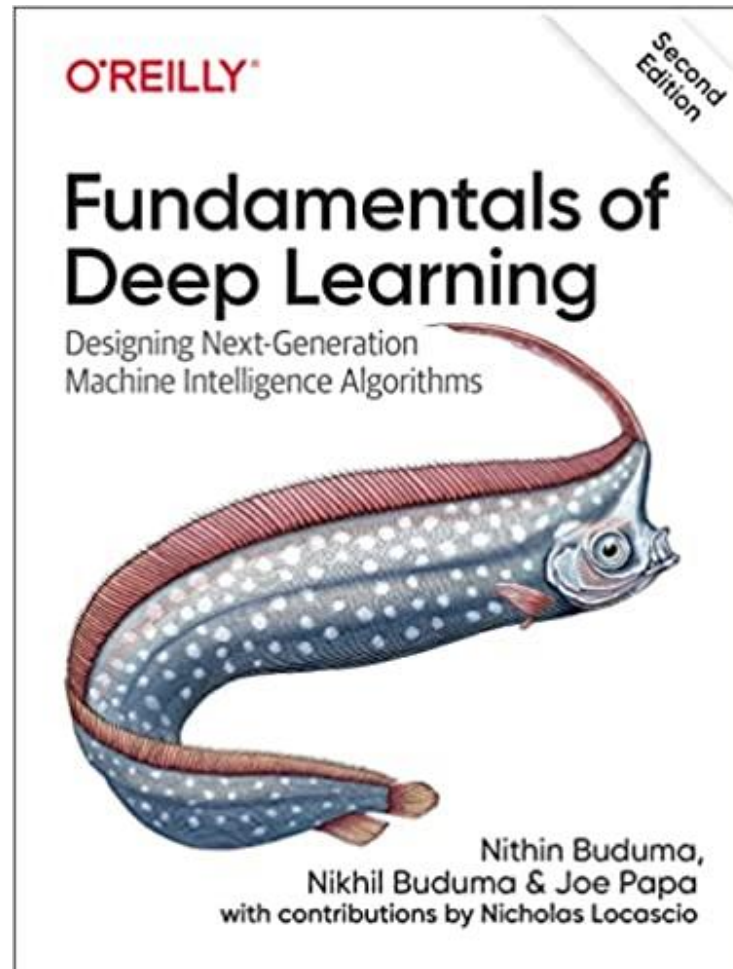
Steven D'Ascoli (2022),

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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:
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2nd Edition, O'Reilly Media.



NVIDIA Developer Program

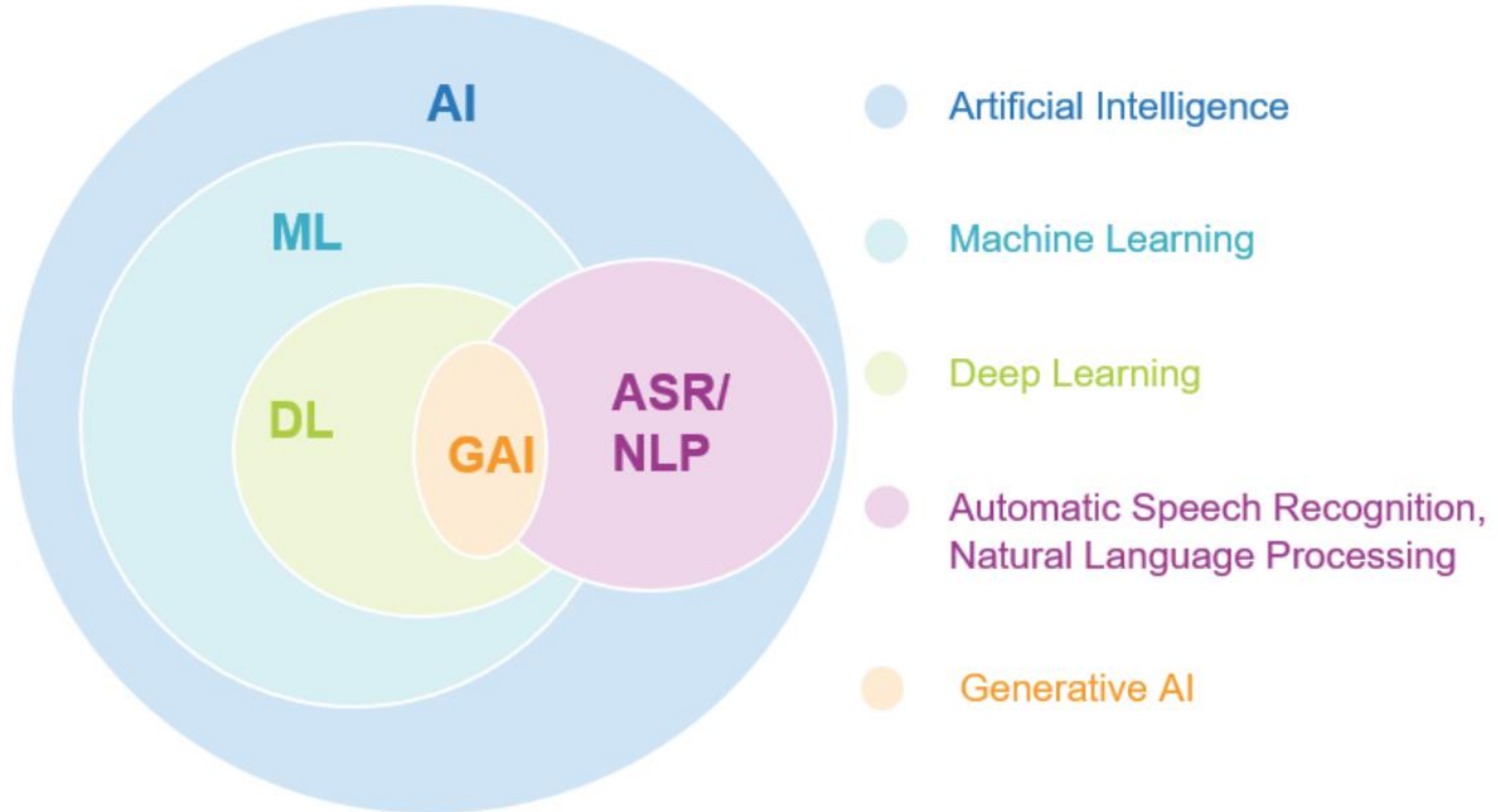
<https://developer.nvidia.com/join-nvidia-developer-program>

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

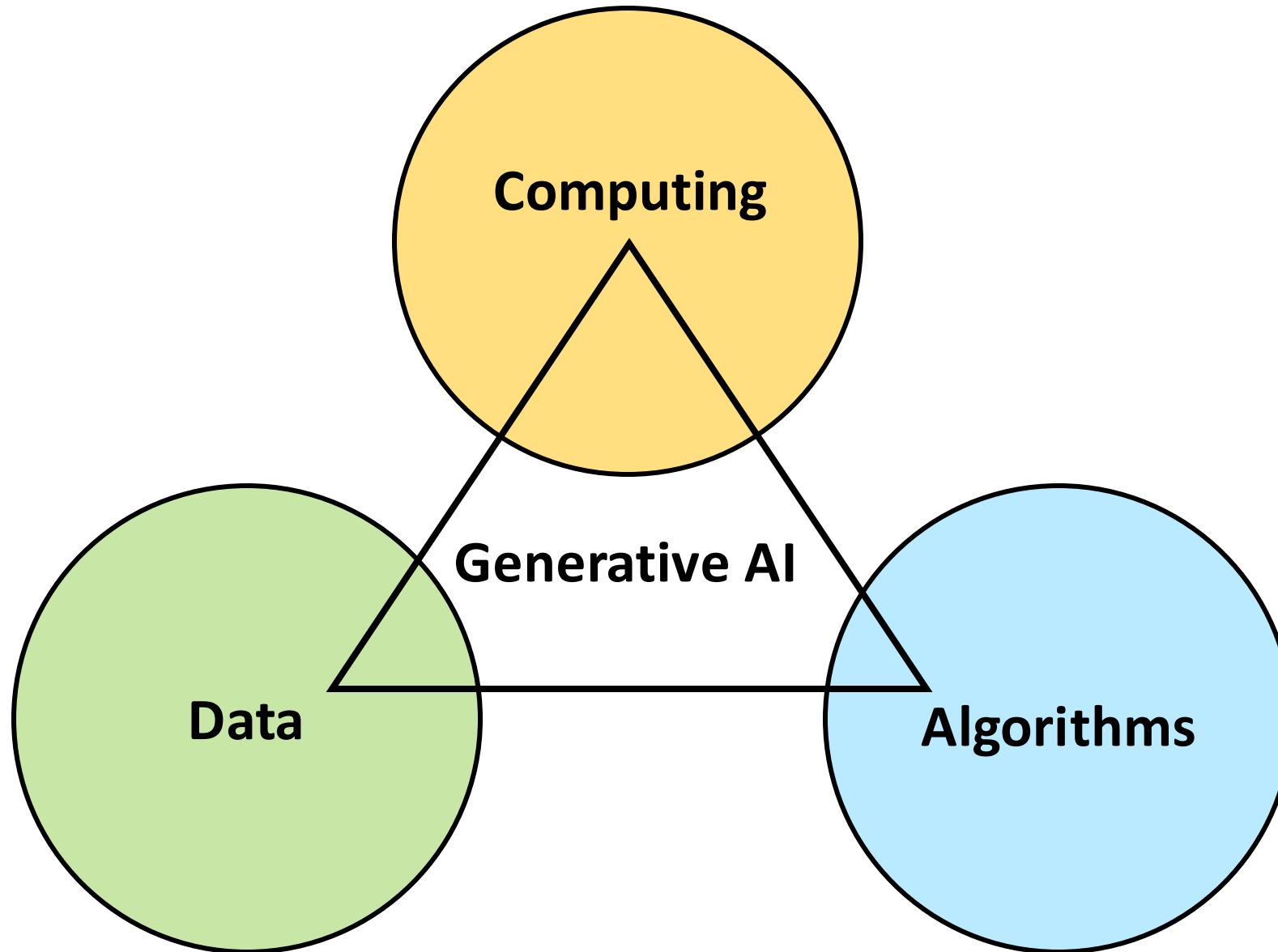
Perception AI

Speech recognition
Deep recommender systems
Medical imaging

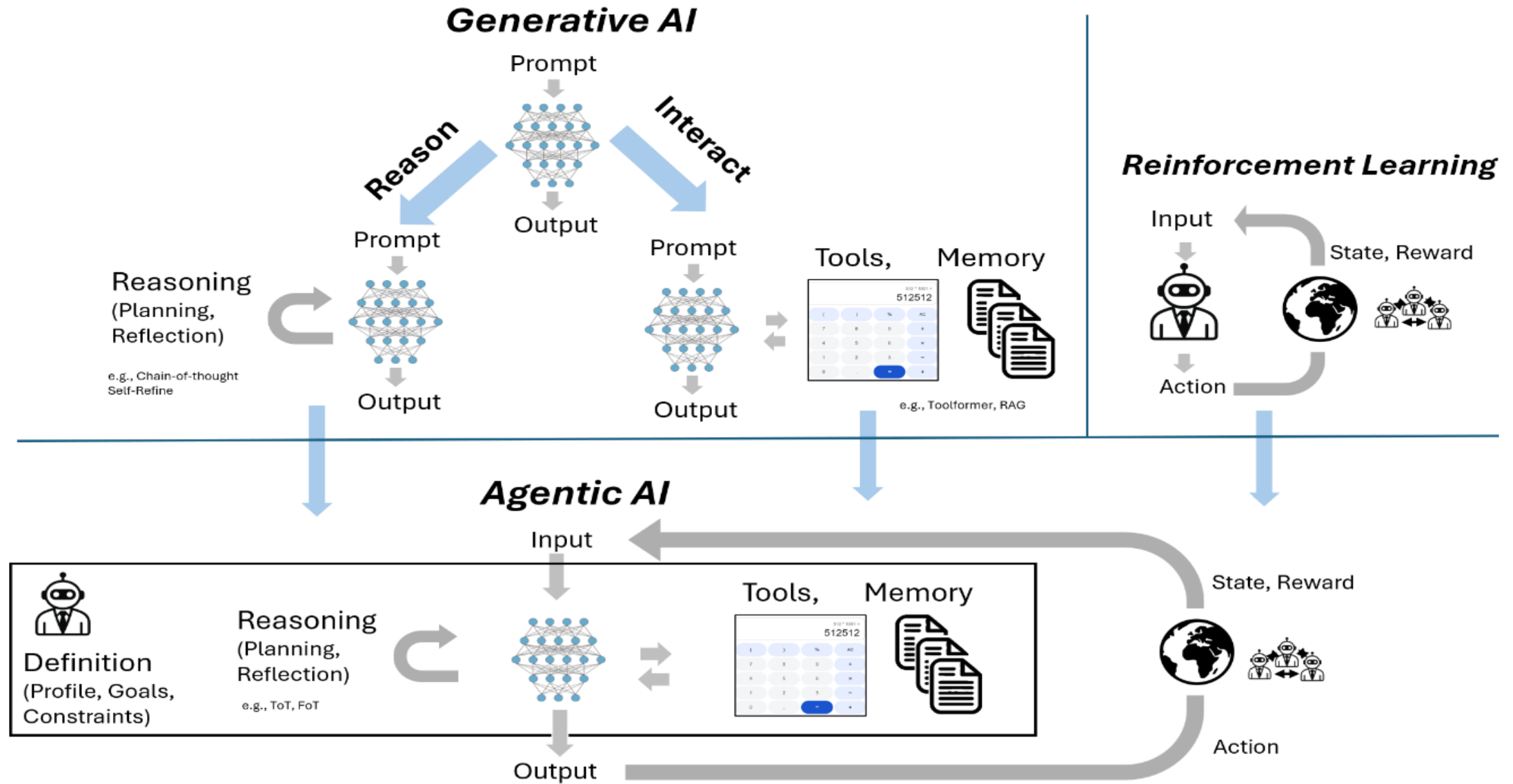
2012 AlexNet

Deep learning breakthrough

Generative AI



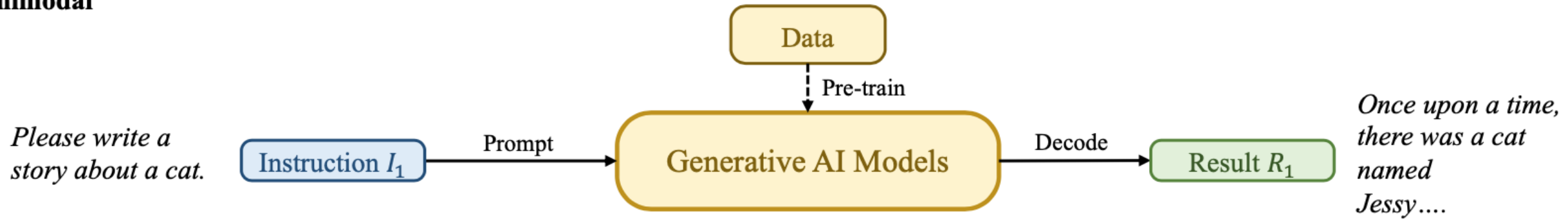
From Generative AI to Agentic AI



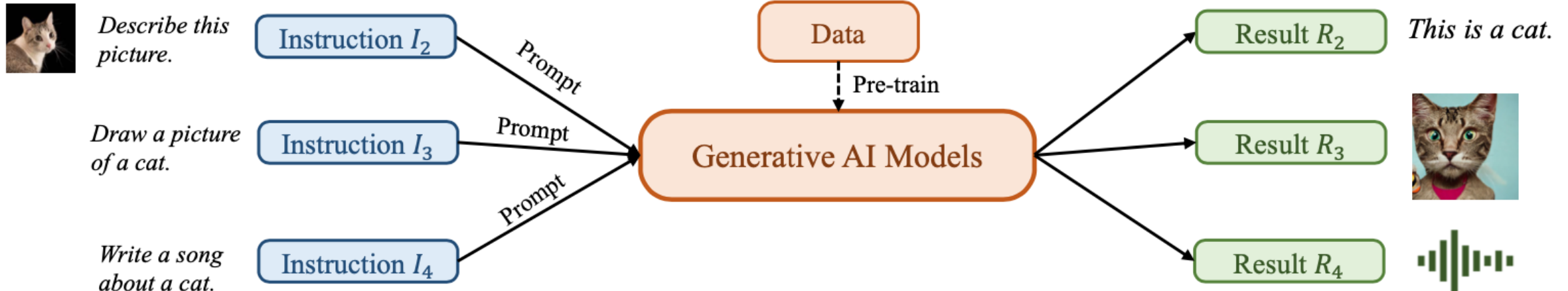
Generative AI (Gen AI)

AI Generated Content (AIGC)

Unimodal

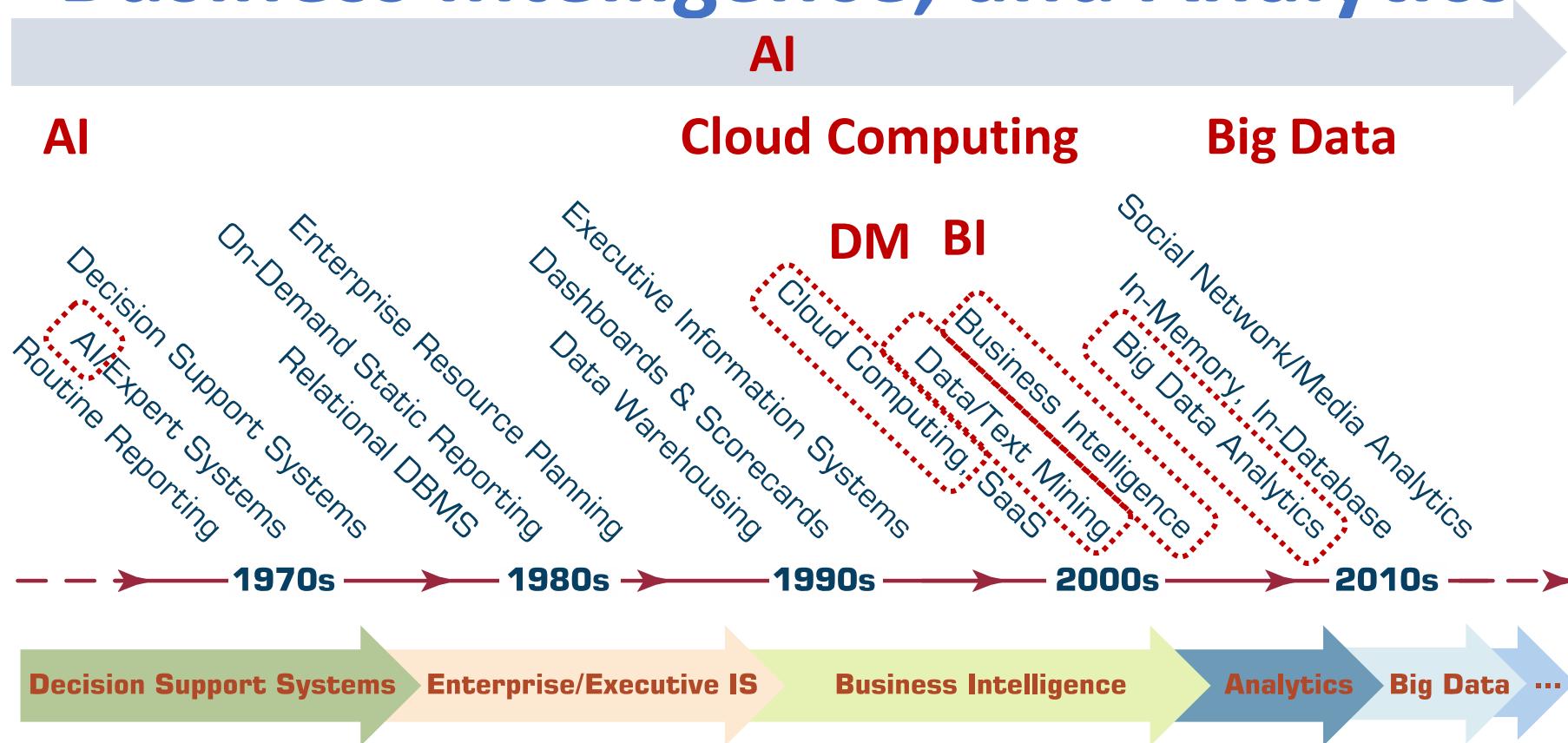


Multimodal

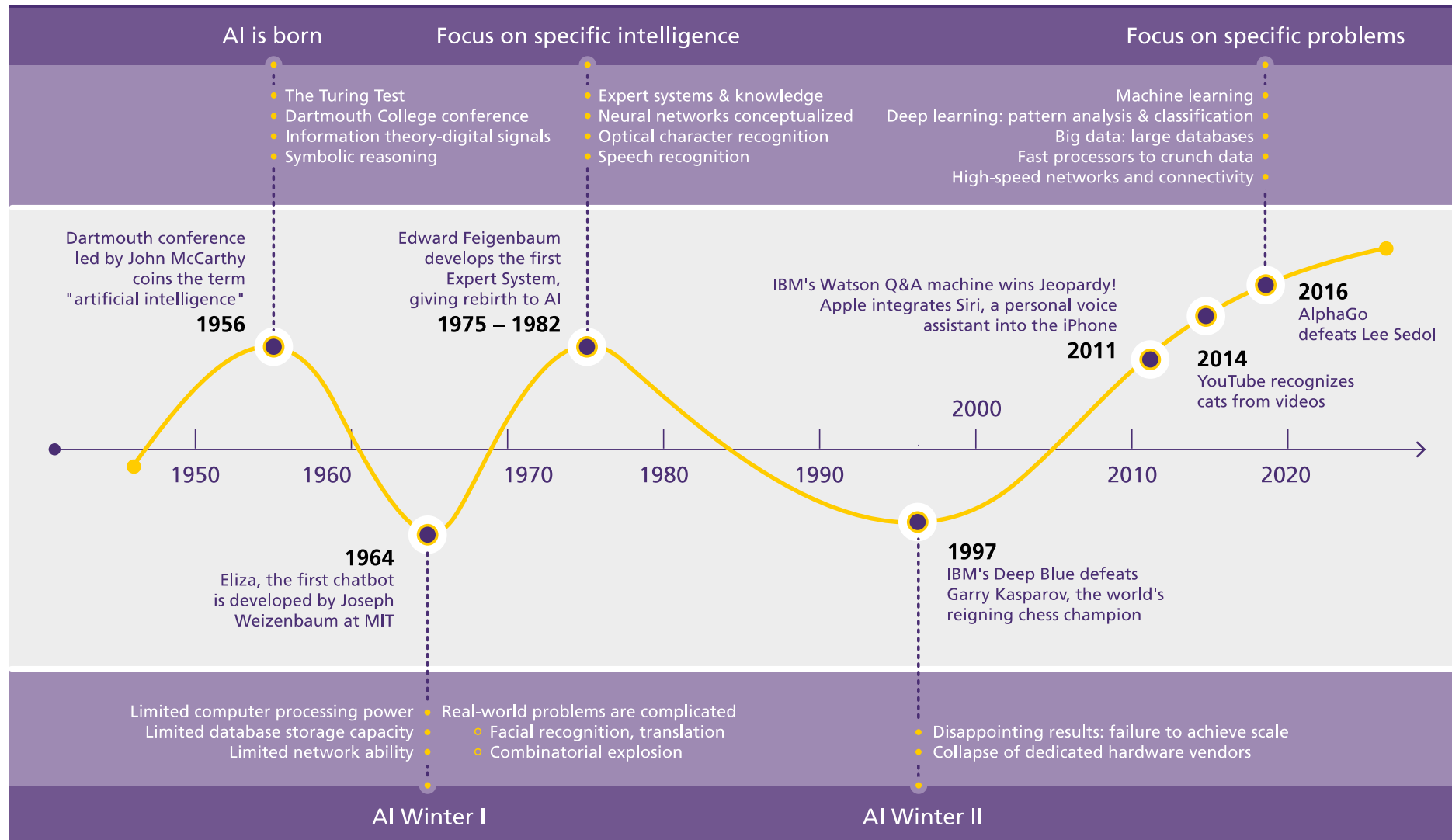


AI, Big Data, Cloud Computing

Evolution of Decision Support, Business Intelligence, and Analytics

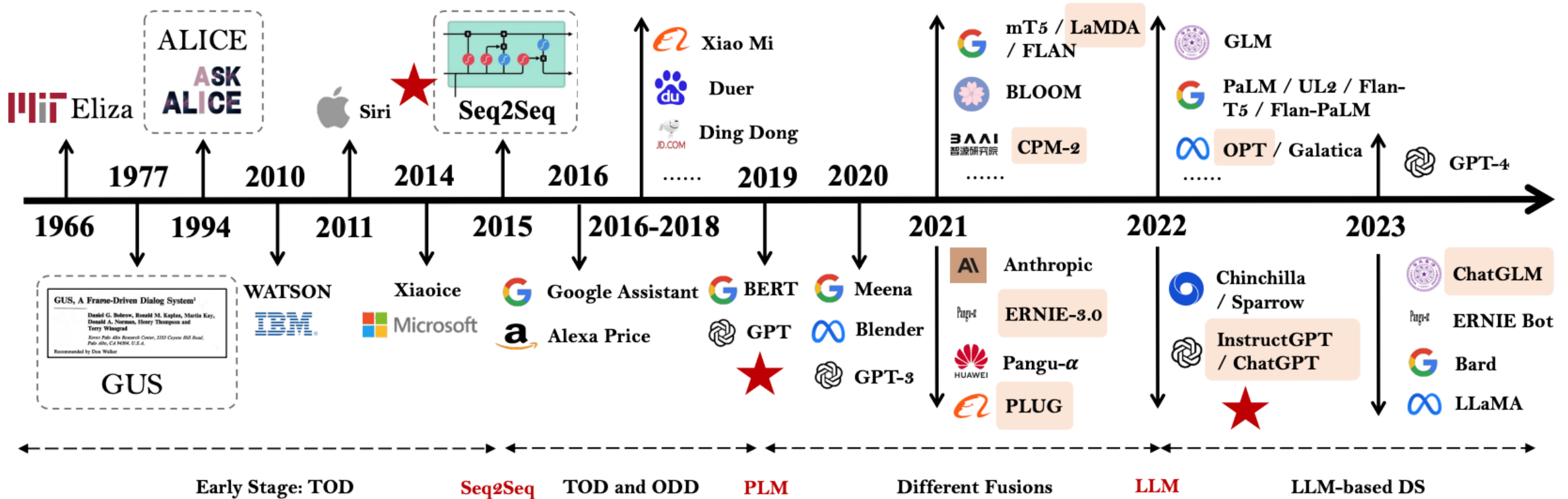


The Rise of AI



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)



Task-oriented DS (TOD), Open-domain DS (ODD)

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

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

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**

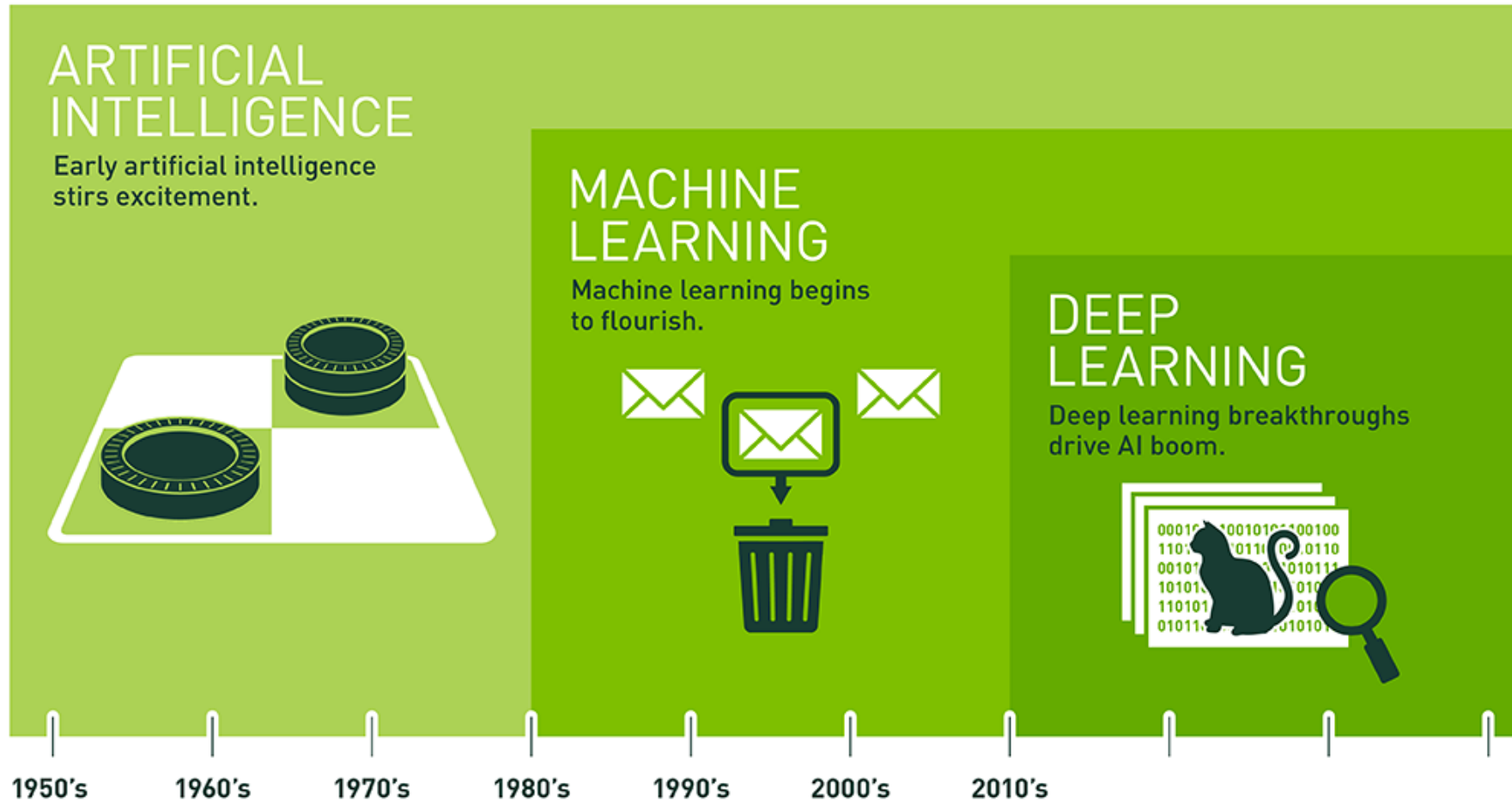
Artificial Intelligence:

Philosophy and Ethics of AI

The Future of AI

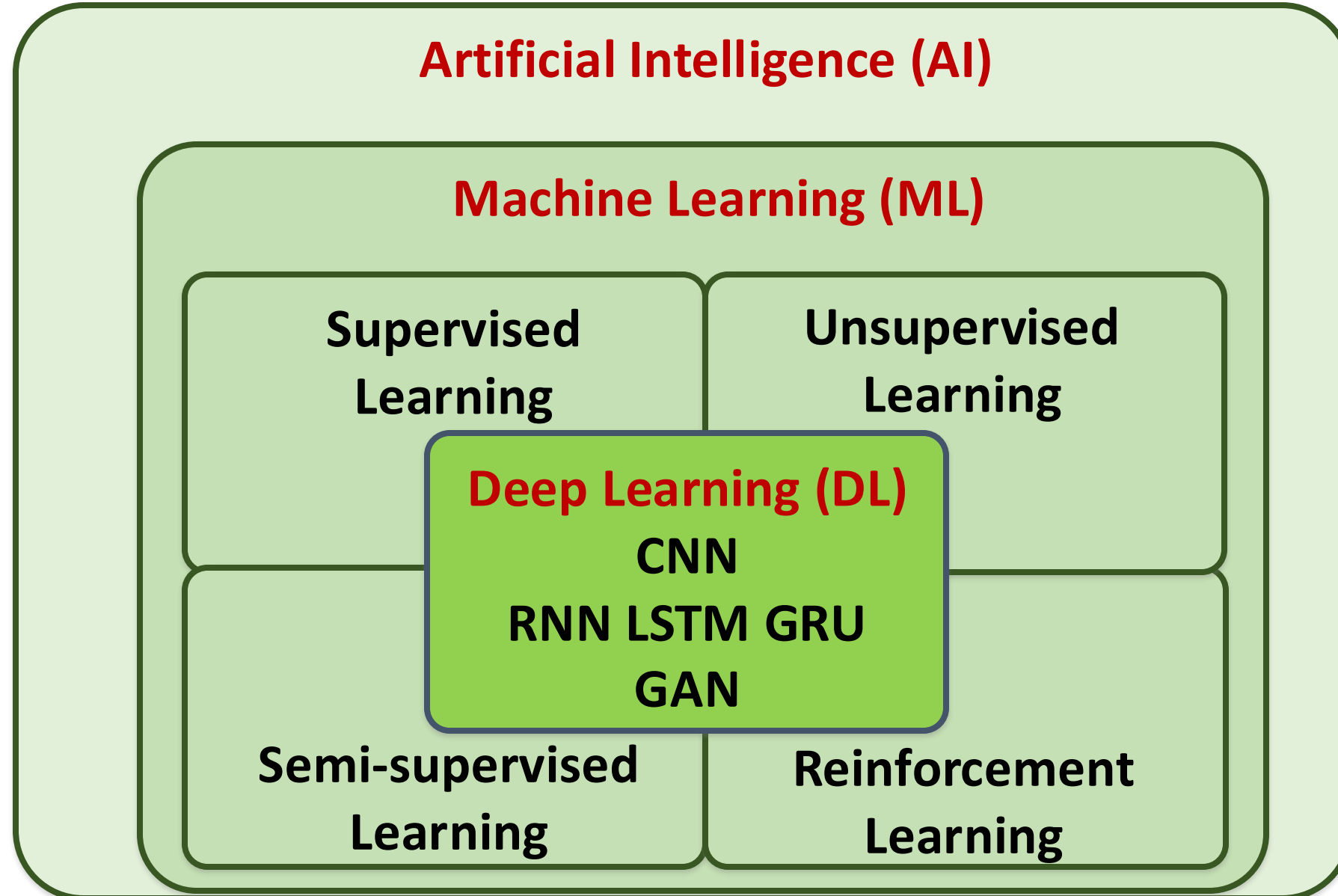
Artificial Intelligence

Machine Learning & Deep Learning

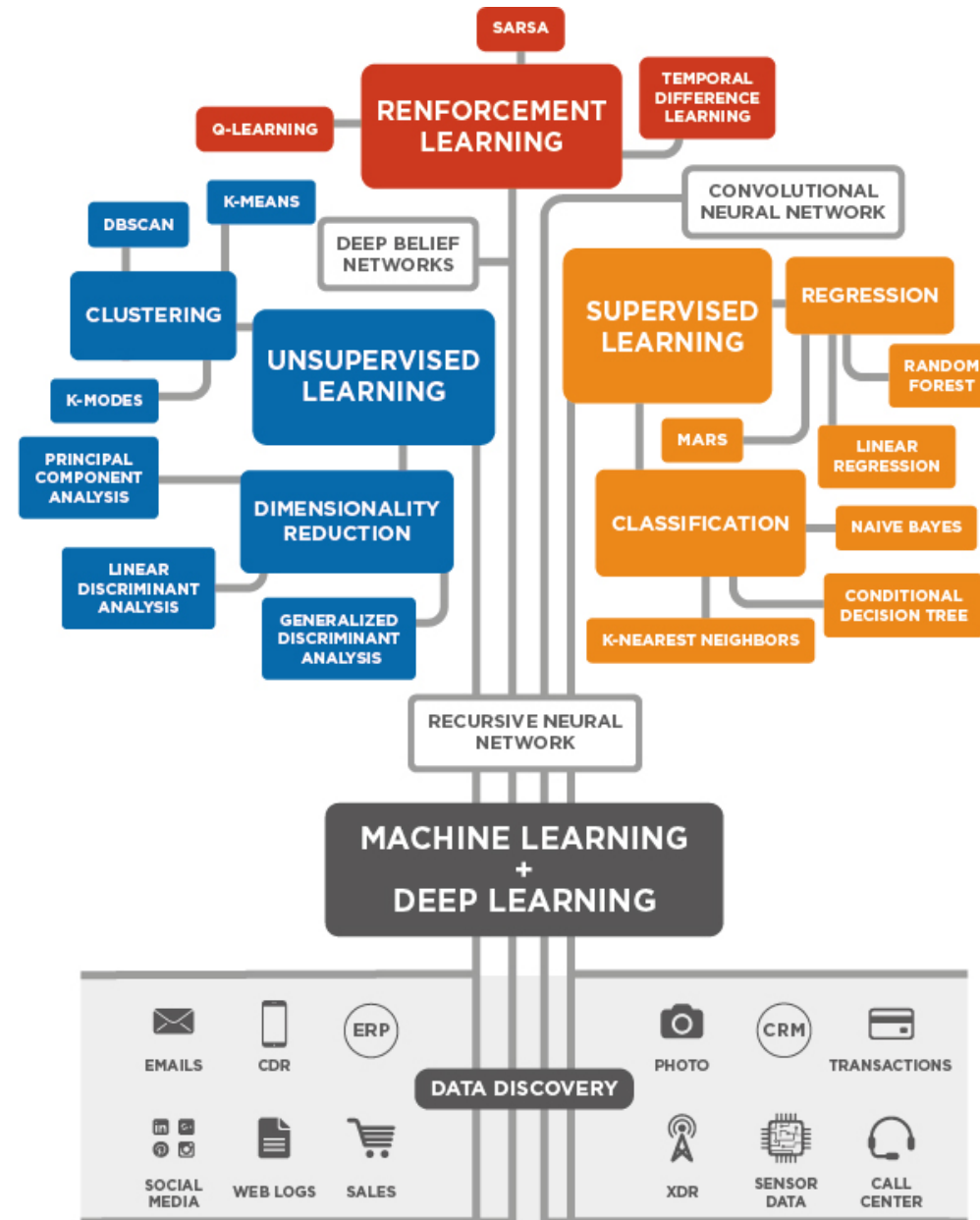


Since an early flush of optimism in the 1950s, smaller subsets of artificial intelligence – first machine learning, then deep learning, a subset of machine learning – have created ever larger disruptions.

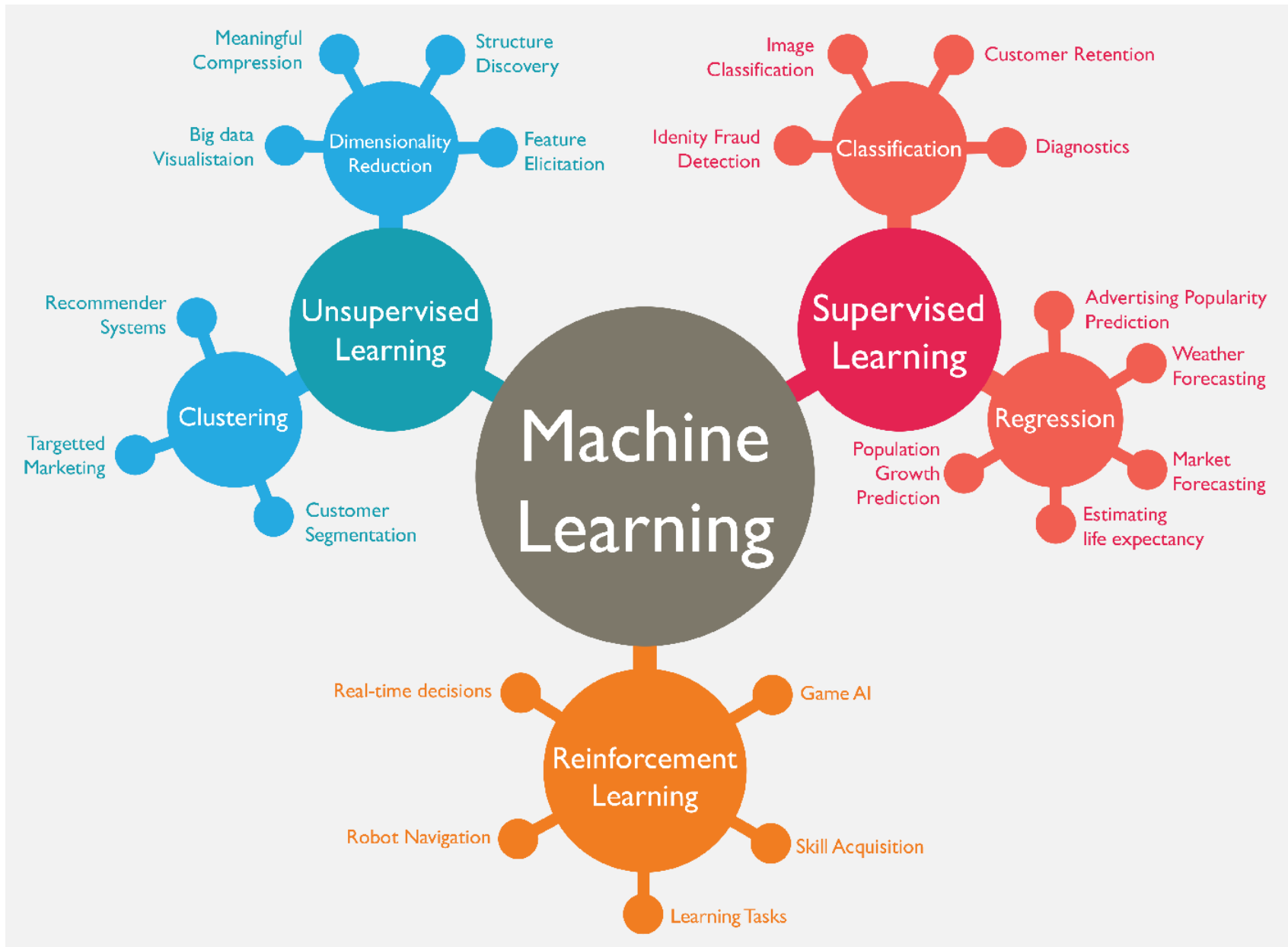
AI, ML, DL



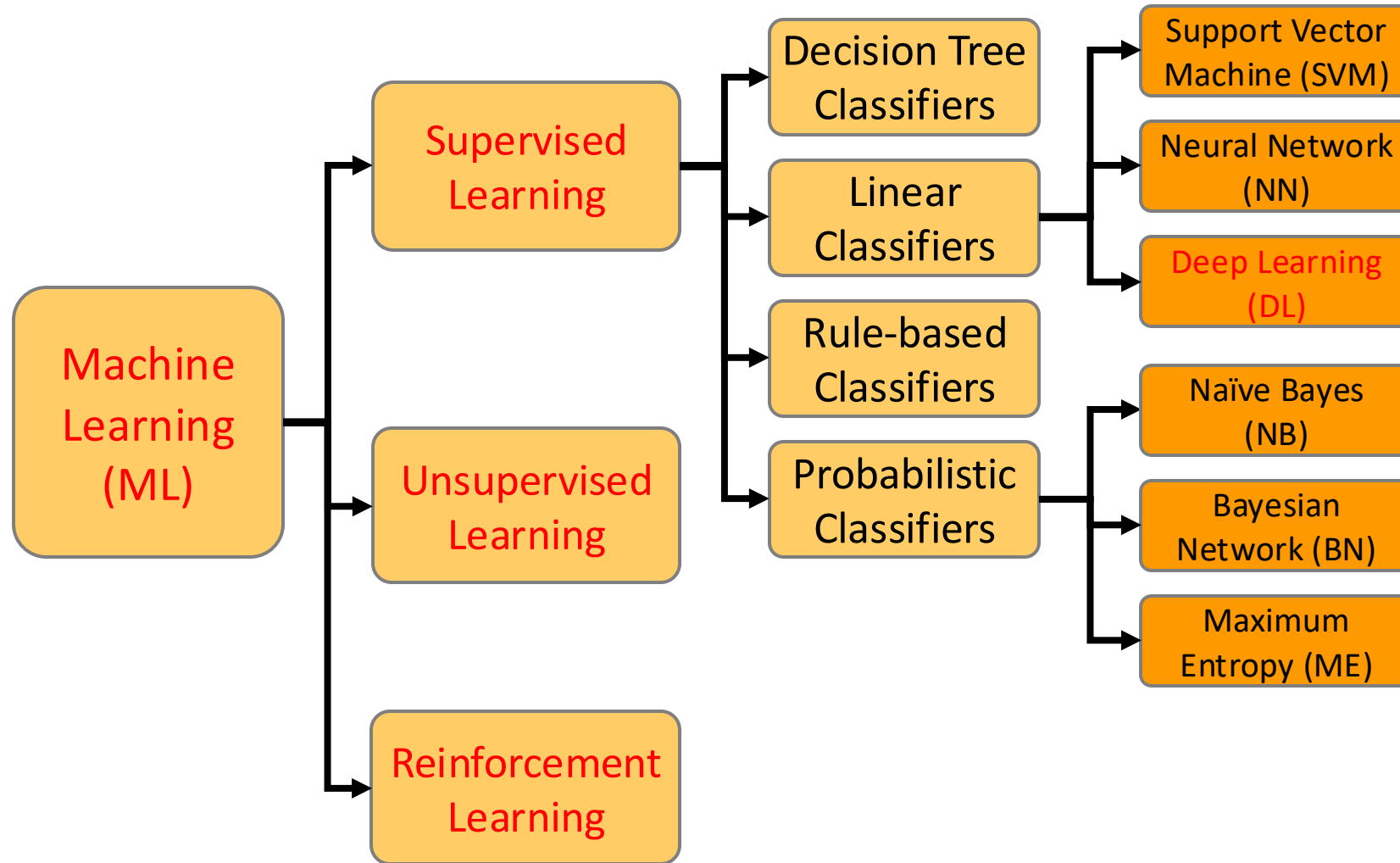
3 Machine Learning Algorithms



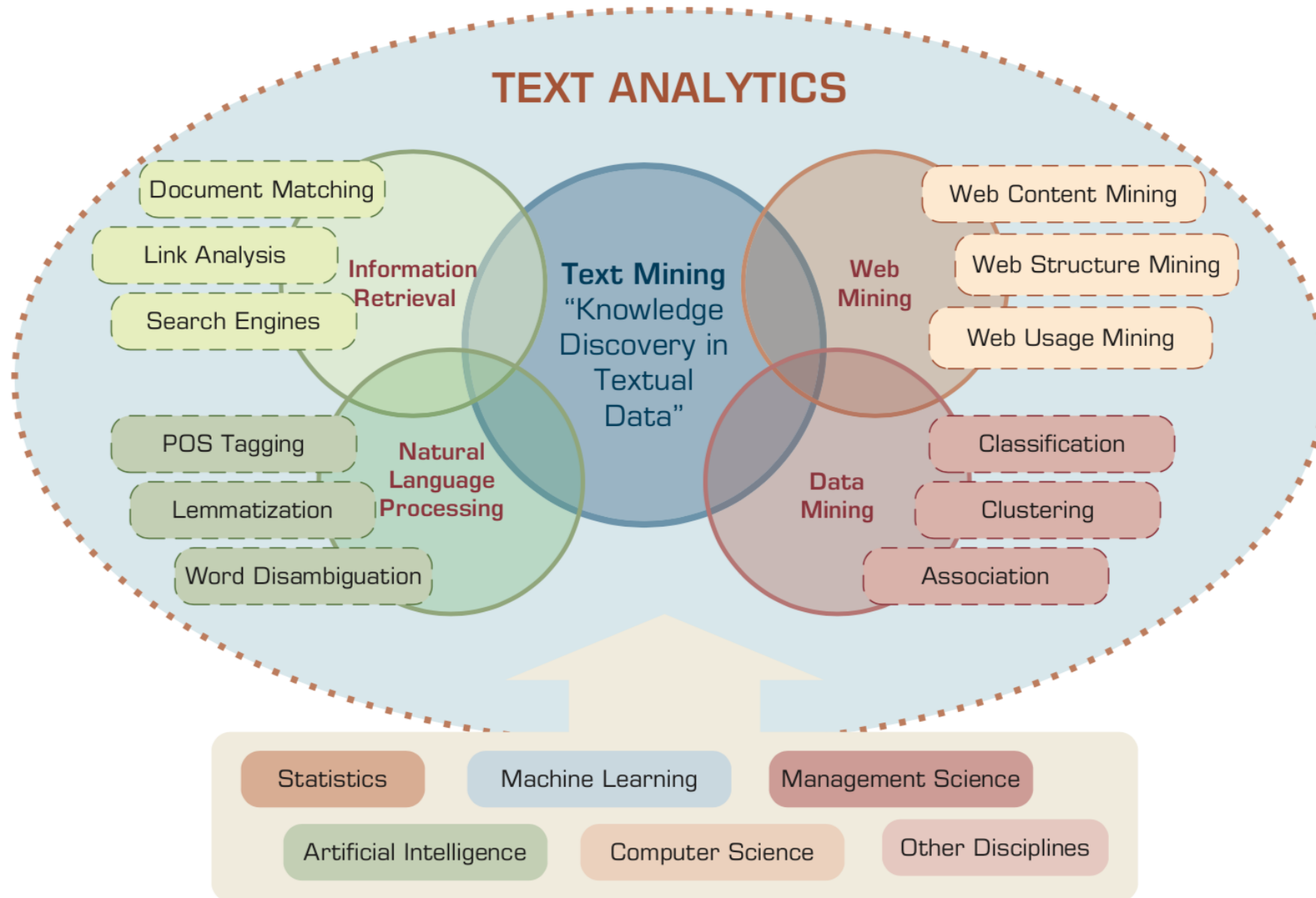
Machine Learning (ML)



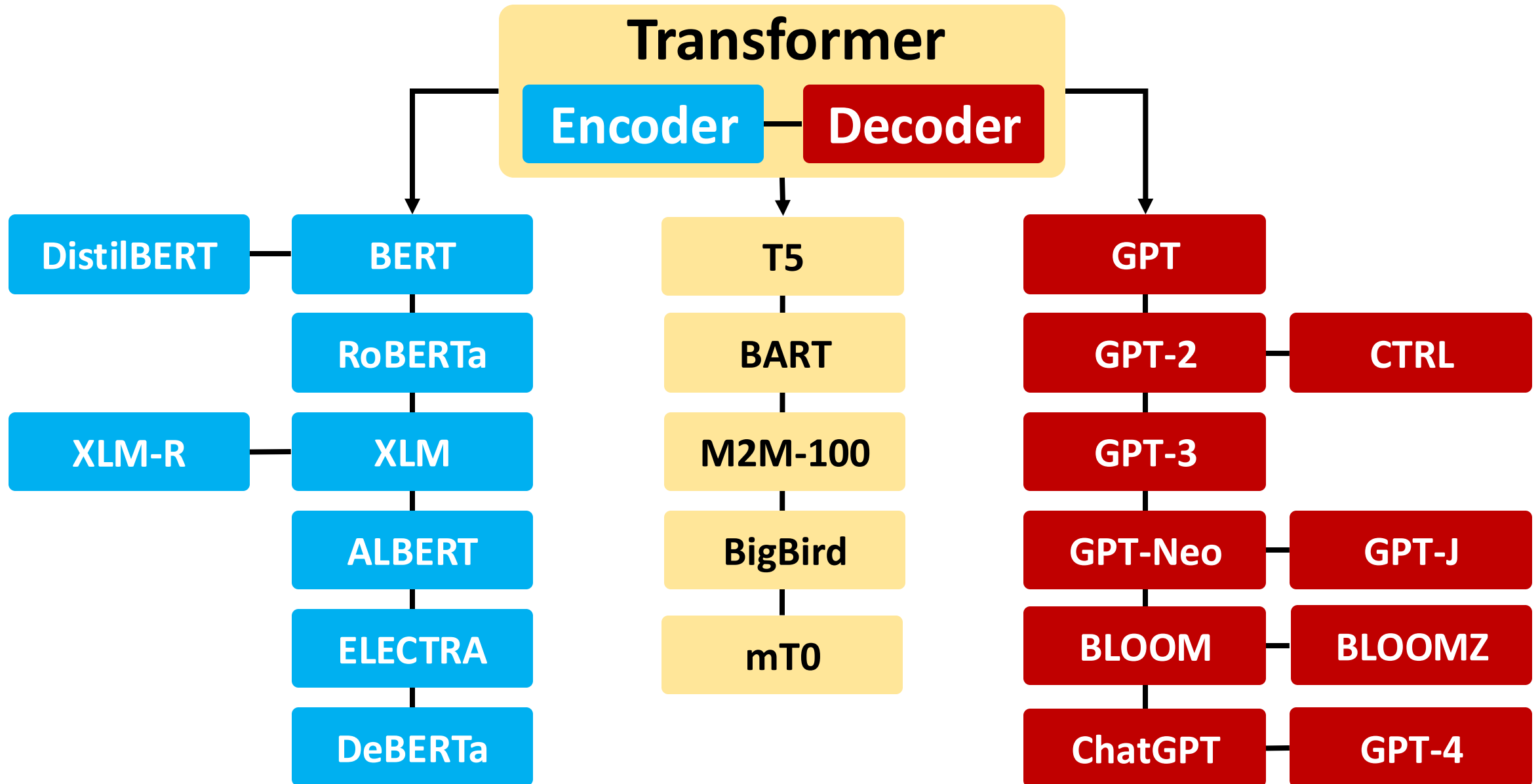
Machine Learning (ML) / Deep Learning (DL)



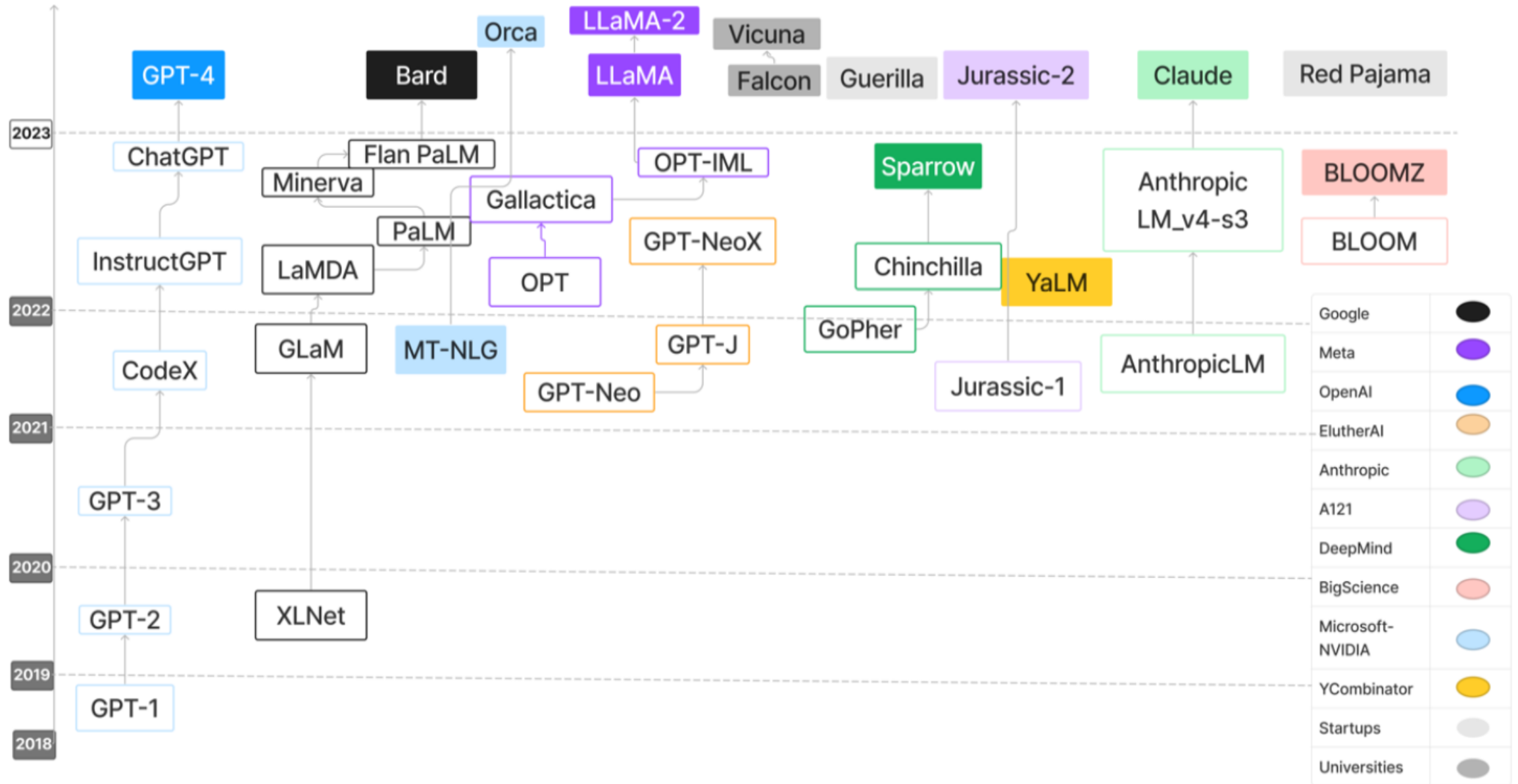
AI for Text Analytics



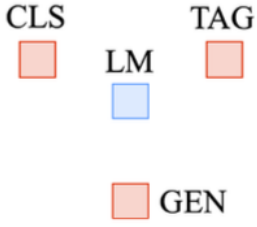
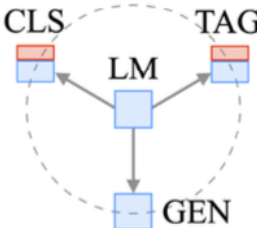
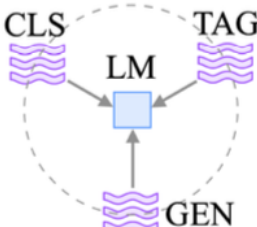
Transformer Models



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)	
Transfer Learning: Pre-training, Fine-Tuning (FT)		
c. Pre-train, Fine-tune	Objective (e.g. masked language modeling, next sentence prediction)	
GAI: Pre-train, Prompt, and Predict (Prompting)		
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 (±) ↑↓	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
G gemini-2.5-pro	1	2	3	1	1	1	1	1
chatgpt-4o-lates...	2	4	3	13	2	5	4	1
gpt-5-high	2	2	3	1	7	5	11	6
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
gpt-4.5-preview-...	3	5	4	8	1	4	3	1
gpt-5-chat	5	3	3	8	3	5	3	1
qwen3-max-preview	6	4	2	1	7	4	4	3
AI claude-opus-4-20...	8	4	3	6	2	2	2	7
deepseek-r1-0528	8	8	4	10	8	15	13	14
deepseek-v3.1	8	6	4	1	7	6	5	9
deepseek-v3.1-th...	8	4	3	1	2	4	1	7
XL grok-4-0709	8	10	12	1	4	6	8	7
kimi-k2-0711-pre...	8	10	7	13	16	24	22	7
kimi-k2-0905-pre...	8	5	3	-	6	16	12	7
qwen3-235b-a22b-...	8	4	3	2	9	6	4	7
Z glm-4.5	10	7	4	7	14	7	8	10

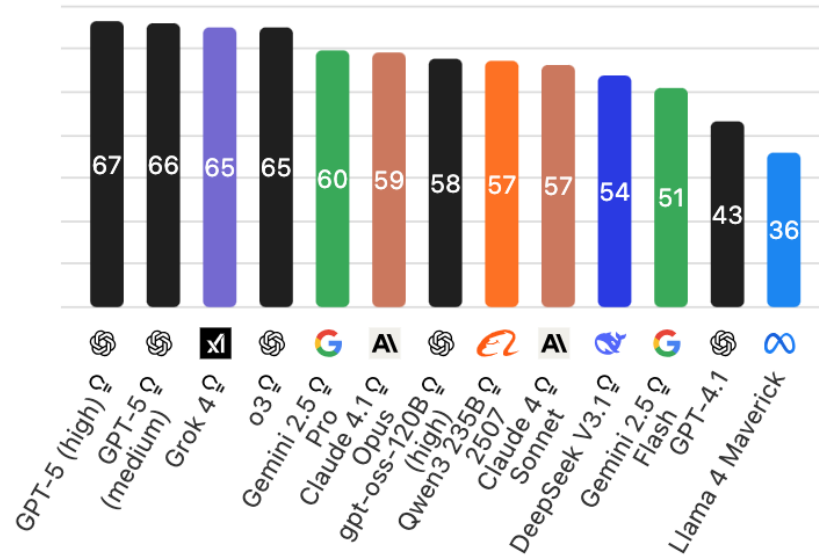
<https://huggingface.co/spaces/lmarena-ai/lmarena-leaderboard>

Artificial Analysis Intelligence Index

Intelligence, Speed, Price

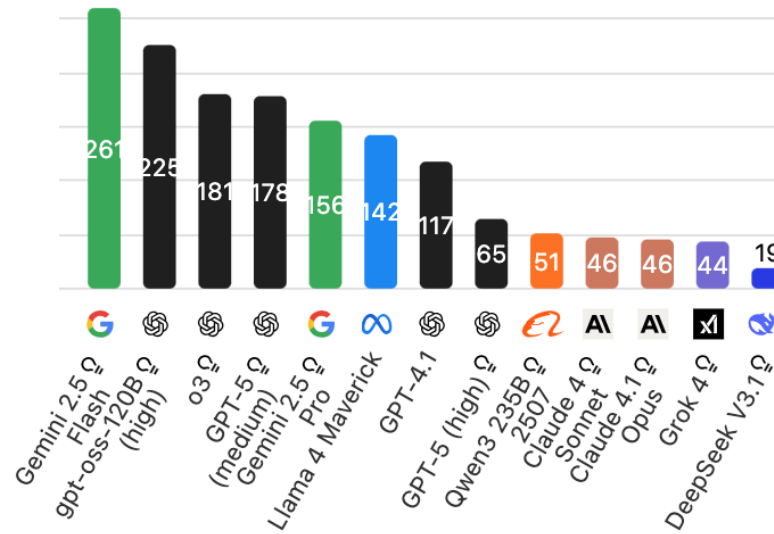
INTELLIGENCE

Artificial Analysis Intelligence Index; Higher is better



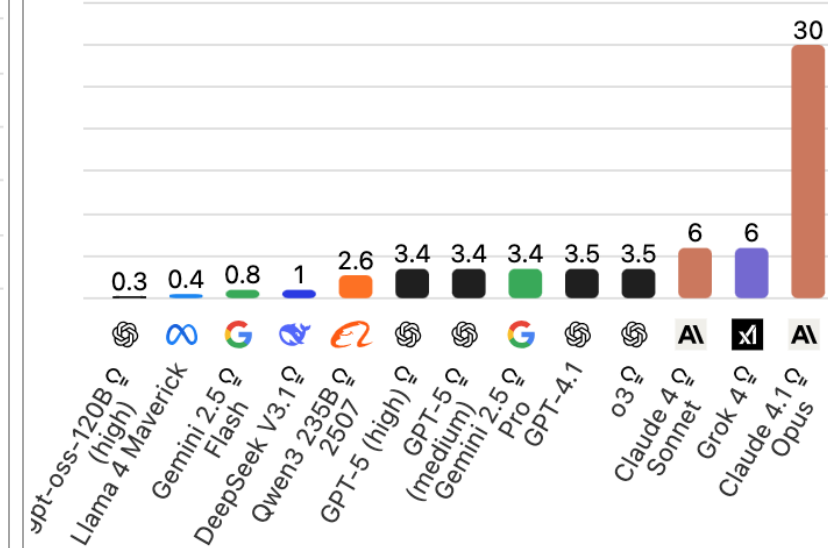
SPEED

Output Tokens per Second; Higher is better



PRICE

USD per 1M Tokens; Lower is better

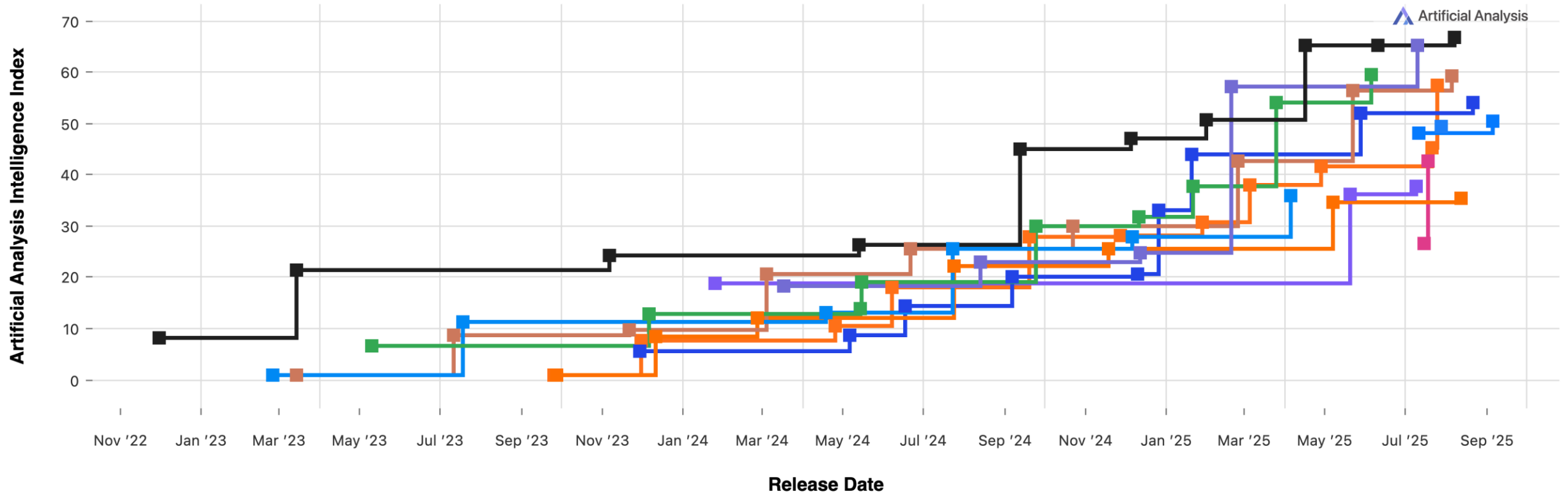


Artificial Analysis Intelligence Index 2022-2025

Frontier Language Model Intelligence, Over Time

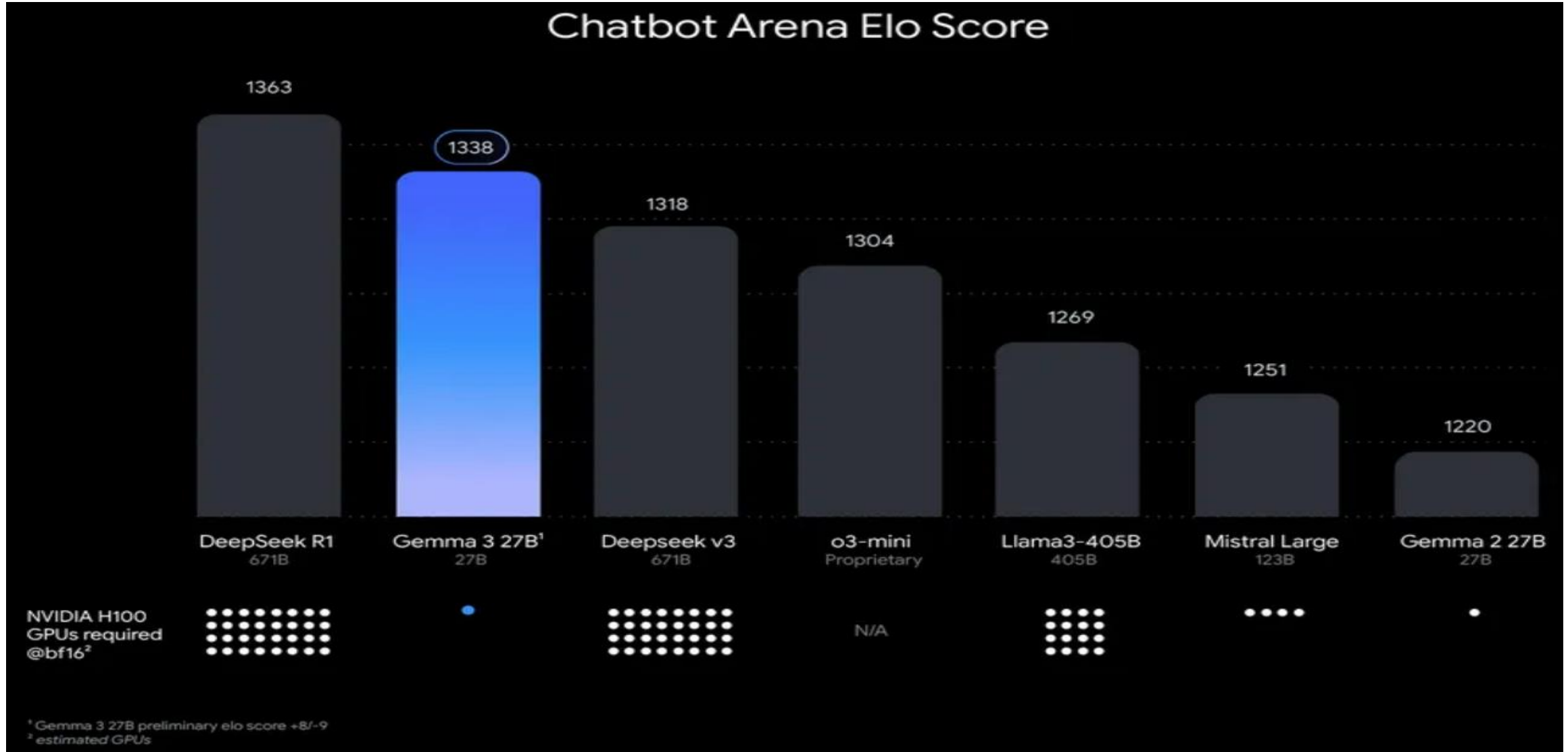
Artificial Analysis Intelligence Index v3.0 incorporates 10 evaluations: MMLU-Pro, GPQA Diamond, Humanity's Last Exam, LiveCodeBench, SciCode, AIME 2025, IFBench, AA-LCR, Terminal-Bench Hard, τ^2 -Bench Telecom

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

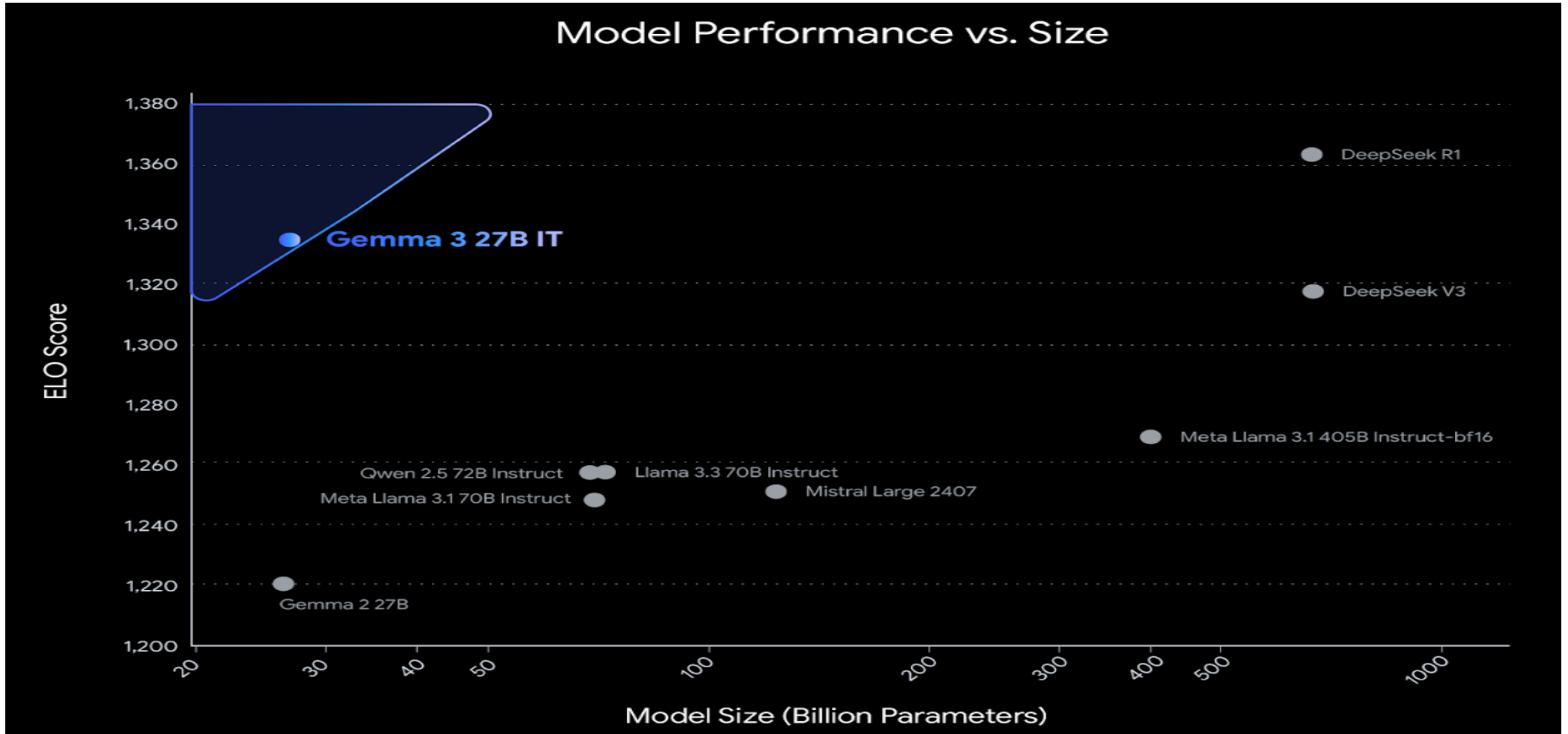


Google Gemma 3 Multimodality (vision-language input and text outputs)

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

Source: <https://developers.googleblog.com/en/introducing-gemma3/>

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



Source: <https://developers.googleblog.com/en/introducing-gemma3/>

Google AI Studio (Gemma 3 27B)

The screenshot displays the Google AI Studio web interface. The top navigation bar includes the 'Google AI Studio' logo, a breadcrumb trail 'Generative AI: A Comprehensive Overview', and utility links for 'Enable Autosave', 'Compare', 'Open in Kaggle', and 'Open in Vertex AI'. A user profile icon is in the top right.

The left sidebar contains a 'Get API key' button and a list of links: 'Create Prompt', 'Stream Realtime', 'Starter Apps', 'Tune a Model', 'Library', 'Enable chat history', 'Prompt Gallery', 'Developer documentation', 'Developer forum', and 'Changelog' (marked as 'NEW'). A disclaimer at the bottom of the sidebar states: 'Gemma models may make mistakes, so double-check its response. Gemma is provided under and subject to the Gemma Terms of Use.'

The main content area features an article titled 'Generative AI: A Deep Dive'. The article text reads: '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:'. Below this is a section '1. What is Generative AI?' which defines generative AI as models that 'create new content' (text, images, audio, video, code) and 'produces new data'. It contrasts this with traditional AI that 'analyzes or acts on existing data'. A 'Key Characteristics' section follows, listing four points: 'Learns Patterns', 'Generates Novel Content', 'Probabilistic' generation, and the requirement for 'Large Datasets'.

On the right, the 'Run settings' panel is visible. It includes a 'Get code' button, a 'Model' dropdown set to 'Gemma 3 27B', a 'Token count' of '1,760 / 131,072', a 'Temperature' slider set to '1', and an 'Advanced settings' section with 'Safety settings' (including an 'Edit safety settings' link) and an 'Add stop sequence' button. The 'Output length' is set to '8192'.

At the bottom, there is a text input field with the placeholder 'Type something', a 'Run' button, and a 'Share' icon.

Grok 3 Deep Search





Generative AI

**Completed**
49s · 71 Sources

 Thinking

 **Exploring user intent**

 Researching recent developments

 Investigating healthcare applications

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.

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

 10 results found

 **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

Home

Discover

Spaces

Library

Generative AI

Deep Research Images Sources 39 54 steps

linkedinThe Future of Generative AI: Key Trends and Opportunities in...

ciklumTop 10 GenAI Trends to Watch in Technology 2025 and Beyond

research.aimultipleTop 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

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

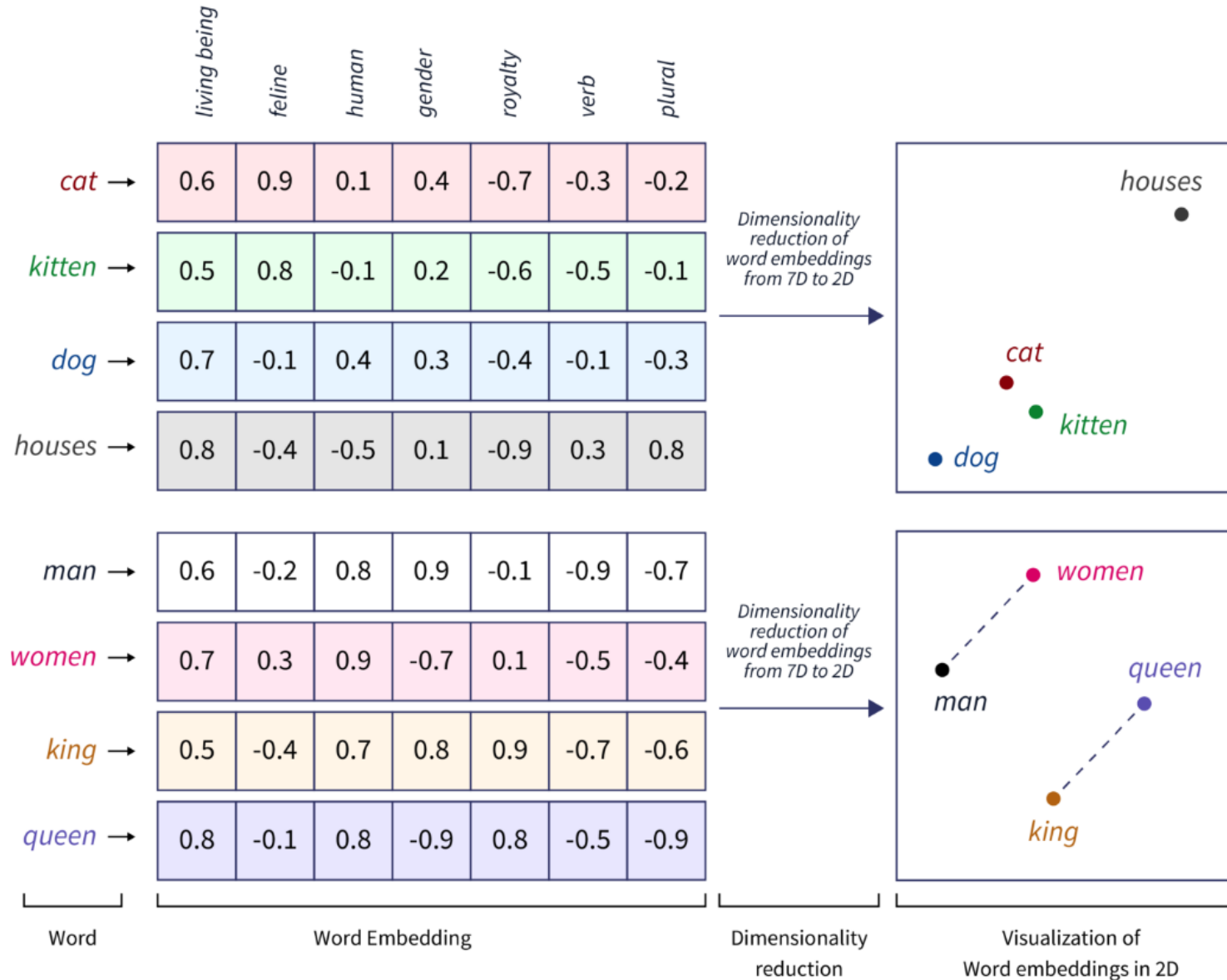
```
<|im_start|>system<|im_sep|>You are a helpful assistant  
<|im_end|><|im_start|>user<|im_sep|><|im_end|><|im_start|>  
assistant<|im_sep|>
```

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

☐ Show whitespace

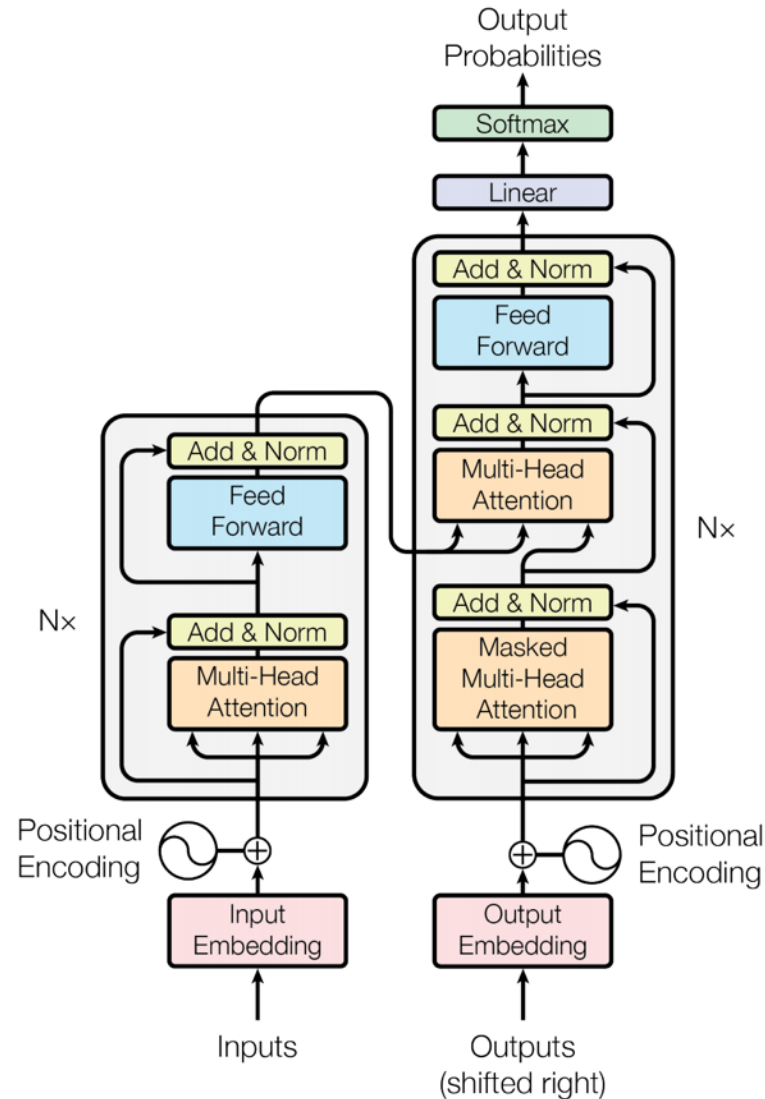
<https://tiktokenizer.vercel.app/>

Word Embeddings



Transformer (Attention is All You Need)

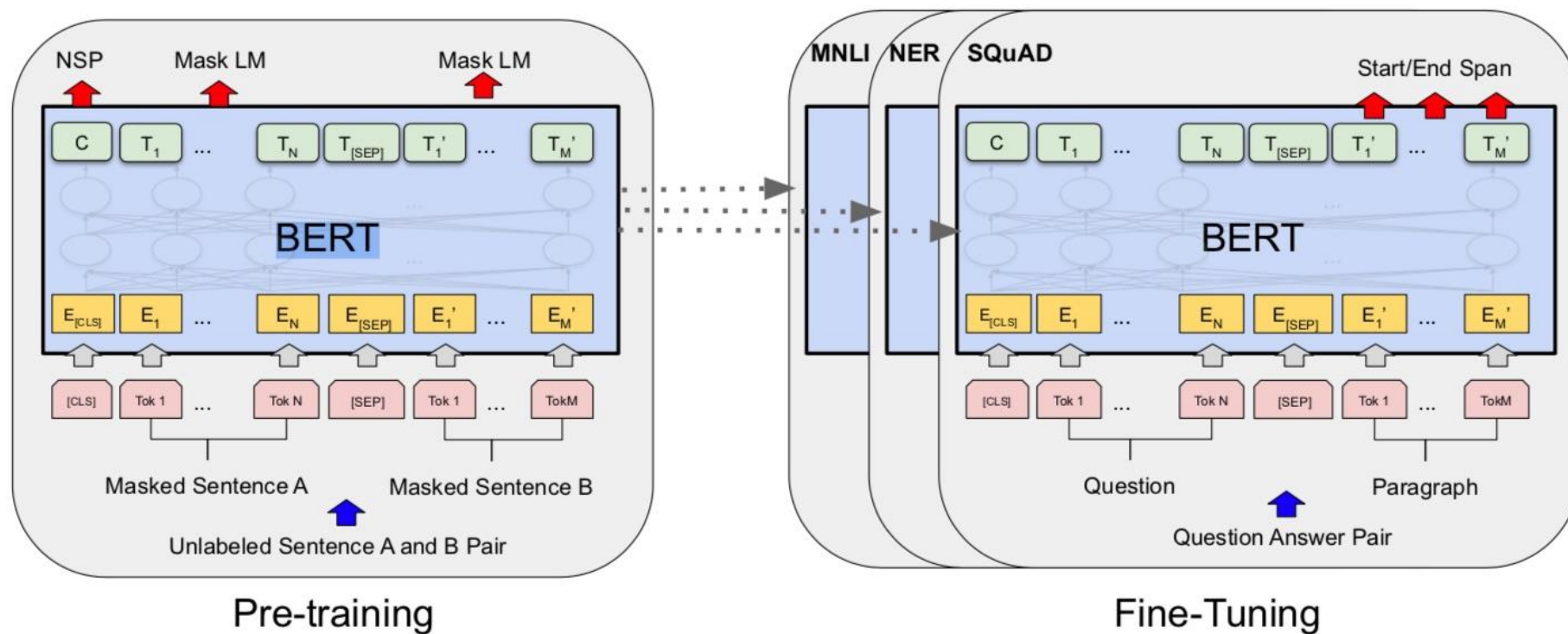
(Vaswani et al., 2017)



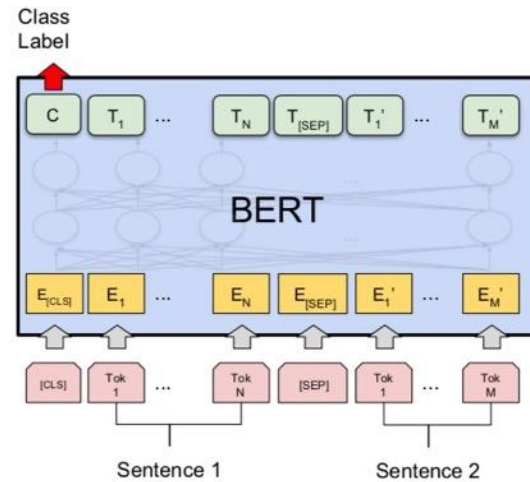
BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding

BERT (Bidirectional Encoder Representations from Transformers)

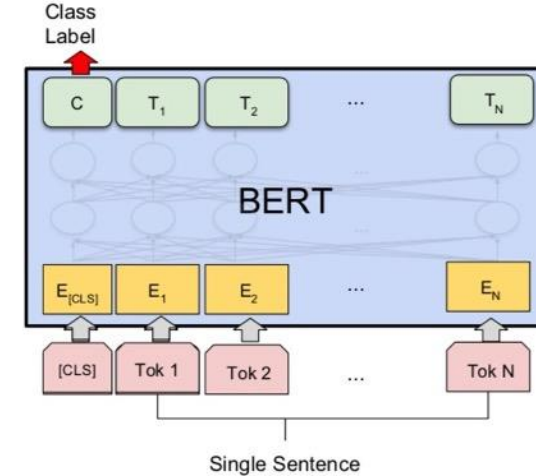
Overall pre-training and fine-tuning procedures for BERT



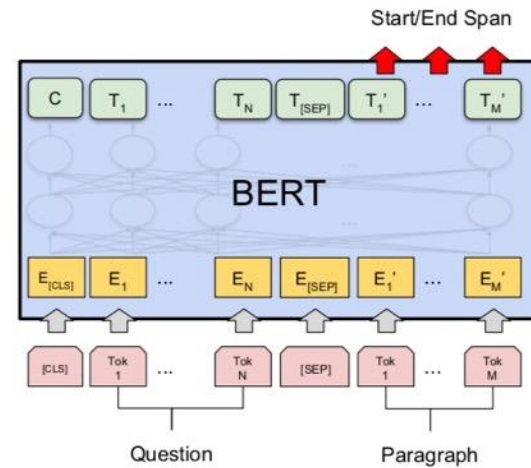
Fine-tuning BERT on Different Tasks



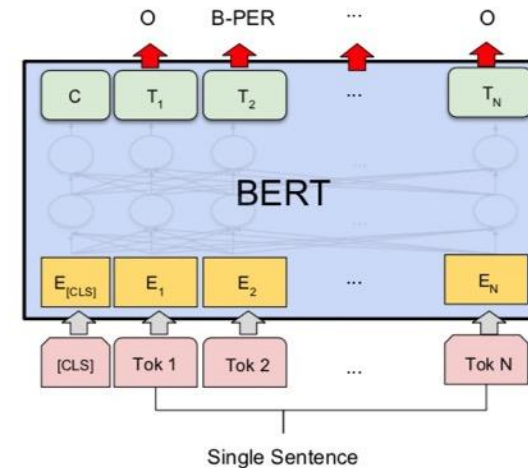
(a) Sentence Pair Classification Tasks:
MNLI, QQP, QNLI, STS-B, MRPC,
RTE, SWAG



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



(c) Question Answering Tasks:
SQuAD v1.1

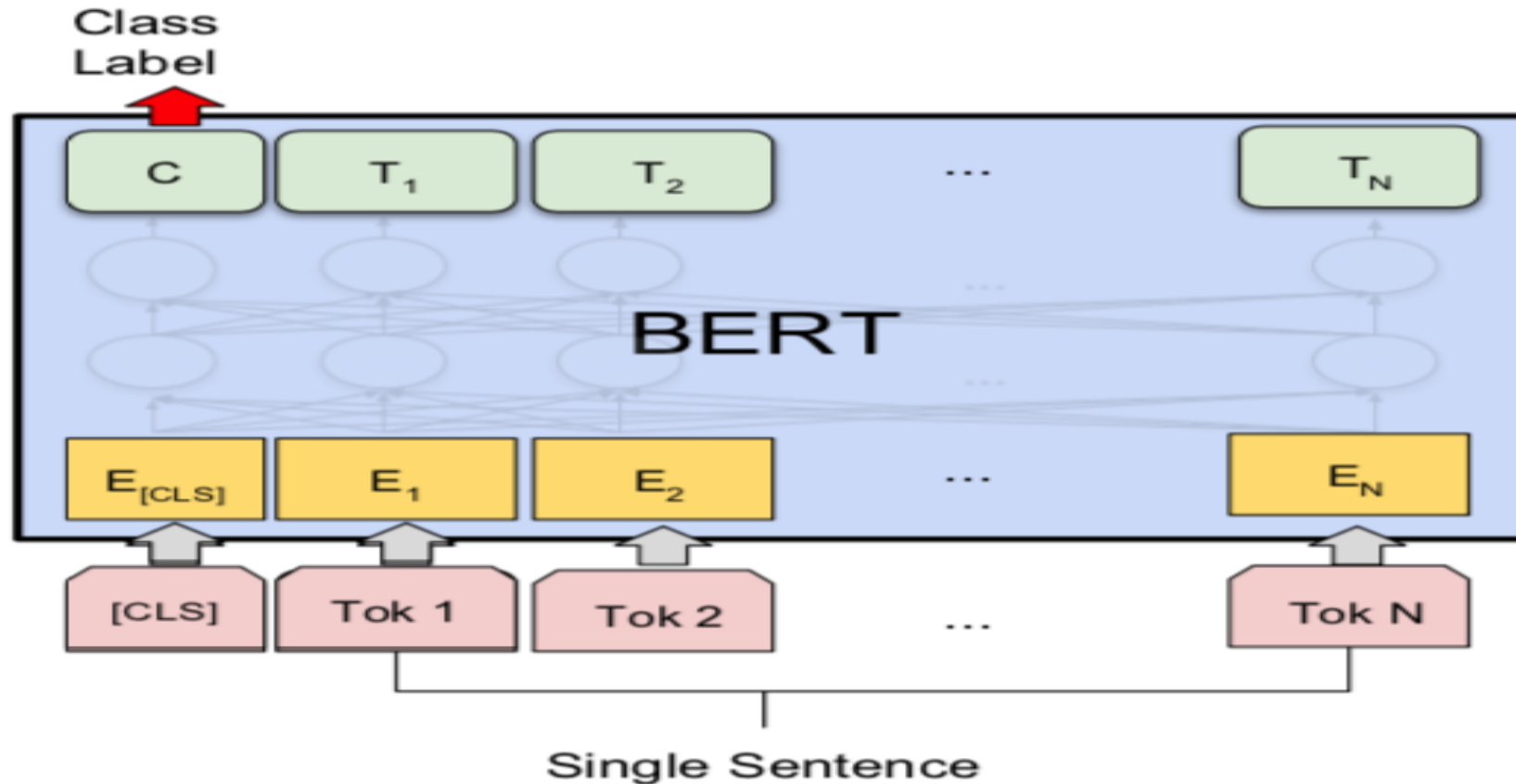


(d) Single Sentence Tagging Tasks:
CoNLL-2003 NER

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

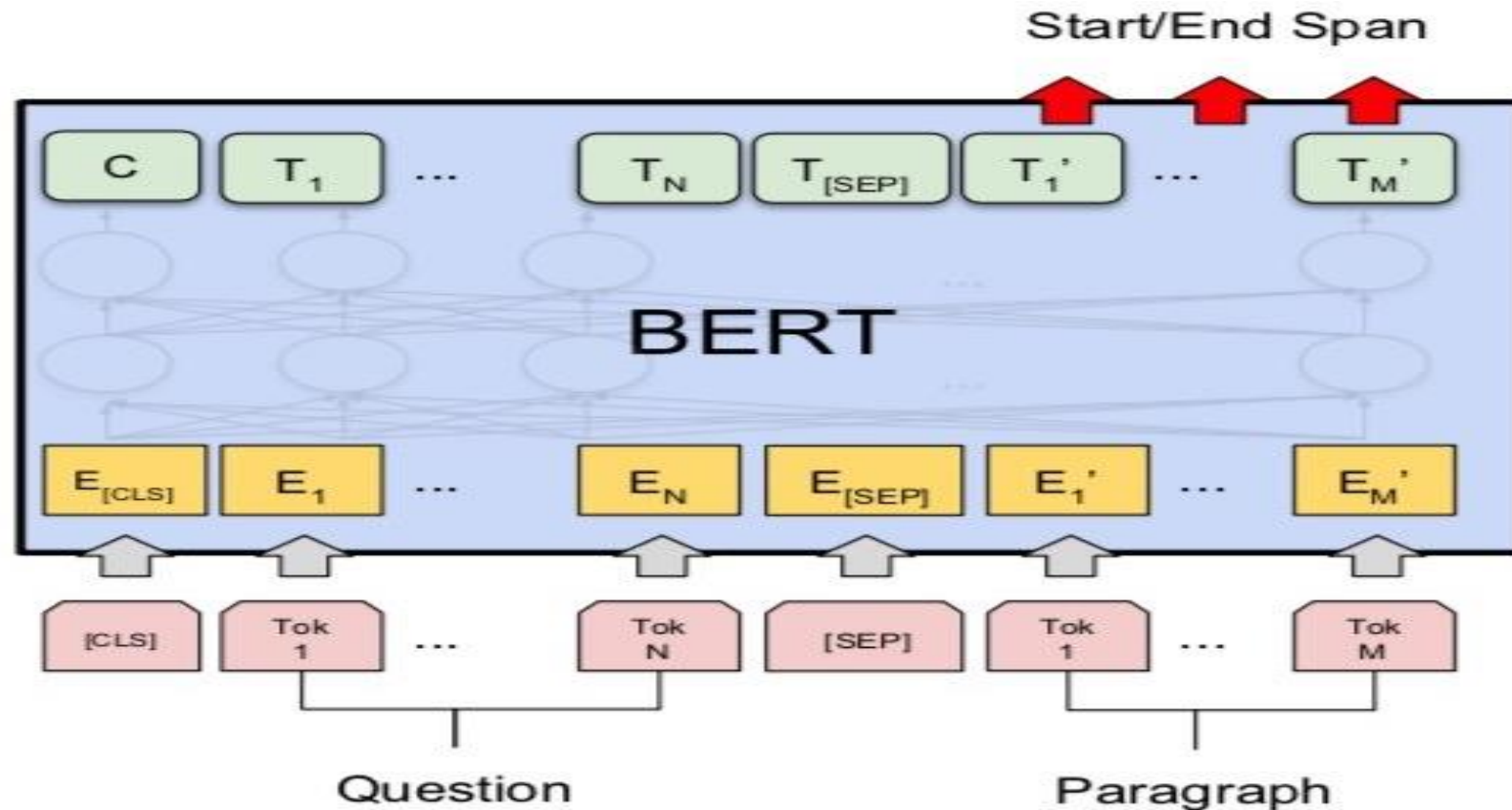
"Bert: Pre-training of deep bidirectional transformers for language understanding." arXiv preprint arXiv:1810.04805.

Sentiment Analysis: Single Sentence Classification



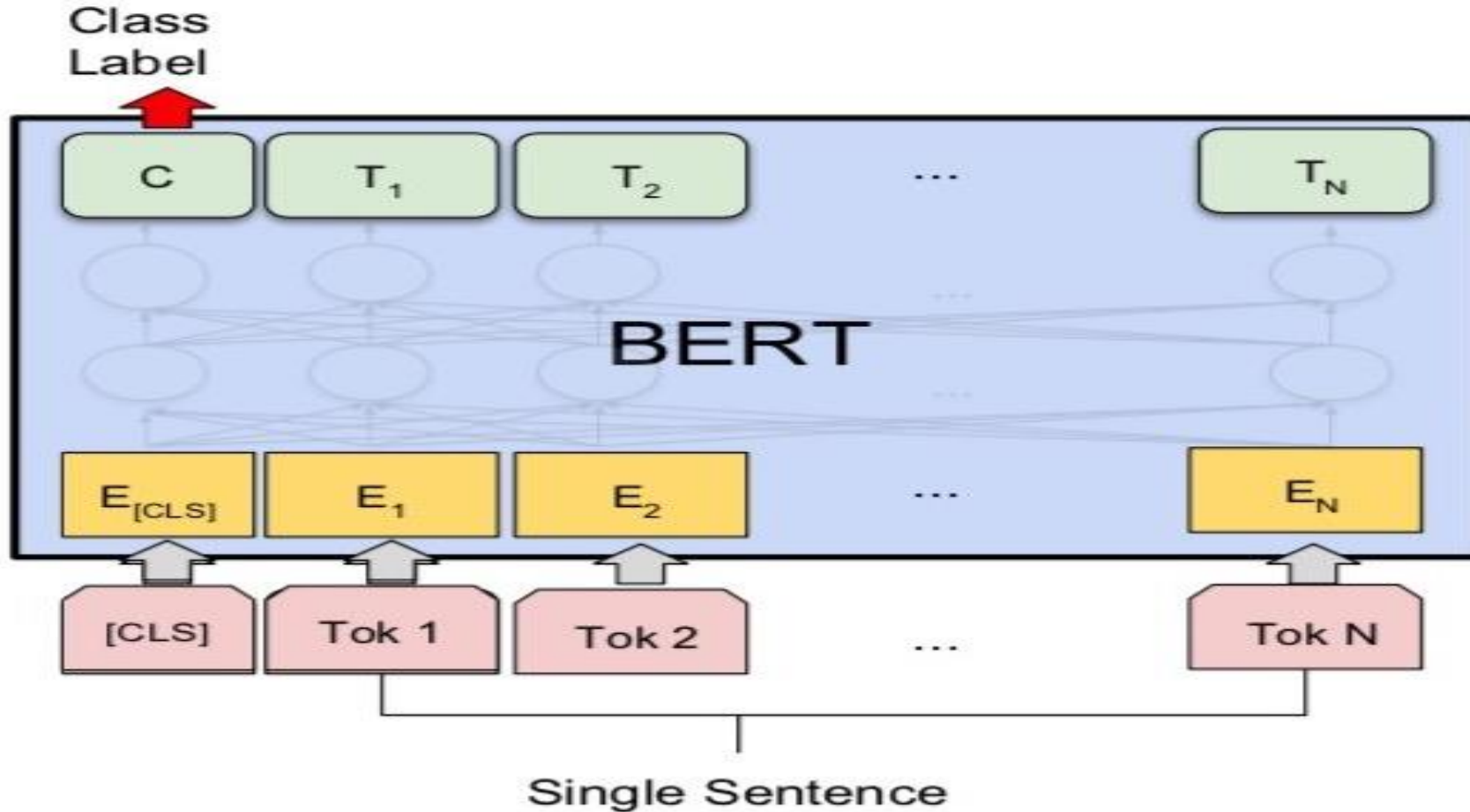
(b) Single Sentence Classification Tasks:
SST-2, CoLA

Fine-tuning BERT on Question Answering (QA)



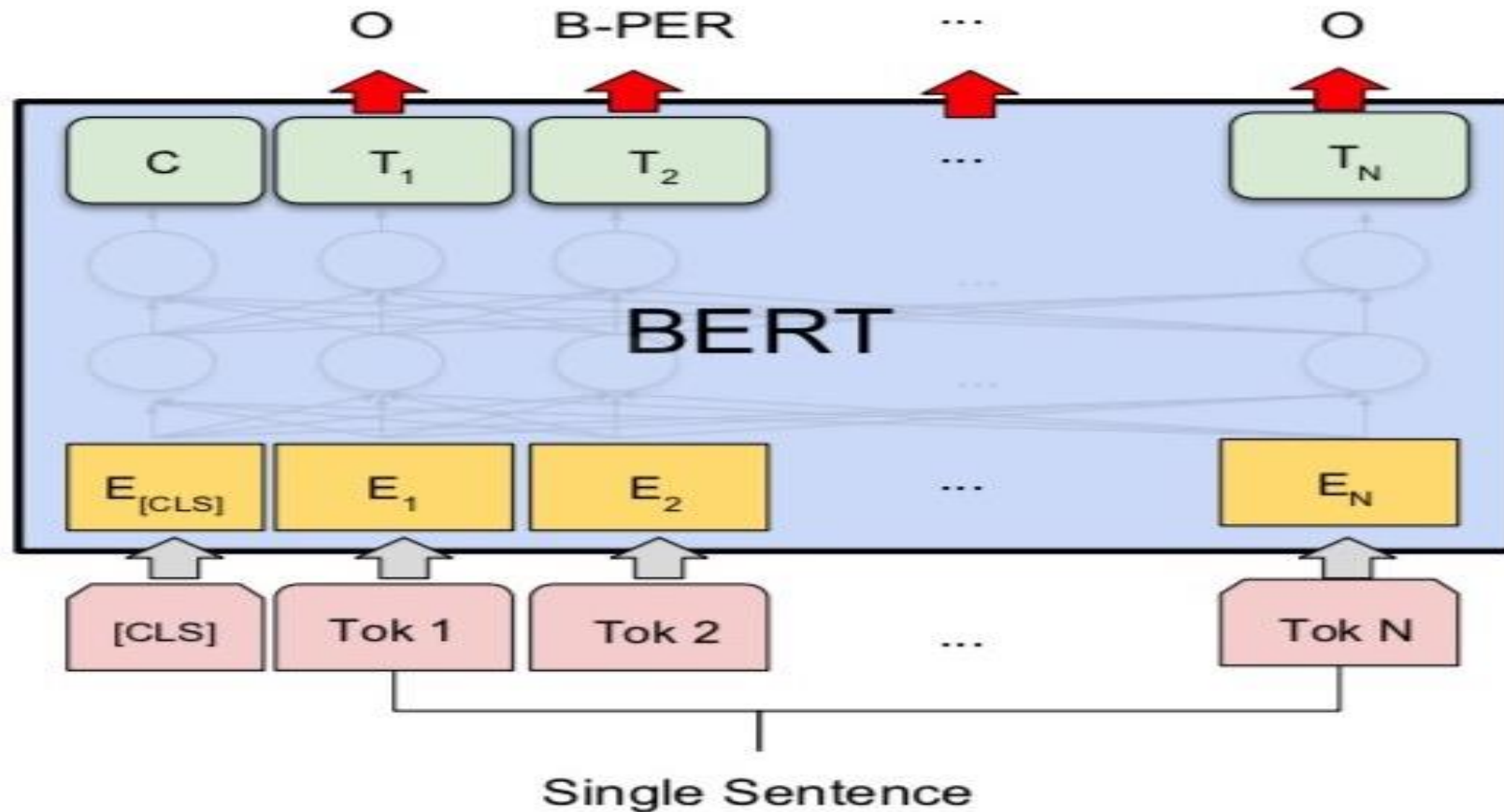
(c) Question Answering Tasks:
SQuAD v1.1

Fine-tuning BERT on Dialogue Intent Detection (ID; Classification)



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

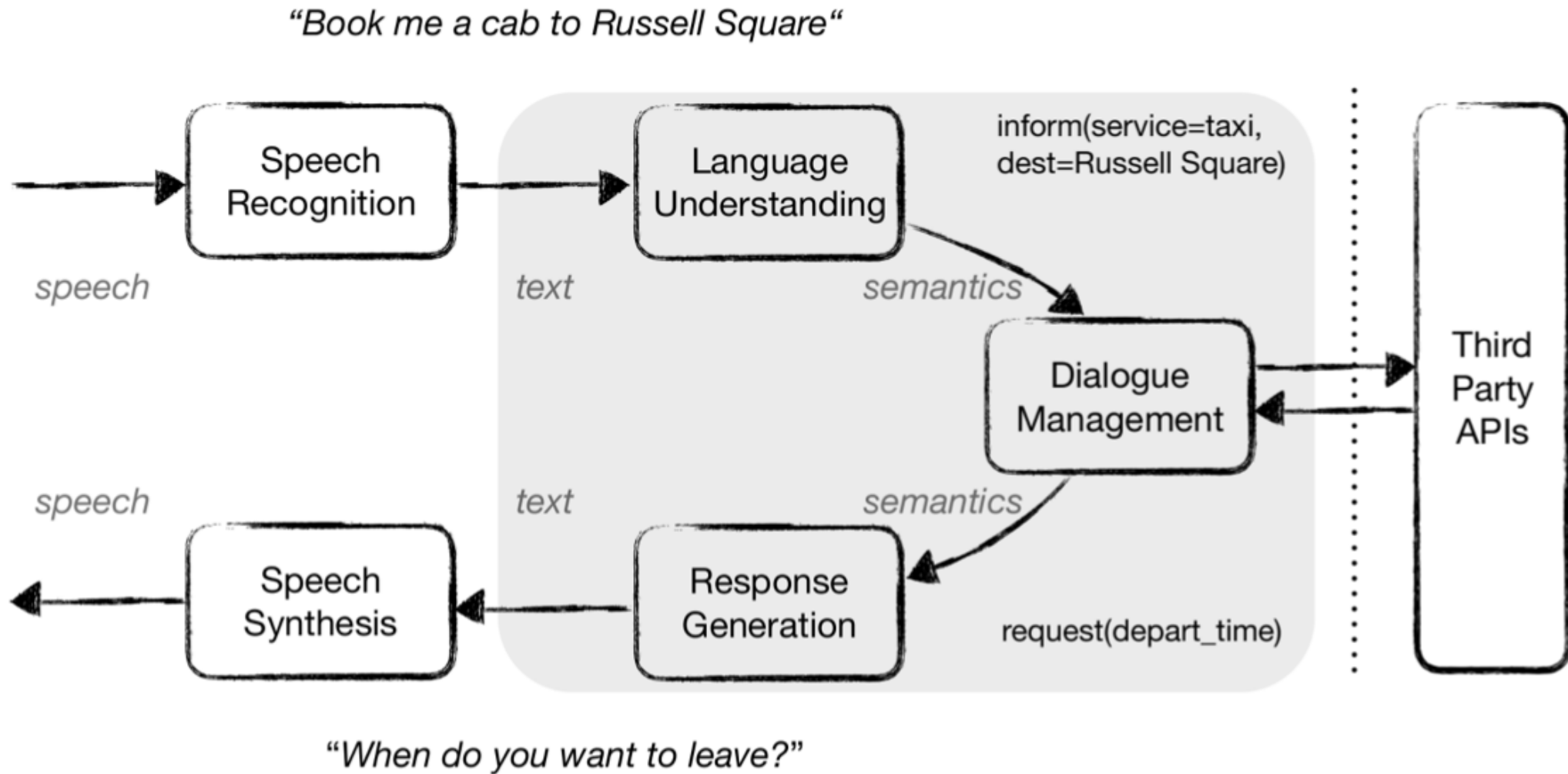
Fine-tuning BERT on Dialogue Slot Filling (SF)



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

Task-Oriented Dialogue (ToD) System

Speech, Text, NLP

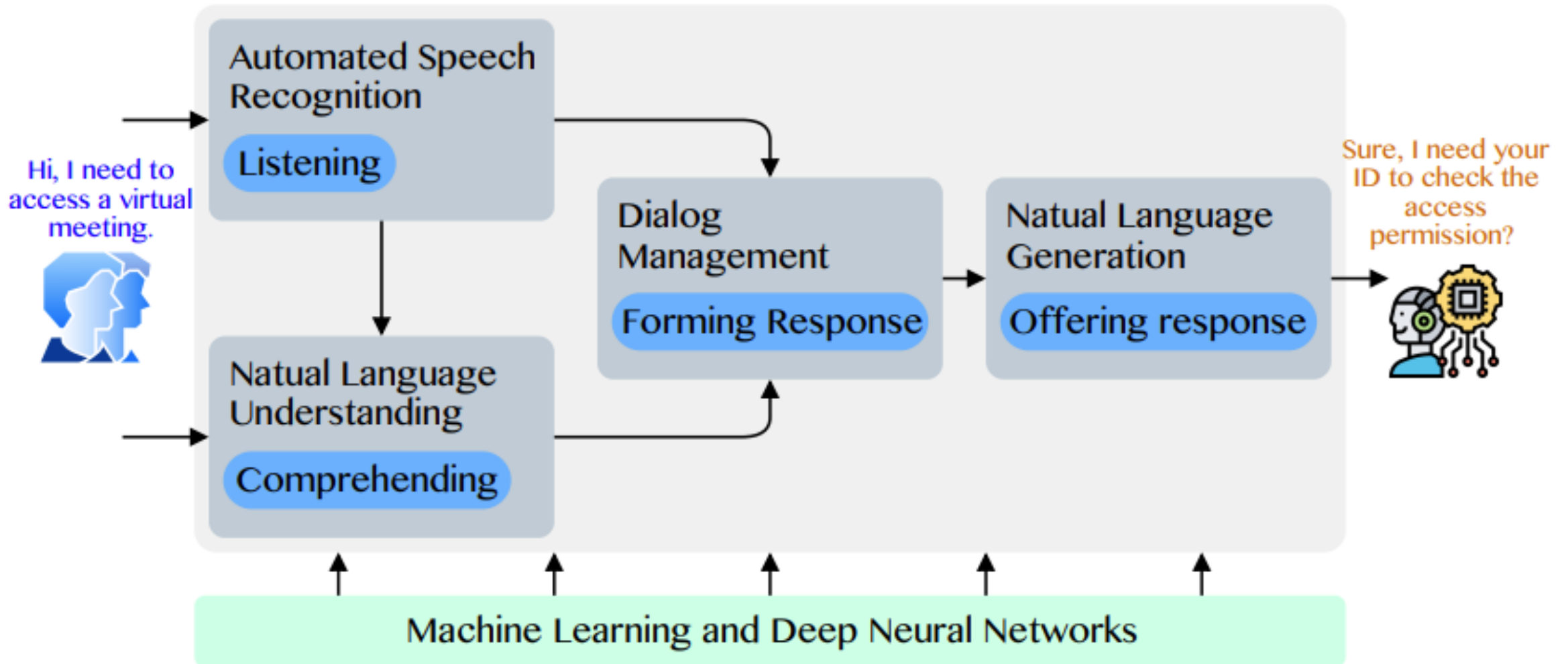


Source: Razumovskaia, Evgeniia, Goran Glavas, Olga Majewska, Edoardo M. Ponti, Anna Korhonen, and Ivan Vulic.

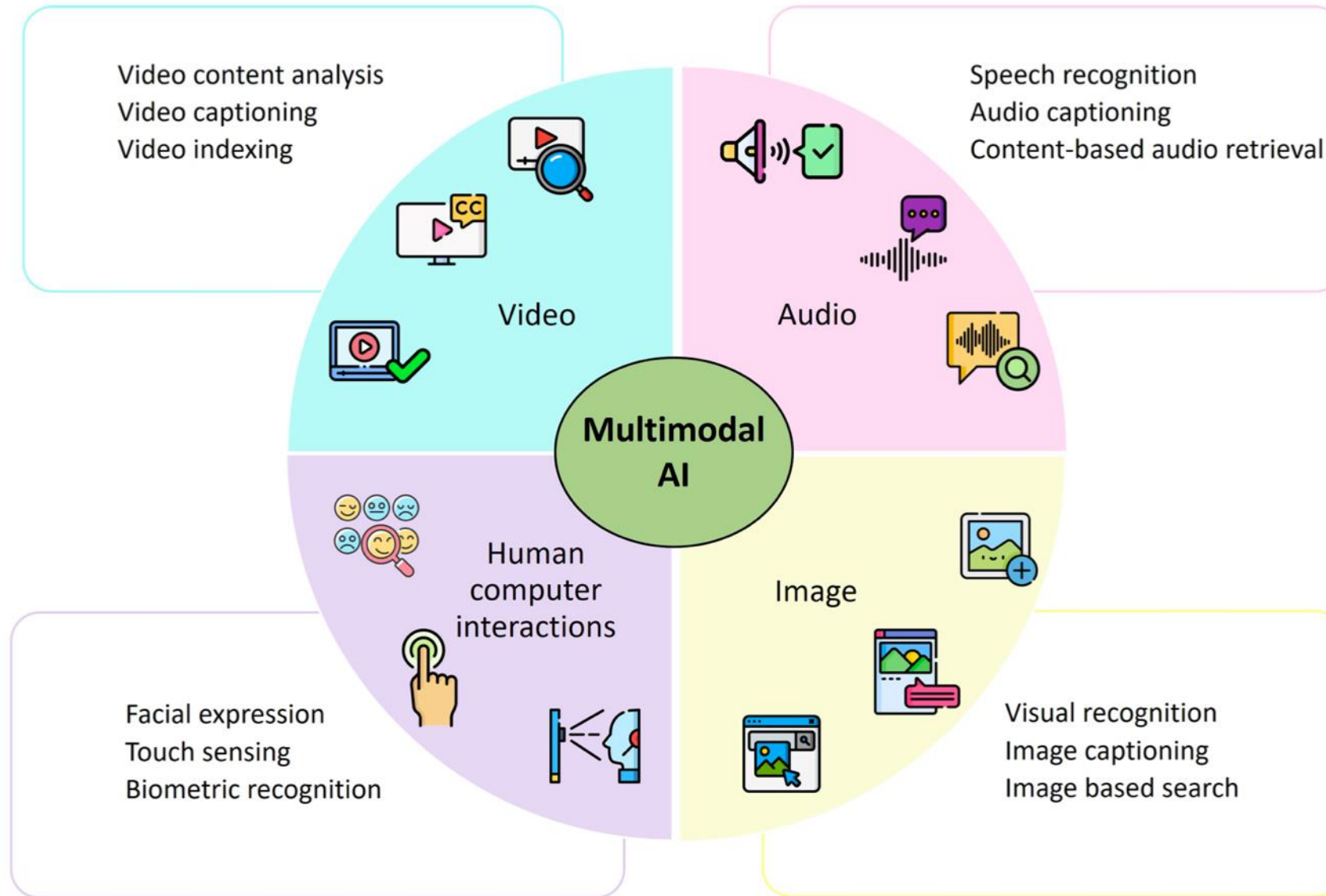
"Crossing the conversational chasm: A primer on natural language processing for multilingual task-oriented dialogue systems." Journal of Artificial Intelligence Research 74 (2022): 1351-1402.

Conversational AI

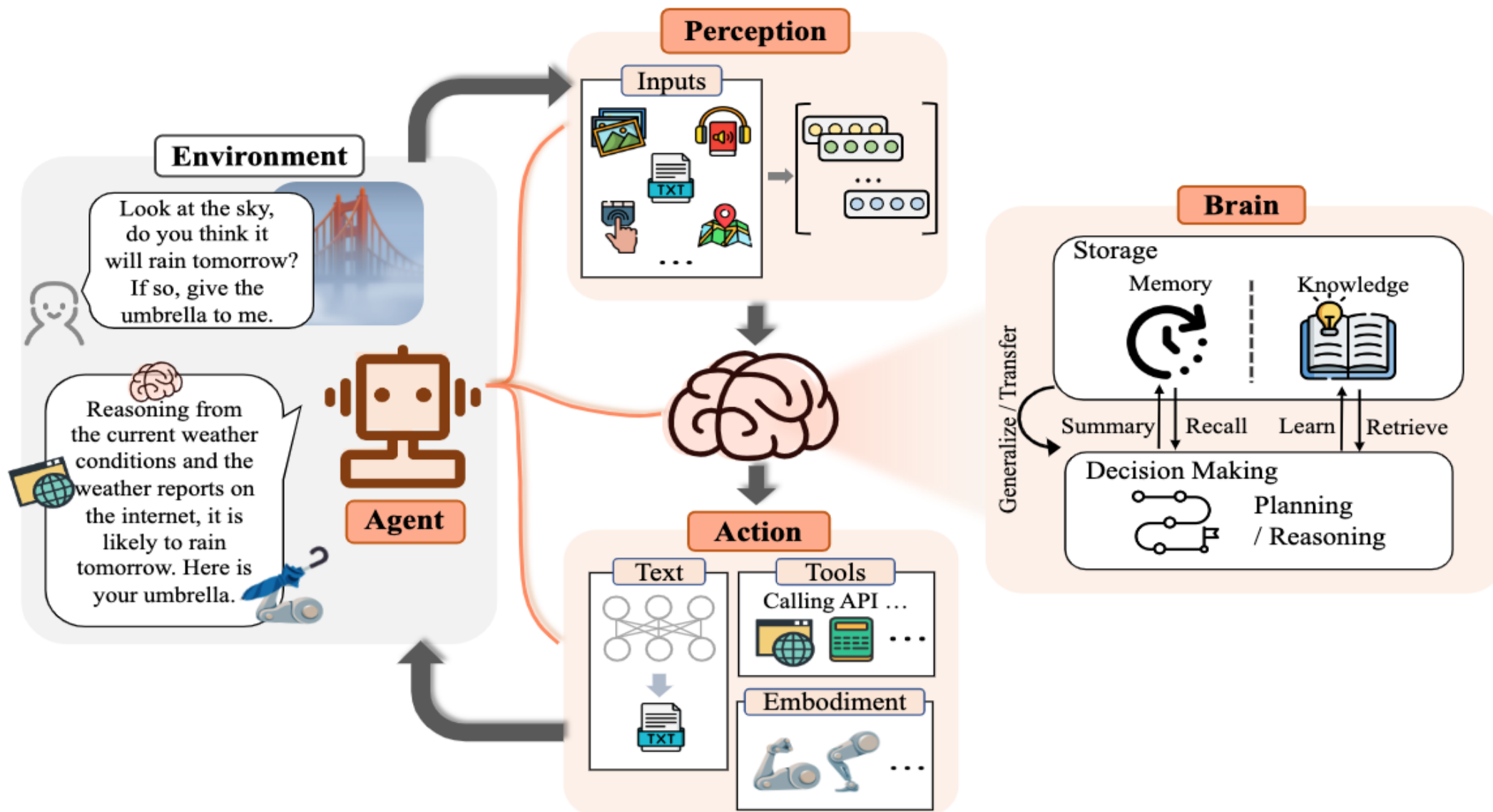
to deliver contextual and personal experience to users



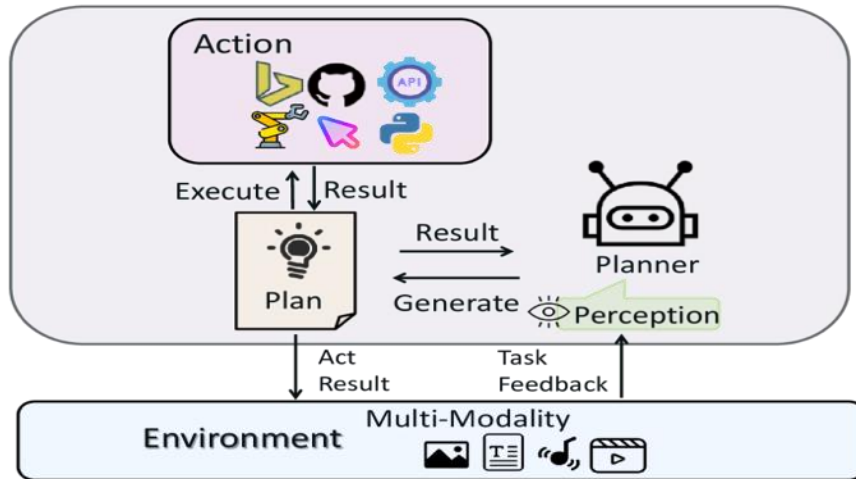
Technological Integration for Multimodal AI



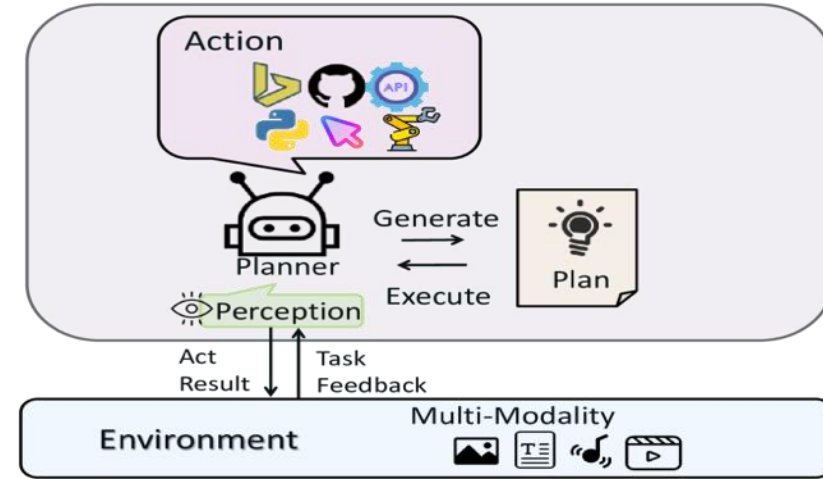
Large Language Model (LLM) based Agents



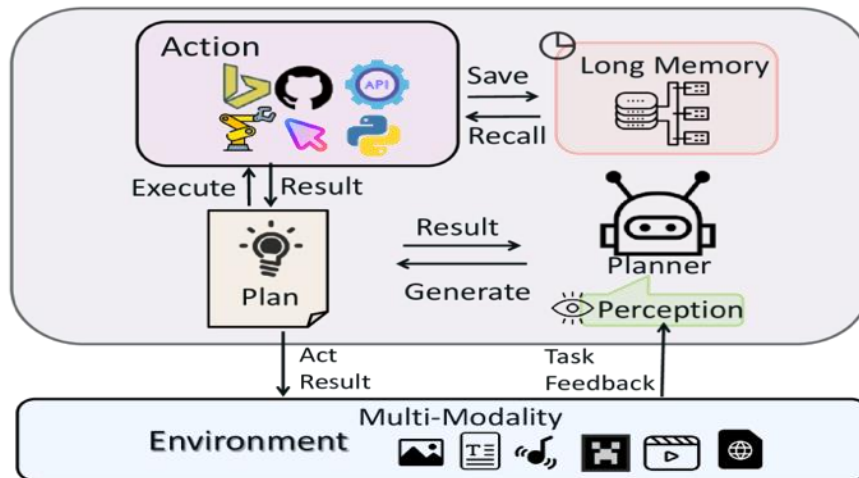
Large Multimodal Agents (LMA)



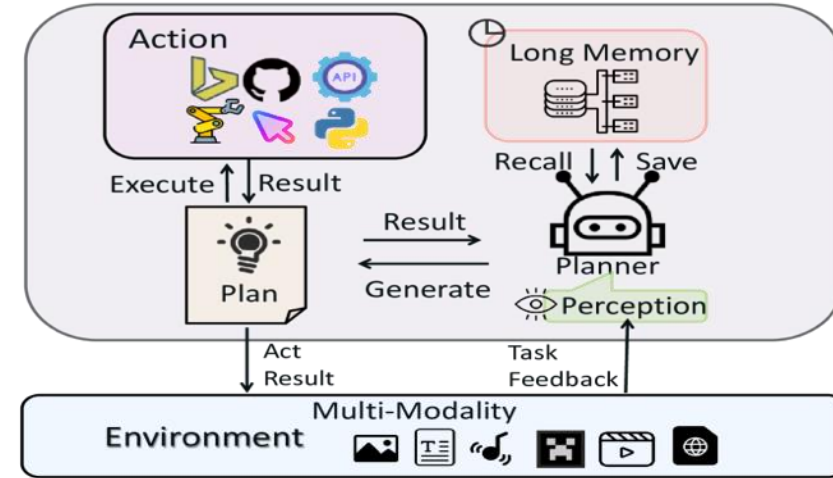
(a)



(b)

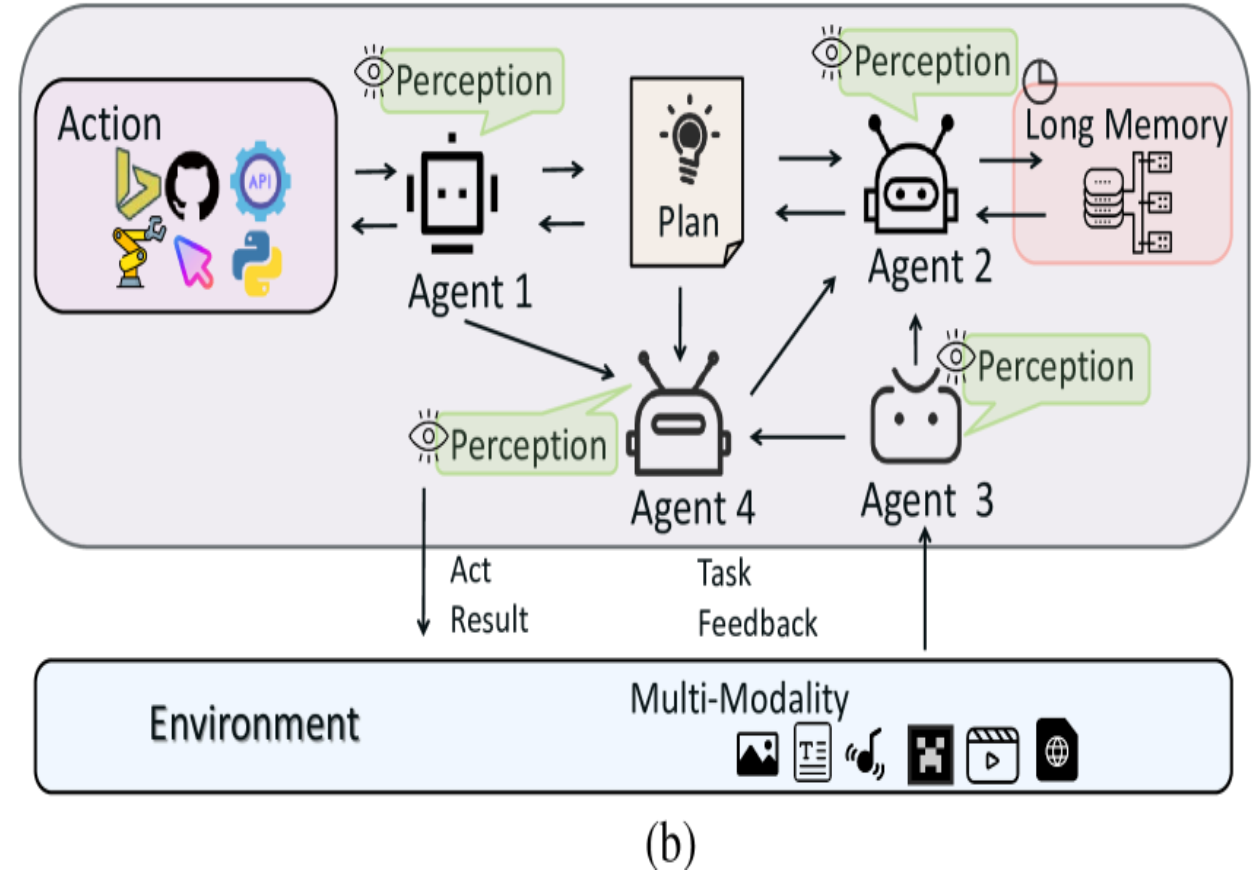
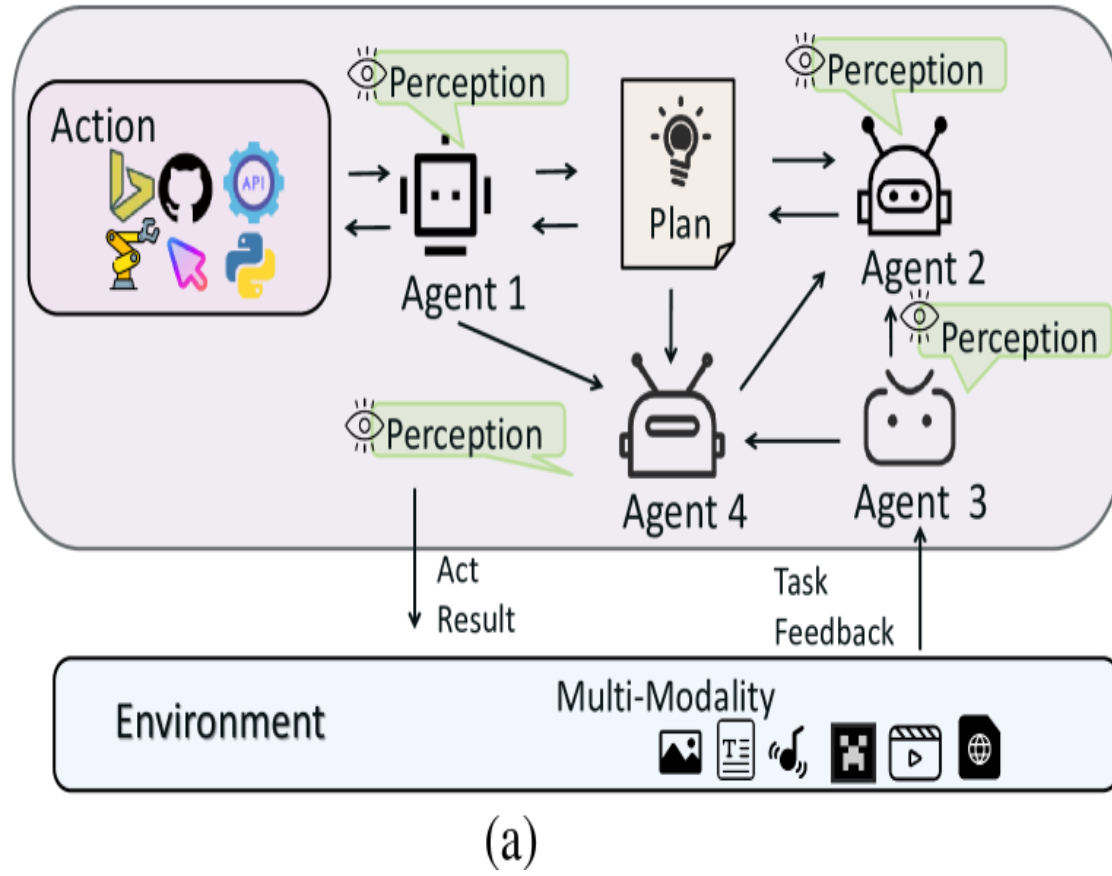


(c)



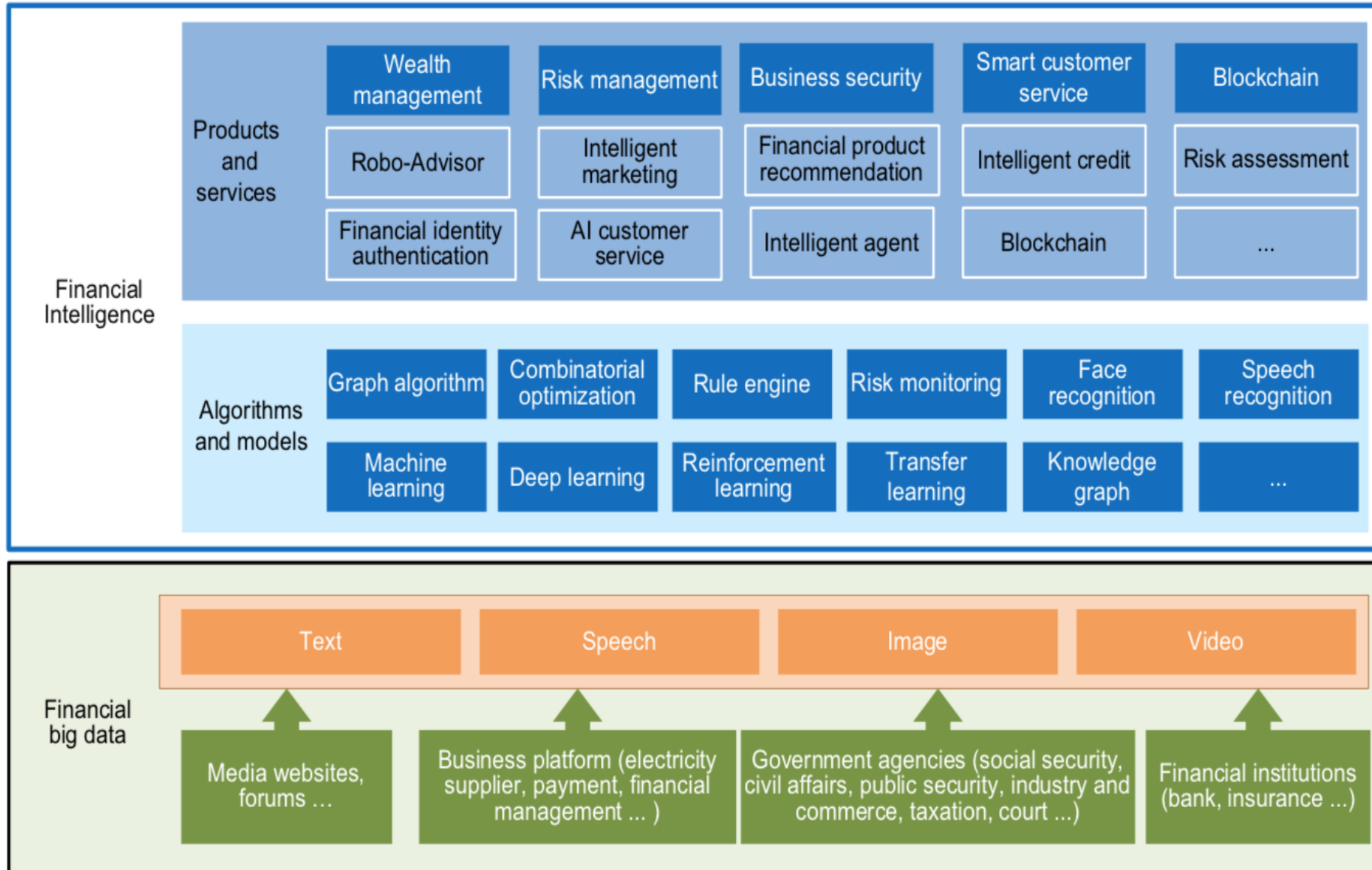
(d)

Large Multimodal Agents (LMA)



FinBrain: when Finance meets AI 2.0

(Zheng et al., 2019)



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

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.

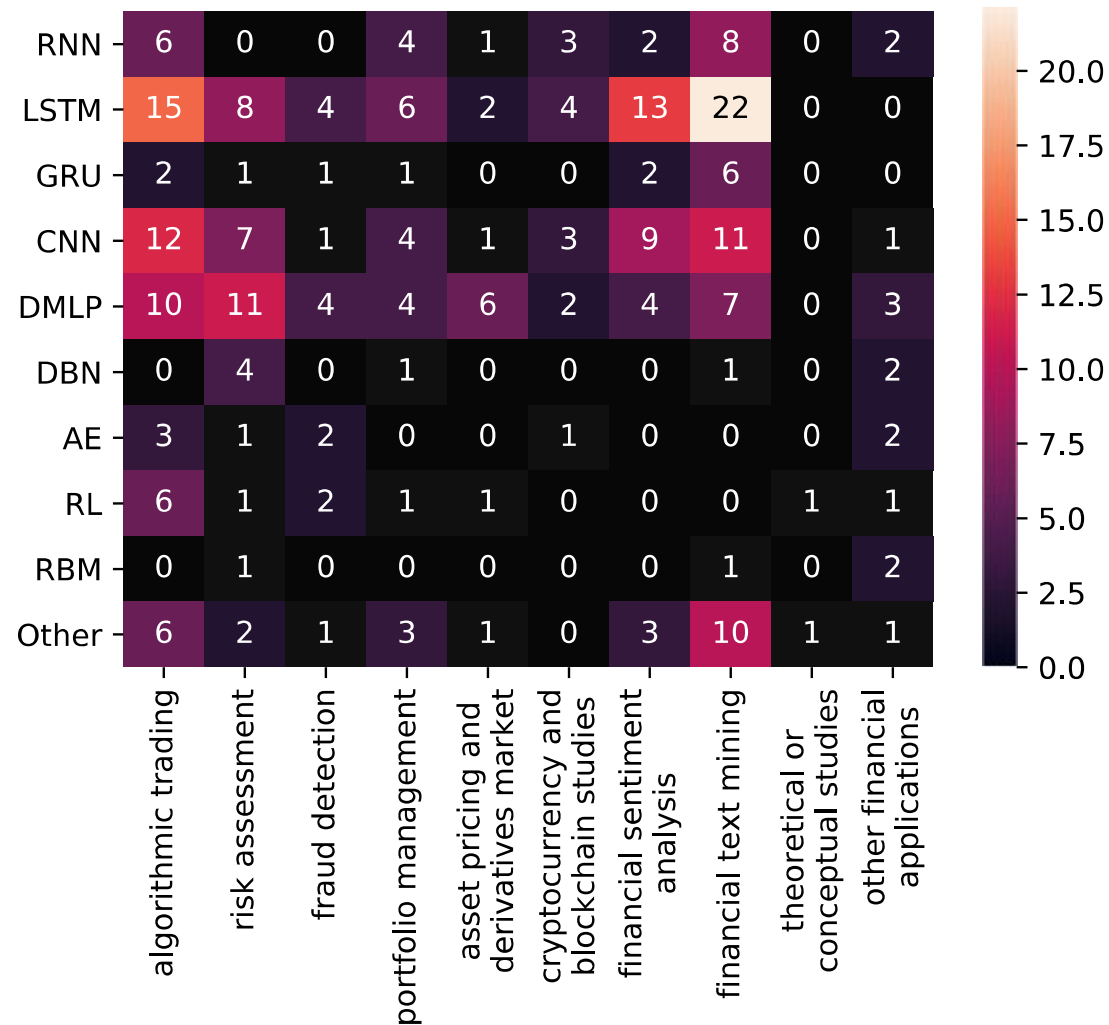
**Financial
time series forecasting with
deep learning:
A systematic literature review:
2005–2019
Applied Soft Computing (2020)**

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.

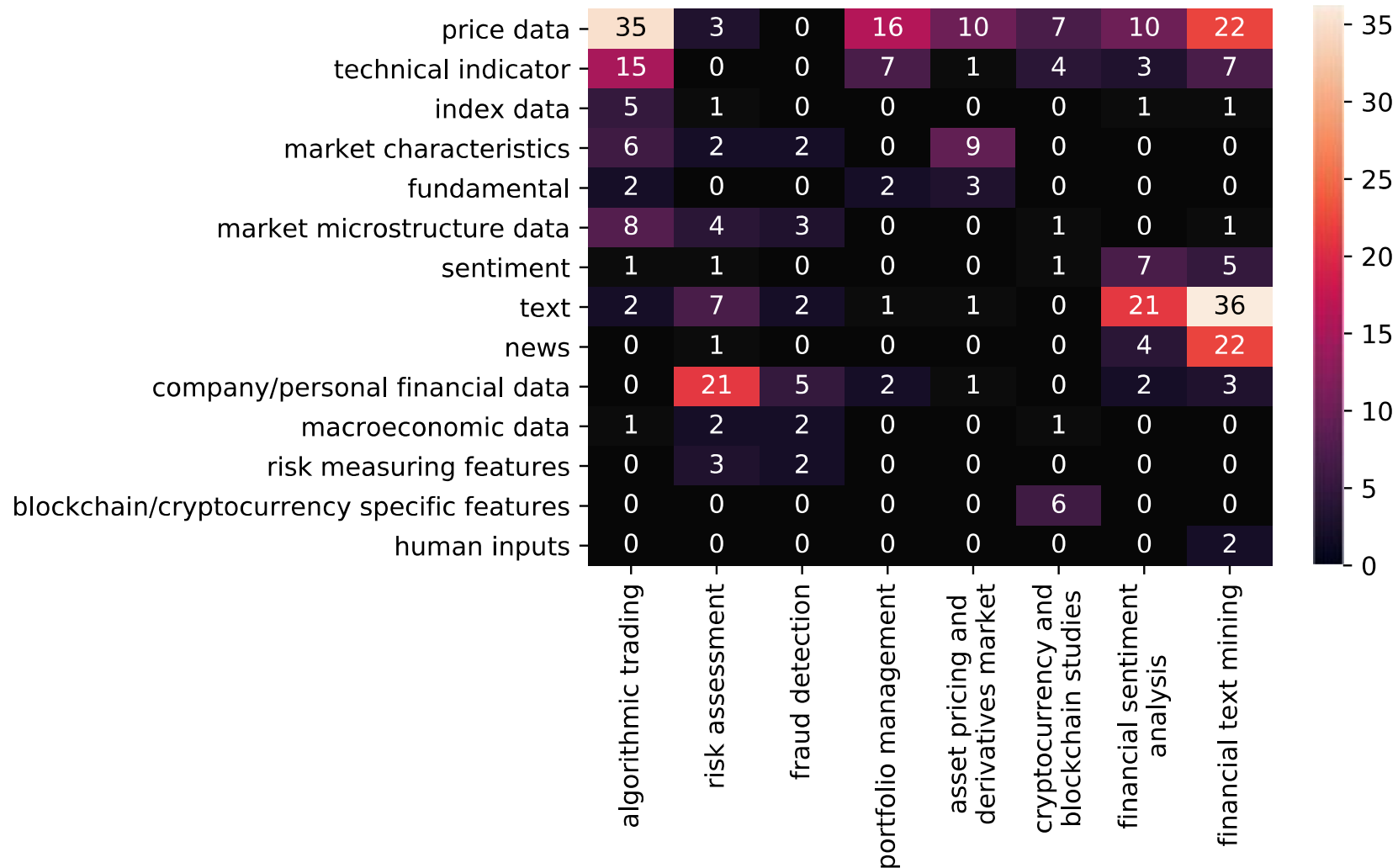
Deep learning for financial applications:

Topic-Model Heatmap



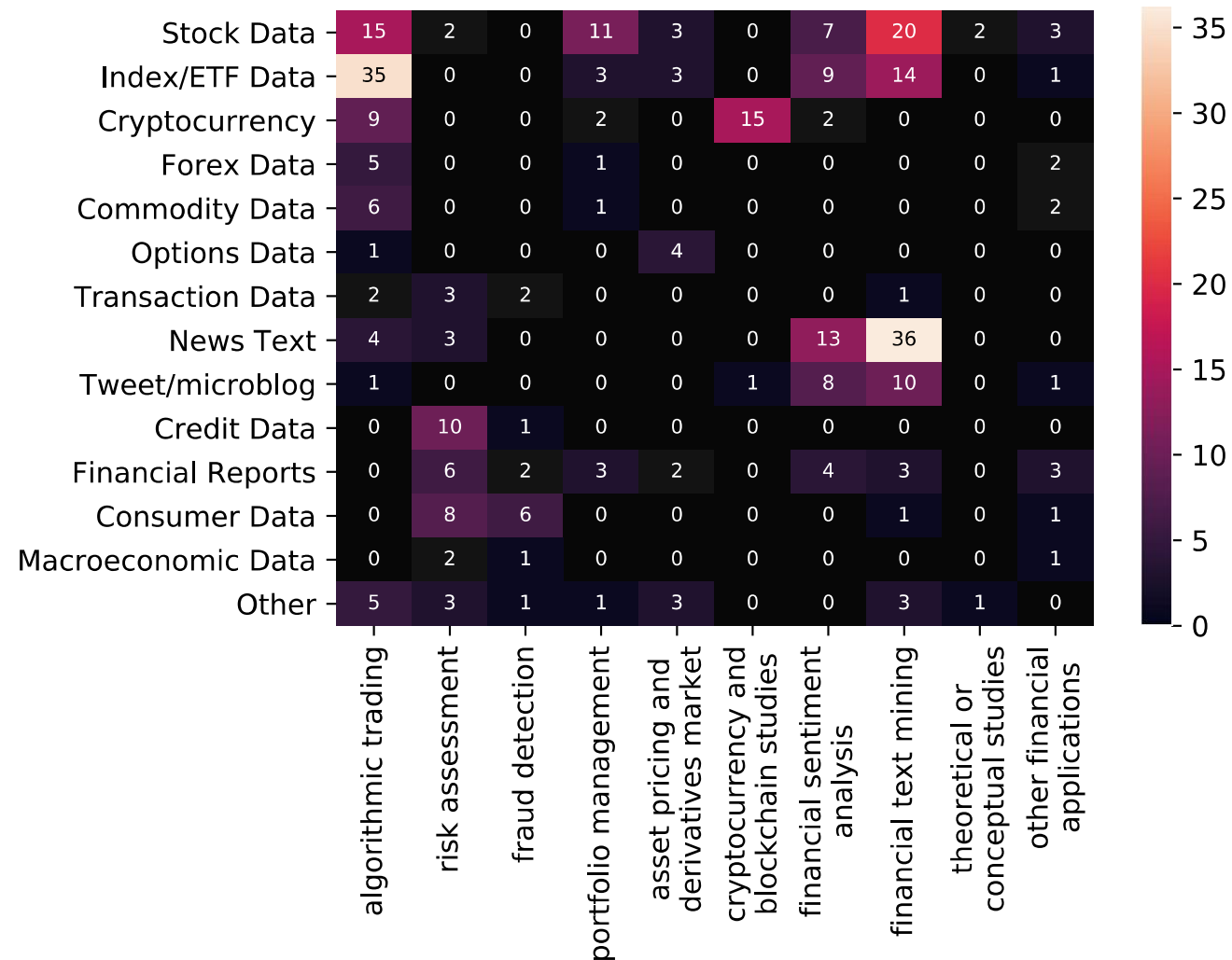
Deep learning for financial applications:

Topic-Feature Heatmap



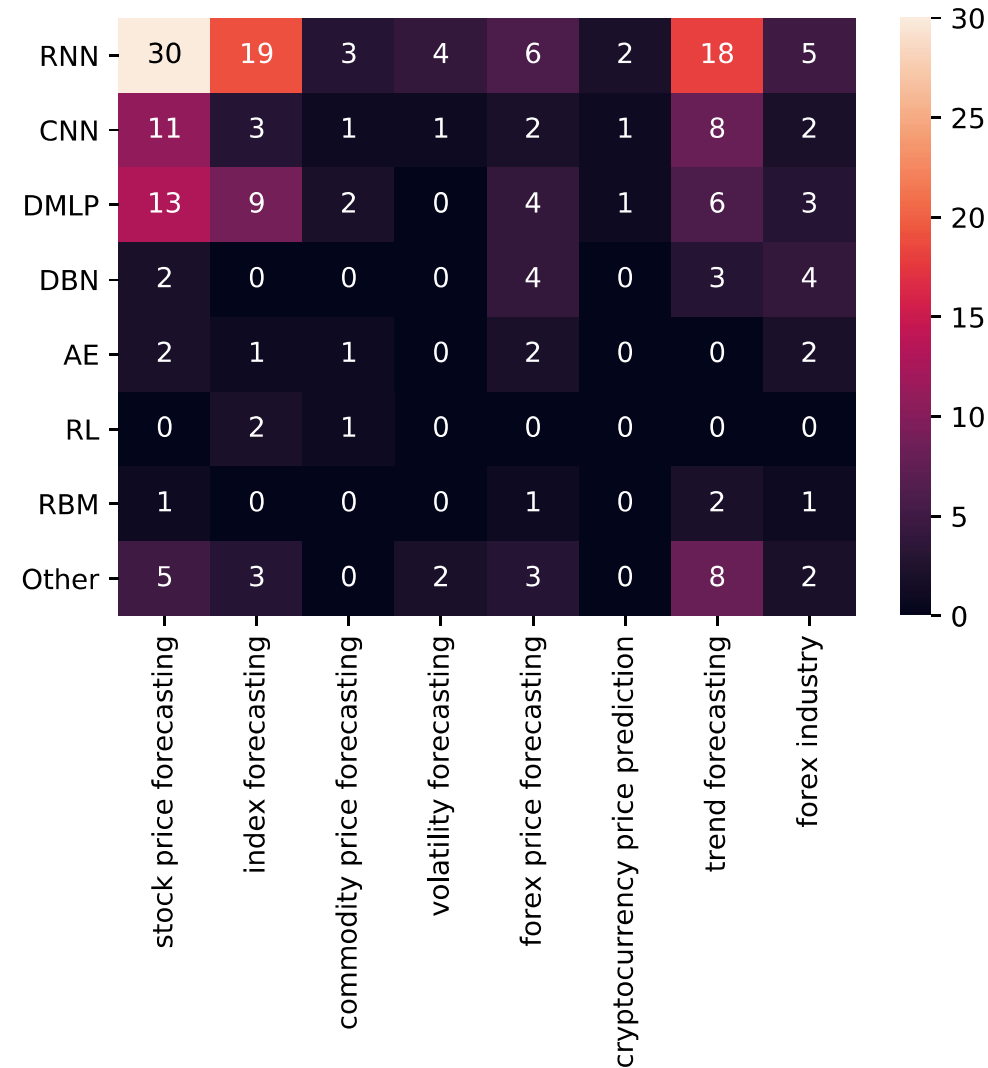
Deep learning for financial applications:

Topic-Dataset Heatmap



Financial time series forecasting with deep learning:

Topic-model heatmap



Papers with Code

State-of-the-Art (SOTA)



Search for papers, code and tasks



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Semantic Segmentation

33 leaderboards
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

<https://paperswithcode.com/sota>

Python in Google Colab (Python101)

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

python101.ipynb - Colaboratory

<https://colab.research.google.com/drive/1FEG6DnGvwfUbeo4zJ1zTunjMqf2RkCrT?authuser=2#scrollTo=wsh36fLxDKC3>

File Edit View Insert Runtime Tools Help

COMMENT SHARE

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



University Ambassador

Certified Instructor



Cloud
Ambassador

2020 Cohort



Accredited
Educator



Solutions
Architect
Associate



Cloud
Practitioner

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Email: myday@gm.ntpu.edu.tw

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