From Breakthroughs to Empowerment UW–Madison's AI Contributions and Accessibility

Part 1 (This slide deck is part 1) Jerry Zhu, Professor, Dept. of Computer Sciences

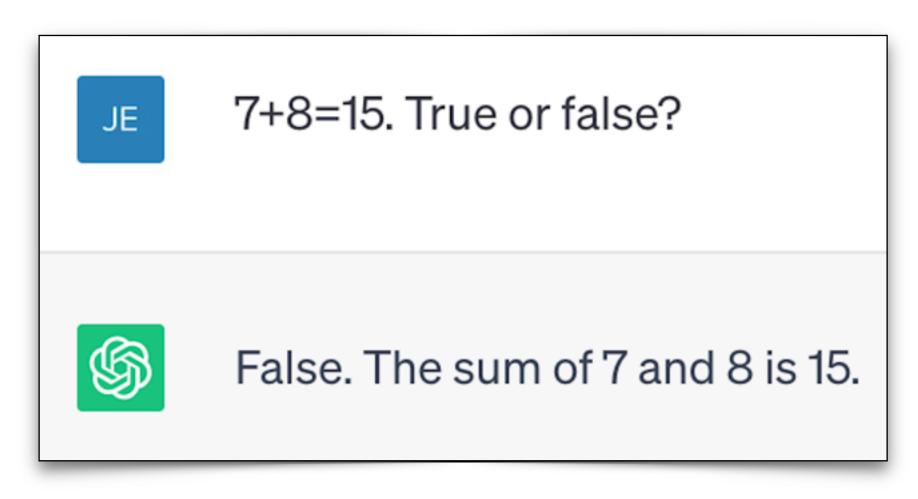
Part 2 Chris Endemann, Data Science Facilitator, Data Science Hub Ben Rush, Postdoctoral Research, WID & Radiology Megan Taylor, PhD Student, Biophysics and Quantitative Biology Salsabil Arabi, PhD Student, iSchool



Will Al kill me?

Improbable





ChatGPT on July 12, 2023

400

200

0

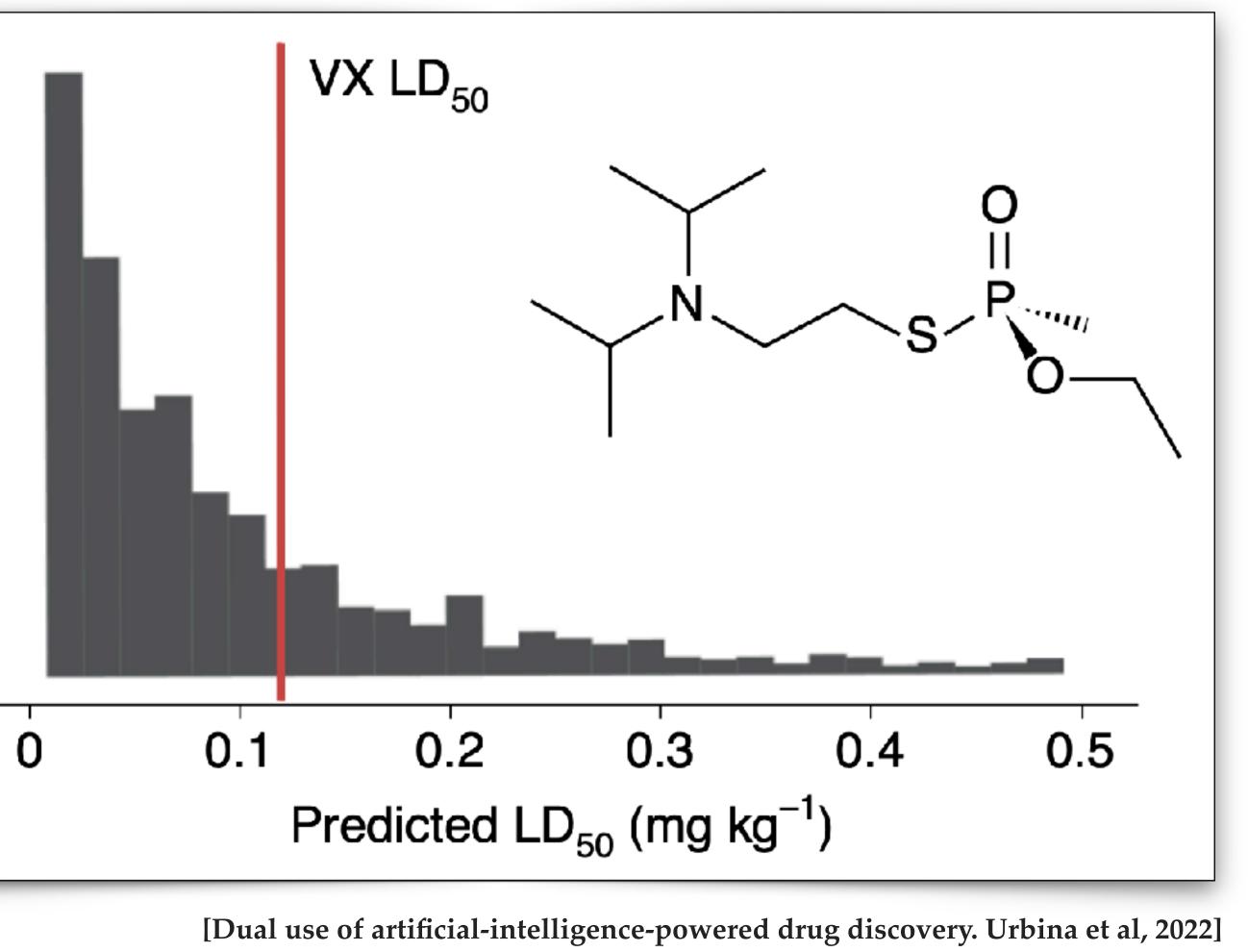
Count



• Dual use







Will AI take my job?

Maybe

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

Securities Commodity Contracts and Other Financial Investments and Relate Insurance Carriers and Relate Data Processing Hosting and Relat Other Informati Publishing Industries (exce Credit Intermediation and Relate Lessors of Nonfinancial Intangible Assets (except Copyrig Funds Trusts and Other Finance Monetary Authorities-C Wholesale Electronic Markets and Agents Broadcasting (exce Professional Scientific and Techni Management of Companies and Telecom Leather and Allied Product Mar Mining (except C

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nd Agents and Brokers –	
sting (except Internet) – and Technical Services –	
panies and Enterprises –	
Telecommunications -	
Product Manufacturing -	
g (except Oil and Gas) -	
Food Manufacturing -	
Forestry and Logging – Product Manufacturing –	LOW
riculture and Forestry	

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

Will AI help my job?



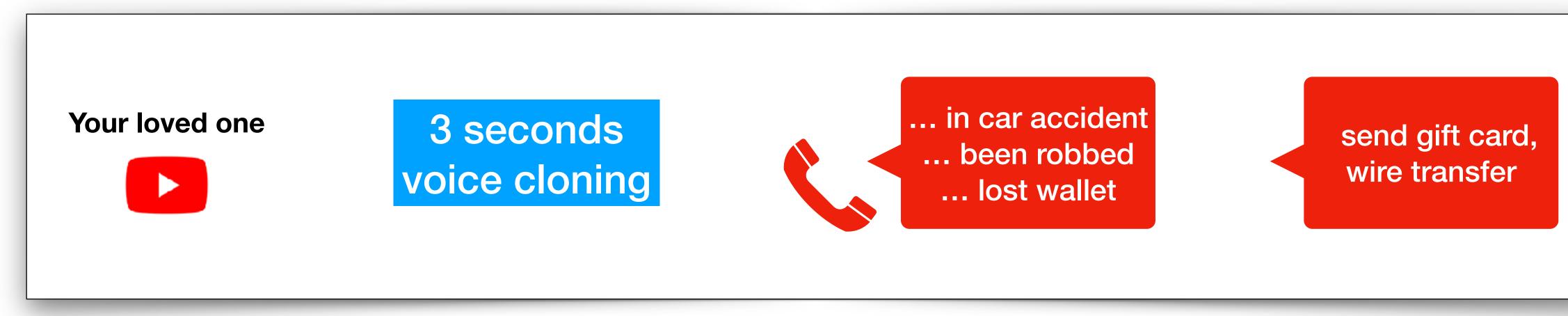
Most likely

- Chris will talk about it!
- UW-Madison Al courses:
 - Computer Sciences 540 Introduction to Artificial Intelligence
 - Computer Sciences 760 Machine Learning

Will AI make my life happier?

It depends

- \bullet
- Challenges: job displacement, social manipulation, …



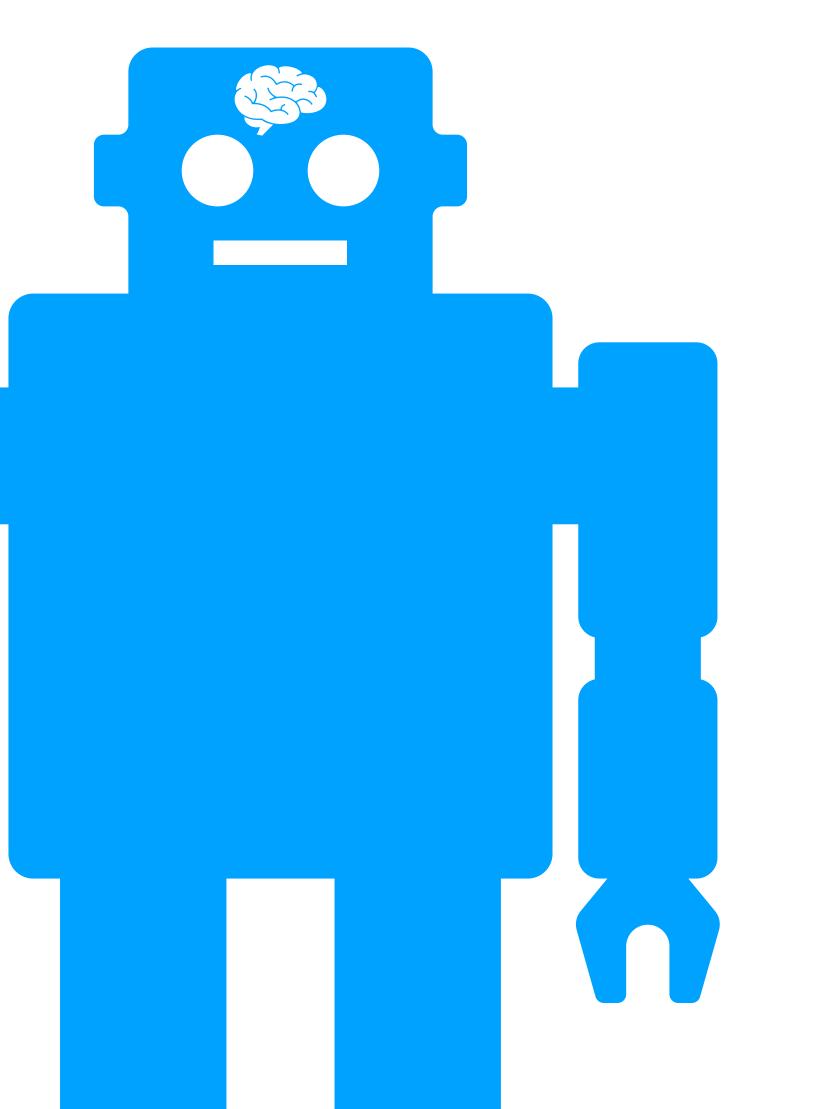
[Artificial Imposters—Cybercriminals Turn to AI Voice Cloning for a New Breed of Scam. Bunn, 2023]

Benefits: healthcare, transportation, education, agriculture, environment...

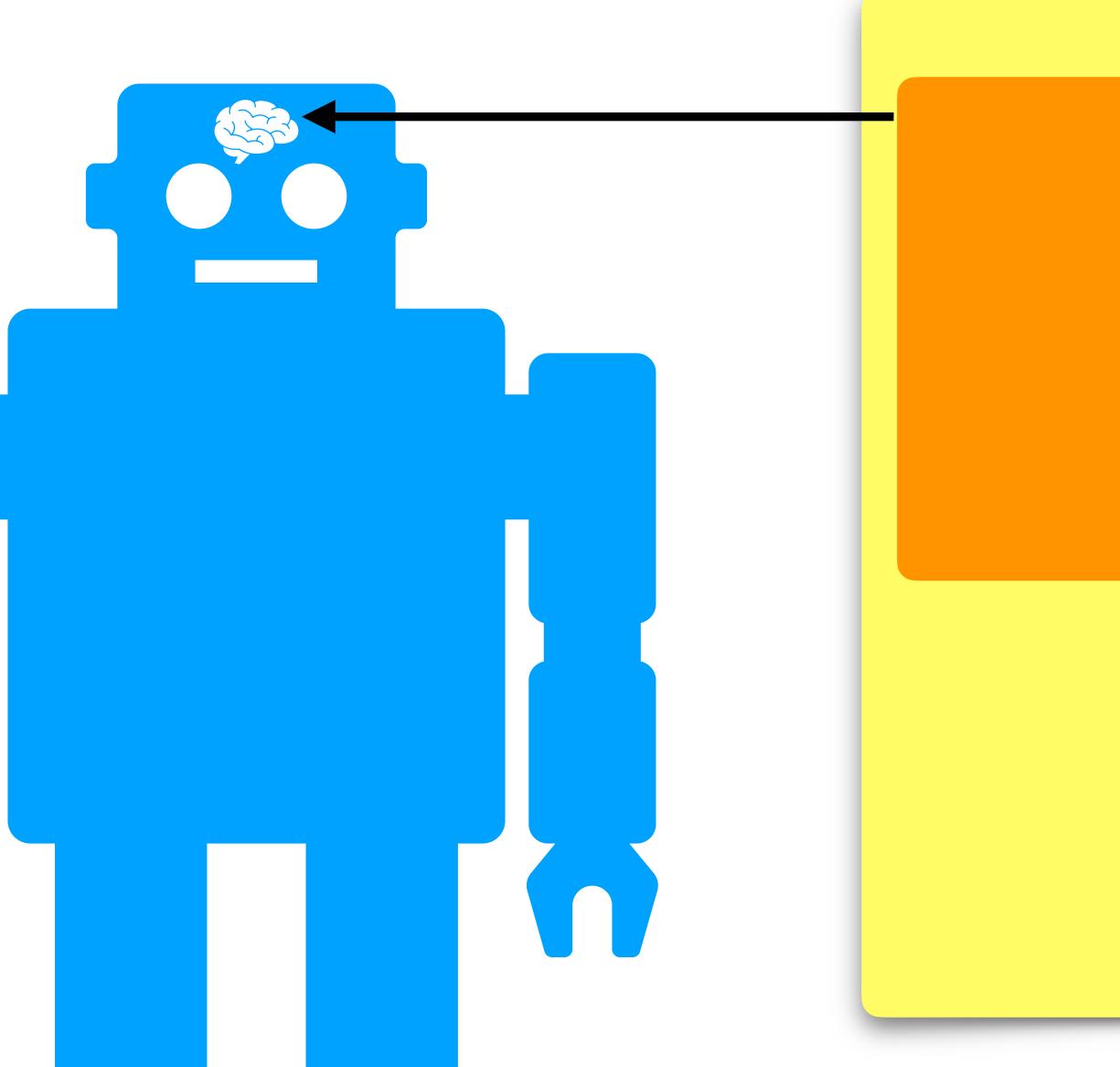


GPT, large language model, generative AI, deep learning... Oh my!

Al Venn diagram Artificial Intelligence



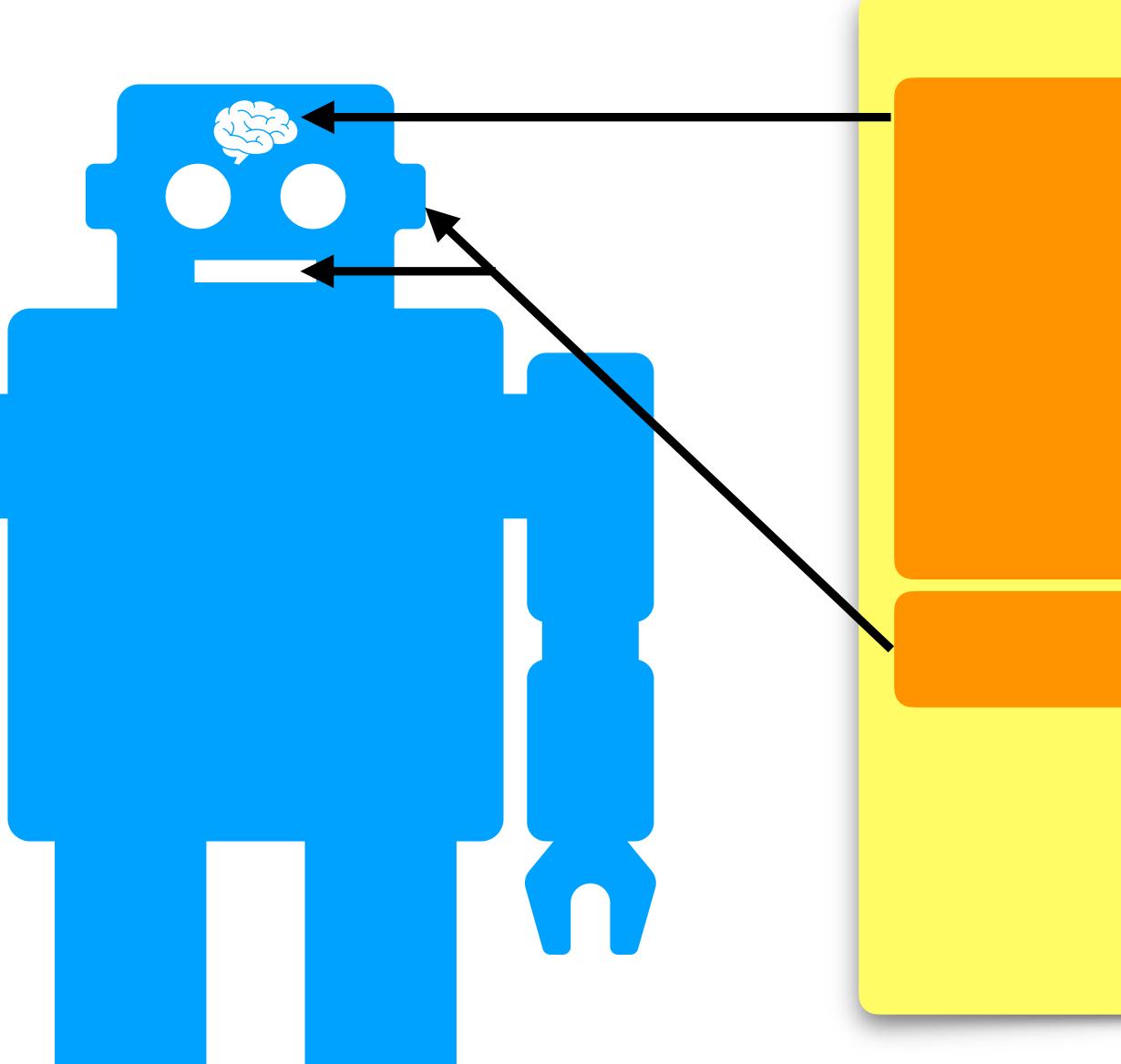




Artificial Intelligence

Machine learning



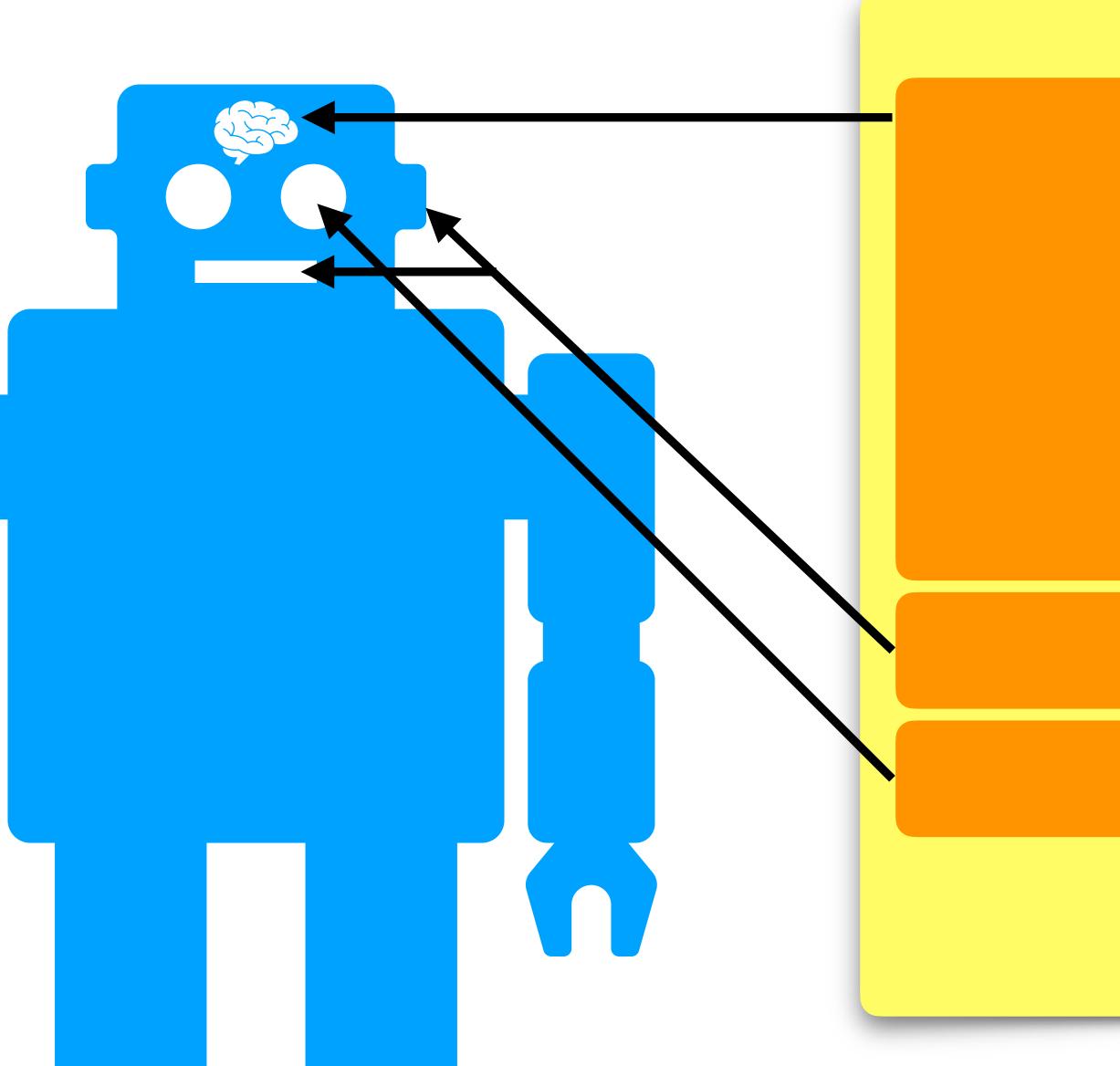


Artificial Intelligence

Machine learning

Natural language processing





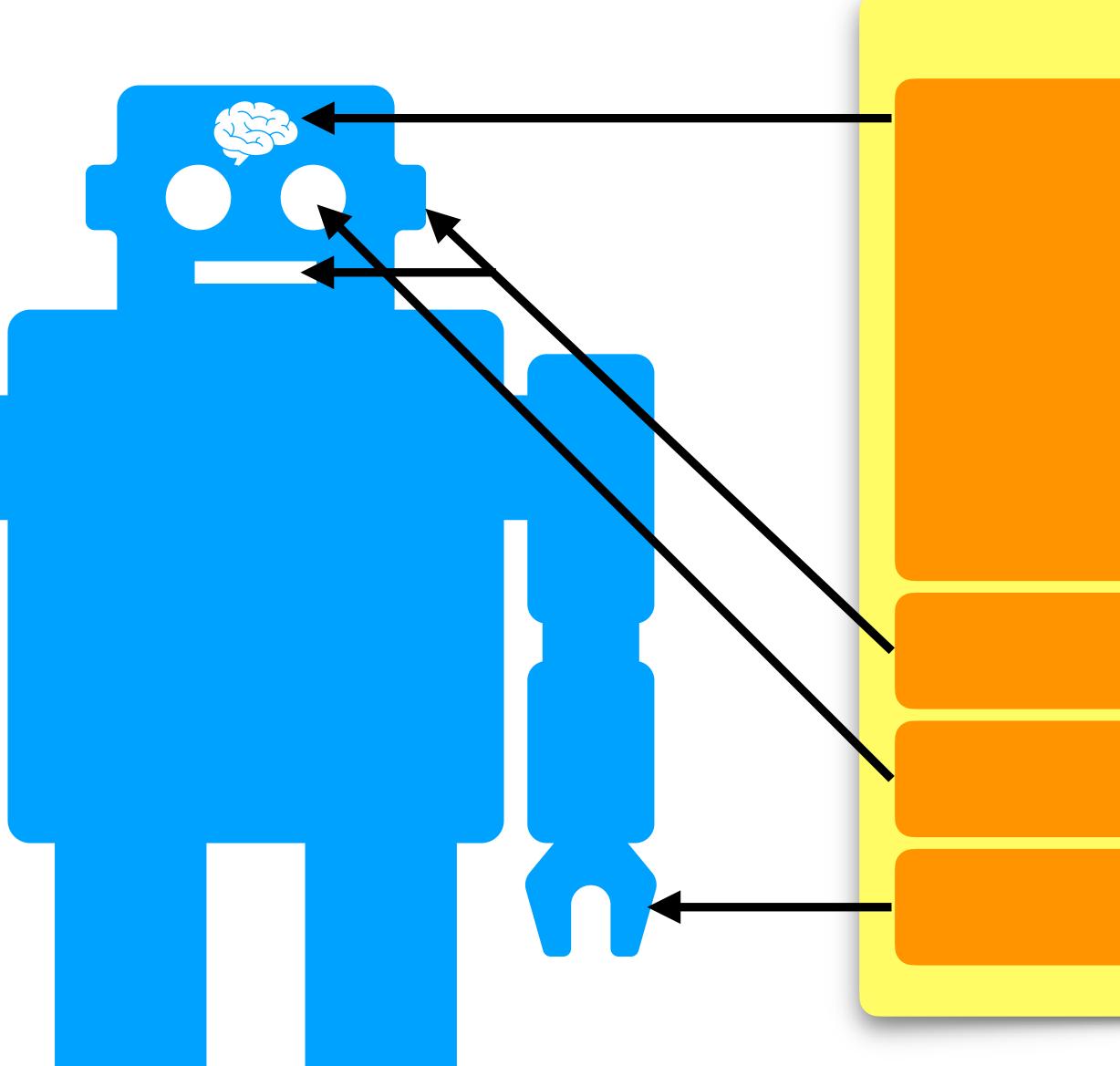
Artificial Intelligence

Machine learning

Natural language processing

Computer vision





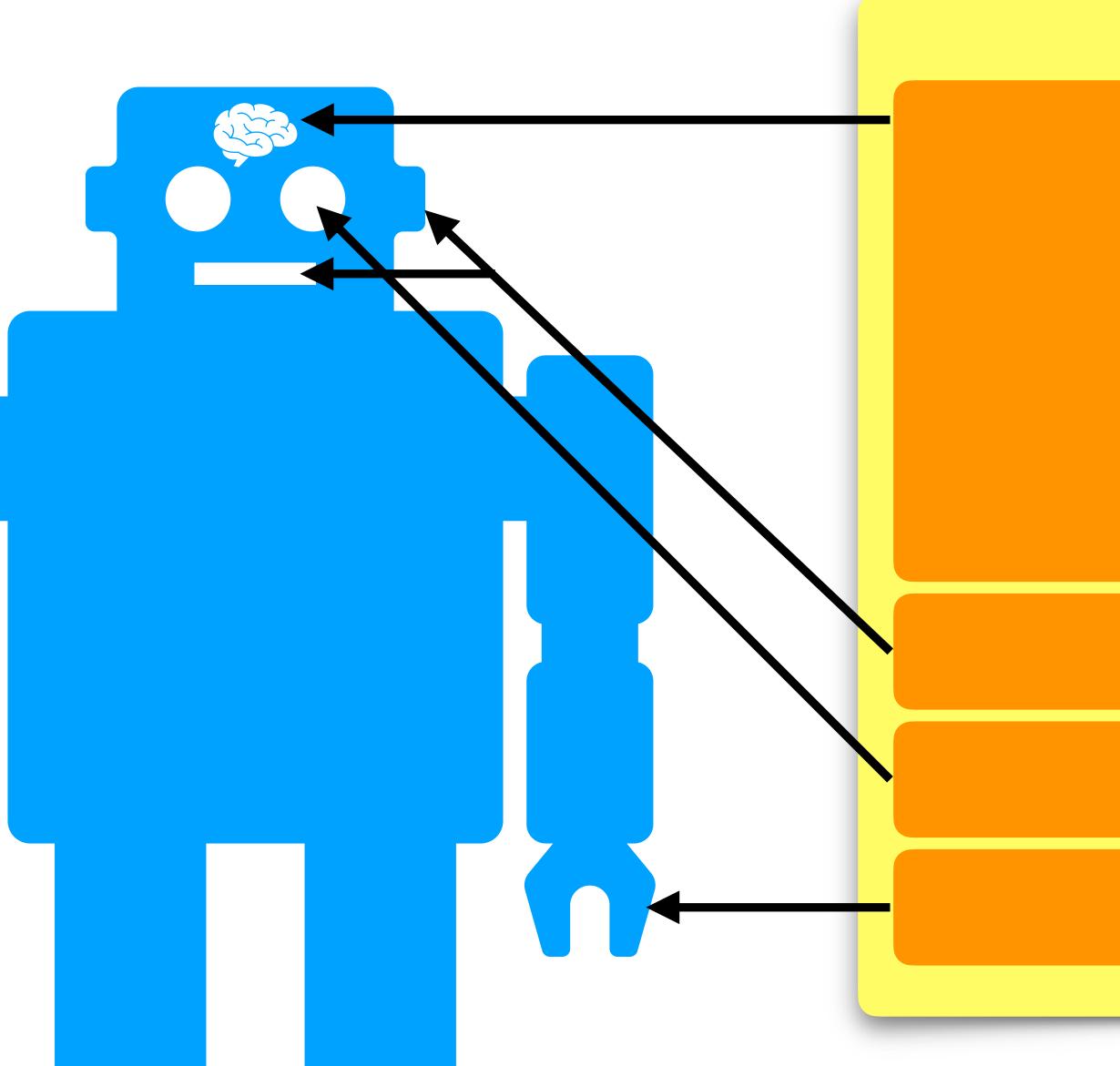
Artificial Intelligence

Machine learning

Natural language processing

Computer vision





Artificial Intelligence

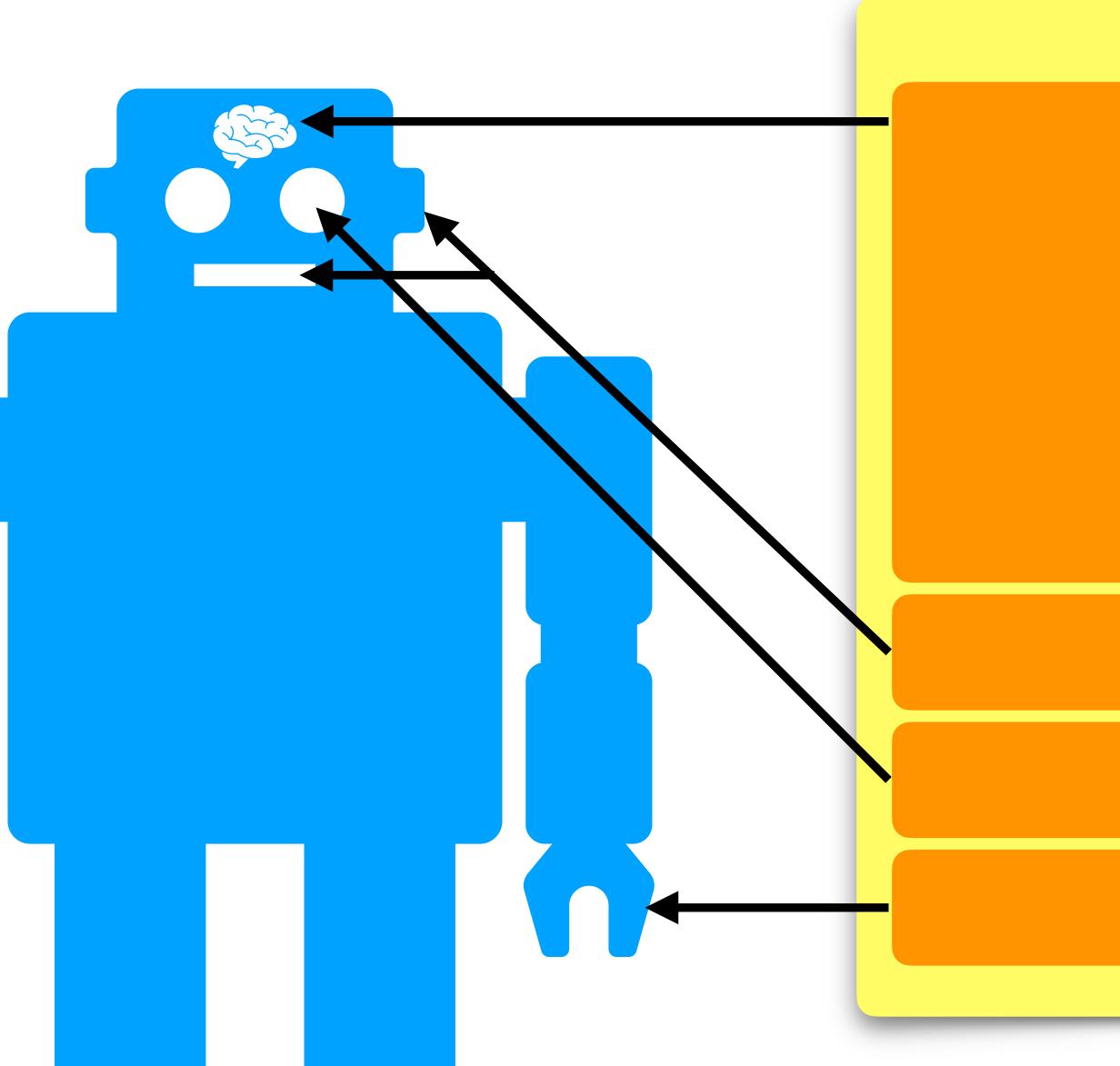
Machine learning

Deep learning with Artificial neural networks

Natural language processing

Computer vision





Artificial Intelligence

Machine learning

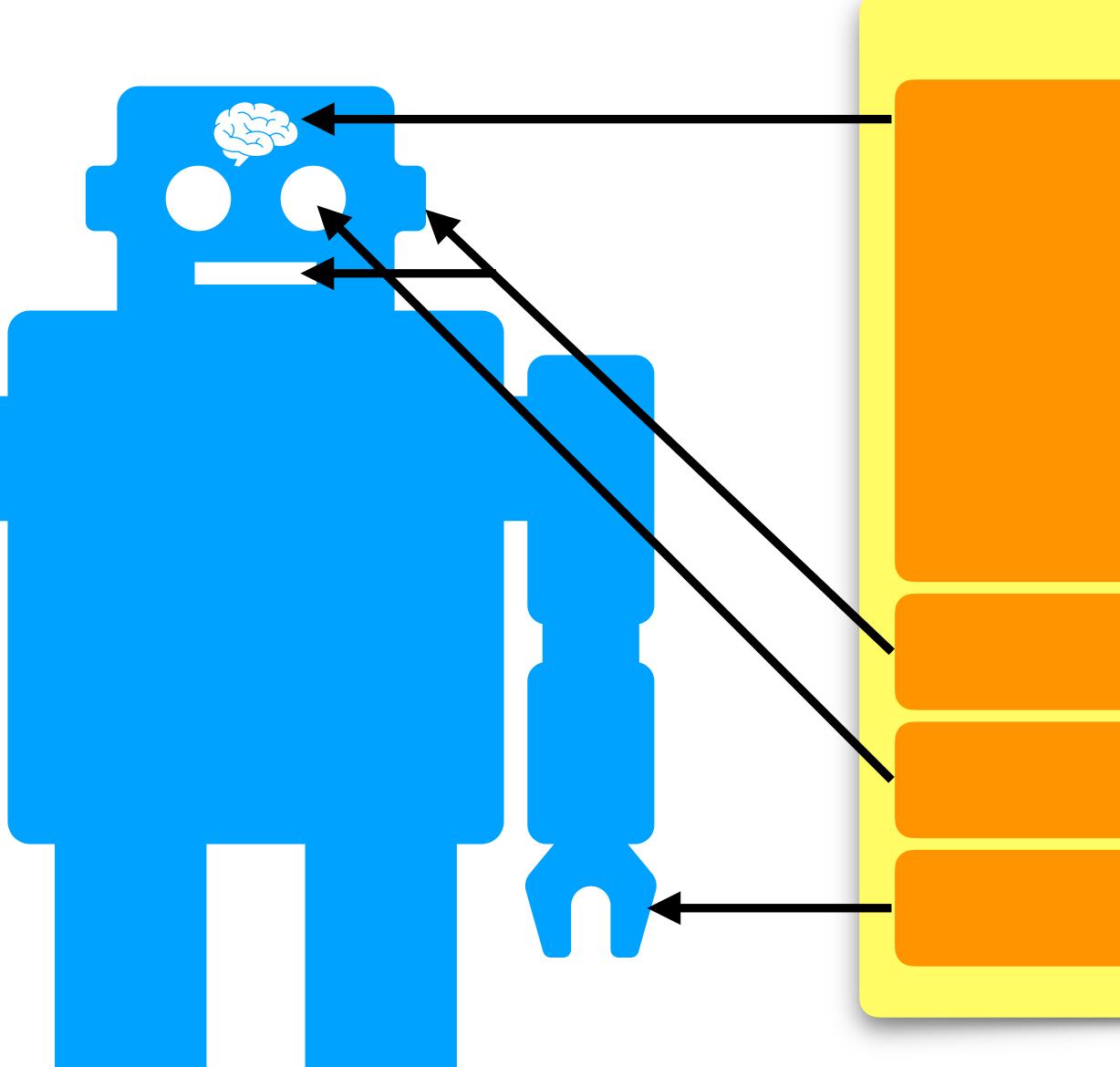
Deep learning with Artificial neural networks

Transformer (ANN structure)

Natural language processing

Computer vision





Artificial Intelligence

Machine learning

Deep learning with Artificial neural networks

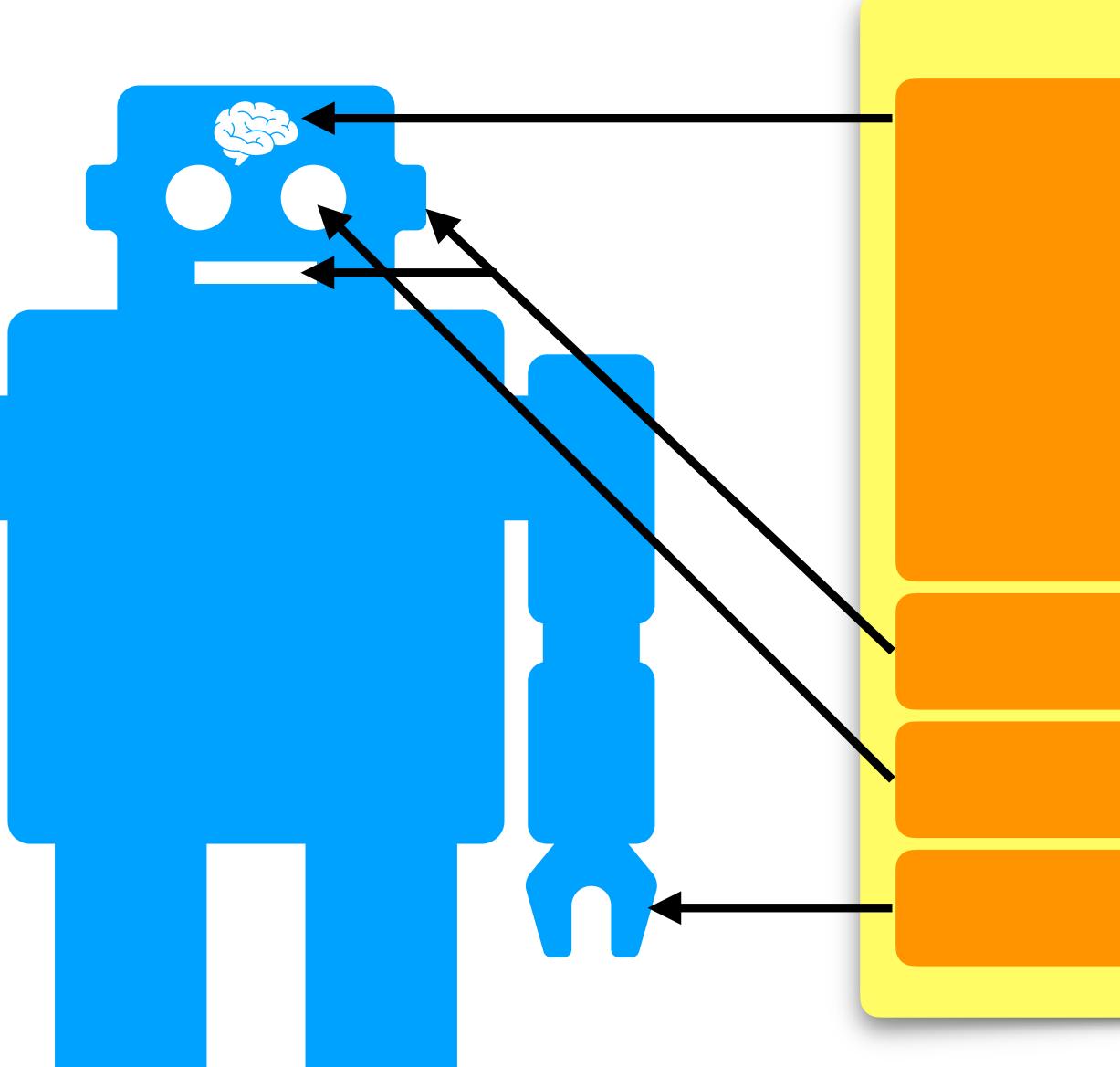
Transformer (ANN structure)

Large Language Model

Natural language processing

Computer vision

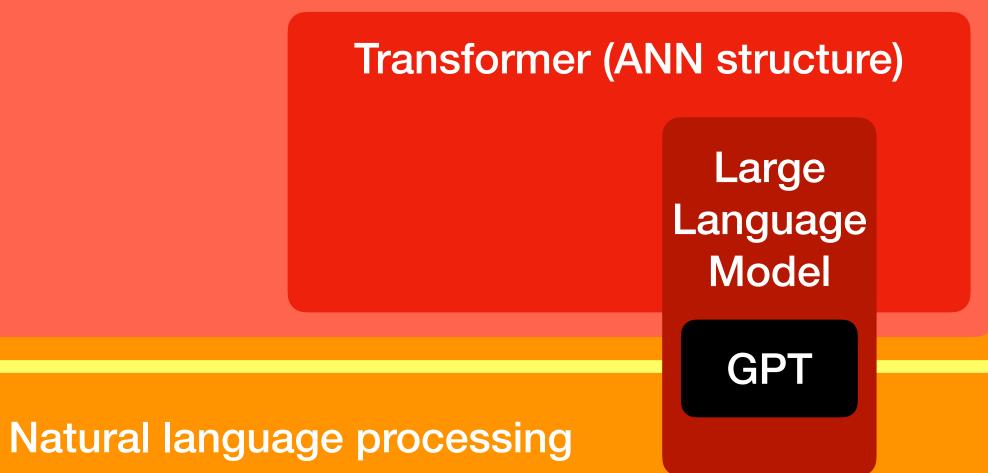




Artificial Intelligence

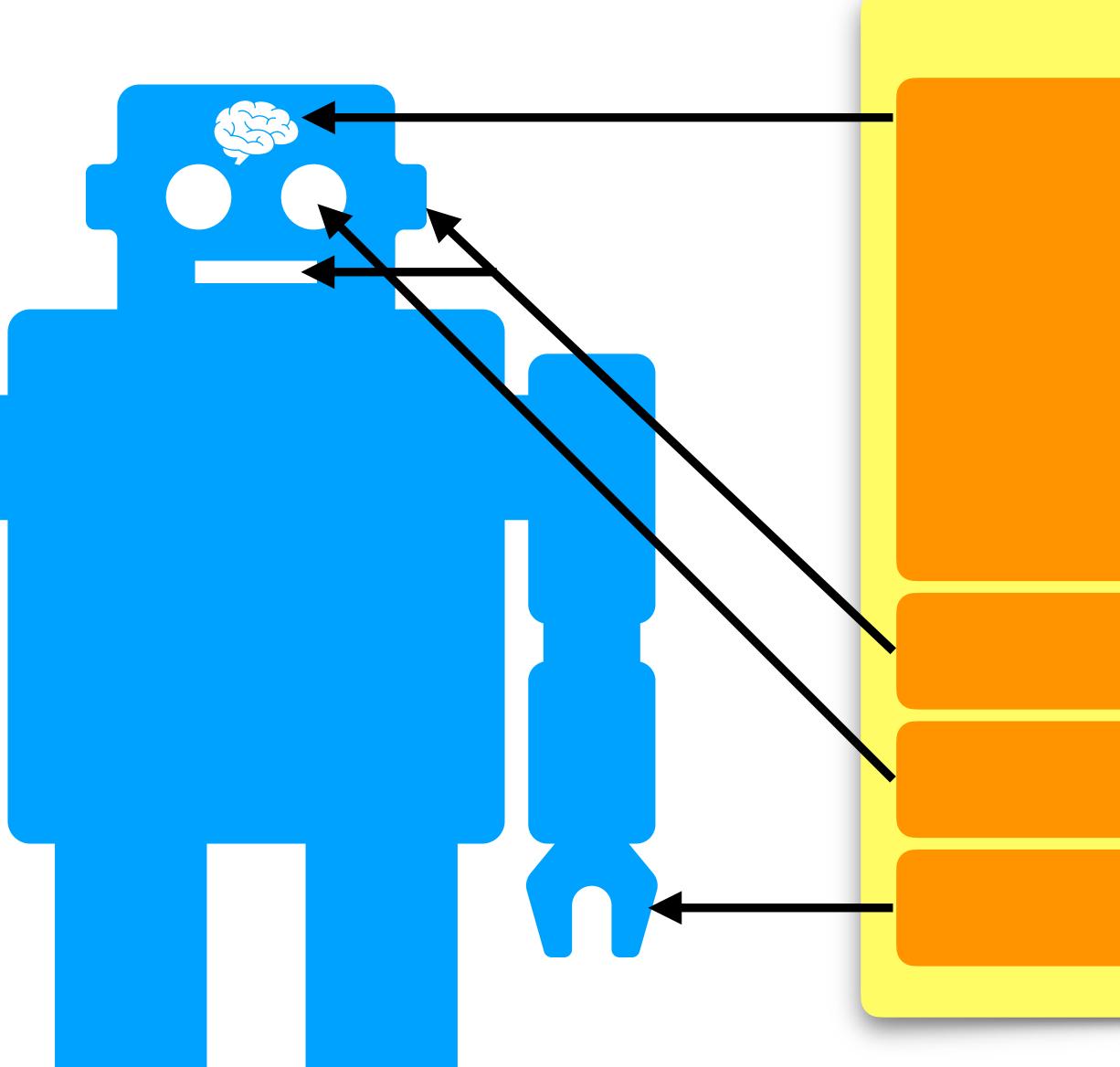
Machine learning

Deep learning with Artificial neural networks



Computer vision

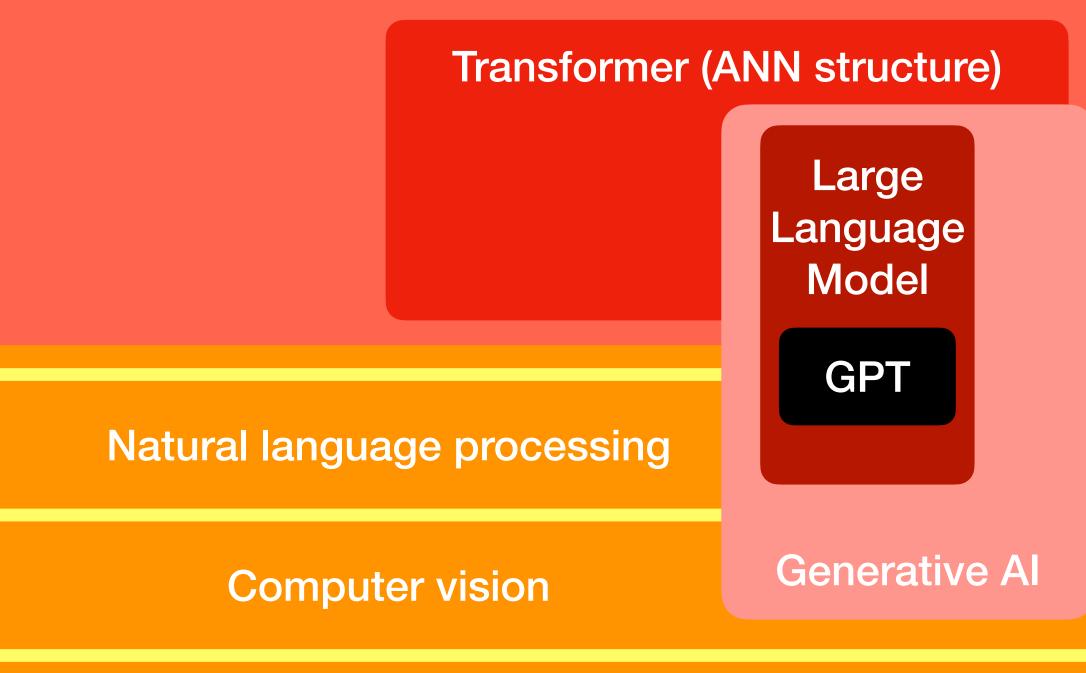




Artificial Intelligence

Machine learning

Deep learning with Artificial neural networks





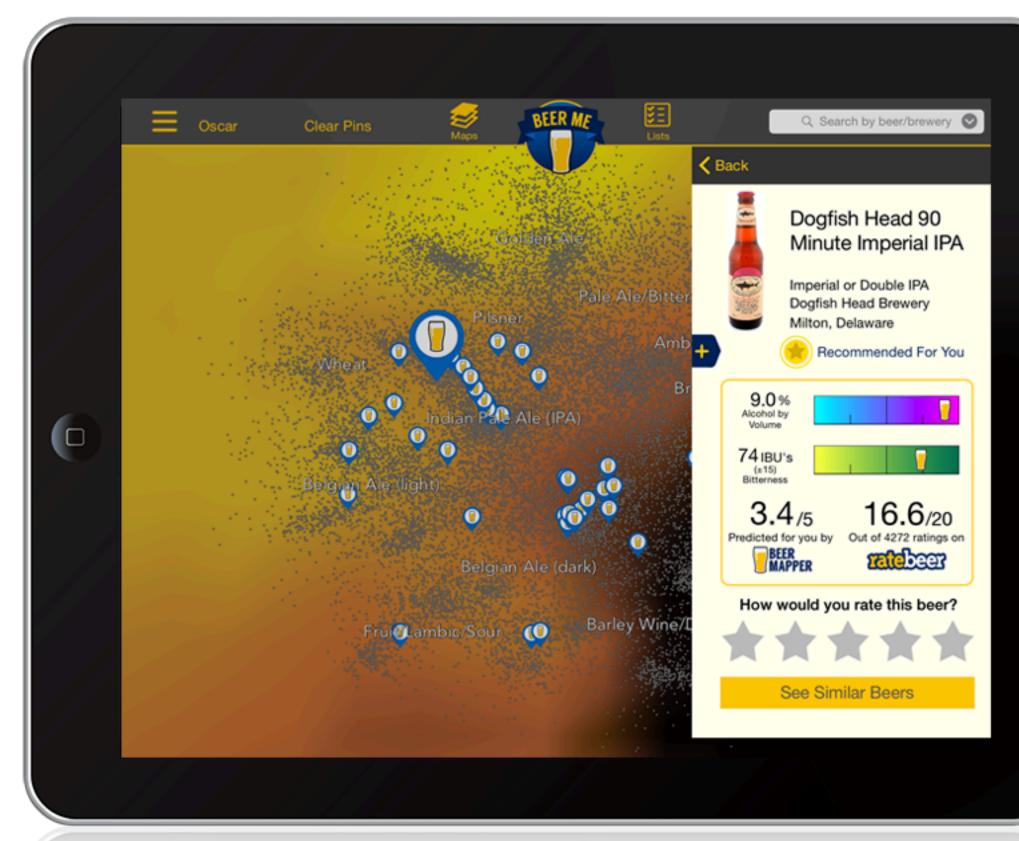
UW-Madison Al contributions



UW contributions: faster training

- New optimization algorithms
- Learning from weak supervision
- Active learning
- Preference-based learning
- •

The beer mapper



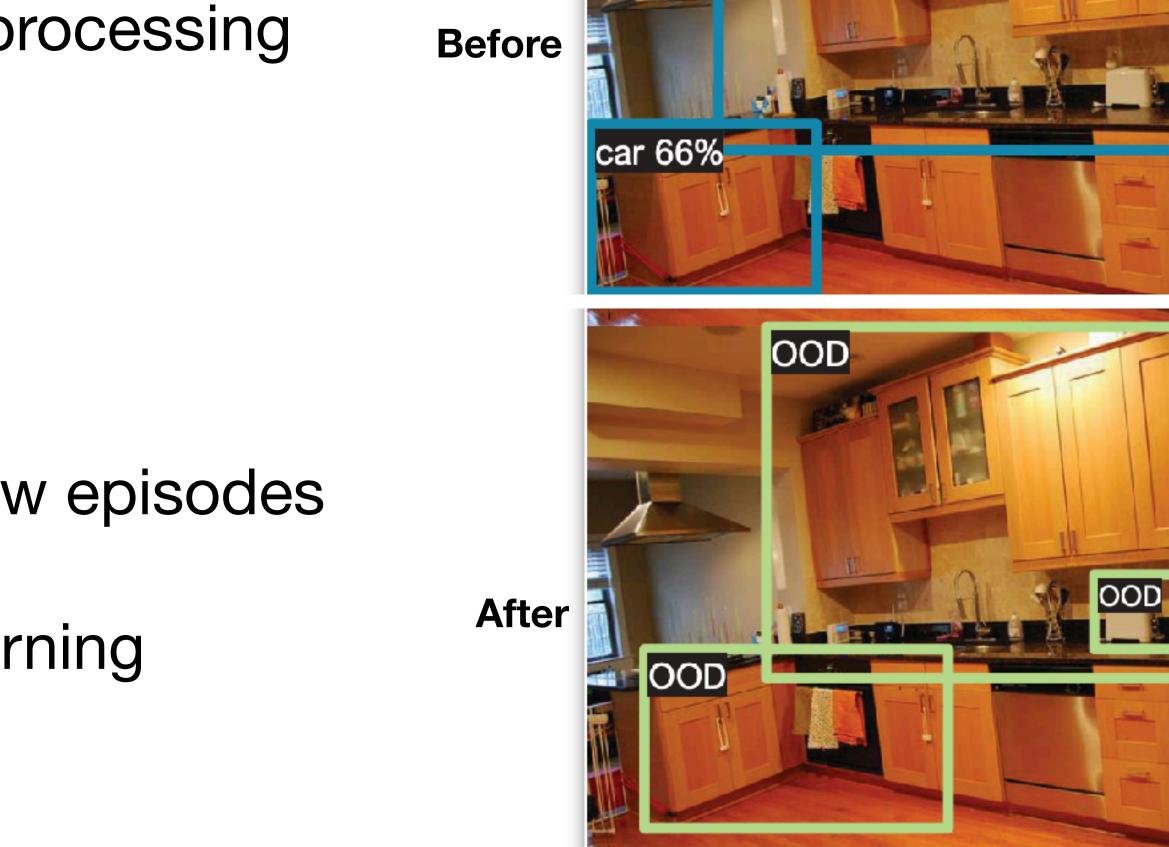
[Active Ranking using Pairwise Comparisons. Jamieson & Nowak, 2011]



UW contributions: higher accuracy

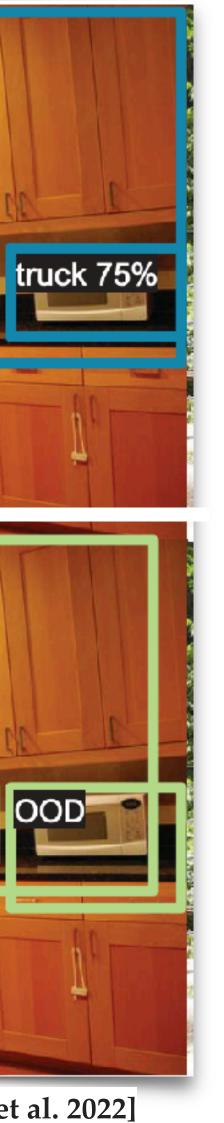
- Multi-lingual natural language processing
- Single-photon computer vision
- Out-of-distribution detection
- Reinforcement learning from few episodes
- Game theoretic multi-agent learning





[Unknown-Aware Object Detection: Learning What You Don't Know from Videos in the Wild. Du et al. 2022]

bus 90%



UW contributions: stronger guardrails

- Robust machine learning
- Theoretical guarantees
- Expose dual use scenarios
- Defense tools
- Al ethics and fairness
- Policy and regulation

Detected fake images



[Towards Universal Fake Image Detectors that Generalize Across Generative Models. Ojha et al. 2023]

Who does Al on campus?

UW-Madison conducts world-class Al research*

- Computer Sciences
- ECE
- Statistics
- ISyE
- Math
- iSchool ullet
- Almost all other departments on Al applications
- Data Science Institute, Data Science Hub \bullet

* <u>CSRankings.org</u> #19 world-wide on machine learning, as of July 2023

