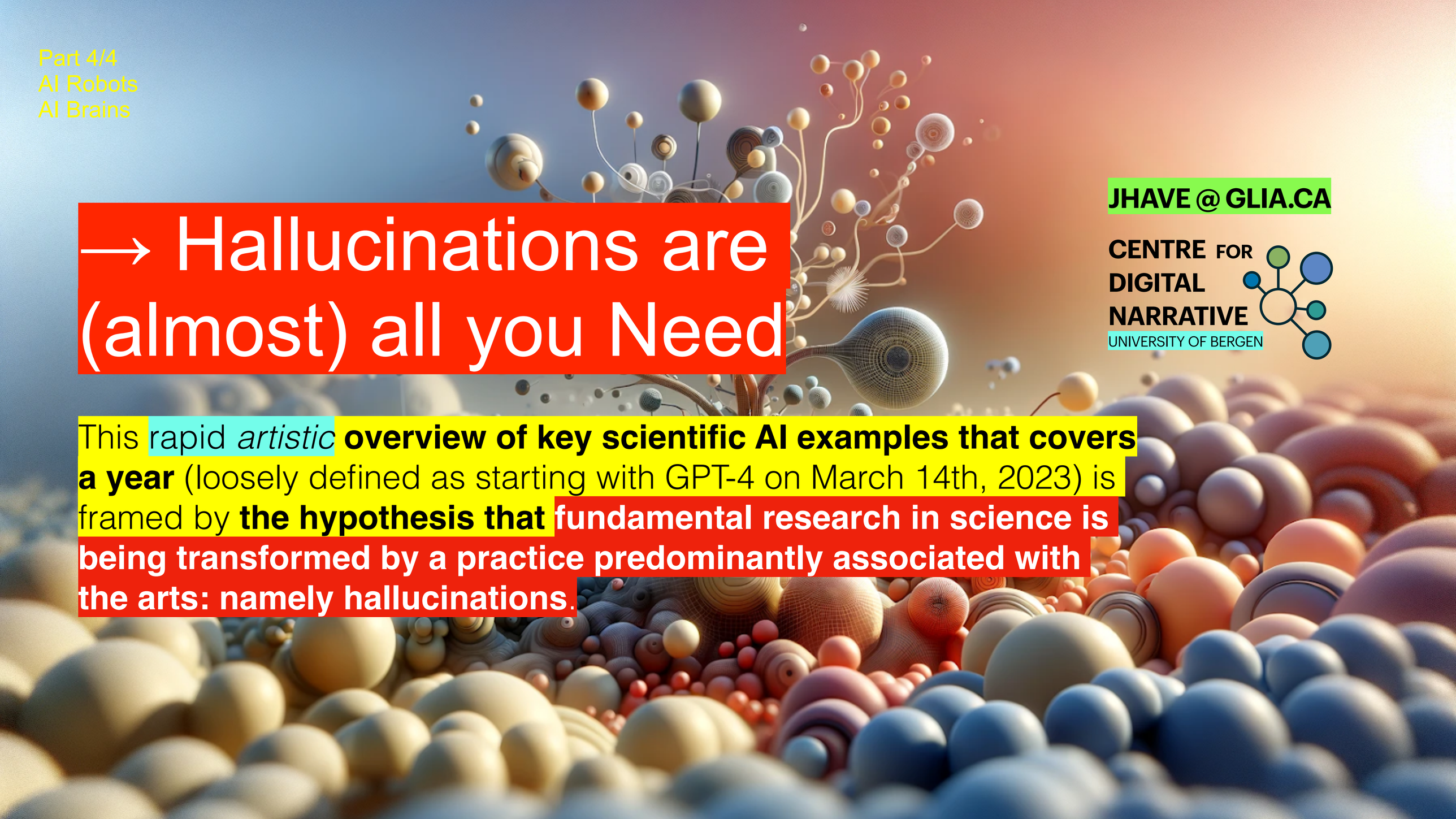
Part 4/4
AI Robots
AI Brains

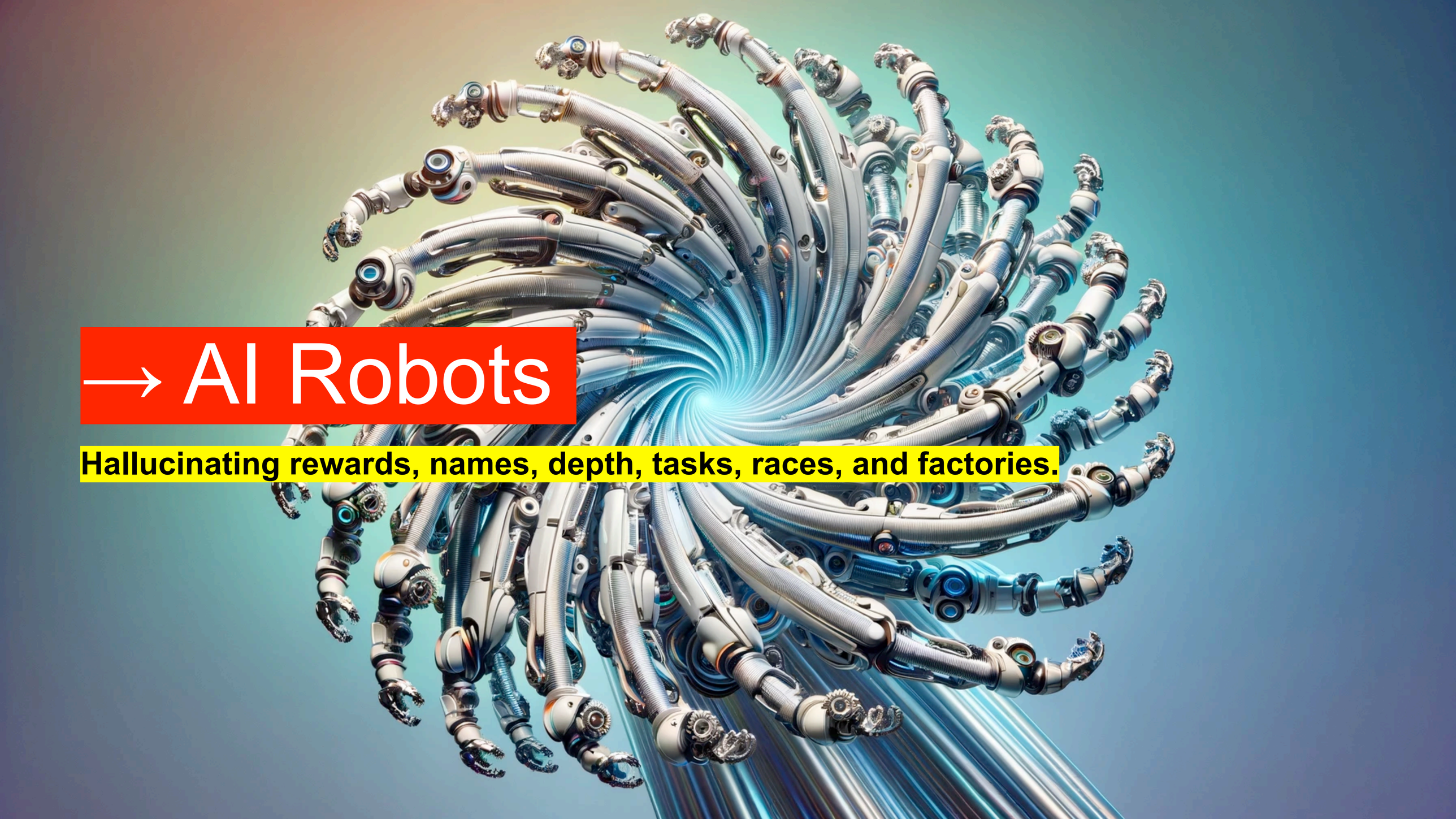
→ Hallucinations are (almost) all you Need

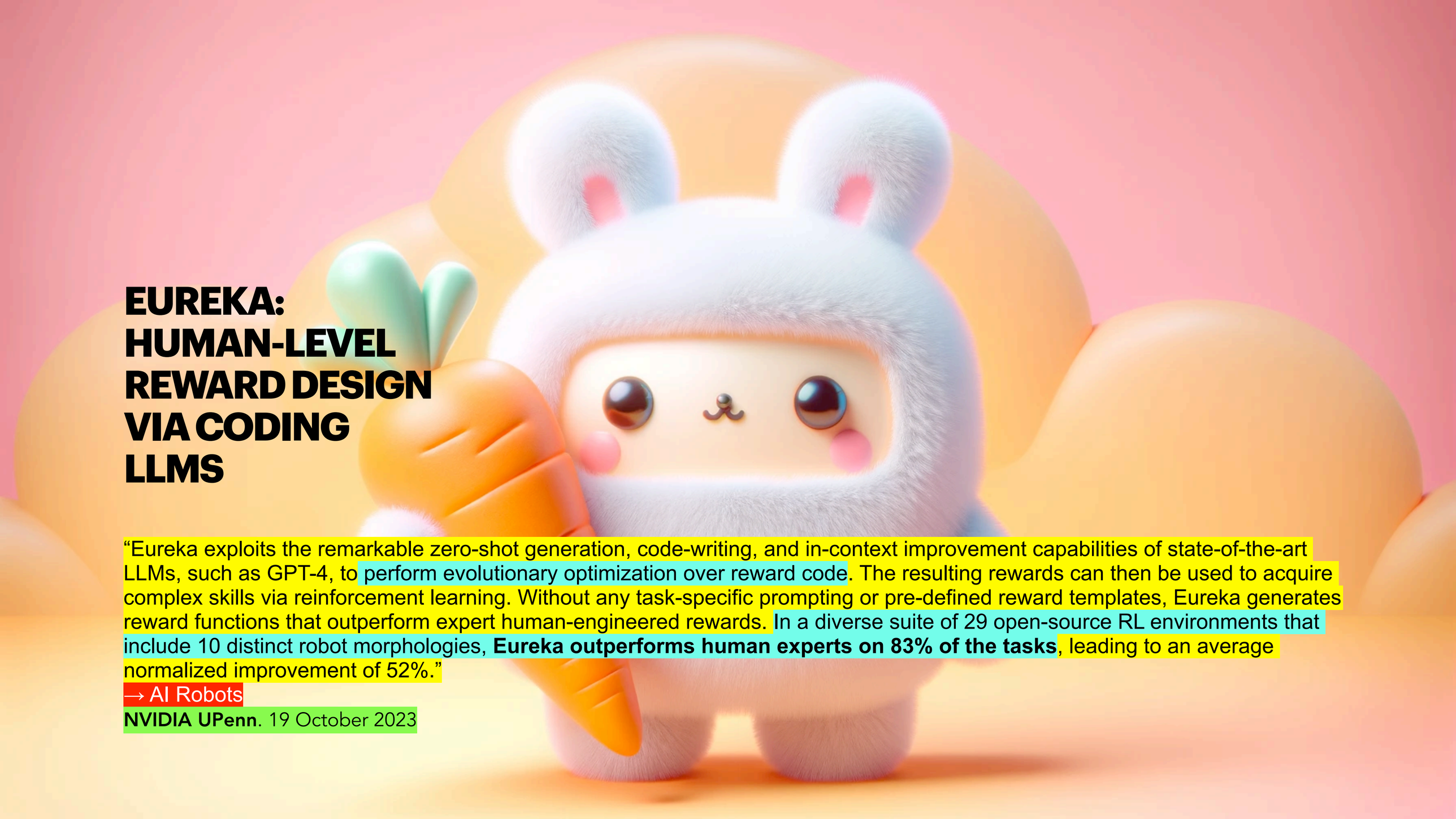
JHAVE @ GLIA.CA

CENTRE FOR DIGITAL NARRATIVE
UNIVERSITY OF BERGEN



This rapid *artistic* **overview of key scientific AI examples that covers a year** (loosely defined as starting with GPT-4 on March 14th, 2023) is framed by **the hypothesis that fundamental research in science is being transformed by a practice predominantly associated with the arts: namely hallucinations**.


→ AI Robots
Hallucinating rewards, names, depth, tasks, races, and factories.



EUREKA: HUMAN-LEVEL REWARD DESIGN VIA CODING LLMS

“Eureka exploits the remarkable zero-shot generation, code-writing, and in-context improvement capabilities of state-of-the-art LLMs, such as GPT-4, to perform evolutionary optimization over reward code. The resulting rewards can then be used to acquire complex skills via reinforcement learning. Without any task-specific prompting or pre-defined reward templates, Eureka generates reward functions that outperform expert human-engineered rewards. In a diverse suite of 29 open-source RL environments that include 10 distinct robot morphologies, **Eureka outperforms human experts on 83% of the tasks**, leading to an average normalized improvement of 52%.”

→ AI Robots

NVIDIA UPenn. 19 October 2023

SEGMENT ANYTHING

“a new task, model, and dataset for image segmentation…. often competitive with or even superior to prior fully supervised results. We are releasing the Segment Anything Model (SAM) and corresponding dataset (SA-1B) of 1B masks and 11M images at **https://segment-anything.com/** to foster research into foundation models for computer vision.”

→ AI Robots

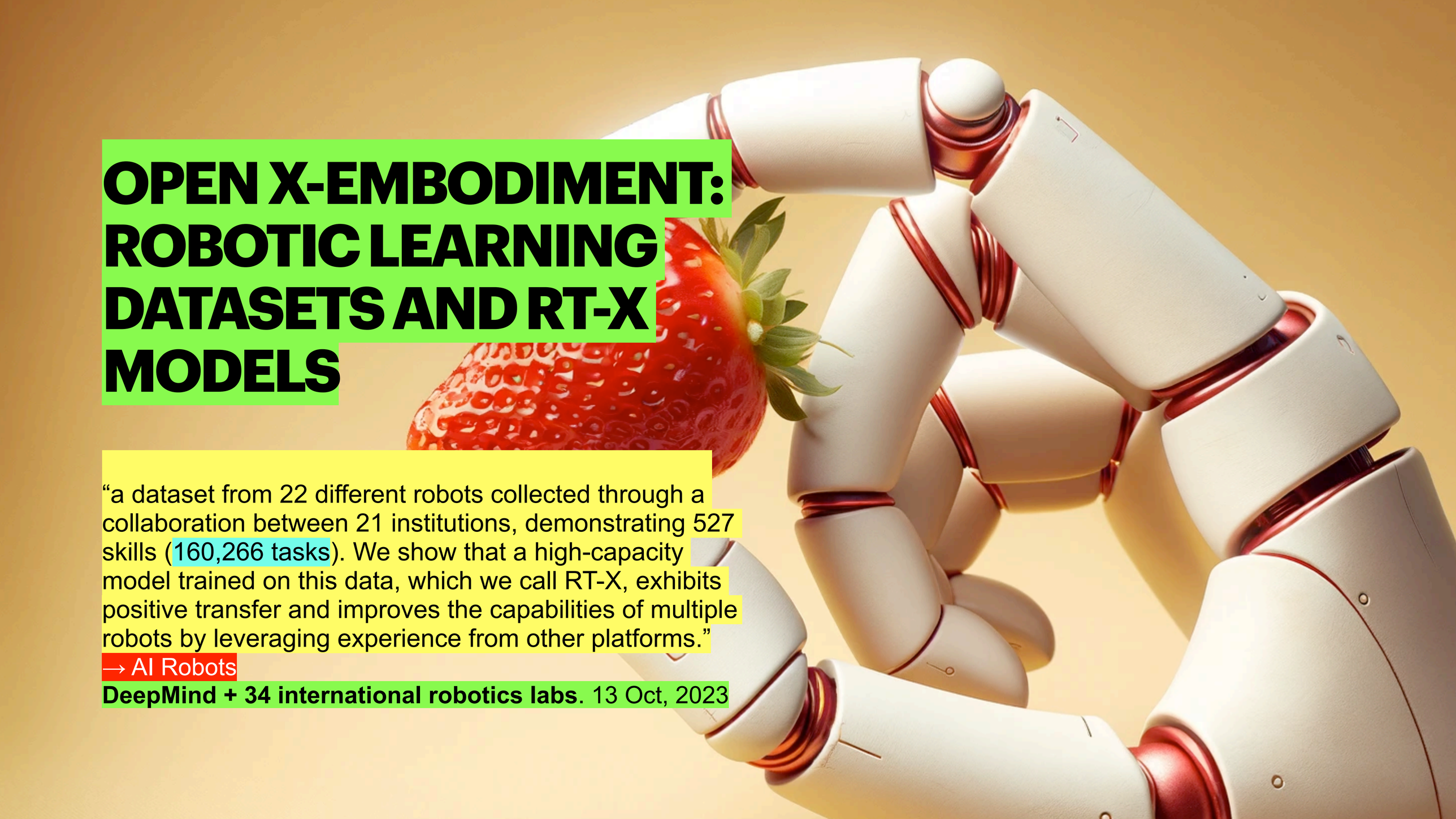
Meta. 5 April 2023

“a highly practical solution for robust monocular depth estimation. Without pursuing novel technical modules, we aim to build a simple yet powerful foundation model dealing with any images under any circumstances. To this end, we scale up the dataset by designing a data engine to collect and automatically annotate large-scale unlabeled data (~62M) … models released: https://github.com/LiheYoung/Depth-Anything ”

→ AI Robots

ByteDance. 19 January 2024

OPEN X-EMBODIMENT: ROBOTIC LEARNING DATASETS AND RT-X MODELS



“a dataset from 22 different robots collected through a collaboration between 21 institutions, demonstrating 527 skills (160,266 tasks). We show that a high-capacity model trained on this data, which we call RT-X, exhibits positive transfer and improves the capabilities of multiple robots by leveraging experience from other platforms.”

→ AI Robots

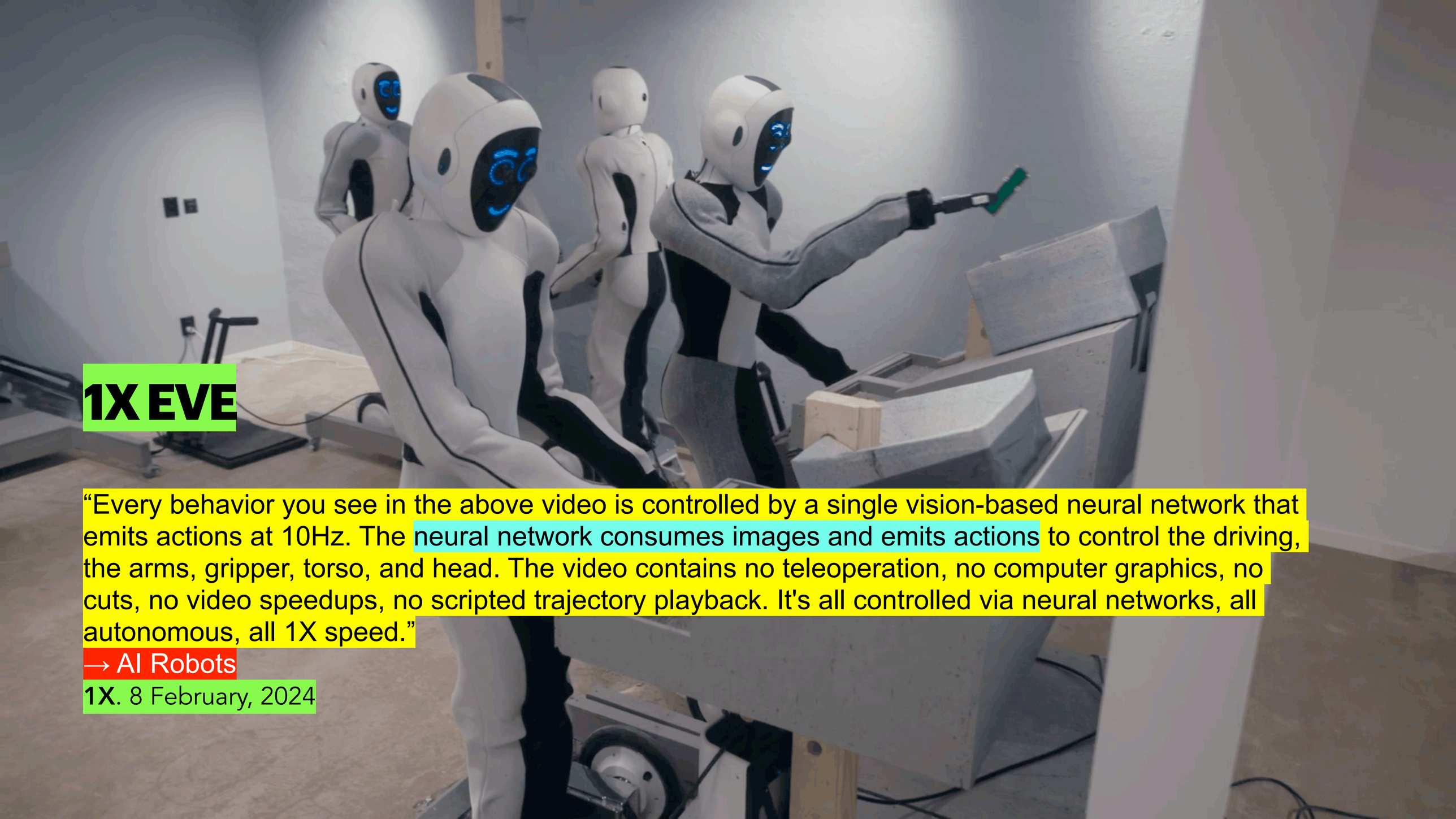
DeepMind + 34 international robotics labs. 13 Oct, 2023

CHAMPION-LEVEL DRONE RACING USING DEEP REINFORCEMENT LEARNING

“Swift, an autonomous system that can race physical vehicles at the level of the human world champions. The system combines deep reinforcement learning (RL) in simulation with data collected in the physical world. Swift competed against three human champions, including the world champions of two international leagues, in real-world head-to-head races. Swift won several races against each of the human champions and demonstrated the fastest recorded race time”

→ AI Robots

Nature. 30 August, 2023.

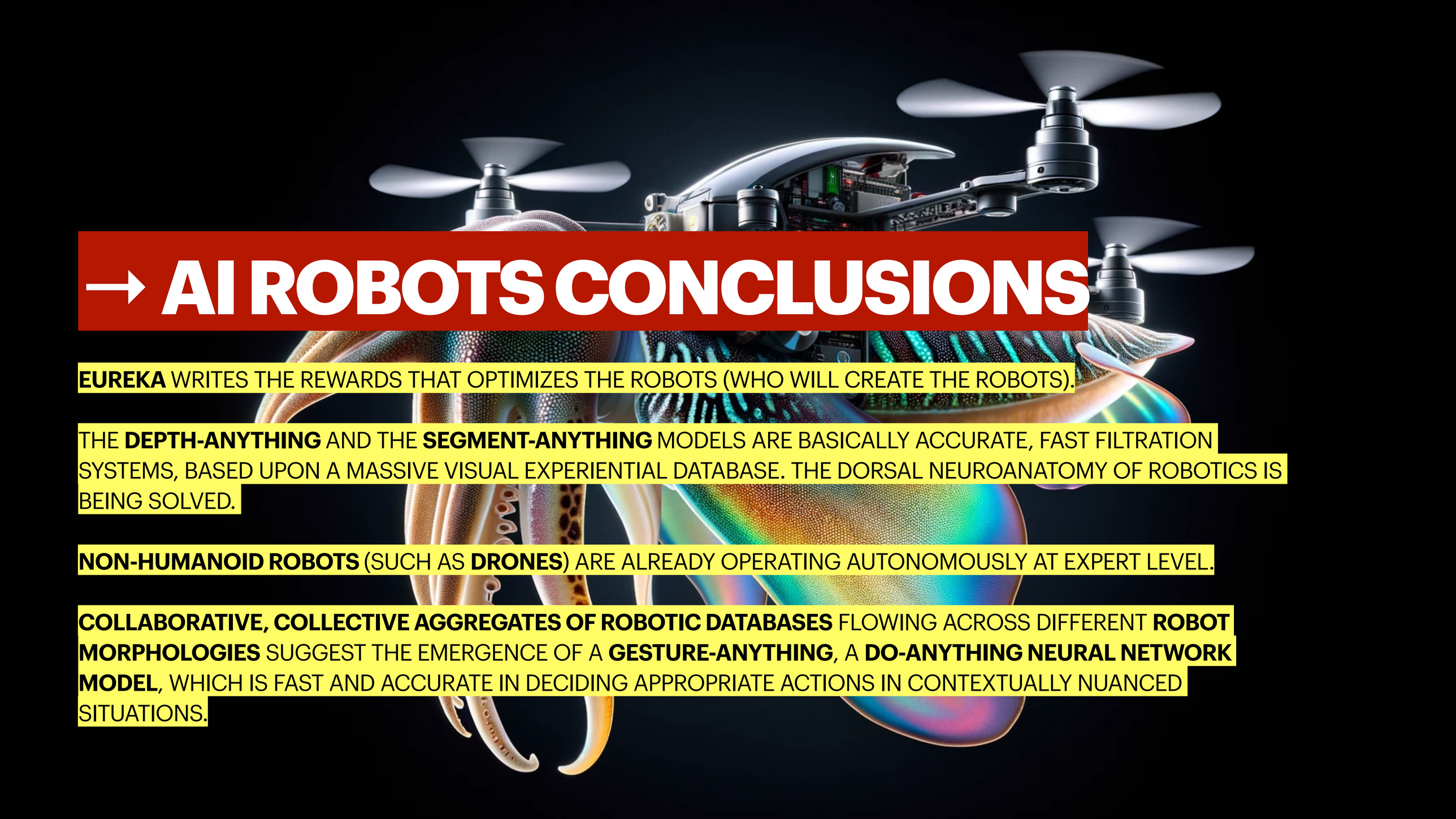


1X EVE

“Every behavior you see in the above video is controlled by a single vision-based neural network that emits actions at 10Hz. The neural network consumes images and emits actions to control the driving, the arms, gripper, torso, and head. The video contains no teleoperation, no computer graphics, no cuts, no video speedups, no scripted trajectory playback. It's all controlled via neural networks, all autonomous, all 1X speed.”

→ AI Robots

1X. 8 February, 2024



→ AI ROBOTS CONCLUSIONS

EUREKA WRITES THE REWARDS THAT OPTIMIZES THE ROBOTS (WHO WILL CREATE THE ROBOTS).

THE **DEPTH-ANYTHING** AND THE **SEGMENT-ANYTHING** MODELS ARE BASICALLY ACCURATE, FAST FILTRATION SYSTEMS, BASED UPON A MASSIVE VISUAL EXPERIENTIAL DATABASE. THE DORSAL NEUROANATOMY OF ROBOTICS IS BEING SOLVED.

NON-HUMANOID ROBOTS (SUCH AS **DRONES**) ARE ALREADY OPERATING AUTONOMOUSLY AT EXPERT LEVEL.

COLLABORATIVE, COLLECTIVE AGGREGATES OF ROBOTIC DATABASES FLOWING ACROSS DIFFERENT **ROBOT MORPHOLOGIES** SUGGEST THE EMERGENCE OF A **GESTURE-ANYTHING**, A **DO-ANYTHING NEURAL NETWORK MODEL**, WHICH IS FAST AND ACCURATE IN DECIDING APPROPRIATE ACTIONS IN CONTEXTUALLY NUANCED SITUATIONS.

→ AI Brains

Hallucinated distinctions, discoveries, geometry.

BRAIN ORGANOID RESERVOIR COMPUTING FOR AI

“adaptive reservoir computation of biological neural networks in a brain organoid. In this approach—which is termed **Brainoware**—computation is performed by sending and receiving information from the brain organoid using a high-density multielectrode array. By applying spatiotemporal electrical stimulation, nonlinear dynamics and fading memory properties are achieved, as well as unsupervised learning from training data by reshaping the organoid functional connectivity.”

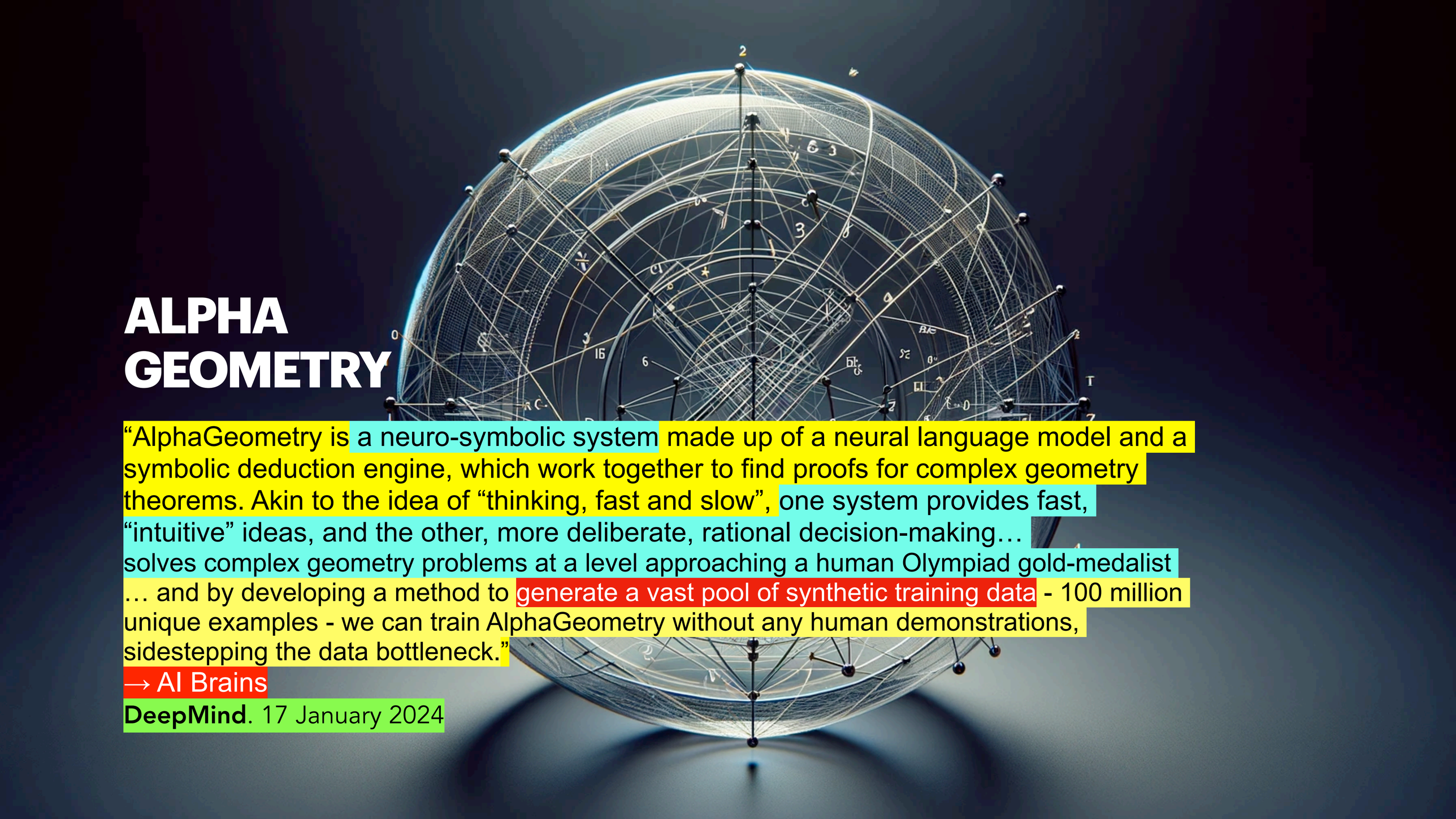
→ AI Brains

Nature Electronics. December 11, 2023

FUNSEARCH: MAKING NEW DISCOVERIES IN MATHEMATICAL SCIENCES USING LLMS

"As LLMs have been shown to "hallucinate" factually incorrect information, using them to make verifiably correct discoveries is a challenge. But what if we could harness the creativity of LLMs by identifying and building upon only their very best ideas?"

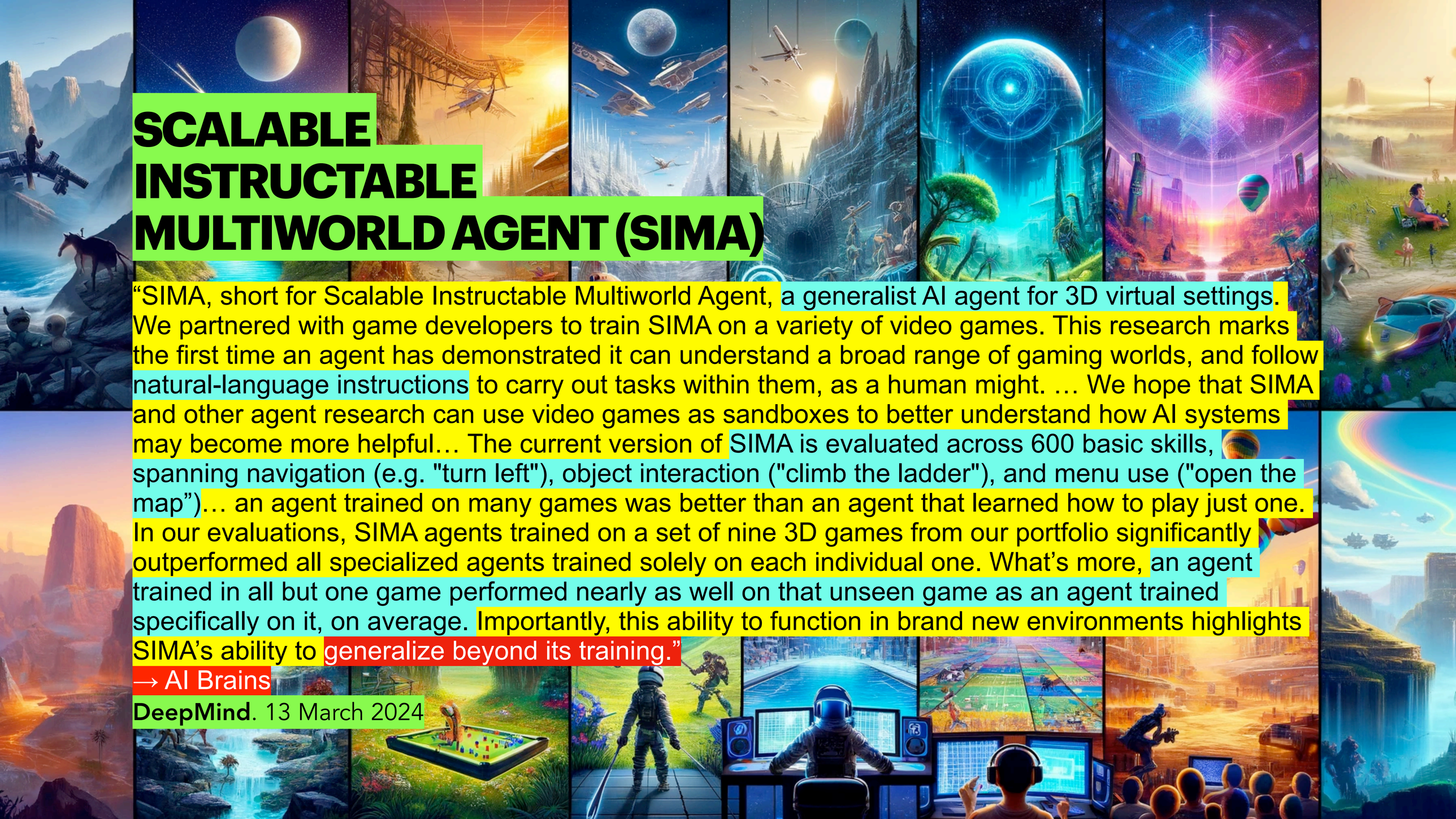
"a method to search for new solutions in mathematics and computer science. FunSearch works by pairing a pre-trained LLM, whose goal is to provide creative solutions in the form of computer code, with an automated "evaluator", which guards against hallucinations and incorrect ideas… FunSearch discovered new solutions for the **cap set problem**, a longstanding open problem in mathematics. In addition, to demonstrate the practical usefulness of FunSearch, we used it to discover more effective algorithms for the **"bin-packing" problem**."
→ AI Brains
Google DeepMind. December 14, 2023



ALPHA GEOMETRY

“AlphaGeometry is a neuro-symbolic system made up of a neural language model and a symbolic deduction engine, which work together to find proofs for complex geometry theorems. Akin to the idea of “thinking, fast and slow”, one system provides fast, “intuitive” ideas, and the other, more deliberate, rational decision-making…
solves complex geometry problems at a level approaching a human Olympiad gold-medalist
… and by developing a method to generate a vast pool of synthetic training data - 100 million unique examples - we can train AlphaGeometry without any human demonstrations, sidestepping the data bottleneck.”
→ AI Brains
DeepMind. 17 January 2024


INDUCE +
DEDUCE
NEURO +
SYMBOLIC
SIMULATE
THEN TEST

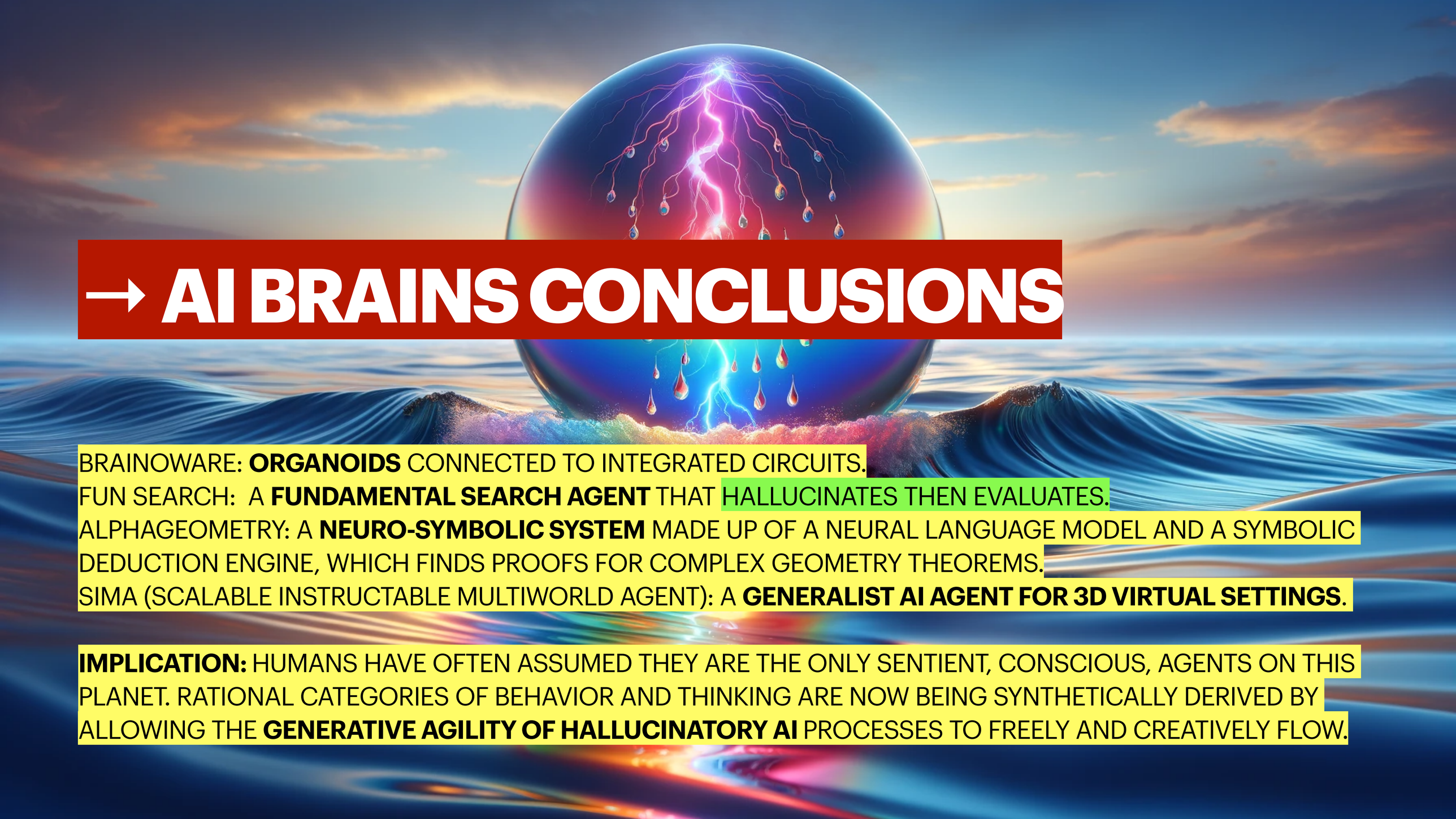


SCALABLE INSTRUCTABLE MULTIWORLD AGENT (SIMA)

“SIMA, short for Scalable Instructable Multiworld Agent, a generalist AI agent for 3D virtual settings. We partnered with game developers to train SIMA on a variety of video games. This research marks the first time an agent has demonstrated it can understand a broad range of gaming worlds, and follow natural-language instructions to carry out tasks within them, as a human might. … We hope that SIMA and other agent research can use video games as sandboxes to better understand how AI systems may become more helpful… The current version of SIMA is evaluated across 600 basic skills, spanning navigation (e.g. "turn left"), object interaction ("climb the ladder"), and menu use ("open the map”)… an agent trained on many games was better than an agent that learned how to play just one. In our evaluations, SIMA agents trained on a set of nine 3D games from our portfolio significantly outperformed all specialized agents trained solely on each individual one. What’s more, an agent trained in all but one game performed nearly as well on that unseen game as an agent trained specifically on it, on average. Importantly, this ability to function in brand new environments highlights SIMA’s ability to generalize beyond its training.”

→ AI Brains

DeepMind. 13 March 2024



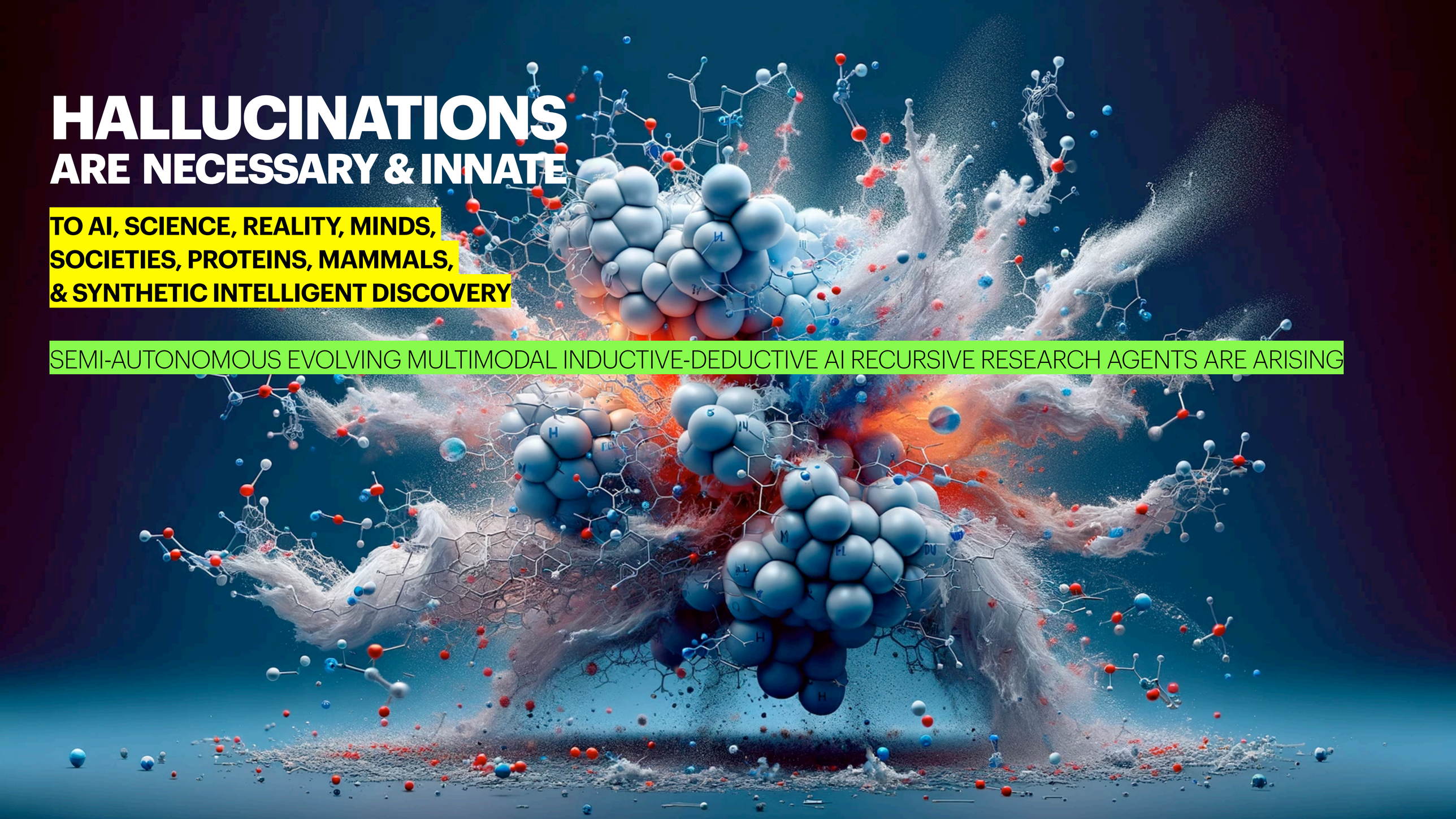
→ AI BRAINS CONCLUSIONS

BRAINOWARE: **ORGANOIDS** CONNECTED TO INTEGRATED CIRCUITS.
FUN SEARCH: A **FUNDAMENTAL SEARCH AGENT** THAT HALLUCINATES THEN EVALUATES.
ALPHAGEOMETRY: A **NEURO-SYMBOLIC SYSTEM** MADE UP OF A NEURAL LANGUAGE MODEL AND A SYMBOLIC DEDUCTION ENGINE, WHICH FINDS PROOFS FOR COMPLEX GEOMETRY THEOREMS.
SIMA (SCALABLE INSTRUCTABLE MULTIWORLD AGENT): A **GENERALIST AI AGENT FOR 3D VIRTUAL SETTINGS**.

IMPLICATION: HUMANS HAVE OFTEN ASSUMED THEY ARE THE ONLY SENTIENT, CONSCIOUS, AGENTS ON THIS PLANET. RATIONAL CATEGORIES OF BEHAVIOR AND THINKING ARE NOW BEING SYNTHETICALLY DERIVED BY ALLOWING THE **GENERATIVE AGILITY OF HALLUCINATORY AI** PROCESSES TO FREELY AND CREATIVELY FLOW.

CONCLUSIONS

CONTINGENT, SPECULATIVE, EPHEMERAL & BEAUTIFUL


HALLUCINATIONS
ARE NECESSARY & INNATE
TO AI, SCIENCE, REALITY, MINDS,
SOCIETIES, PROTEINS, MAMMALS,
& SYNTHETIC INTELLIGENT DISCOVERY
SEMI-AUTONOMOUS EVOLVING MULTIMODAL INDUCTIVE-DEDUCTIVE AI RECURSIVE RESEARCH AGENTS ARE ARISING

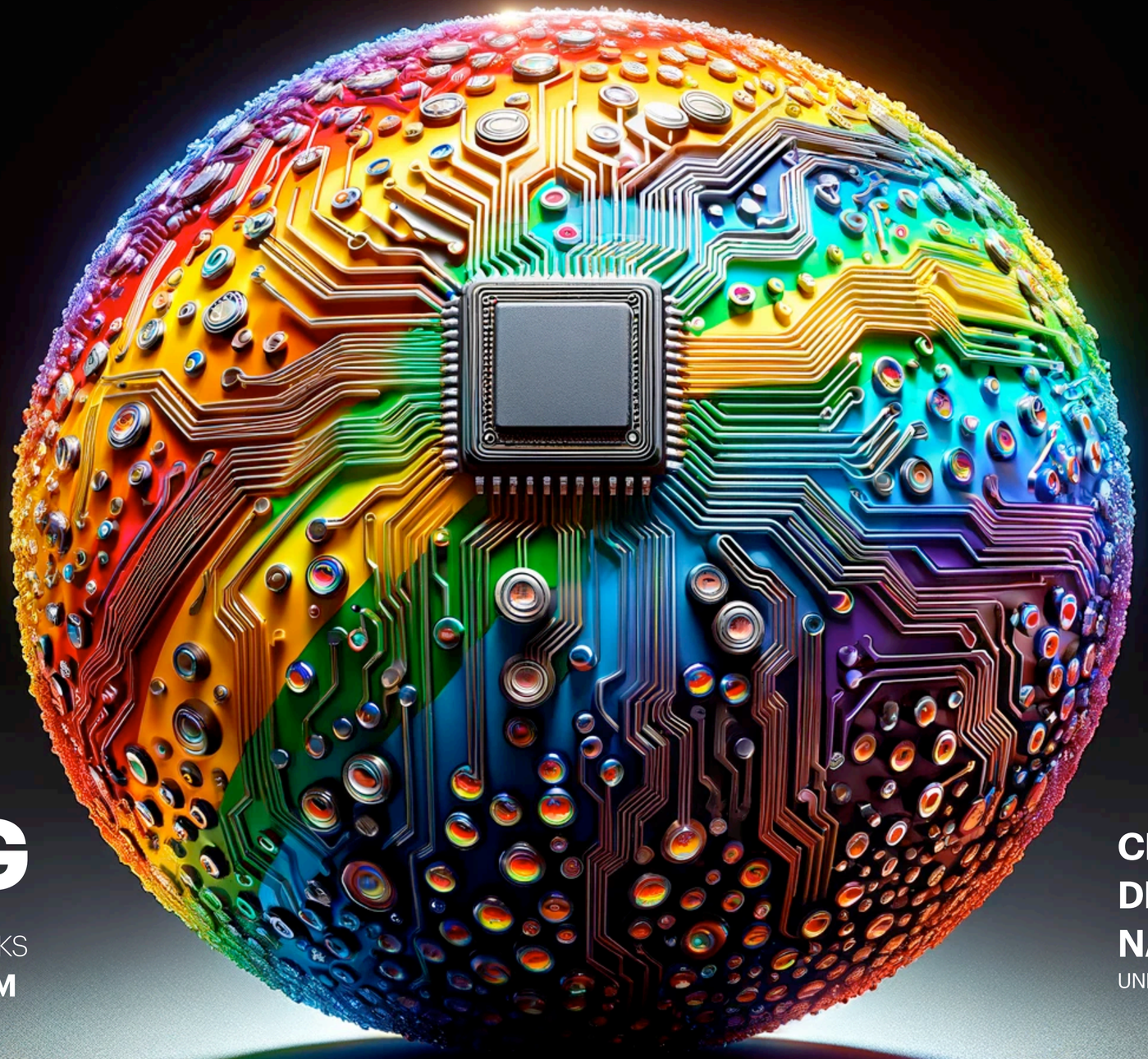

RECAP
Prompting
Let's **Verify Step by Step**
Code
ML Placer: a Graph Placement Methodology for Fast Chip Design
Hardware
Alpha Dev, Alpha Tensor, Alpha Code 2
Sakana Evolutionary AI
Telepathy
Decoding Speech Perception From Non-Invasive Brain Recordings
Toward a Real-Time **Decoding of Images From Brain** Activity
Cinematic Mindscapes: High-Quality Video Reconstruction From Brain Activity
Proteins
AlphaFold Reveals the Structure of the Protein Universe
Alpha Missense (a Variant of Alpha Fold)
Search Algorithm Reveals Nearly **200 New Kinds of CRISPR** Systems
Drugs
Discovery of a Structural Class of Antibiotics With Explainable Deep Learning
LinearDesign: Algorithm for Optimized mRNA Design Improves Stability and Immunogenicity
Diagnostics
PANDA Large-Scale Pancreatic Cancer Detection via Non-Contrast CT and Deep Learning
Acoustic Analysis and **Prediction of Type 2 Diabetes Mellitus Using Smartphone-Recorded Voice** Segments
AlphaFold Found Thousands of Possible **Psychedelics (Serotonin & G-Protein Coupled Recptors)**
Crystals
GNOME:Graph Networks for Materials Exploration
Robots
Eureka: Human-Level Reward Design via Coding LlMs
Segment Anything
Depth Anything
Open X-Embodiment: Robotic Learning Datasets and RT-X Models
BacterAI: Maps Microbial Metabolism Without Prior Knowledge
Champion-Level Drone Racing Using Deep Reinforcement Learning
1X Eve
Organoids
Brain Organoid Reservoir Computing for AI
Logic
FunSearch: Making New Discoveries in Mathematical Sciences Using LLMs
Geometry
Alpha Geometry
SIMA

The preceding framework and examples become the foundation from which it is possible to claim: **If simulation underlies cognition**, and cognition tends toward boundary configurations that give rise to the seemingness of a self and the sense of consciousness, then current AI may internally emulate incipient self-identity formations.

Hallucinations are what we are. As is everything else.

CONCLUSION

Recursive hyper-accelerated semi-autonomous AI hallucinations will transfigure society.



AI SPRING

AN ONGOING SET OF LINKS
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