شبکه عصبی و پردازش زبان طبیعی در پزشکی

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هوش مصنوعی

شبکه عصبی عمیق

هوش مصنوعی مولد
Generative AI

Large Language Model

NLP

Chat - Text

Speech

Visual
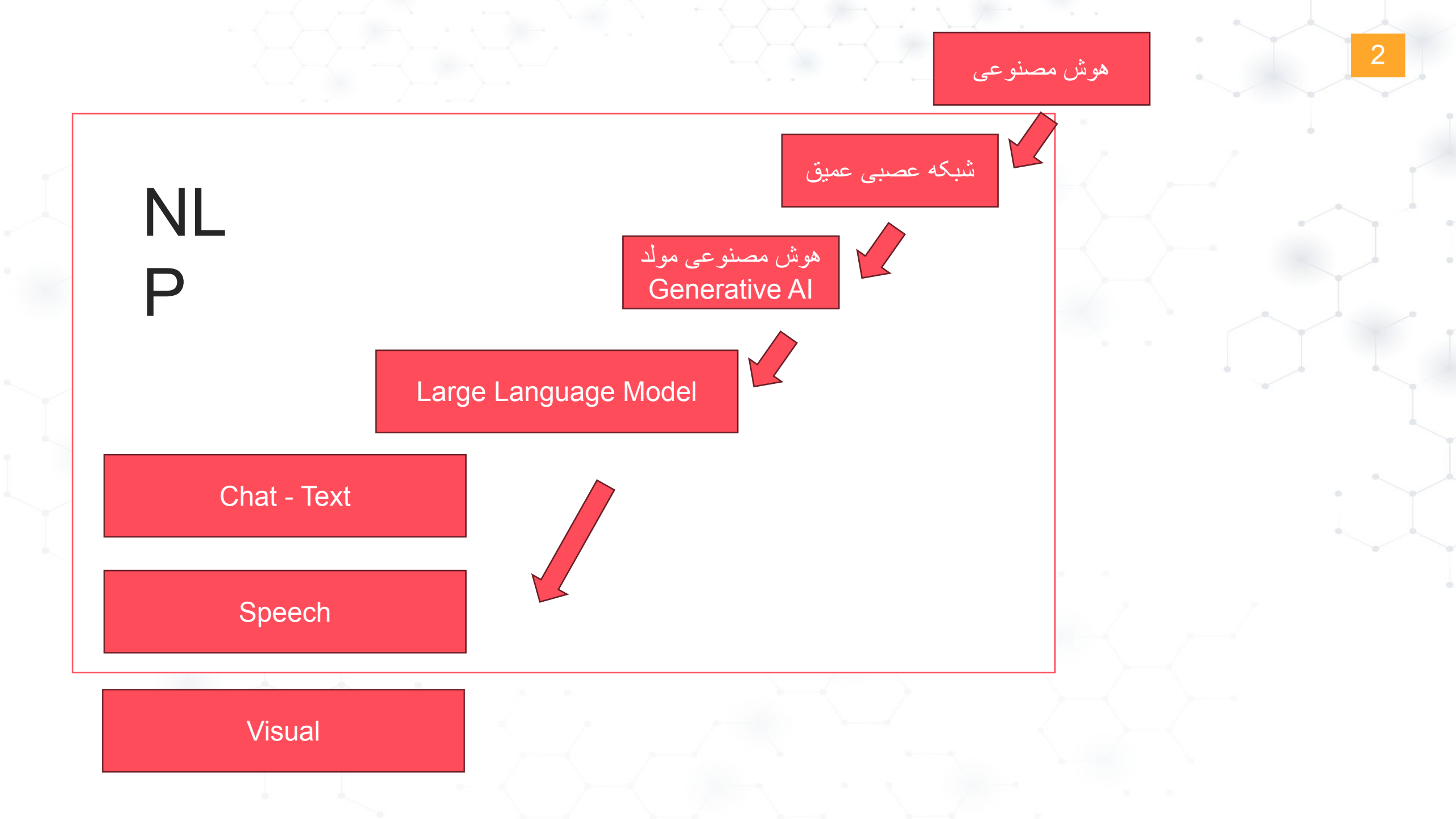
مغز انسان

apple

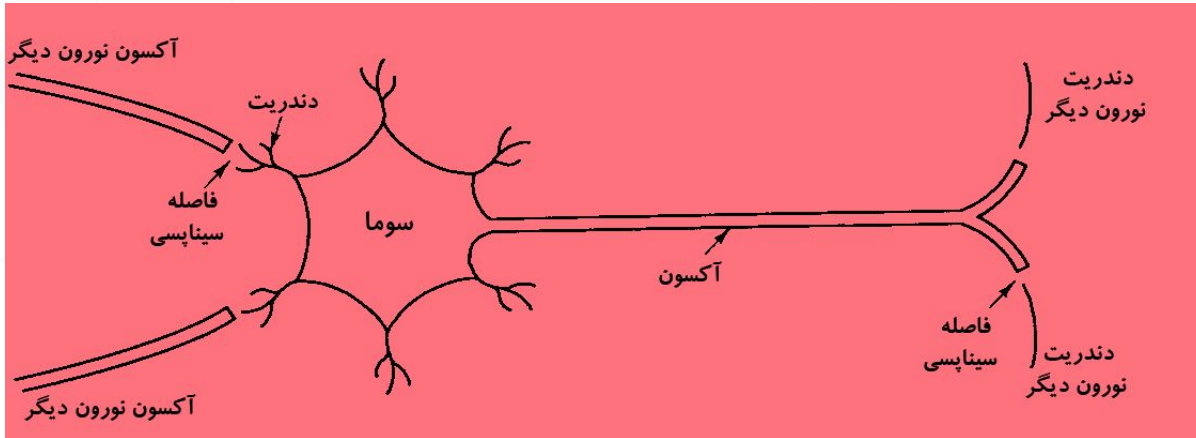| |
|---|
| 0.52 |
| 0.56 |
| -1.67 |
| 0.34 |
| ... |

embedding

مغز انسان ⌂

- مغز انسان = شبکه‌ای بزرگ از عصب‌ها (نرون‌ها)

- 100.000.000.000 نرون

- 10.000 اتصال (سیناپس) برای هر نرون

- حدود هزار تریلیون اتصال (سیناپس)

- شبکه عصبی مصنوعی = شبیه‌سازی شبکه عصبی طبیعی

هوش مصنوعی و شبکه عصبی

- تولد نخستین شبکه عصبی مصنوعی- ۱۹۴۳
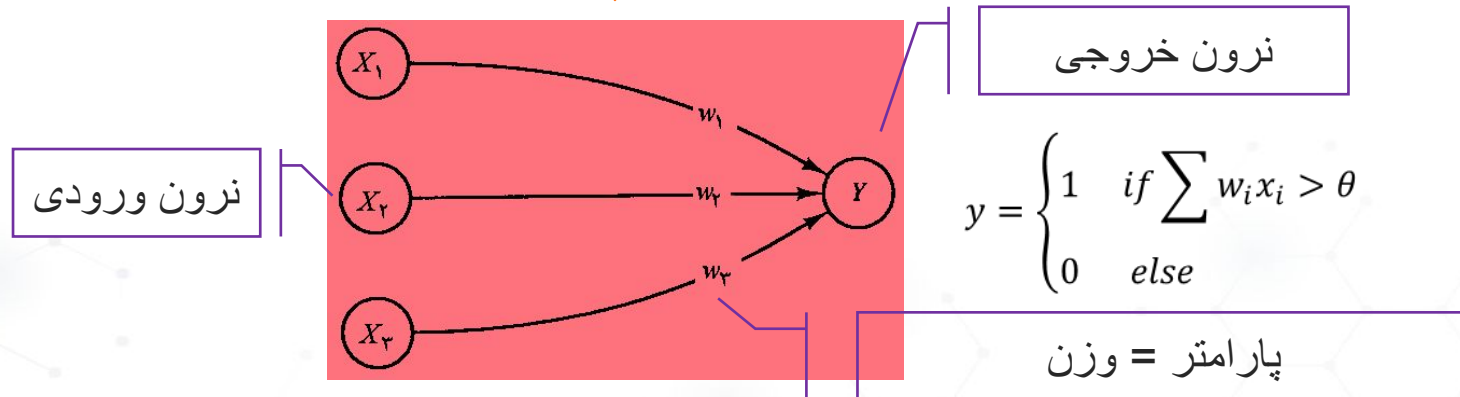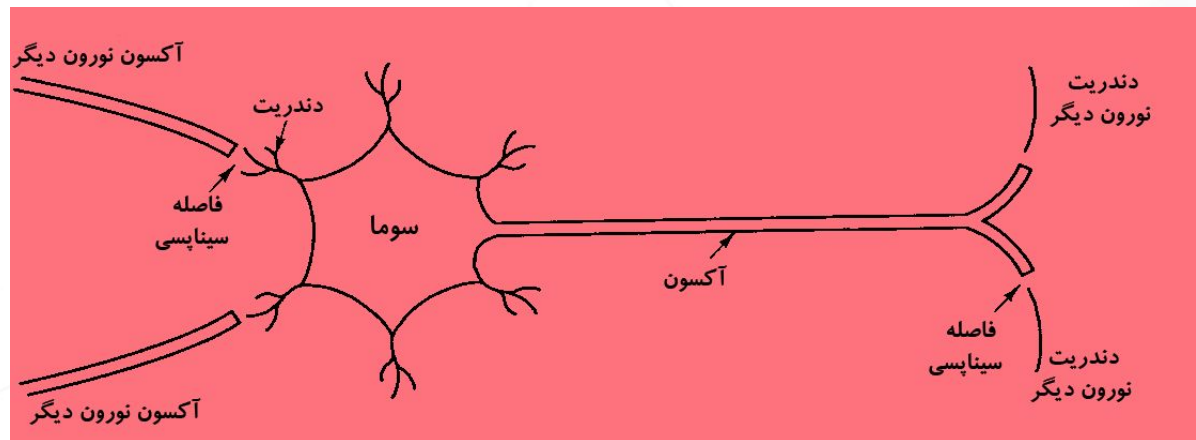
  - مک‌کلاچ و پیتز

- آزمون تورینگ - 1950

  - آلن تورینگ

- تولد واژه هوش مصنوعی- ۱۹۵۵

  - جان مک کارتی

شبکه عصبی مصنوعی

نرون خروجی

نرون ورودی

$$y = \begin{cases} 1 & if \sum w_i x_i > \theta \\ 0 & else \end{cases}$$

پارامتر = وزن

1943- Warren MuCulloch (neuroscientist) and Walter Pitts (logician)

شبکه عصبی مصنوعی: یادگیری

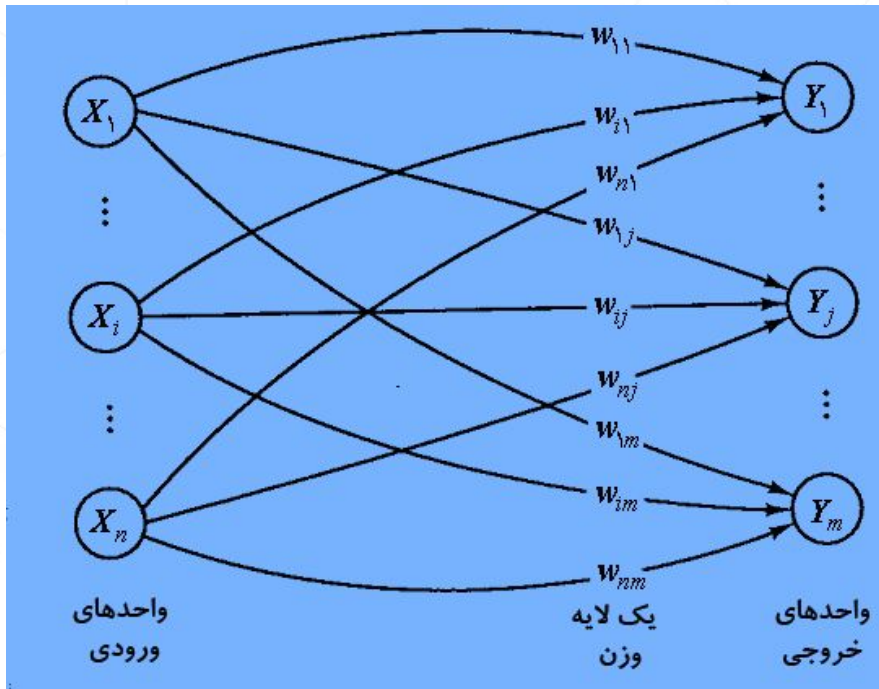- یادگیری پارامترهای مدل از روی نمونه داده: تک لایه
  - هب (دونالد هب)- 1949
  - پرسپترون (روزنبلات)- 1958
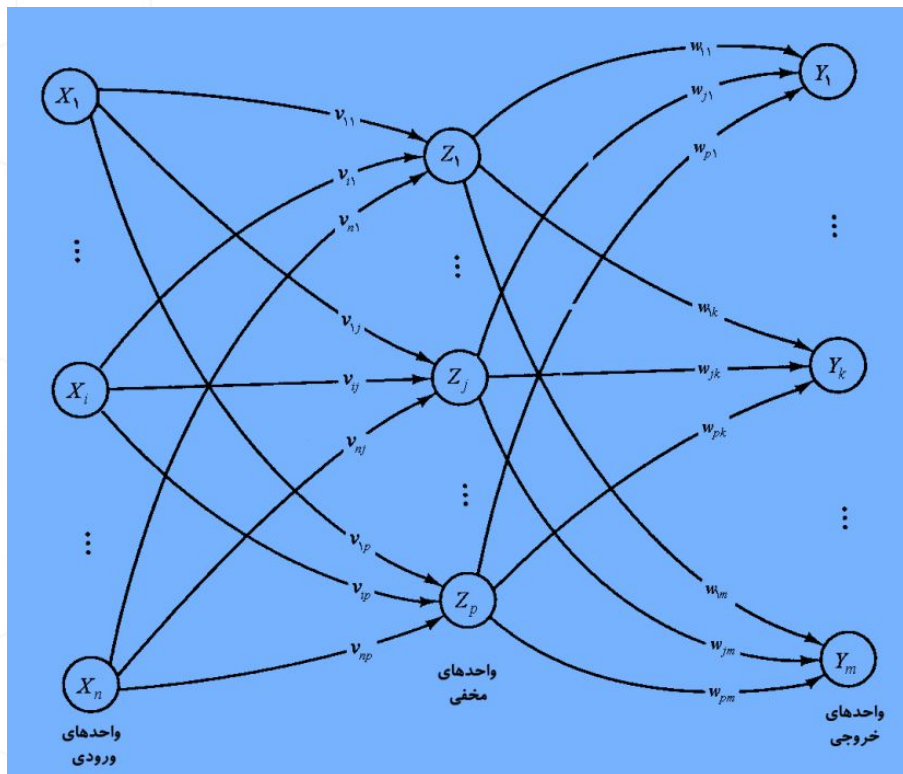 - آدالاین (ویدرو و هاف)- 1960

شبکه عصبی مصنوعی: یادگیری

- پرسپترون چندلایه
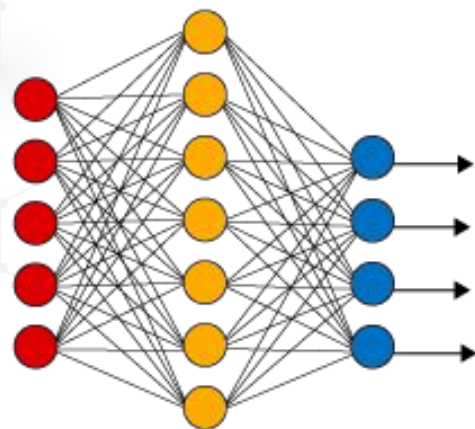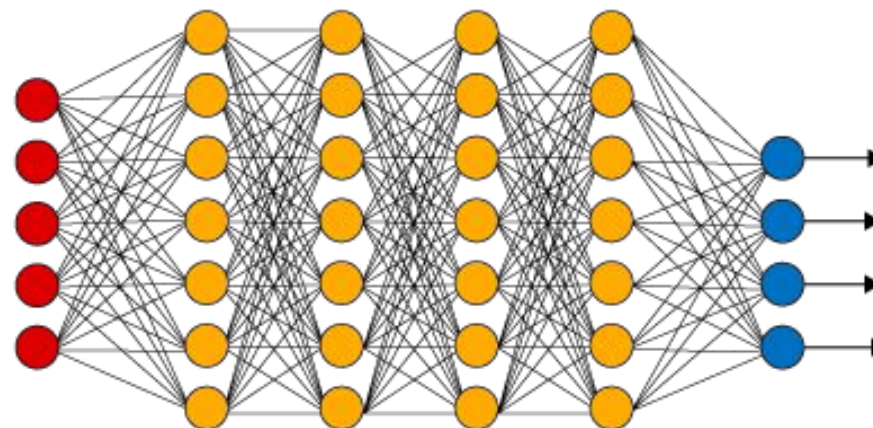 - پس‌انتشار خطا (روملهارت، هینتون و ویلیامز) - 1985

شبکه عصبی عمیق

- افزایش تعداد لایه‌های مخفی

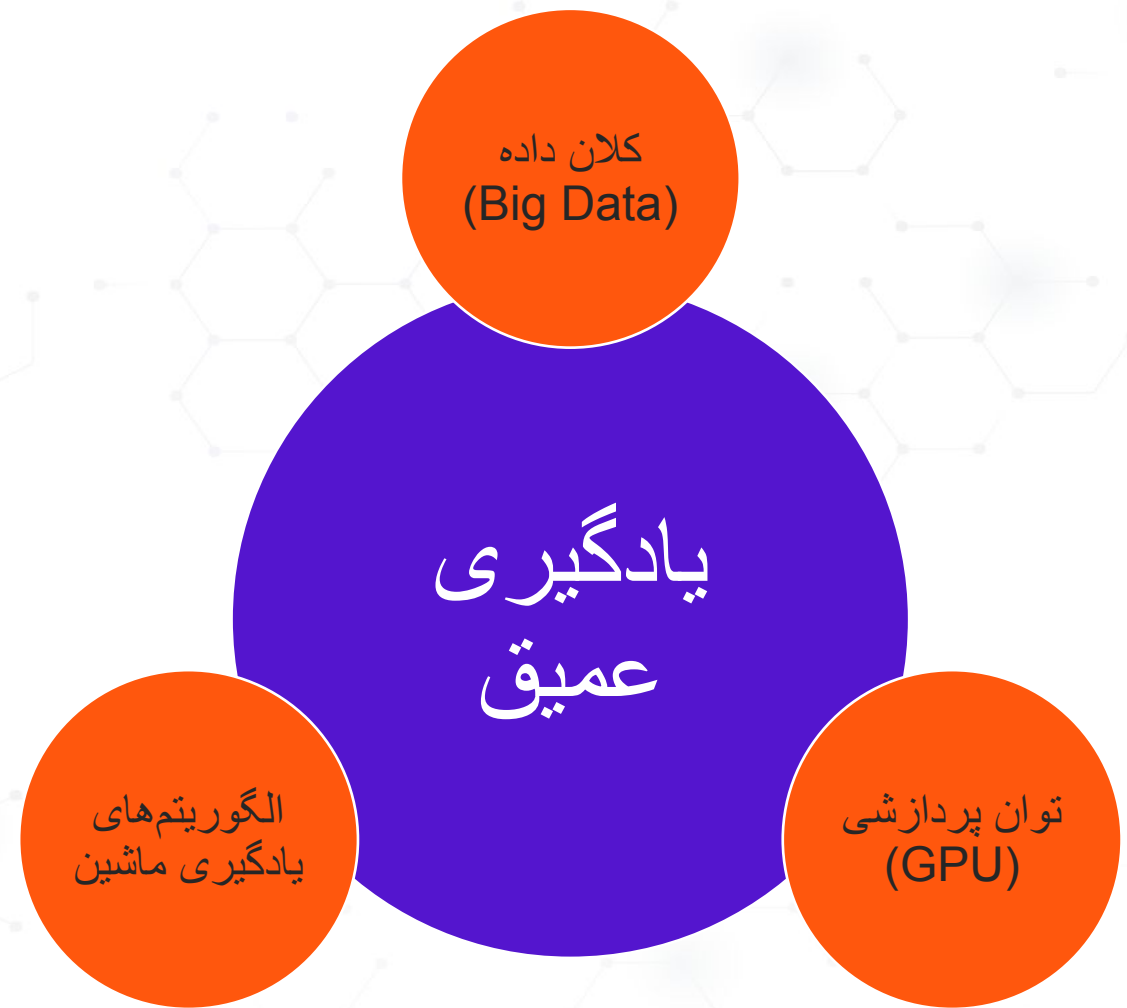Simple Neural Network — Deep Learning Neural Network

● Input Layer ● Hidden Layer ● Output Layer

- مدل پیچیده = تعداد پارامترهای زیاد = توان محاسباتی بالا

2006- Hinton GE, Osindero S, Teh YW

دگرگونی یادگیری با عمیق شدن

کلان داده
(Big Data)

یادگیری عمیق
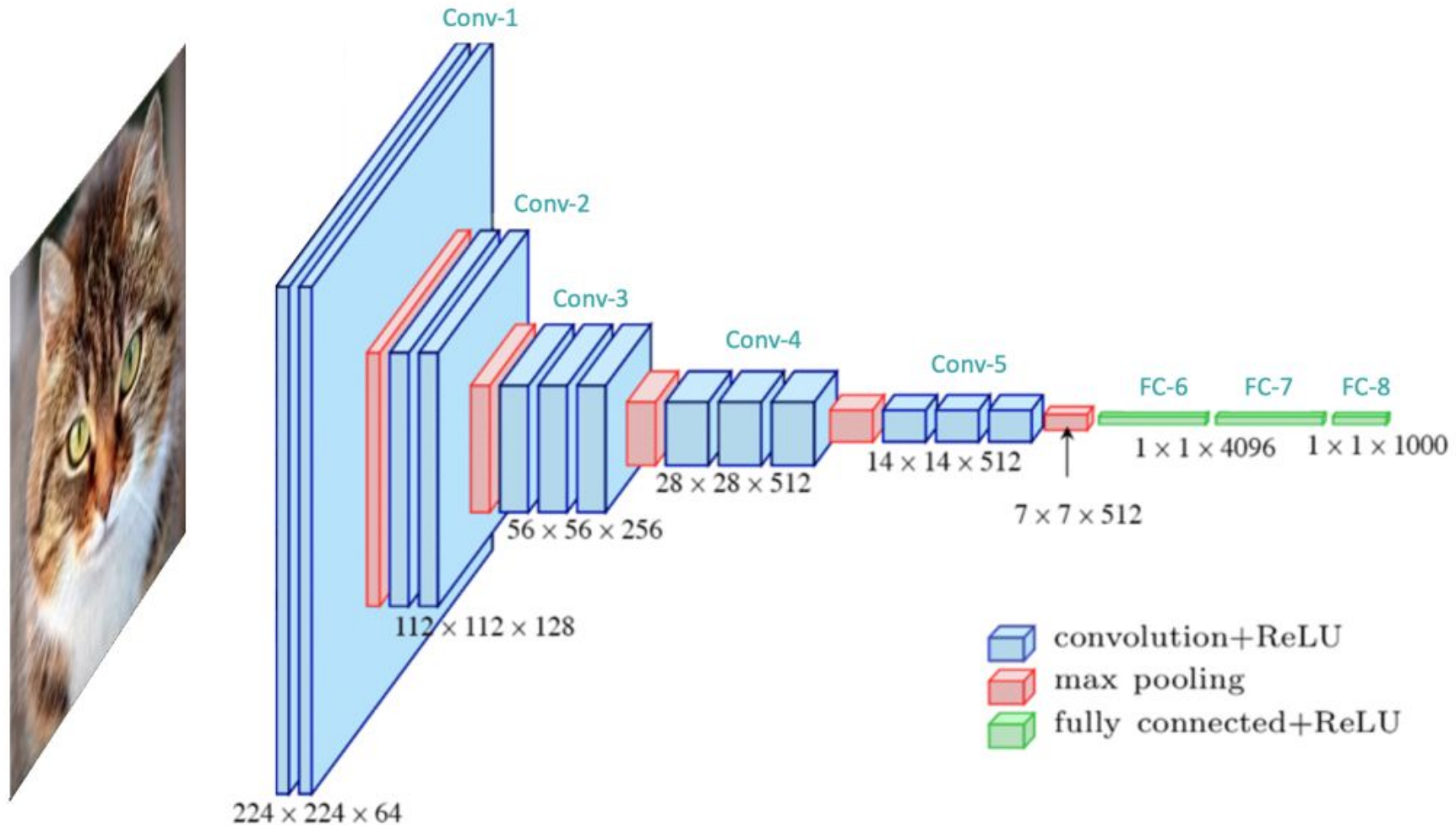
الگوریتم‌های یادگیری ماشین

توان پردازشی
(GPU)

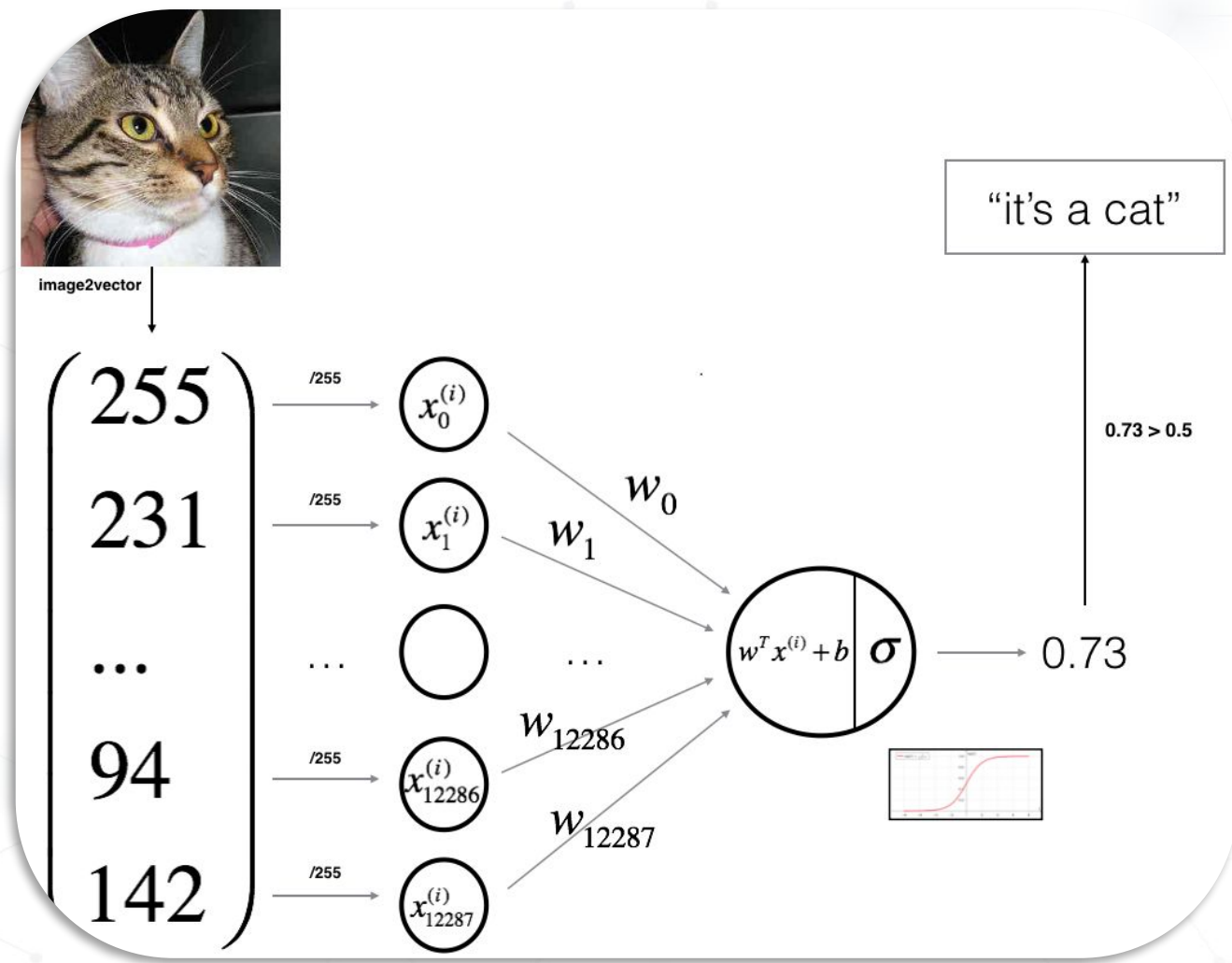# هوش مصنوعی مولد (Generative AI)

- تصویر

- متن

- صدا (گفتار)

- کد (کامپیوتری)

- موسیقی

- ویدیو

- ...
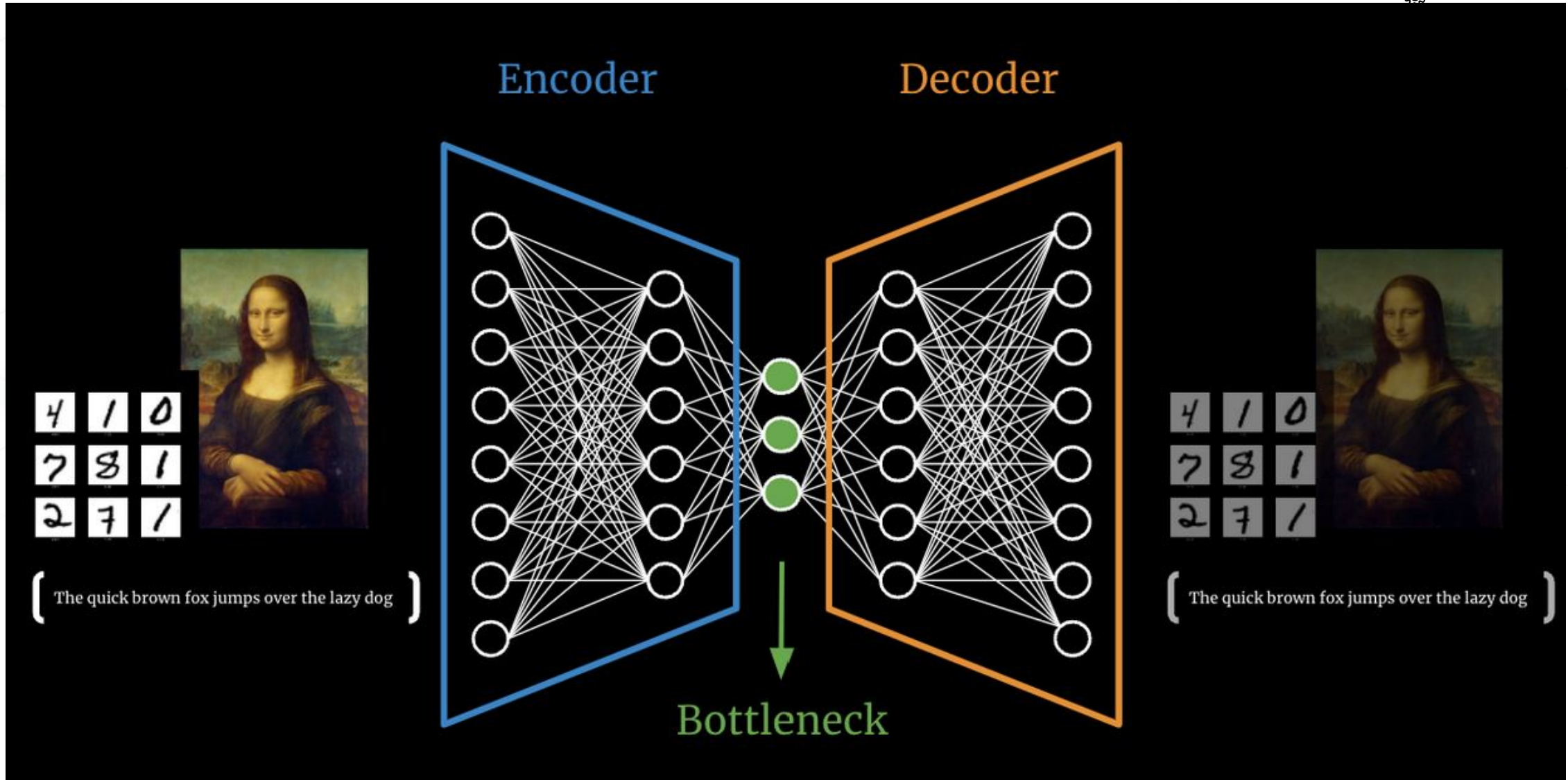
CNN: Conv. Neural Net شبکه

1998- LeCun, Yann, Léon Bottou, Yoshua Bengio, and Patrick Haffner
2012- Krizhevsky, Alex, Ilya Sutskever, and Geoffrey E. Hinton

شبکه عصبی مصنوعی -
Image to text (image captioning)

شبکه Auto-Encoder

2013- Diederik P Kingma; Welling, Max

مدل زبانی Language Model

فارسی یا پارسی زبان رسمی کشور ایران ...

سابقه/بافت متن

پیش‌بینی کلمه بعدی

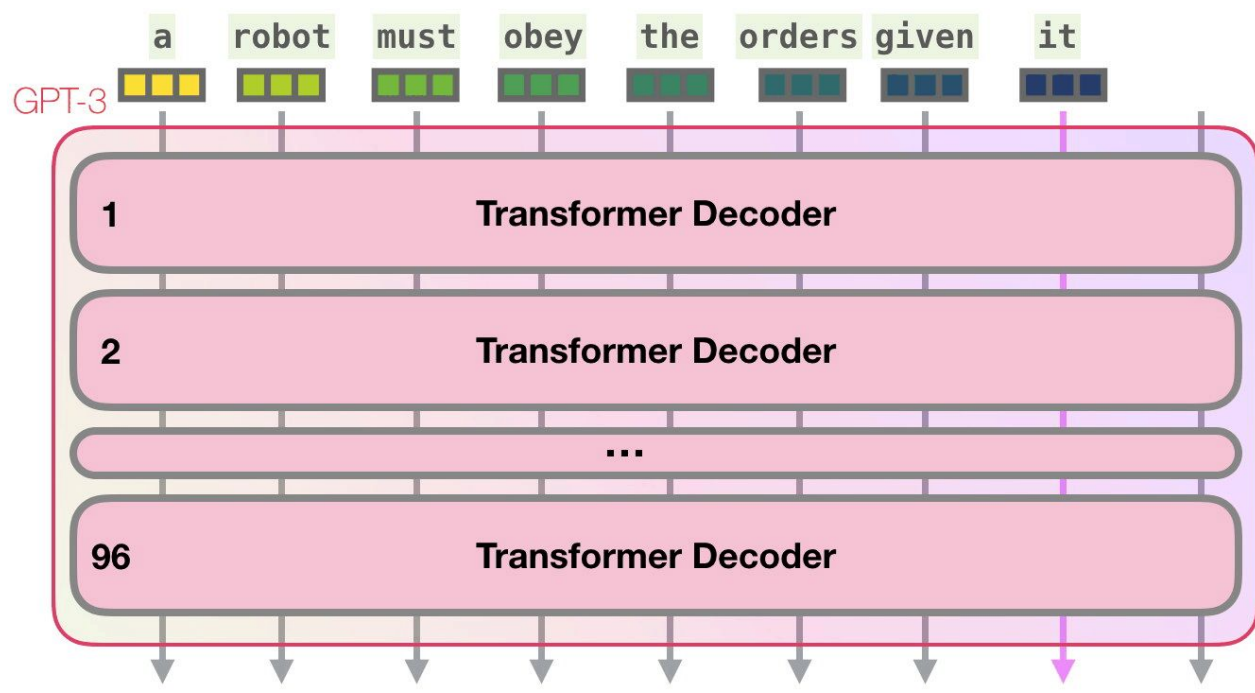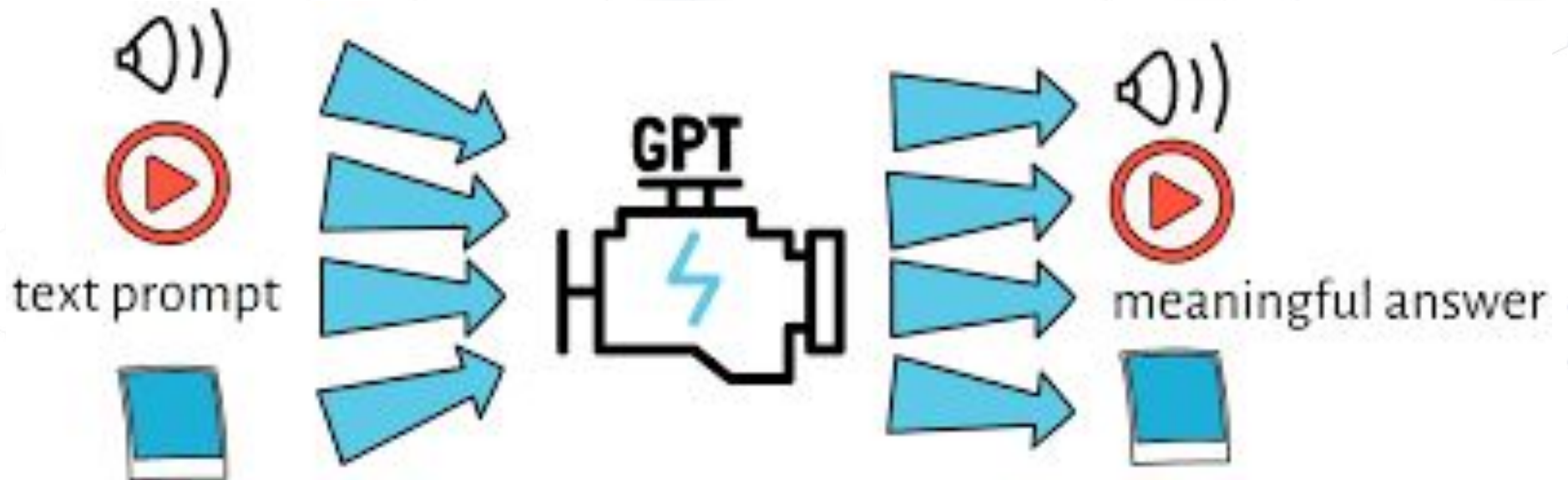# GPT3 مدل زبانی مبتنی بر مبدل: مدل

- مدل GPT3
  - طول دنباله ورودی: 2048 توکن (کلمه)
  - تعداد لایه (رمزگذارها): 96 (هر کدام 1.8 میلیون پارامتر)
  - داده: حدود 500 میلیارد توکن
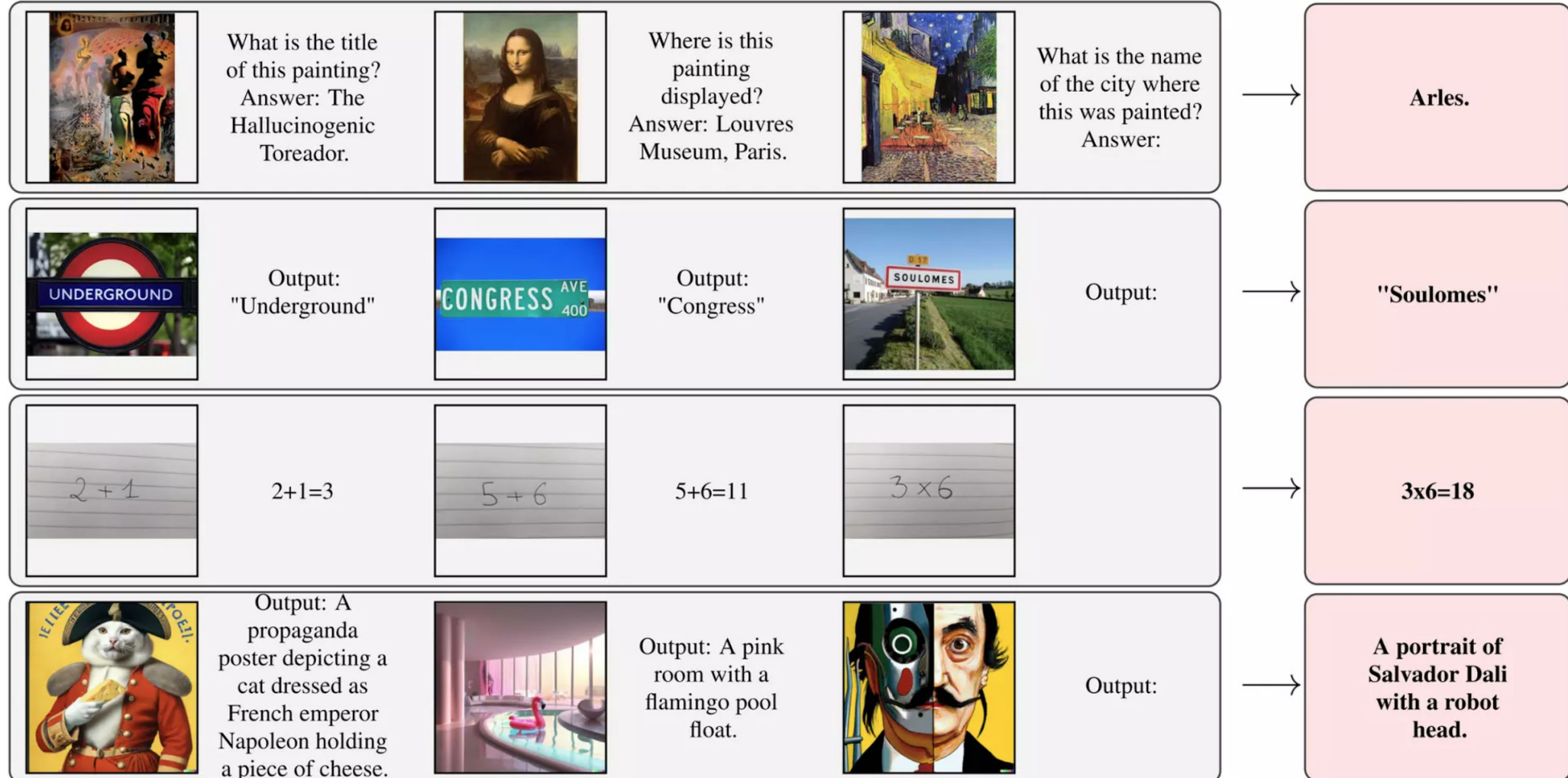
Multi Modal LLM

Multi Modal LLMs

Flamingo: a Visual Language
Model for Few-Shot Learning

2022 – Deep Mind

Flamingo: a Visual Language Model for Few-Shot Learning

Applications

Disease Diagnosis

Disease Diagnosis

disease diagnosis with artificial intelligence

پژوهشگر   تقریباً ۲٬۳۳۰٬۰۰۰ نتیجه (۰٫۲۰ ثانیه)   سال

jmir.org [HTML]   **Artificial intelligence** versus clinicians in **disease** [HTML]
                                    diagnosis: systematic review

medinform.jmir.org - J Shen, CJP Zhang, B Jiang, J Chen… - JMIR medical …, 2019

… Our systematic review identified 9 articles on advanced AI applications for **disease diagnosis**.
These spanned multiple medical subjects, including retinal **diseases**, skin cancers, …

☆ ذخیره   ⁹⁹ ارجاع   بیان شده در 218 یافته   مقاله‌های مربوط   تمام نسخه‌های 12   ≪≪

springer.com [HTML]   Evaluation of **artificial intelligence** techniques in [HTML]
Full View   **disease diagnosis** and prediction

Disease Diagnosis
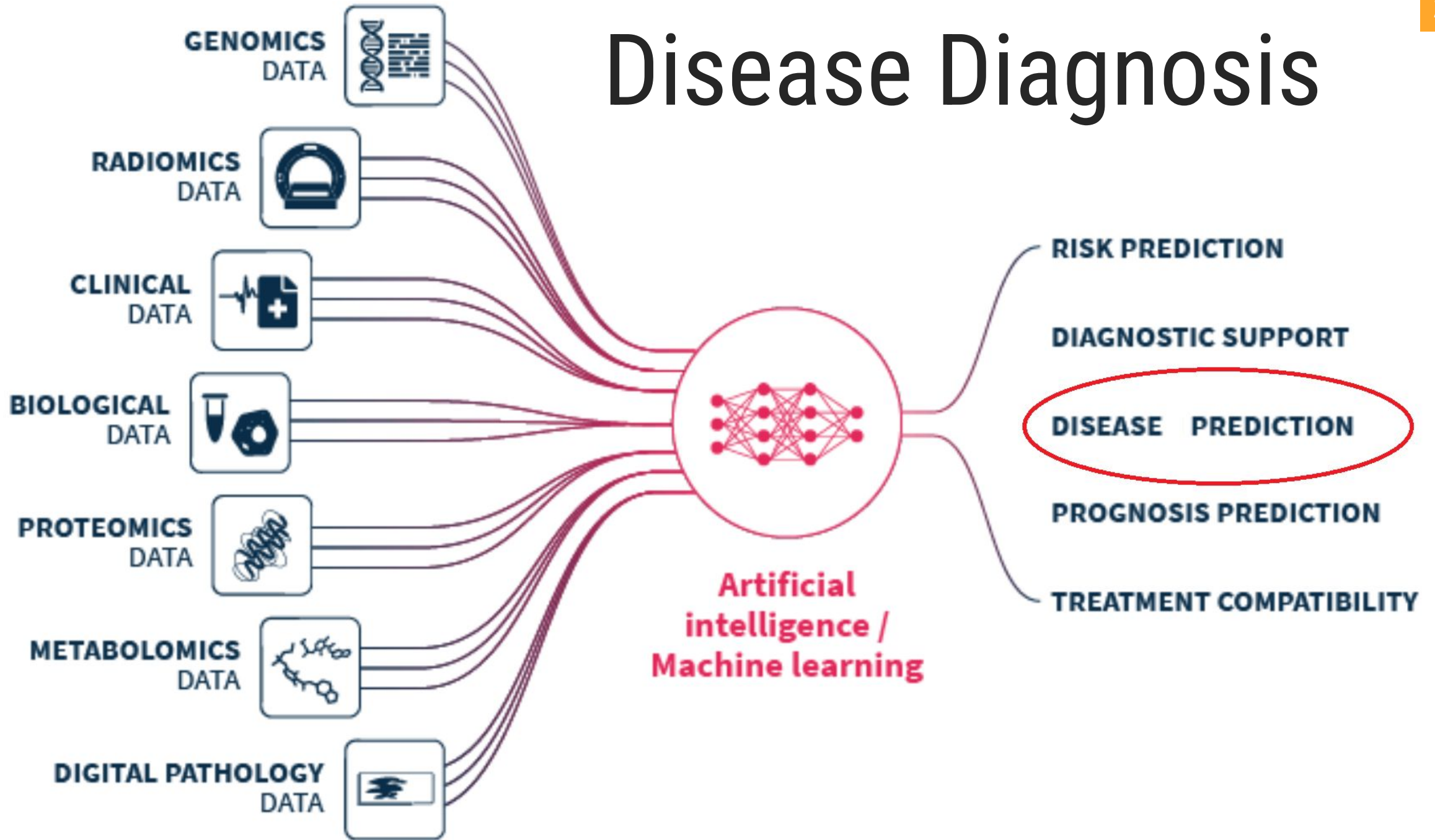
Self Diagnosis Apps, for Patients and Doctors

ADA - apple

WebMD

K health

Symptomate

Ada Health

Supporting better health outcomes and clinical excellence with intelligent technology.

Berlin based

Applications

Health Advice and Chatbot Assistants

Health Advice

- Everyday millions of people turn to the Internet for health information and treatment advice

- In Australia, around 80% of people search the Internet for health information, and nearly 40% seek guidance online for self-treatment

- In the US, almost two-thirds of adults search the Web for health information and roughly one-third utilize it for *self-diagnosis*
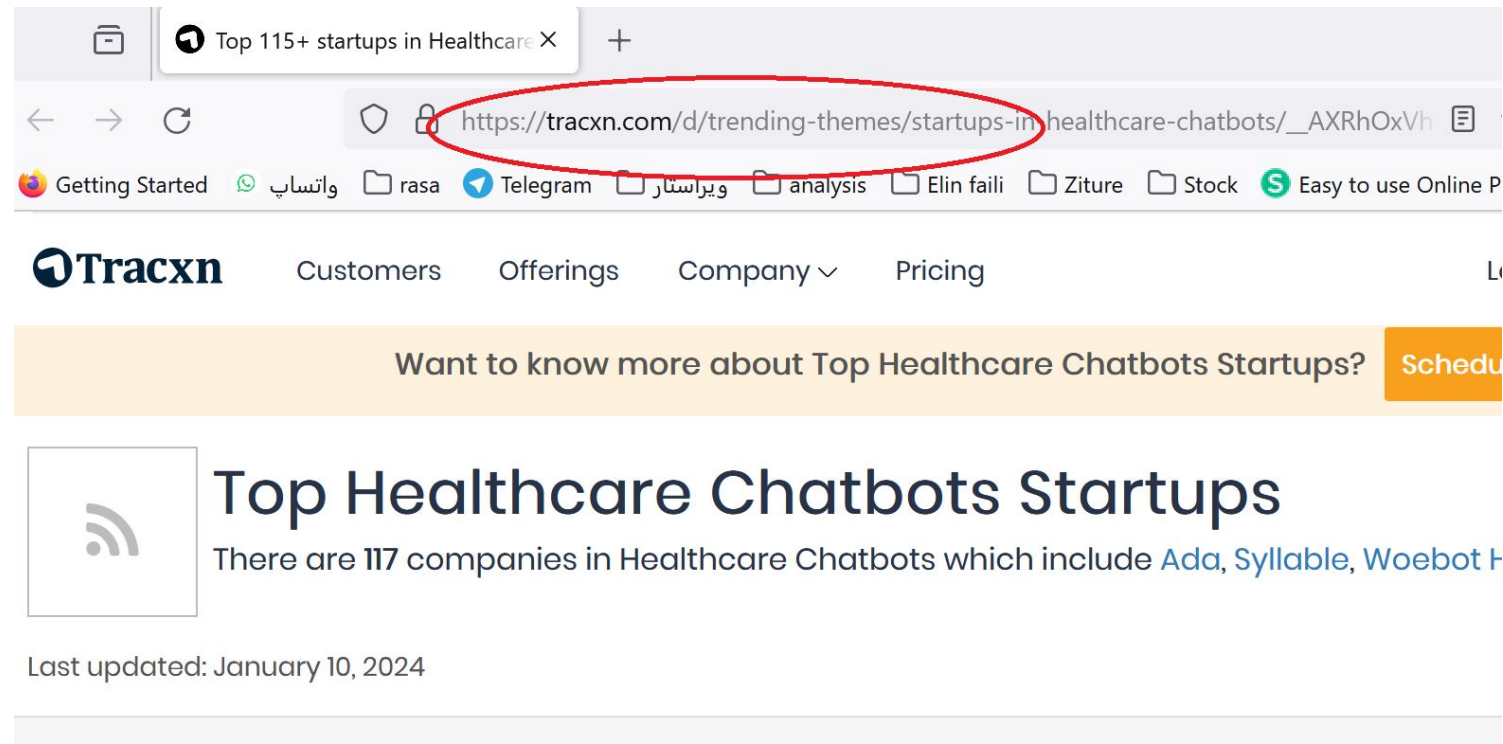
Health Advice

- A recent study showed that half of the patients investigated their symptoms on search engines before visiting emergency departments

- Search engines (e.g., Google and Bing) are exceptional tools for educating people, but they may facilitate misdiagnosis!

- Some governments have even launched "Don't Google It" advertising campaigns to urge their residents to avoid assessing their health using search engines

Health Advice

- In contrary, AI-based *symptom checkers* are tools that can assist patients in self-diagnosing themselves
  - They are constantly and instantly available!

- Studies show that more than 15 million people use symptom checkers per month, a number that is likely to keep growing

- However, the utility and promise of symptom checkers cannot be materialized if they do not prove to be accurate in self-diagnosis

Chatbot in Health

- Market : $1.2 billion by 2032, from $196 million in 2022
- Over a hundred startup in heathcare chatbot

One Remission

Making the lives of cancer survivors easier
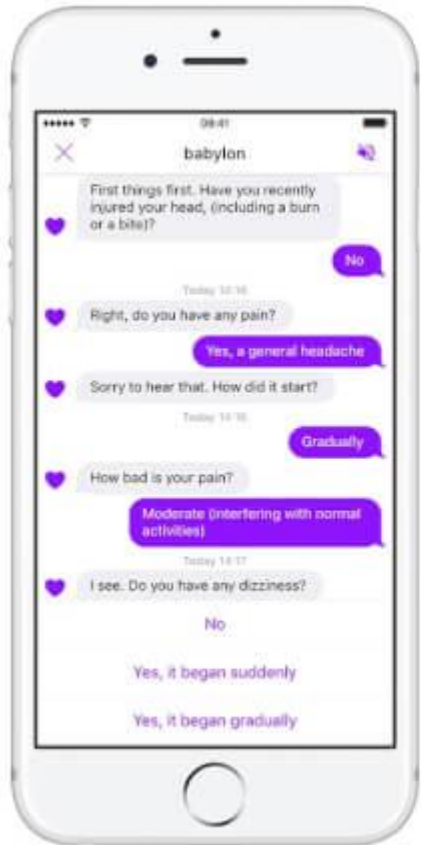
New York-based
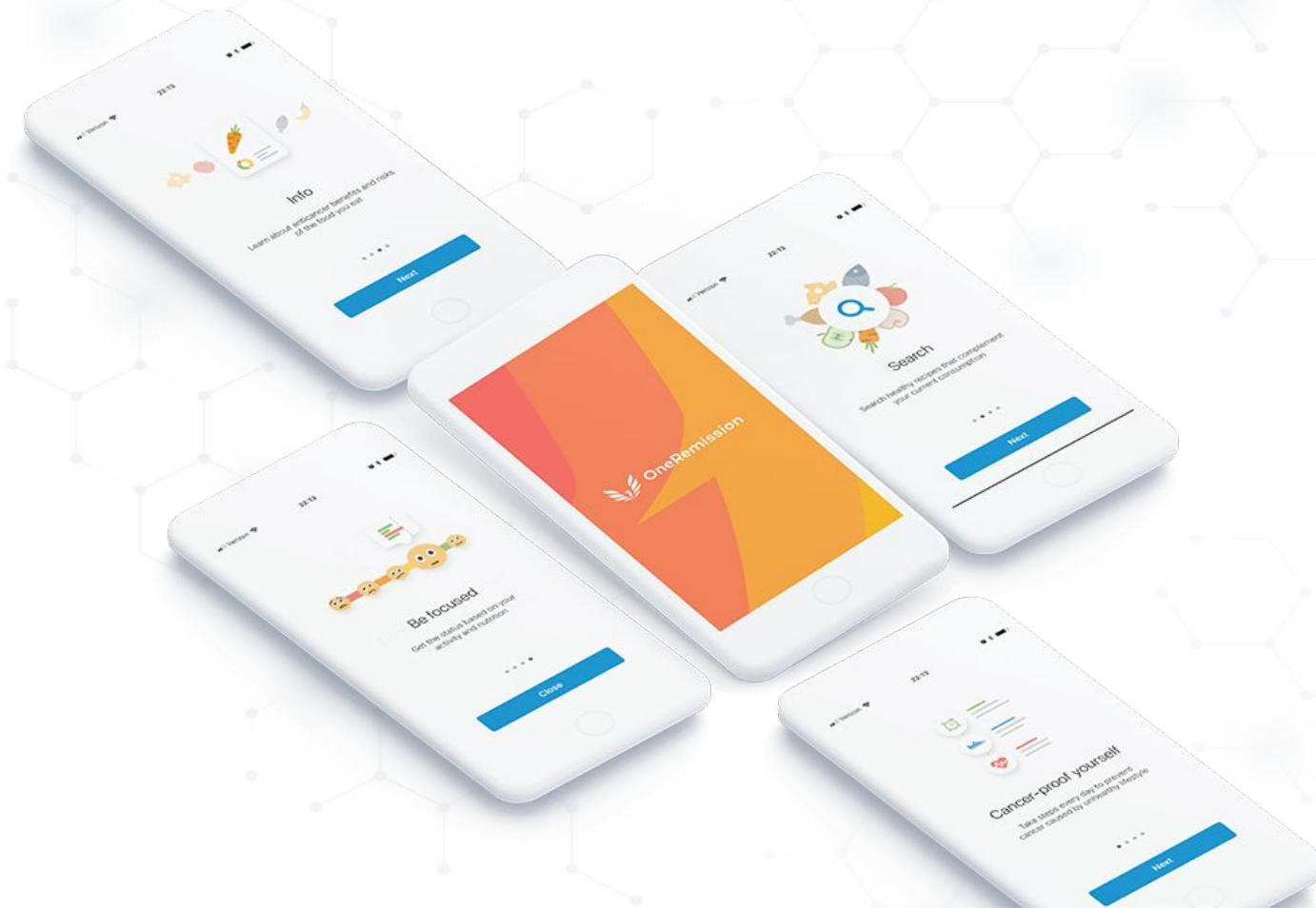
Babylon Health

offers AI consultation based on personal medical history and common medical knowledge as well as live video consultation with a real doctor

Buoy

The chatbot thoroughly asks you about the details of your medical state and offers you

Boston-based

Applications

Interpreting ICD-10 Codes

ICD 10 Coding

The International Statistical Classification of Diseases and Related Health Problems 10th version **(ICD 10)** is the international standard prescribed by WHO.

🔍 automatic icd 10 classification ☰

پژوهشگر تقریبا ۷۶,۲۰۰ نتیجه (۰,۱۱ ثانیه)

qut.edu.au [PDF] **Automatic ICD-10 classification** of cancers from free-text death certificates

Elsevier - B Koopman, G Zuccon, A Nguyen, A Bergheim… - International journal of …, 2015

… This paper proposes an **automatic classification** system for … An effective automated method for cancer **classification** would … a system for the **automatic classification** of cancers from free-

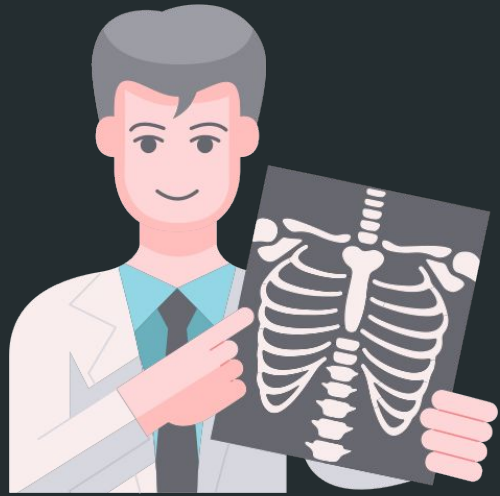# PLM-ICD

**PLM-ICD:
Automatic ICD Coding with
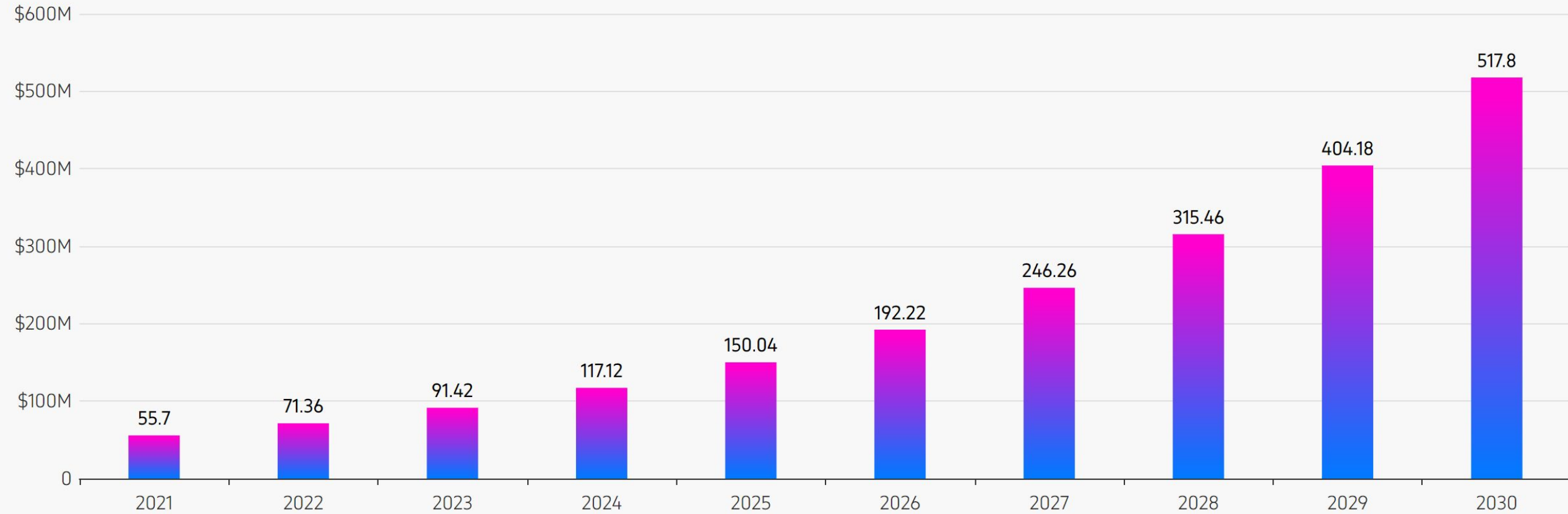Pretrained Language Models**

2022 ACL

Applications

AI in
Radiology

Chart title: Artificial intelligence in radiology: market size forecast, 2021-2030

Data source: Vision Research Reports

AI in radiology market statistics

30% of radiologists use AI in their clinical practices

American College of Radiology

20% plan to purchase AI tools in the near future

American College of Radiology

36.7% AI in the global radiology market CAGR from 2021 to 2030

Vision Research Reports

10 AI use cases in radiology

1 **Enhancing cardiac imaging**   2 **Classifying brain tumors**   3 **Spotting vertebral fractures**

4 **Detecting Alzheimer's disease**   5 **Diagnosing ALS**   6 **Assisting with radiology reporting & data-related tasks**
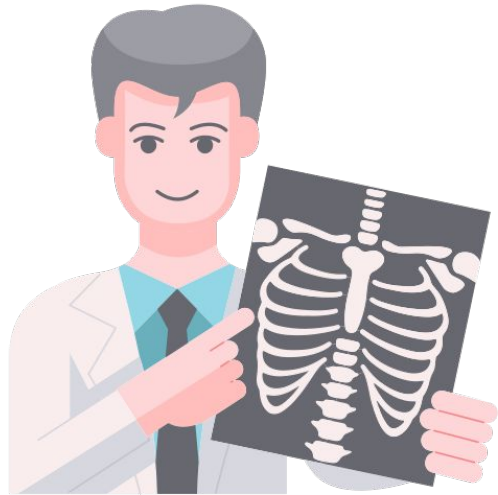
7 **Detecting breast cancer**   8 **Dose optimization**   9 **Detecting pneumonia**   10 **Detecting LVO**

MAIRA-1

MAIRA-1: A specialised large multimodal model for radiology report generation

2023 – Microsoft

LLMs in Medicals

Med-Flamingo

Med-Flamingo: A Multimodal Medical Few-shot Learner

2023 – Snap-Standford

Flamingo: a Visual Language Model for Few-Shot Learning

2022 – Deep Mind

BioGPT

BioGPT: Generative Pre-trained Transformer for Biomedical Text Generation and Mining

2022 - Microsoft

MultiMedBench modalities and tasks
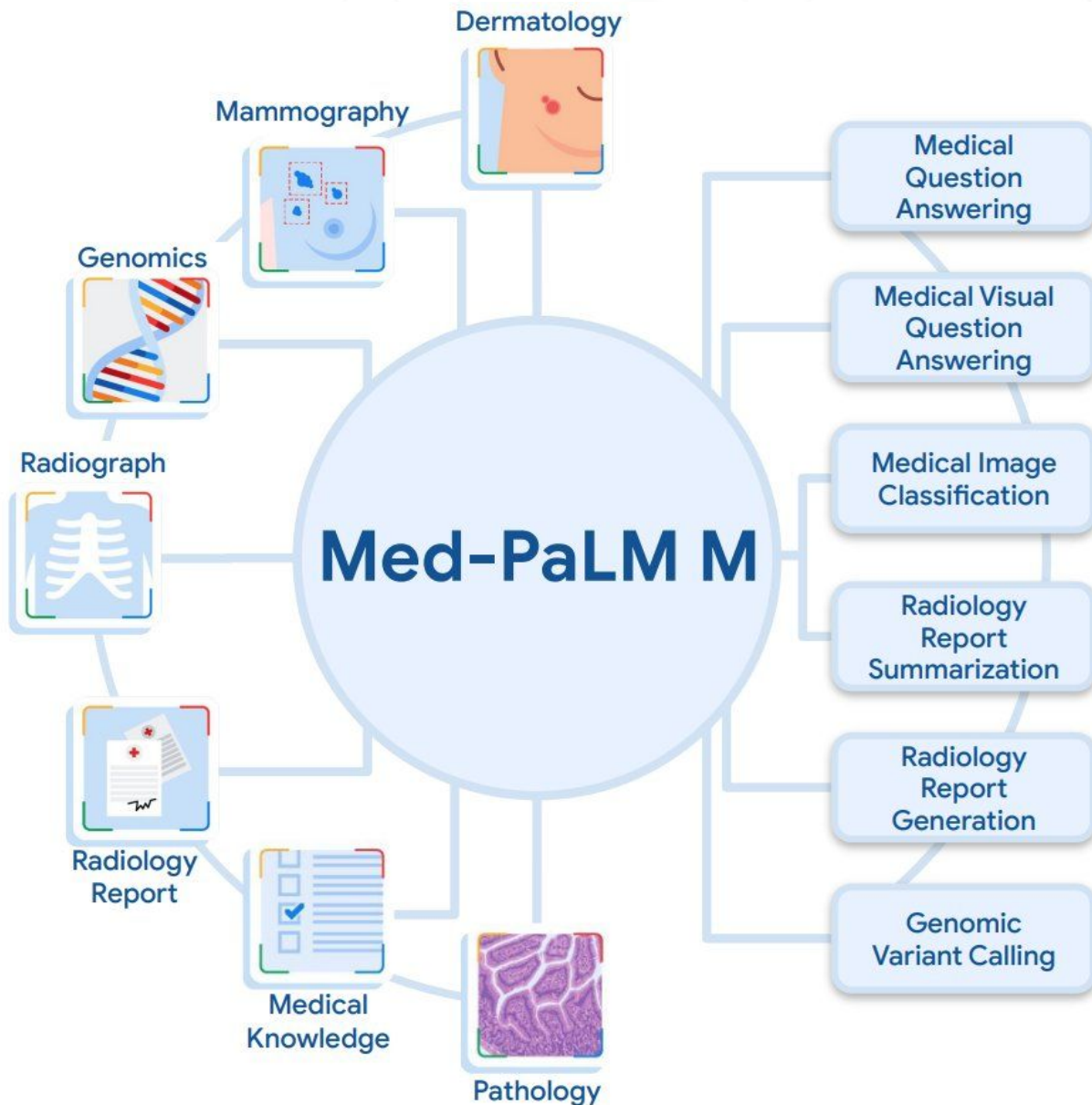
Med-PaLM

Towards Generalist Biomedical AI

2023 - Google

Applications

Medical training

Medical Training

1. *Leverage social media platforms to engage learners.*
2. *Utilize virtual reality (VR) and augmented reality (AR) to offer training opportunities.*
3. *Create simulations for experiential learning.*

1. *Leverage social media platforms to engage learners.*

- **DailyRounds**: A network that offers case studies and discussions, making it ideal for doctors who want to share and learn from real-world medical cases.

- **Virtual Doctors Lounge**: The Virtual Doctors Lounge platform serves as a virtual meeting space for physicians to discuss medical cases, share insights, and seek advice from peers.

- **Among Doctors**: A community where healthcare professionals can network, collaborate, and share their expertise.

- **Student Doctor Network Forum**: An invaluable resource for students and practicing doctors alike, this forum provides a space for educational discussions and career advice.

- **Sermo**: Known for its large network of verified physicians, Sermo offers a platform for medical surveys, discussions, and collaboration on patient care.

2. Utilize virtual reality (VR) and augmented reality (AR) to offer training opportunities.

3. Create simulations for experiential learning.
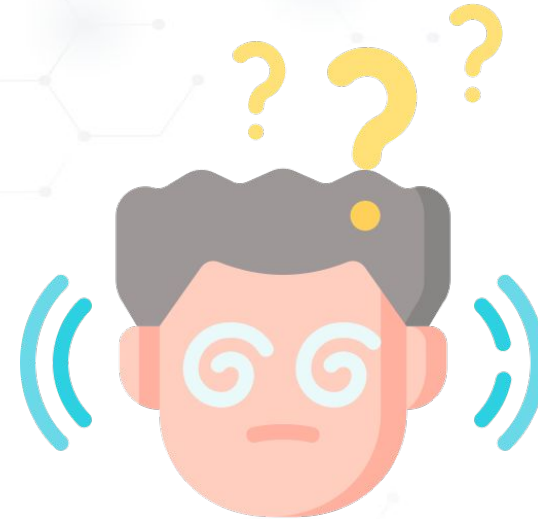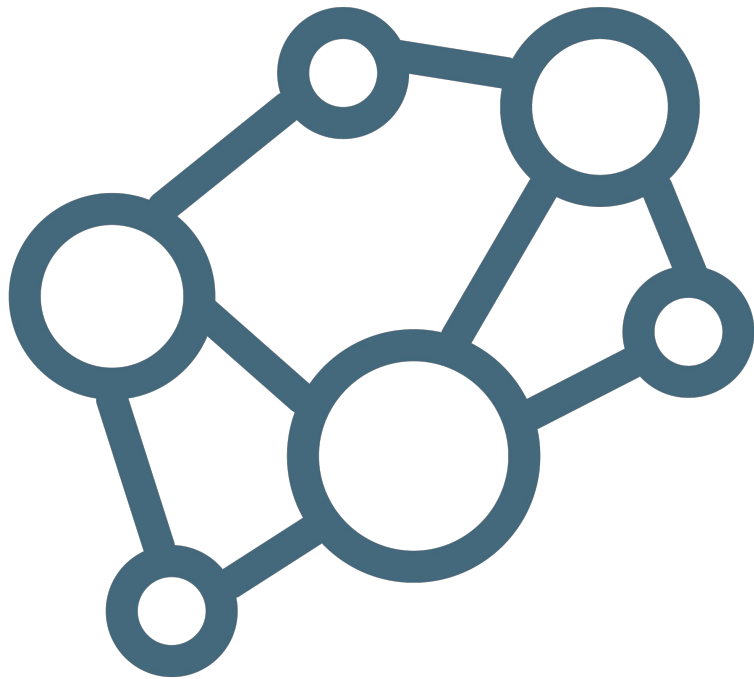
Limitations

resources

Hallucination

RAG

Think and Retrieval: A Hypothesis Knowledge Graph Enhanced Medical Large Language Models

2023 – Arxiv

Med-halt

Med-halt: Medical domain hallucination test for large language models.

2023 – EMNLP

End