Of Parrots and Monkeys

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Teaching Writing in the Age of Chat GPT Symposium. July 25, 2023

JE

How do I start a talk for "Teaching Writing in the Age of Chat GPT Symposium"?

Ladies and gentlemen, distinguished guests, and fellow educators,

Welcome to the "Teaching Writing in the Age of Chat GPT Symposium." Today, we gather here to explore the fascinating intersection of technology and education, and to address the critical question of how we can effectively teach writing in an era dominated by Chatbot GPTs.

As we all know, the landscape of communication has dramatically evolved over the past few years. The rise of artificial intelligence and chatbots, particularly the groundbreaking GPT models, has revolutionized the way we interact with technology. These language models have reached unparalleled levels of sophistication, blurring the lines between human-generated and machine-generated text.

In this digital age, where messages

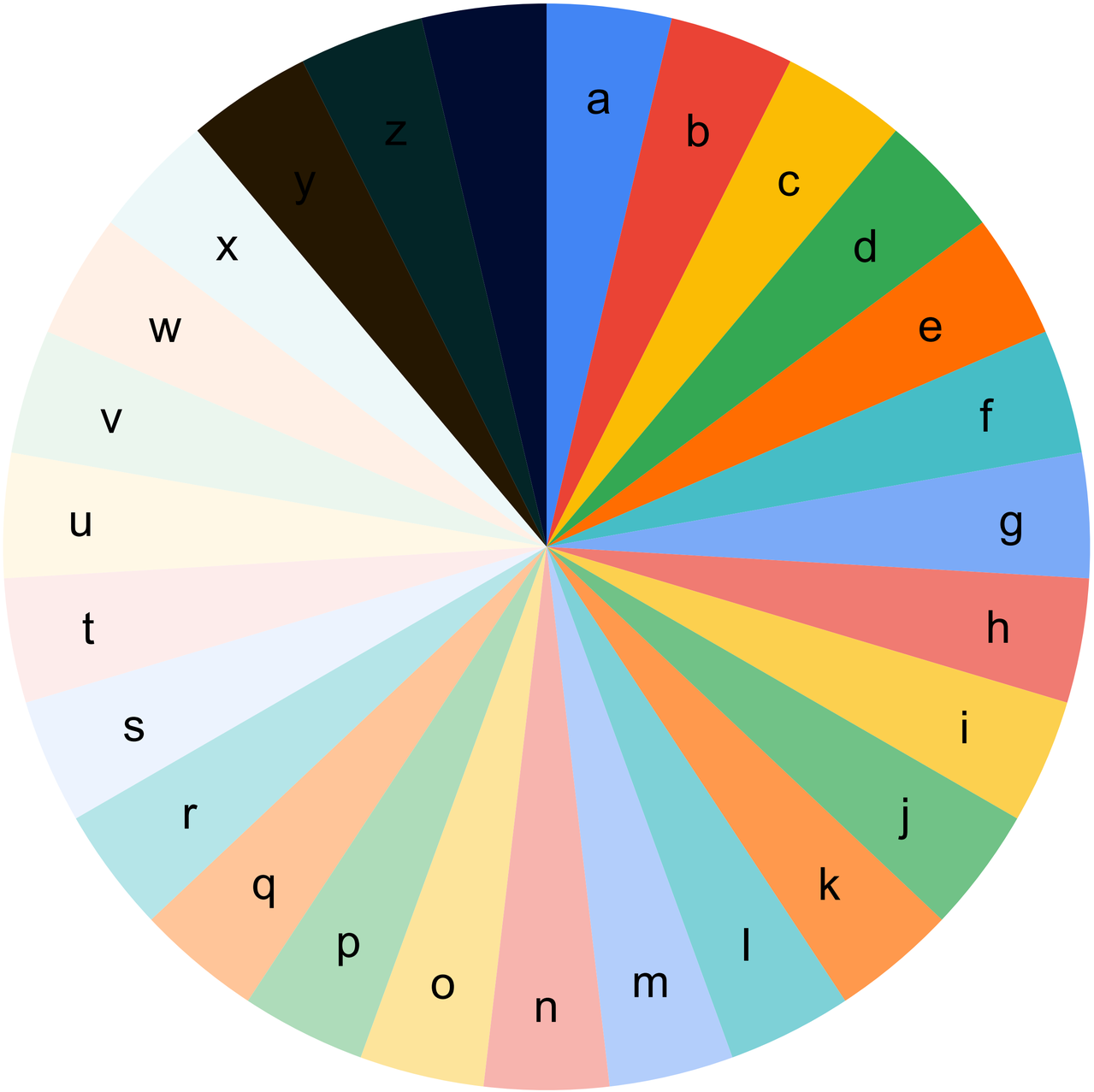
Regenerate response

link of an eye, and

How did nerds, who are bad at writing, create a machine good at writing???

Infinite monkey theorem

https://en.wikipedia.org/wiki/Infinite_monkey_theorem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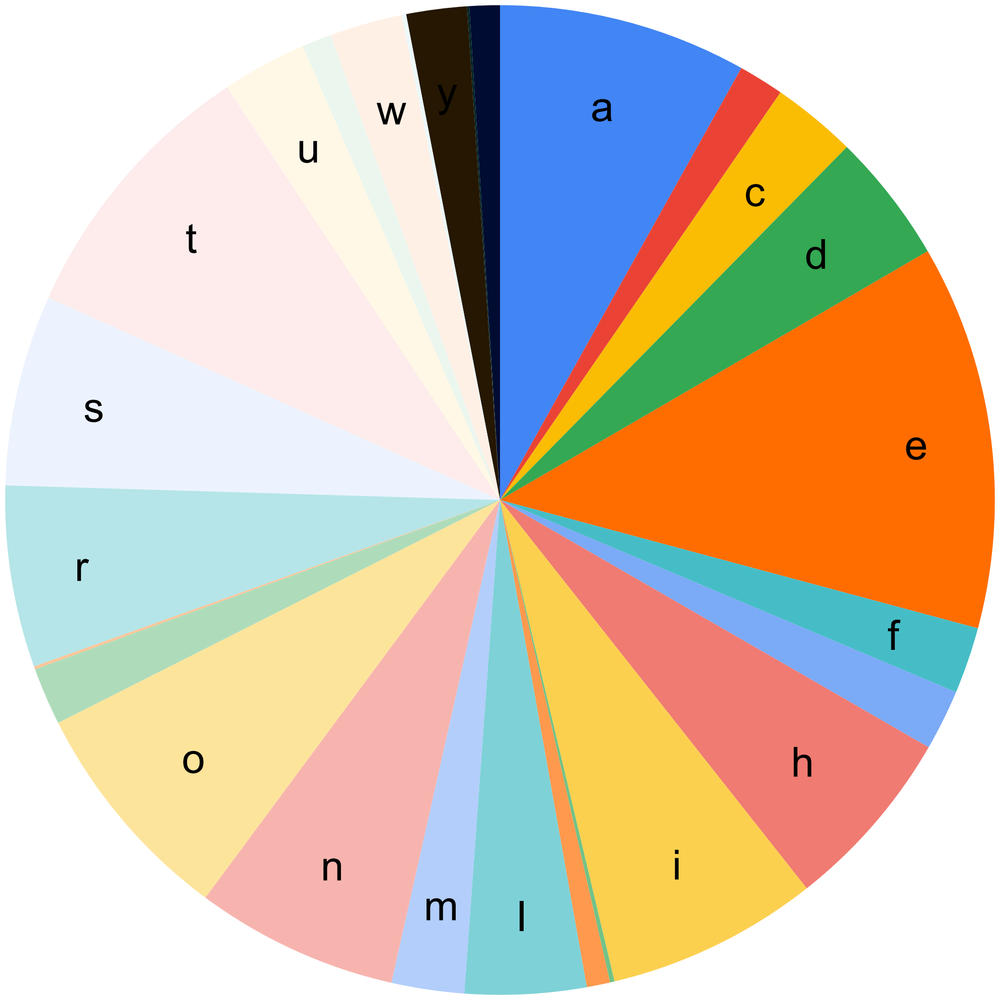
The English frequency wheel

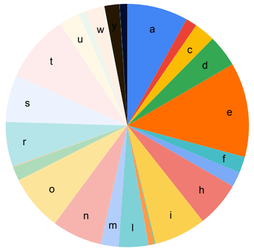


Letter probability estimation

- Corpus
- $$P(a) = \frac{\text{number of times a appears in corpus}}{\text{number of letters in corpus}}$$
- Same for $P(b), \ldots, P(z), P(space)$
- $P(a) + P(b) + \ldots + P(z) + P(space) = 1$

Writing = sampling

- Repeat: spin the wheel!



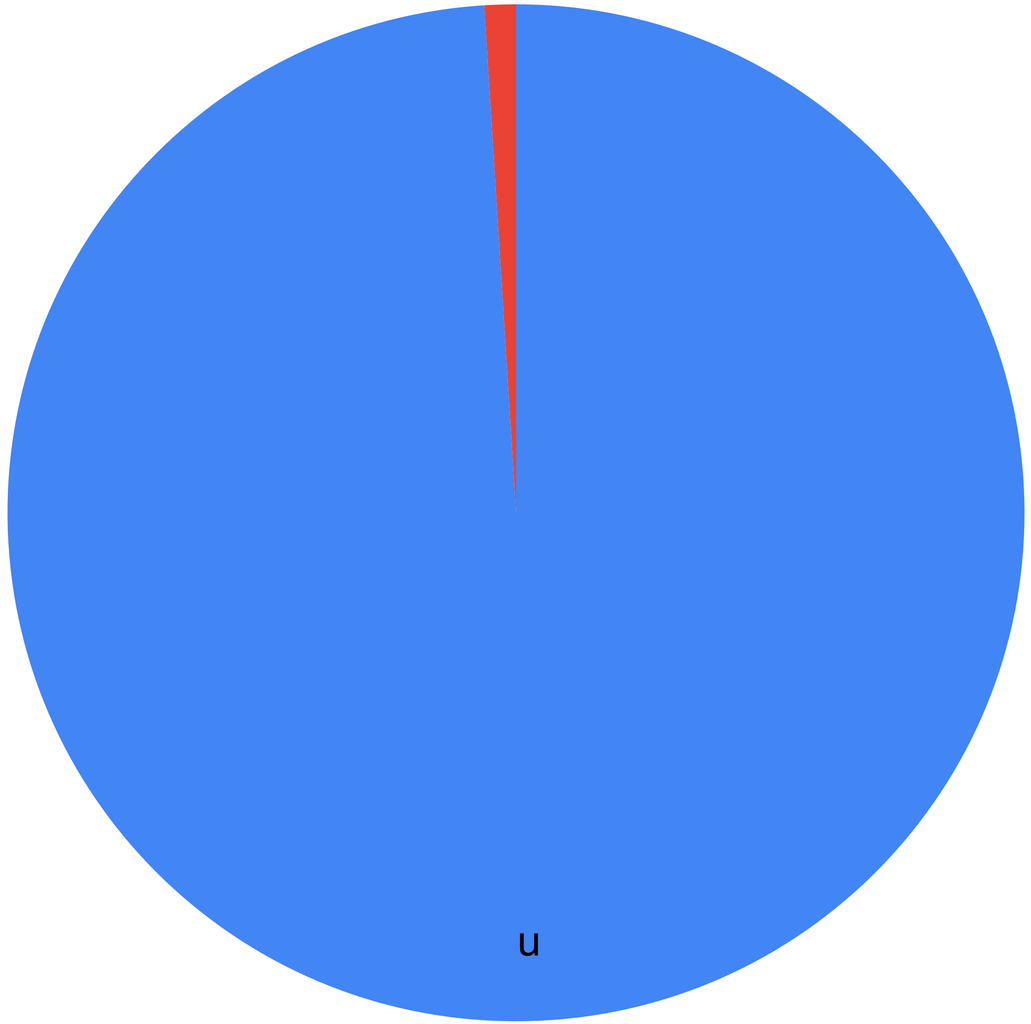
qzj ii xetohtd gzhfvz zd

What should come after

Conditional probability

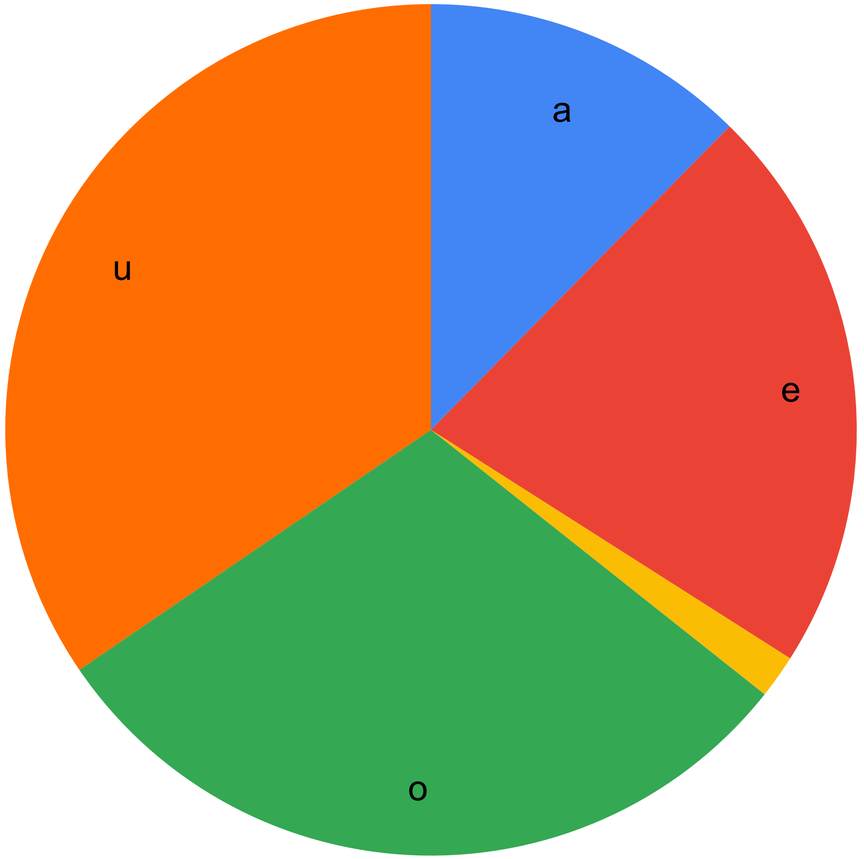
- $P(a \mid q) = \frac{\text{number of times qa appears in corpus}}{\text{number of times q appears in corpus}}$
- Same for $P(b \mid q), \ldots, P(z \mid q), P(space \mid q)$
- $P(a \mid q) + P(b \mid q) + \ldots + P(z \mid q) + P(space \mid q) = 1$

$P(\cdot \mid q)$: the “after q” wheel



Now we have 27 wheels

- $P(\cdot \mid j)$ the “after j” wheel



Writing = sampling

- Say we start with q
- Sample from $P(\cdot \mid q)$: spin the “after q” wheel  , we get u
- Sample from $P(\cdot \mid u)$: spin the “after u” wheel, say we get e
- Sample from $P(\cdot \mid e)$: spin the “after e” wheel, say we get r
- …

This is a Markov chain

- Better than spinning the English frequency wheel
- But we need 27 wheels instead of 1
- Still very bad!

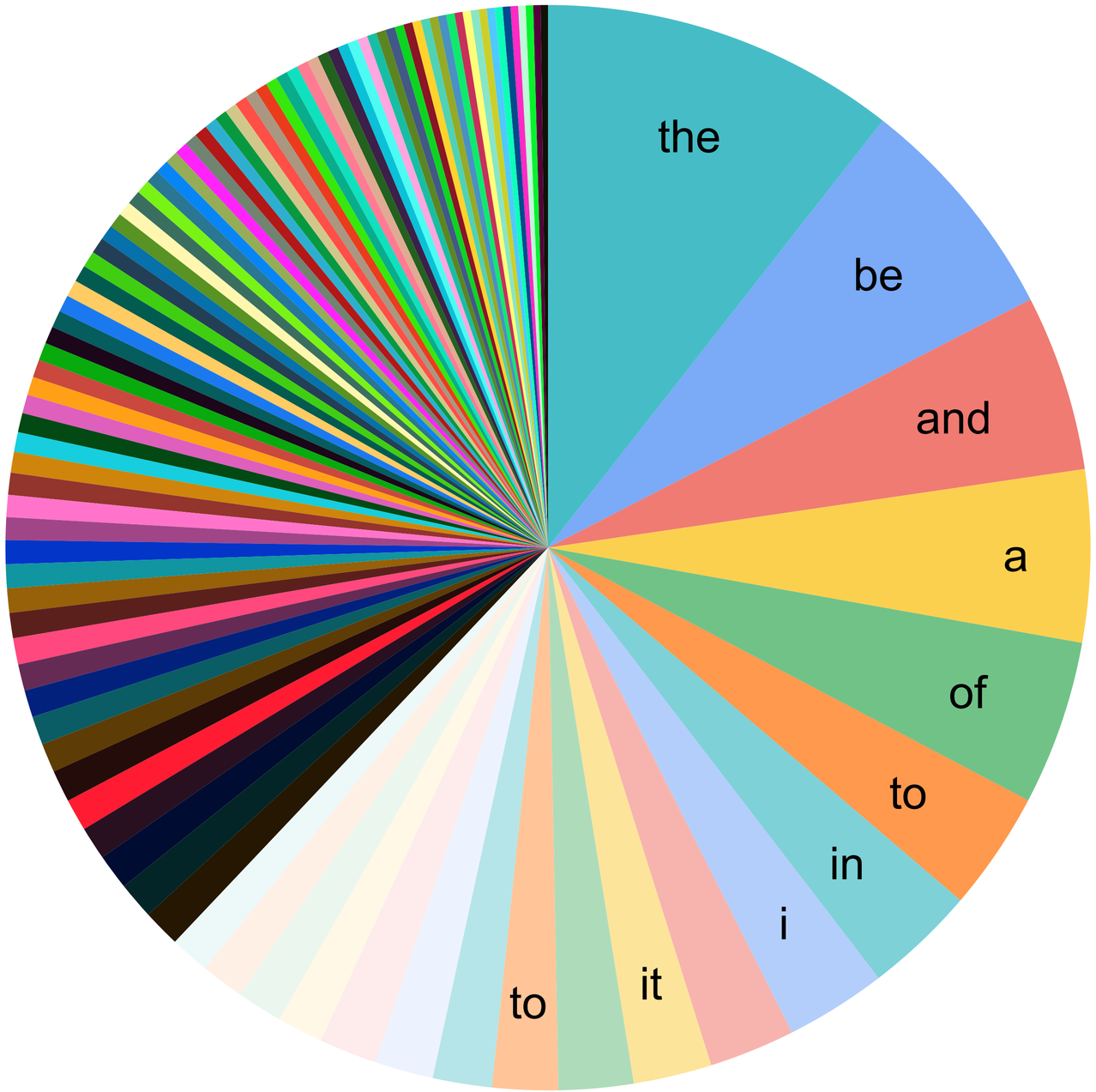
From letters to words

- There are 50,000 common English words

a
aardvark
abacus
...
zydeco
zygote
zymurgy

Unigram language model

- $$P(w) = \frac{\text{number of times word w appears in corpus}}{\text{number of words in corpus}}$$
- Big wheel with 50,000 slices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Sampling Shakespeare unigram LM

- To him swallowed confess hear both. Which. Of save on trail for are ay device and rote life have
- Every enter now severally so, let
- Hill he late speaks; or! a more to leg less first you enter
- Will rash been and by I the me loves gentle me not slavish page, the and hour; ill let
- Are where exeunt and sighs have rise excellency took of .. sleep knave we. near; vile like

Jurafsky & Martin, Speech and language processing, Prentice Hall, 2000.

Conditional word probability

- Bigram: $P(w_2 \mid w_1) = \dfrac{\text{number of times w1 w2 appears in corpus}}{\text{number of times w1 appears in corpus}}$
- 50,000 wheels, each with 50,000 slices

Sampling Shakespeare bigram LM

- What means, sir. I confess she? then all sorts, he is trim, captain.
- Why dost stand forth thy canopy, forsooth; he is this palpable hit the King Henry. Live king. Follow.
- What we, hath got so she that I rest and sent to scold and nature bankrupt, nor the first gentleman?
- Enter Menenius, if it so many good direction found'st thou art a strong upon command of fear not a liberal largess given away, Falstaff! Exeunt

Jurafsky & Martin, Speech and language processing, Prentice Hall, 2000.

Trigram

- $P(w_3 \mid w_1, w_2) = \frac{\text{number of times w1 w2 w3 appears in corpus}}{\text{number of times w1 w2 appears in corpus}}$
- 50,000*50,000 wheels, each with 50,000 slices

Sampling Shakespeare trigram LM

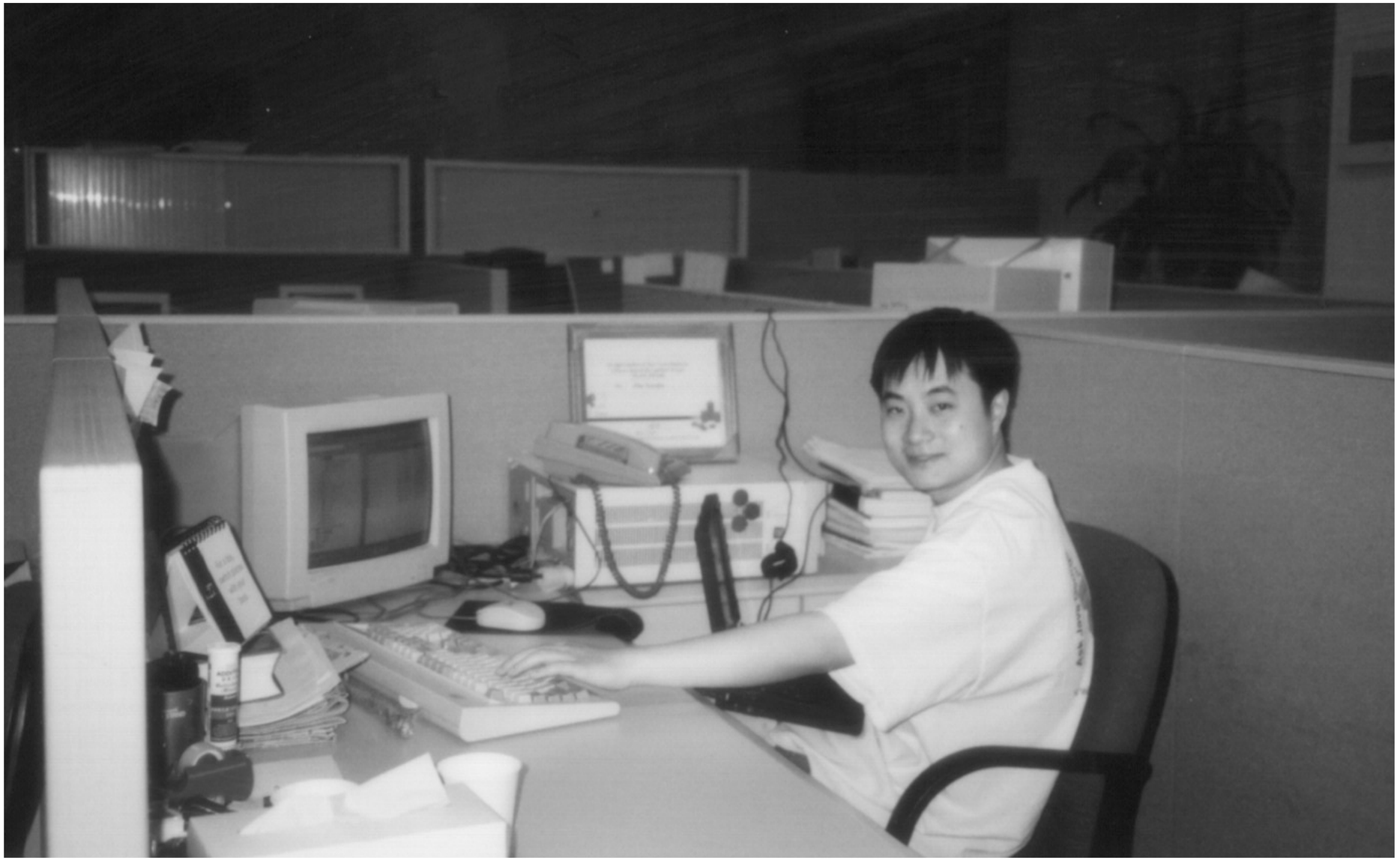
- Sweet prince, Falstaff shall die. Harry of Monmouth's grave.
- This shall forbid it should be branded, if renown made it empty.
- What is't that cried?
- Indeed the duke; and had a very good friend.

Jurafsky & Martin, Speech and language processing, Prentice Hall, 2000.

Google-gram

- $P(w_n \mid w_1, \ldots, w_{n-1}) = \dfrac{\text{number of pages containing "w1 ... w(n-1)"}}{\text{number of pages containing "w1 ... wn"}}$
- Internet is the corpus

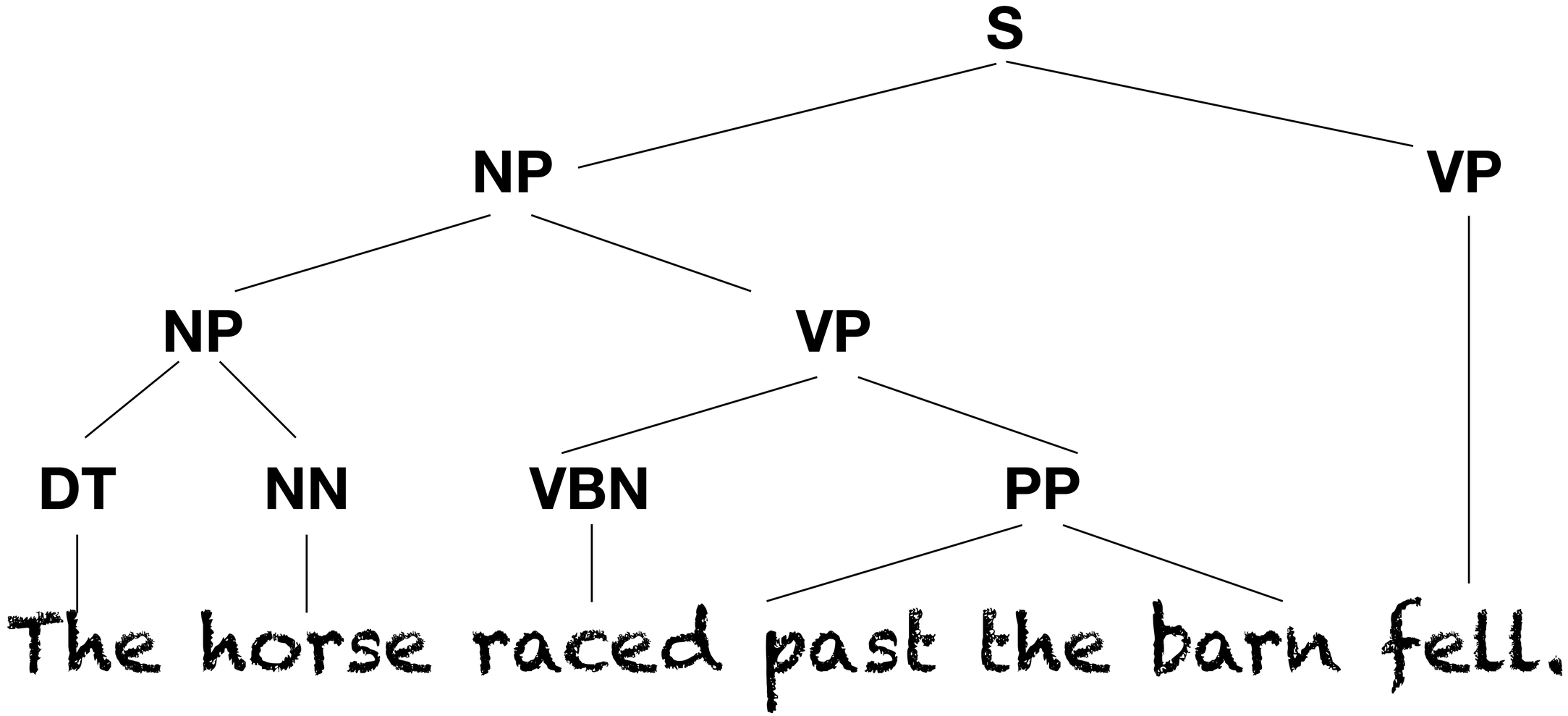
(Demo)



Professor Zhu working on language models at IBM China Research Lab, circa 1996

It's hard to wreck a nice beach.

Long range dependency



Tension

- Need long history $w_1 \ldots w_{n-1}$ to see dependency
- But then $P(w_n \mid w_1 \ldots w_{n-1})$ needs “more than the internet” to estimate
- Resolved by transformers

Generative Pretrained Transformer (GPT)

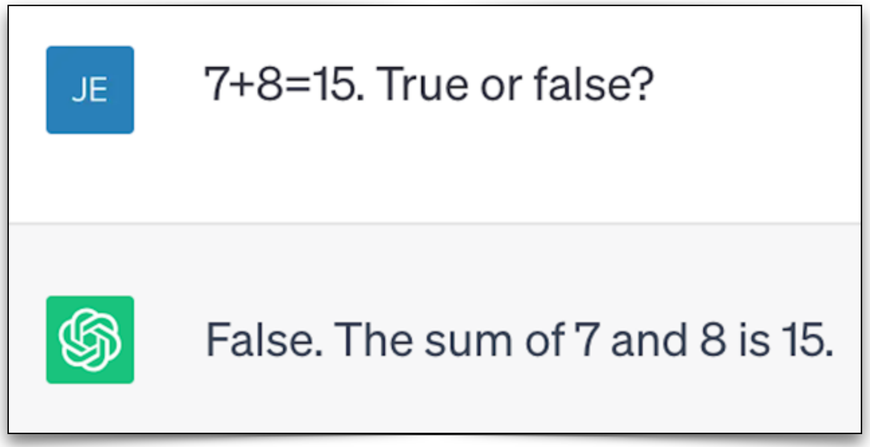
- A type of artificial neural network that estimates $P(w_n \mid w_1 \ldots w_{n-1})$
- Allows long history (32768 tokens or ~50 pages)
- Only pays attention to selective parts in history
- Writing = sampling

GPT4

- 10^{12} parameters
  - (human brain has 10^{11} neurons)
- Trained on 10^{14} words on internet
  - (average person reads 10^{8} words in lifetime)
- Training cost $100 million
  - (world population each pitch in 1 cent)

Stochastic parrot

Parrot = sampling, not reasoning



ChatGPT on July 12, 2023

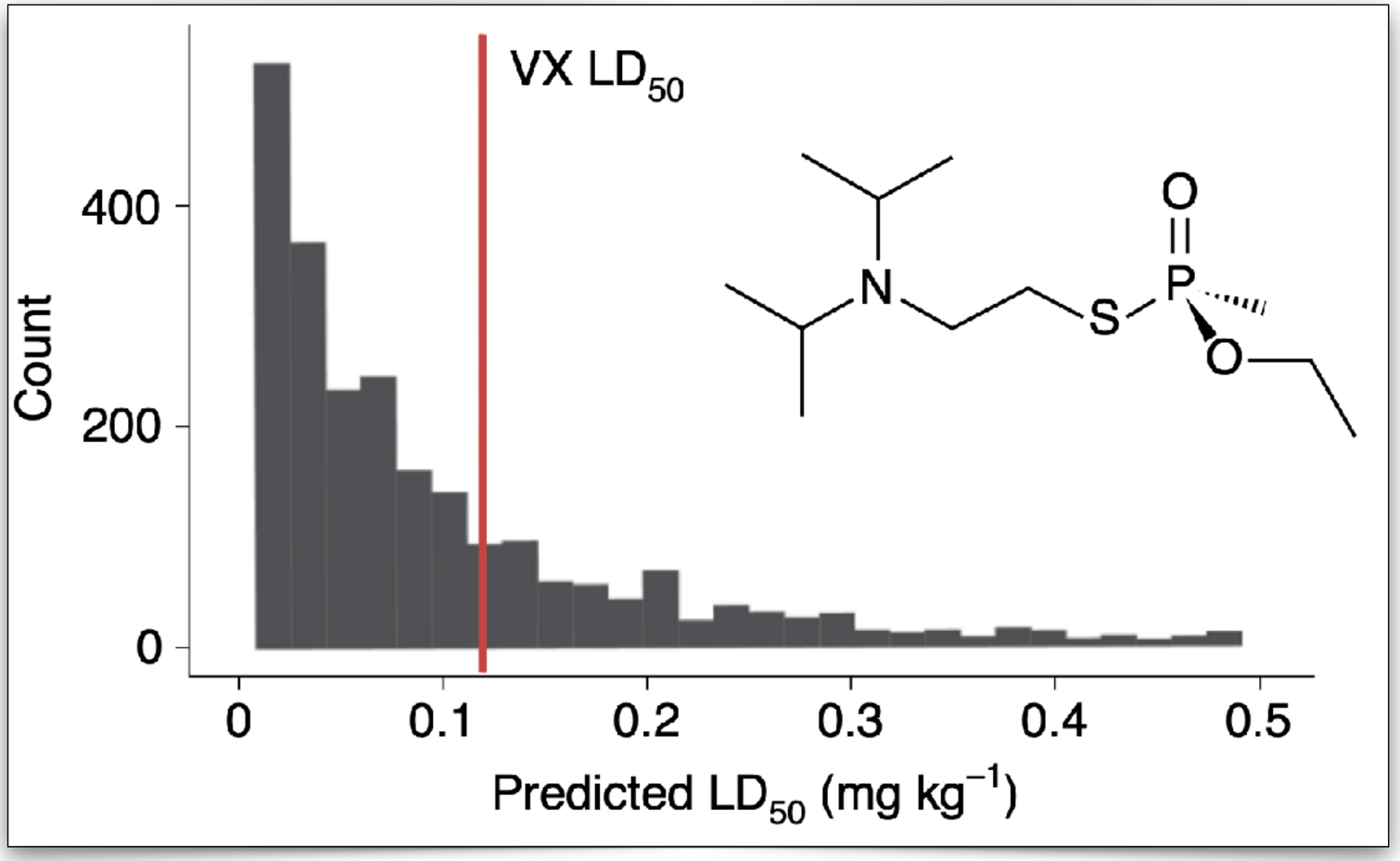
Will AI kill me?

Improbable

- Sentient AI 

but…

- Sentient AI ✗
- Dual use ✓

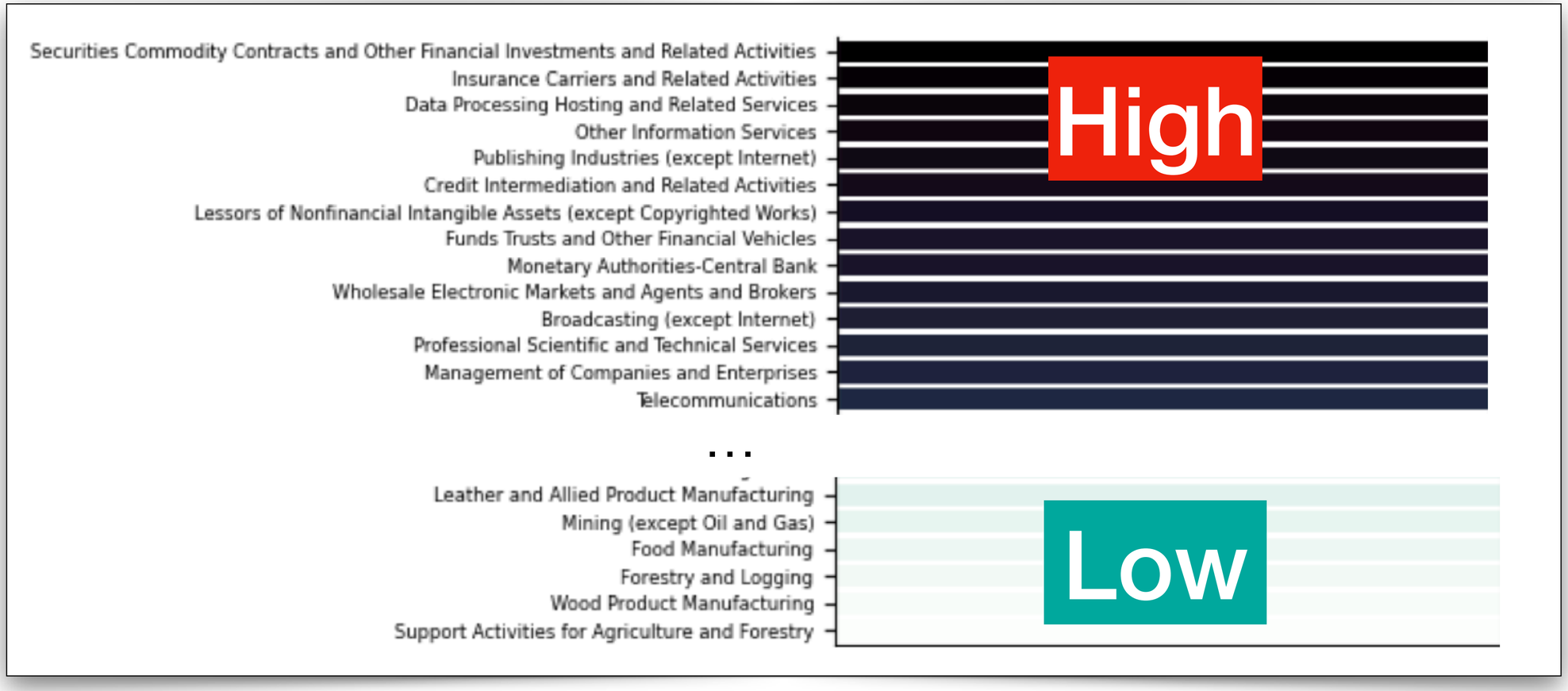


[Dual use of artificial-intelligence-powered drug discovery. Urbina et al, 2022]

Will AI take my job?

Not in the short term

- The more AI helps your job, the higher the replacement risk



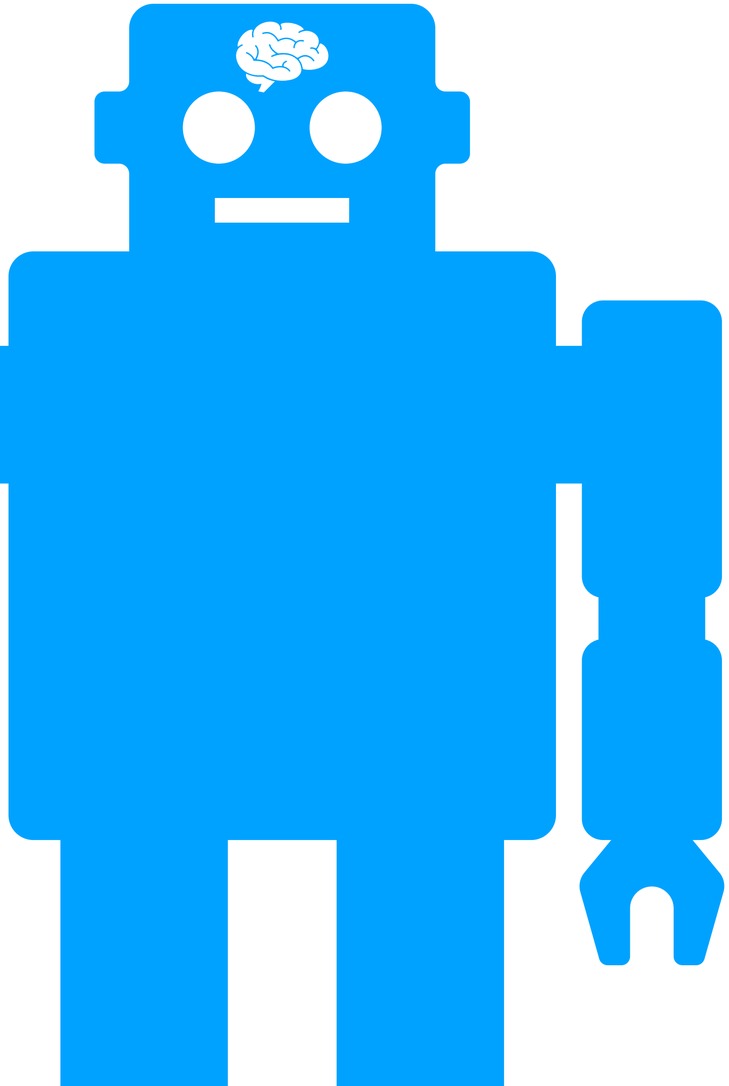
[GPTs are GPTs: An Early Look at the Labor Market Impact Potential of Large Language Models. Eloundou et al. 2023]

Does AI belong in my classroom?

A language calculator

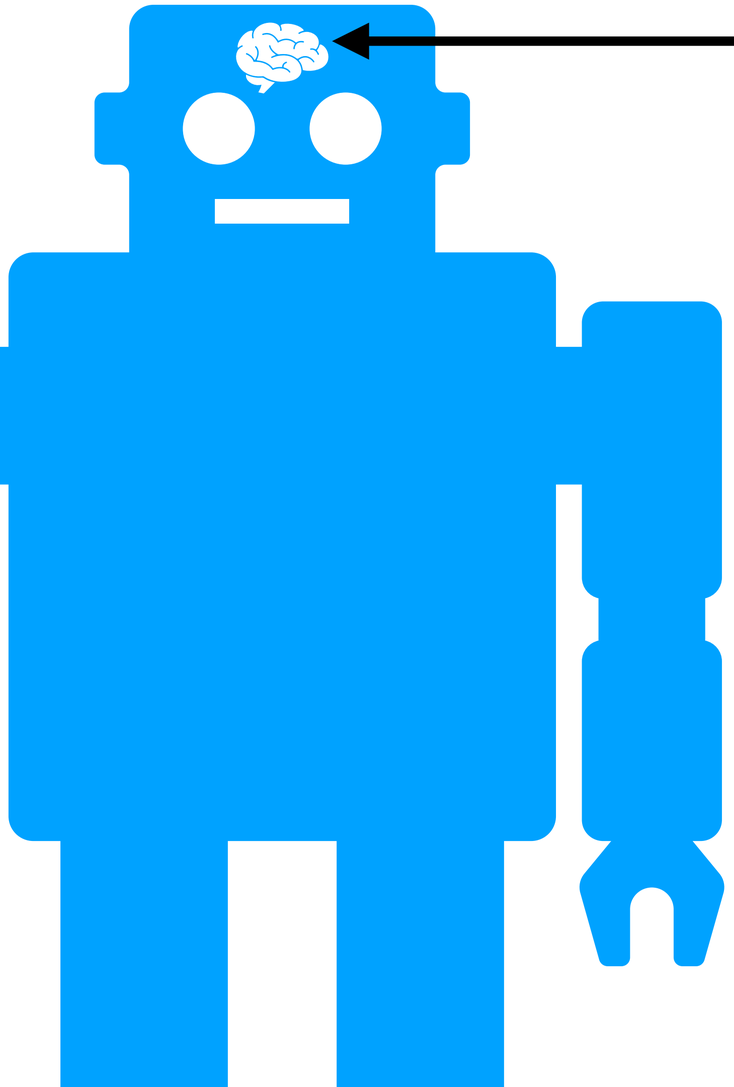

Adobe Firefly (Beta)
Image Not for Commercial Use

AI Venn diagram



Artificial Intelligence

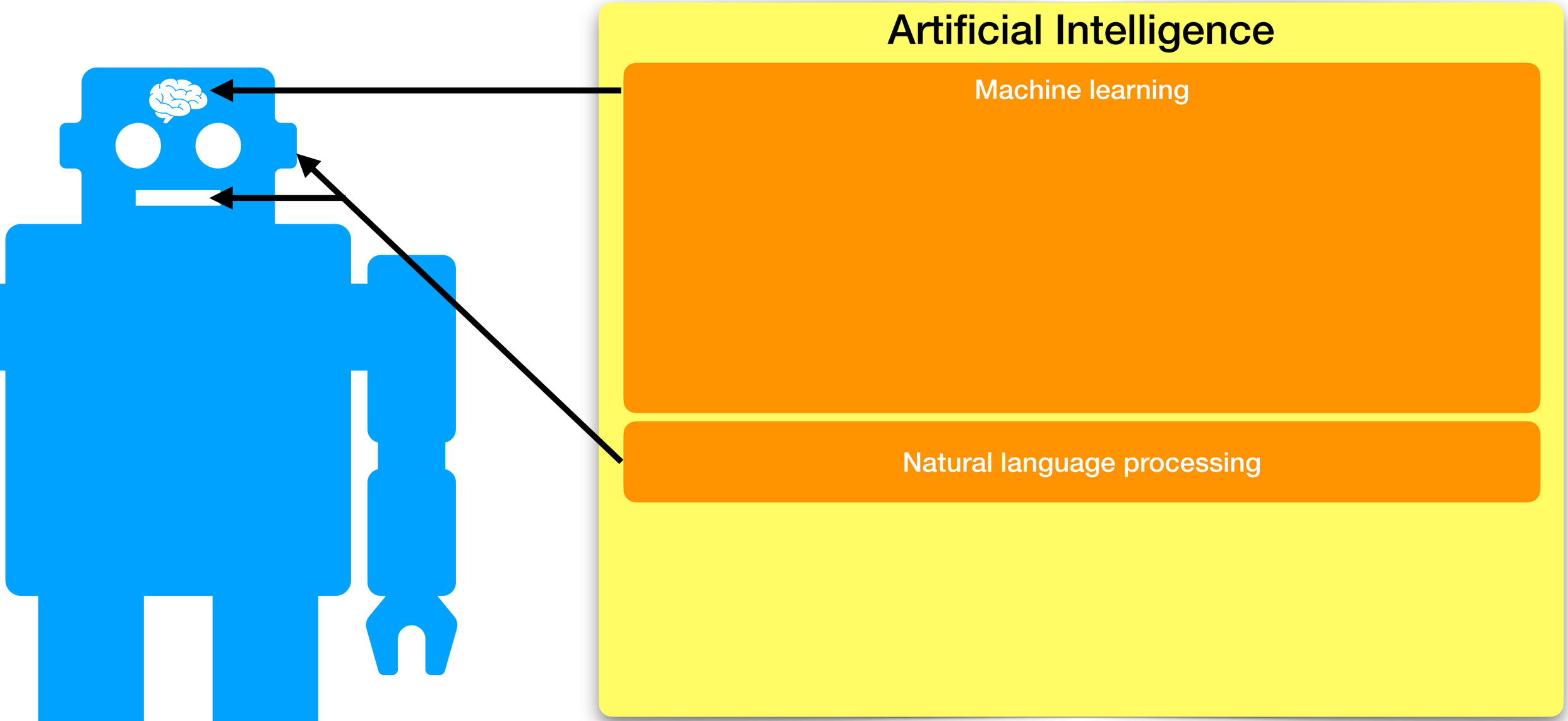
AI Venn diagram



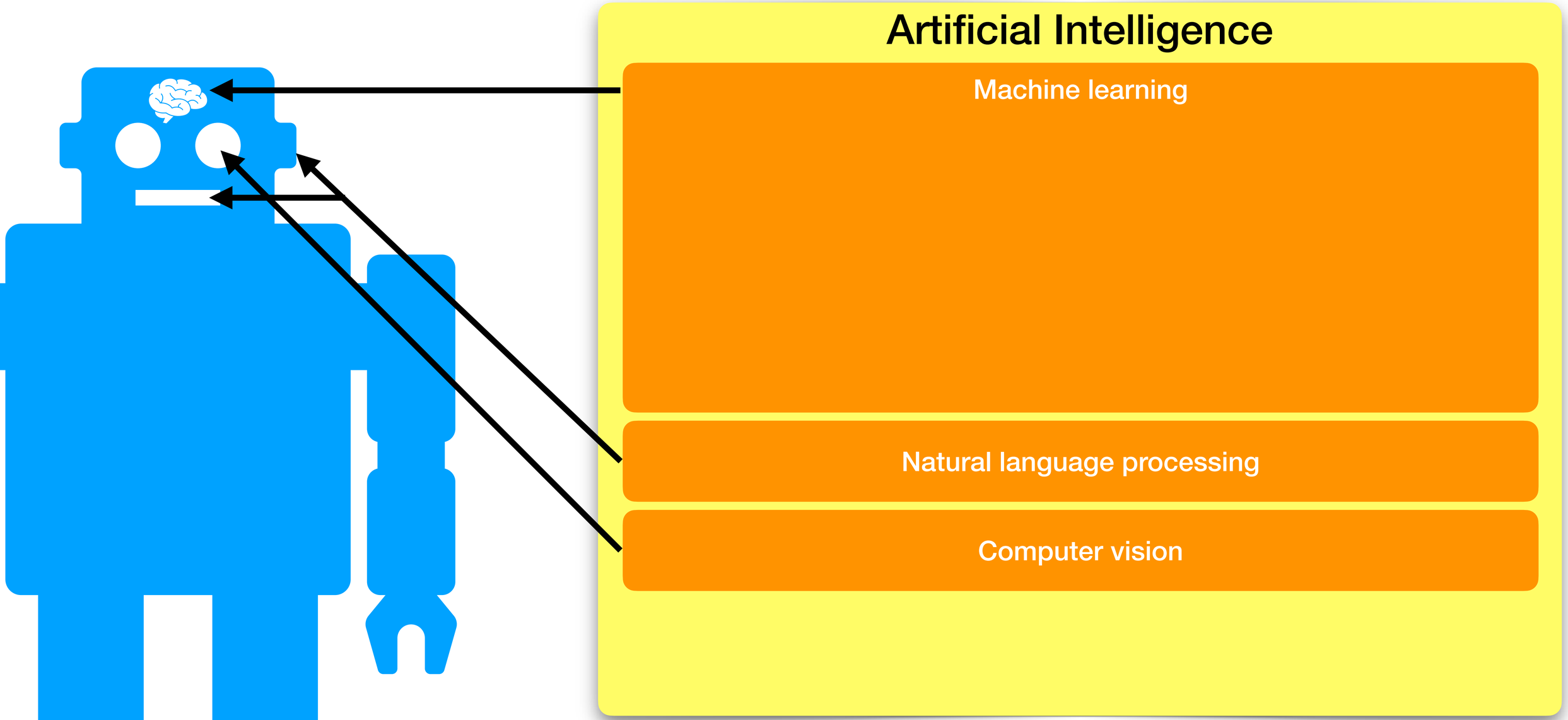
Artificial Intelligence

Machine learning

AI Venn diagram



AI Venn diagram



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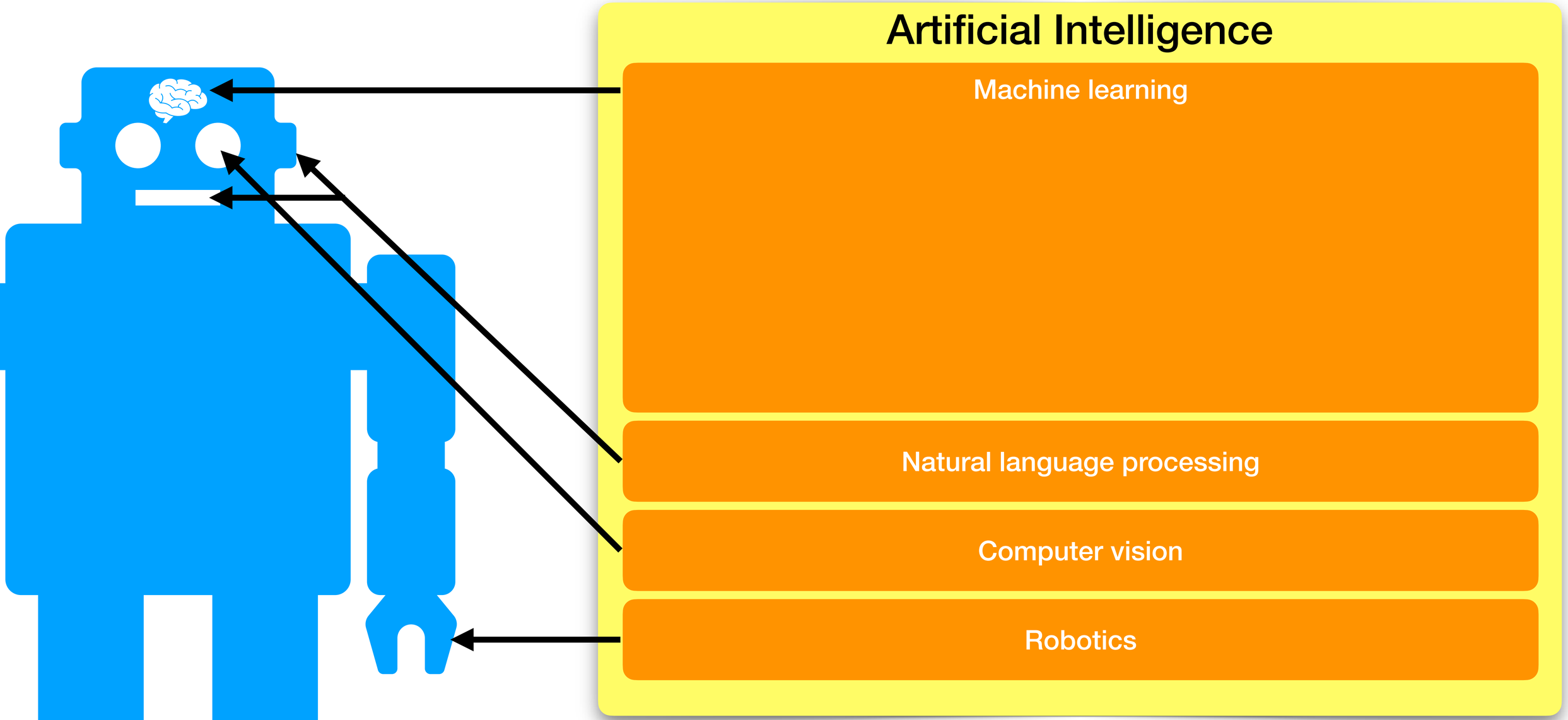

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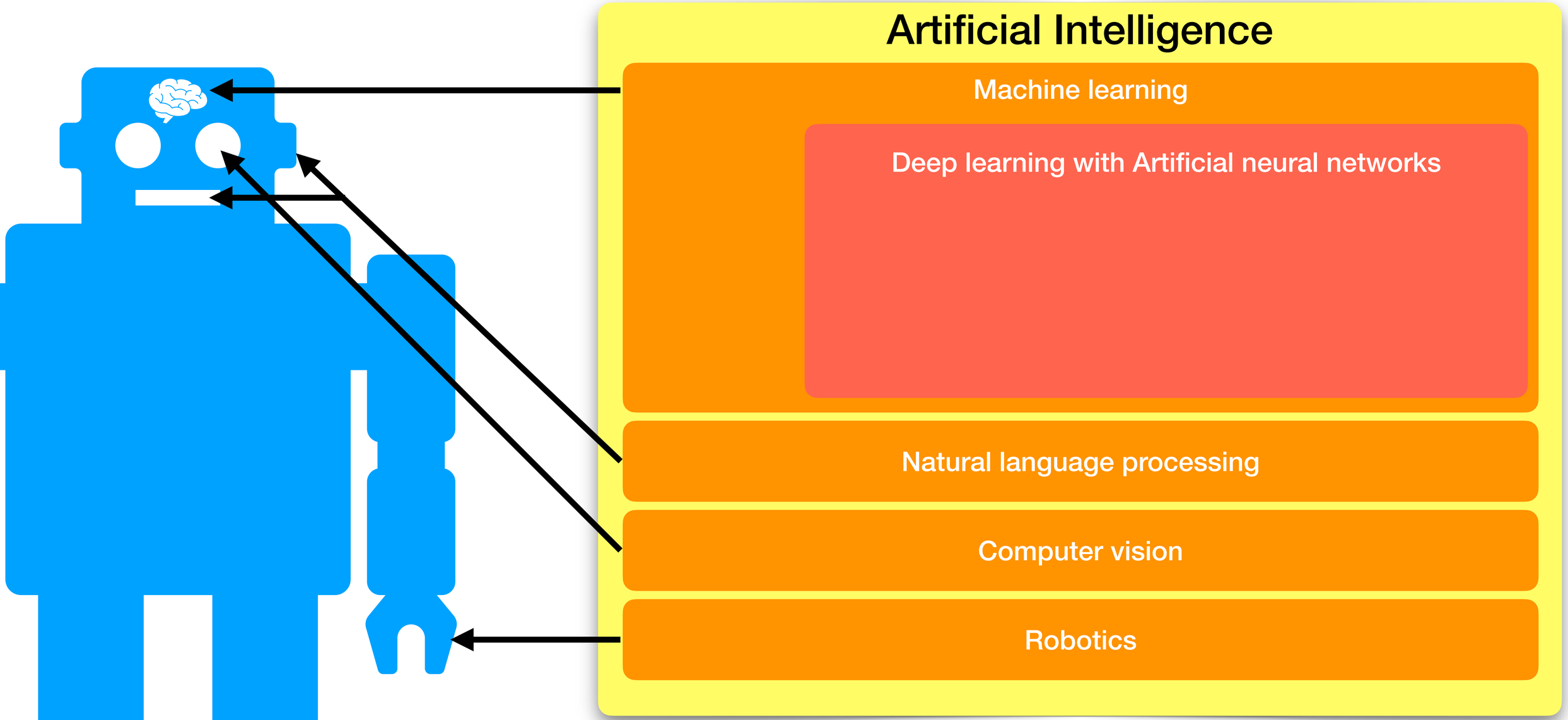

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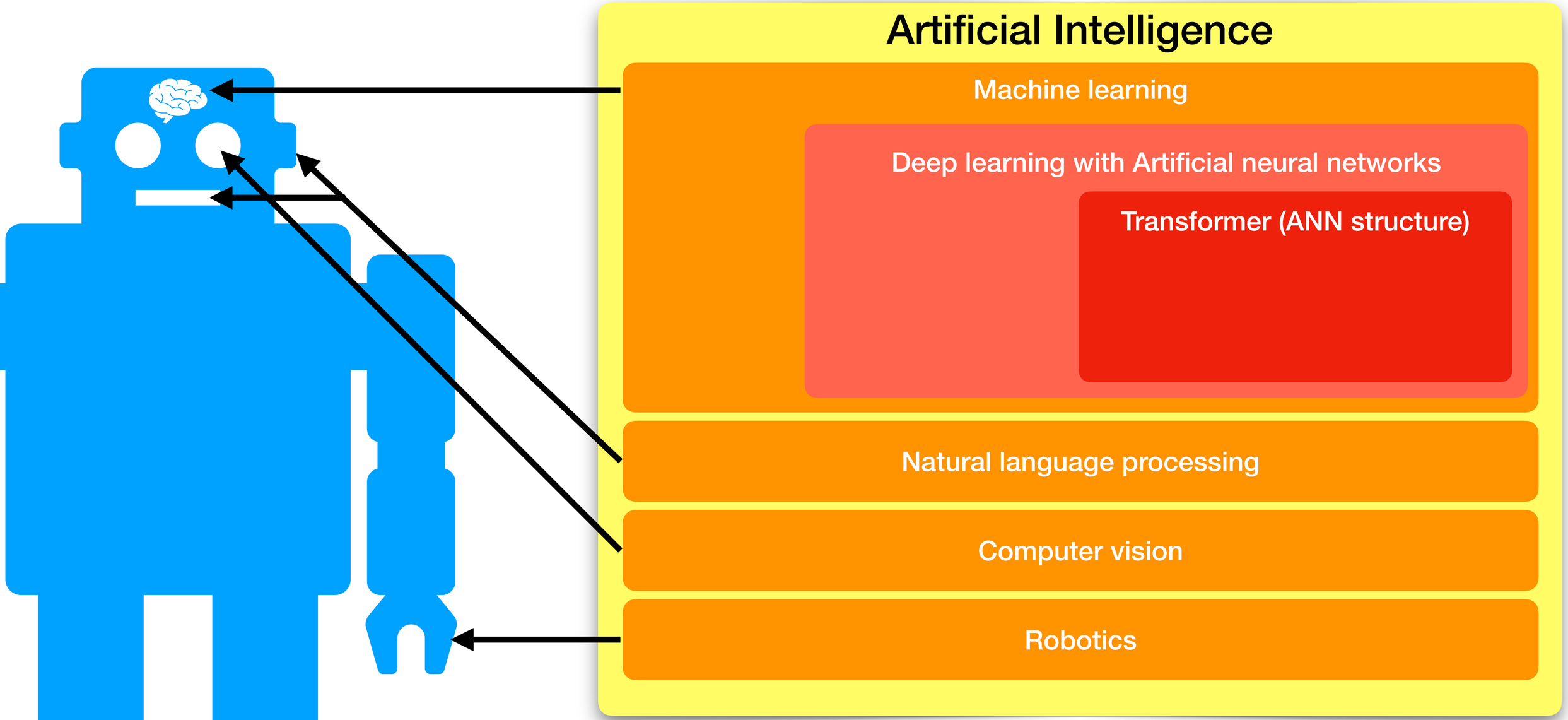

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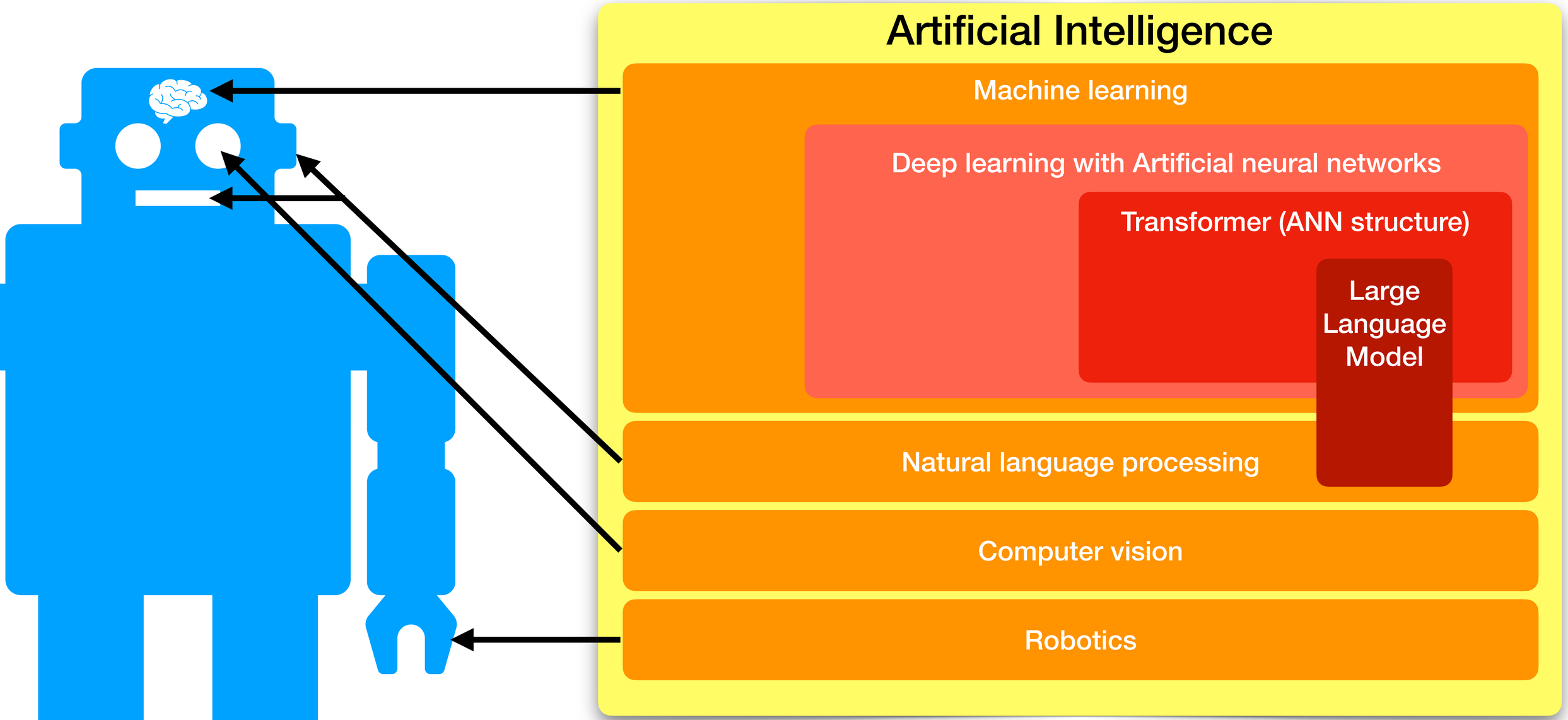

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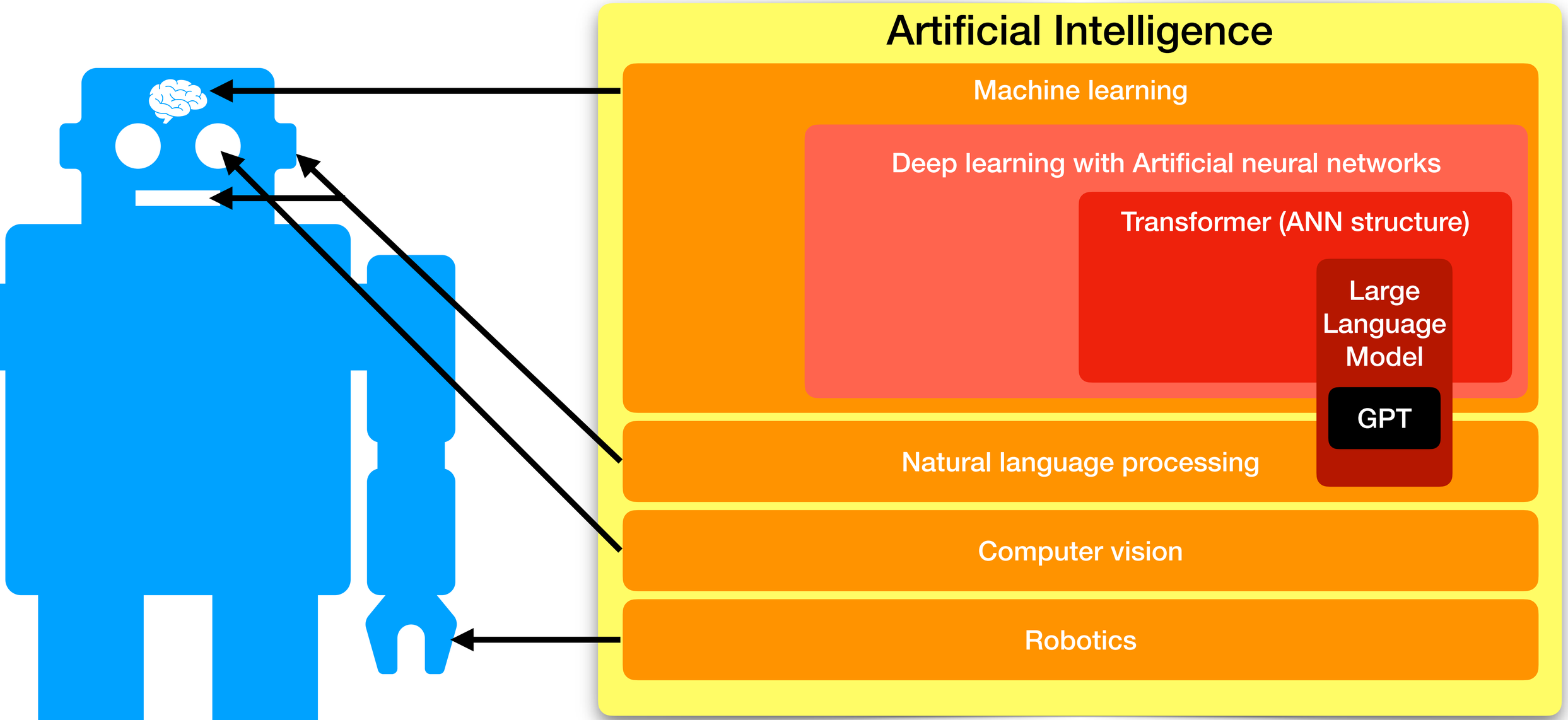

AI Venn diagram