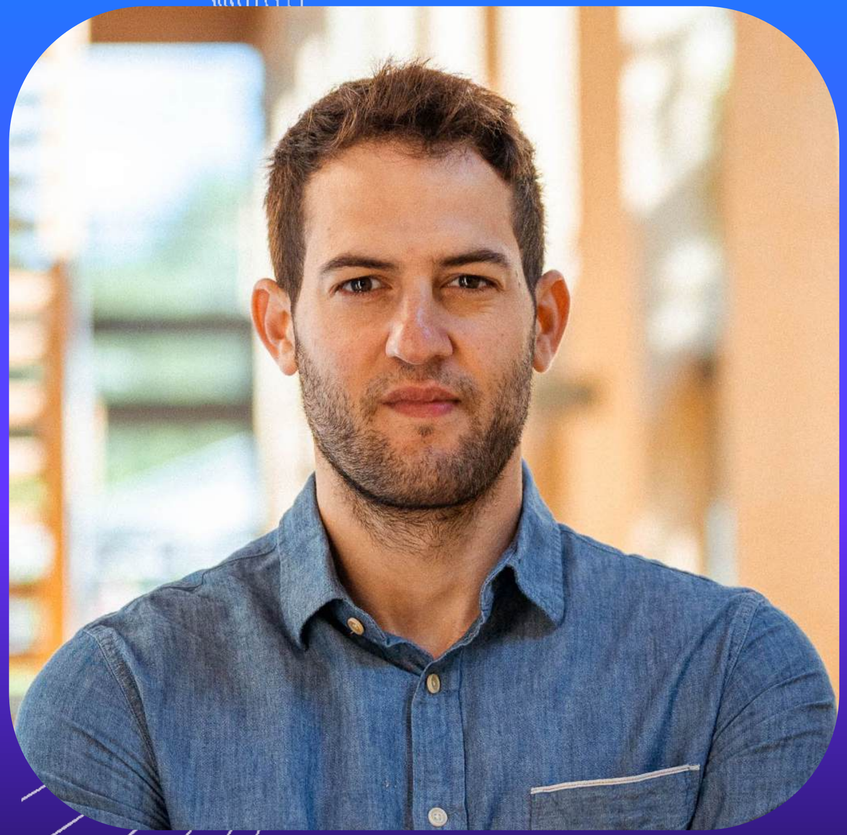
singularity

DEEP
Digital Experience for Executives Program

Mixed Realities and the Enterprise:
Integrating Spatial Computing in Your Business



Aaron Frank

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leisterbüro Band 44

Image: Caddy

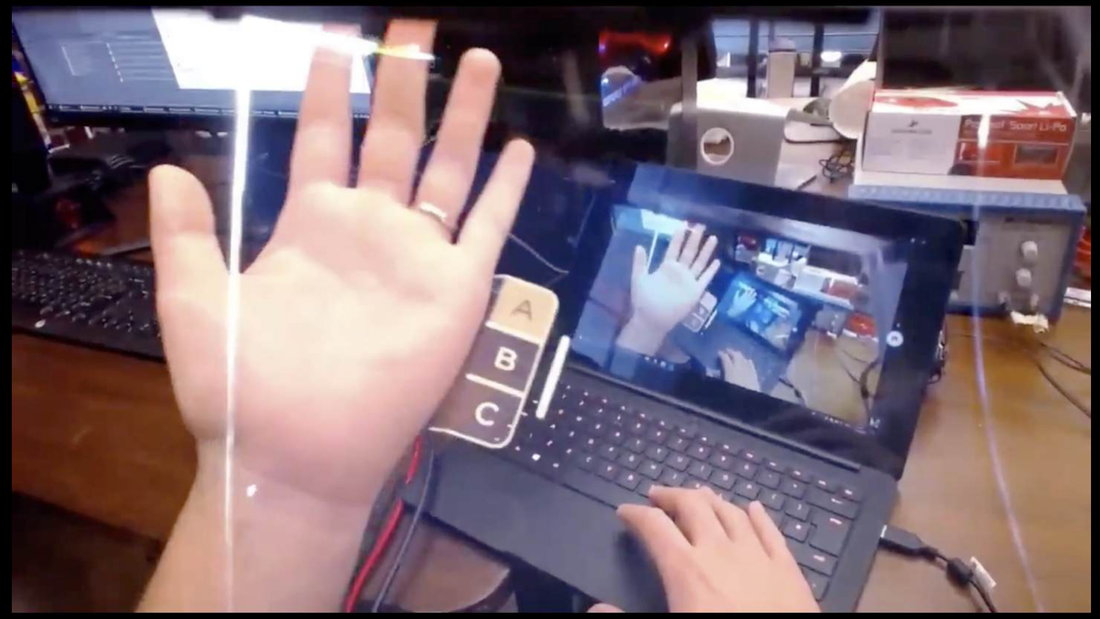
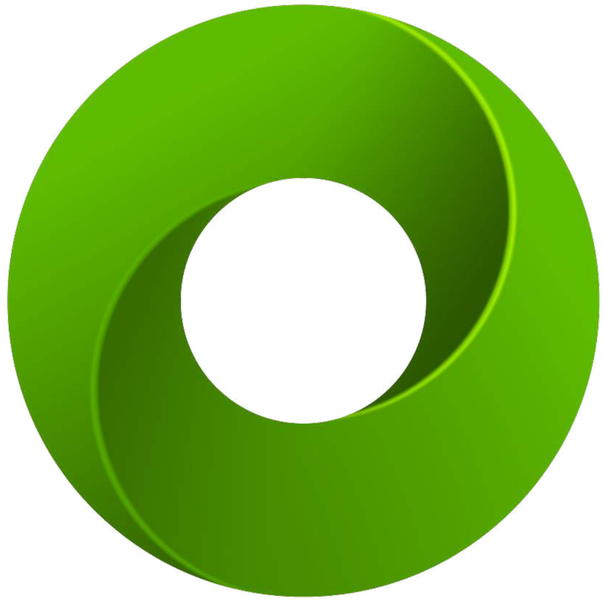


Image: Leap Motion

Image: Siemens

Image: Sony

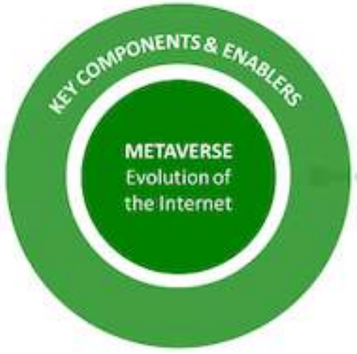


NVIDIA
OMNIVERSE™

the metaverse

THE METAVERSE DEFINED

A HEINEKEN PERSPECTIVE



SPATIAL COMPUTING

From 2D screens, to making use of 3D spaces and other senses

GAME ENGINES

Game engines enabling industrial metaverses

DIGITAL ENVIRONMENTS

Real world AR, immersive online worlds VR

VIRTUAL ECONOMIES

Online economies growing at pace

HEINEKEN

2 WHAT ARE THE MAJOR **FIELDS OF APPLICATION** FOR HEINEKEN?

FIELDS OF APPLICATION FOR HEINEKEN

BUSINESS VALUE ACROSS FUNCTIONS

FIELDS OF METAVERSE BUSINESS APPLICATIONS FOR HEINEKEN

CONSUMER						INDUSTRIAL (DIGITAL TWIN)					COLLABORATION				
BRAND MARKETING	EVENTS	VIRTUAL BARS	SHOPPING	GAMING	ATTRACTIONS	(PREDICTIVE) MAINTENANCE	SIMULATIONS	PRECISION BREWING	OPERATION MANAGEMENT	BUSINESS INTELLIGENCE	EDUCATION & TRAINING	INTERNAL COLLABORATION	EXTERNAL COLLABORATION	RECRUITMENT	ONBOARDING
HEINEKEN SILVER LAUNCH	TIGER STREETFOOD, TECATEVERSE	RESPONSIBLE BAR INDONESIA	DRINKIES, NFTs, TICKETS, MERCHANDISE	LEAGUE OF LEGENDS BRAZIL, F1	HEINEKEN EXPERIENCE					DIGITAL TWIN ITALY BI	BREWERY, OFFICE, CUSTOMERS, UPSKILLING	TIGER TRIBE, GATHER, MS MESH, VIRTUAL BI EXPERIENCE, REMOTE ASSIST	WORLD ECONOMIC FORUM	JOB FAIR KOREA	VR ONBOARDING

the metaverse

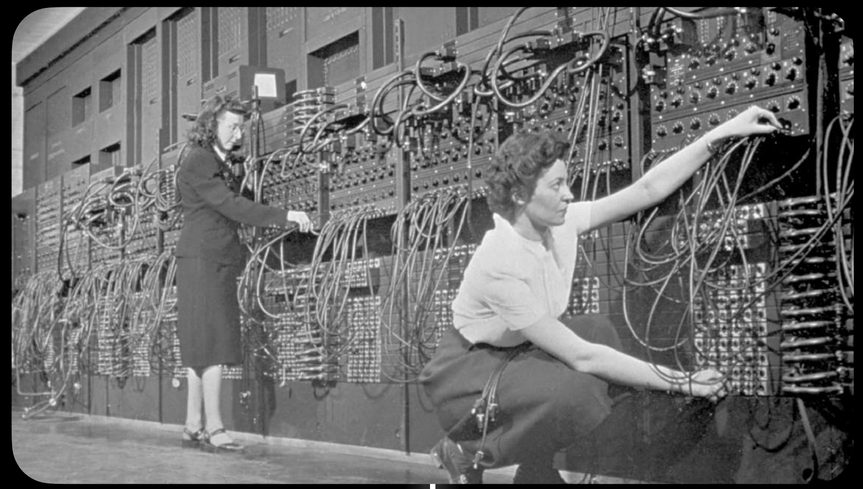
the metaverse

= the internet

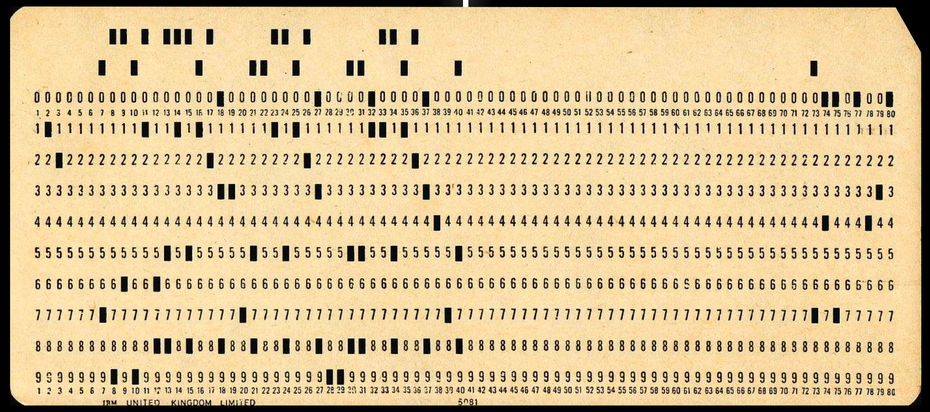
~~the metaverse~~

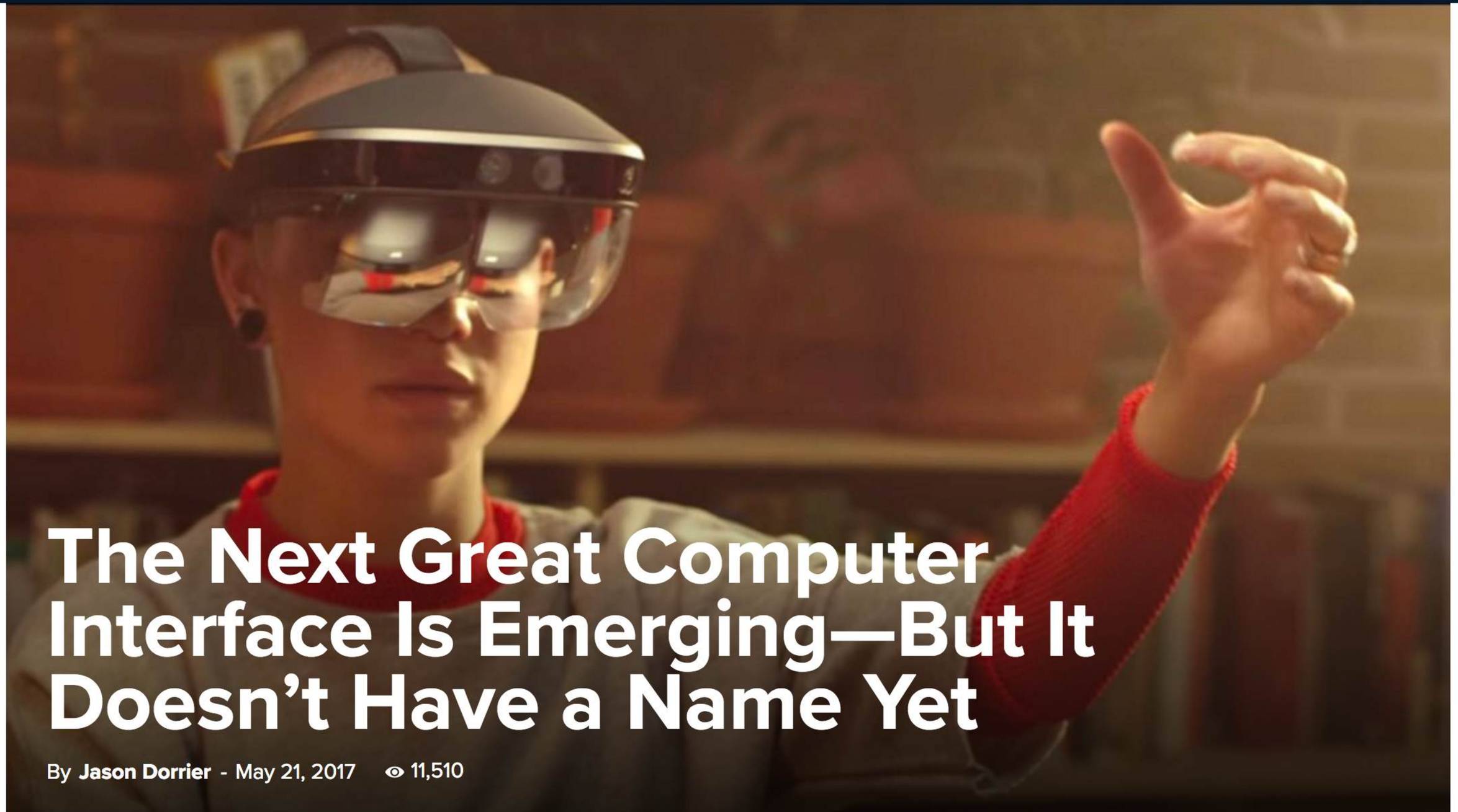
- Spatial Computing
- Game Engines
- Digital Environments
- Virtual Economies

Spatial Computing



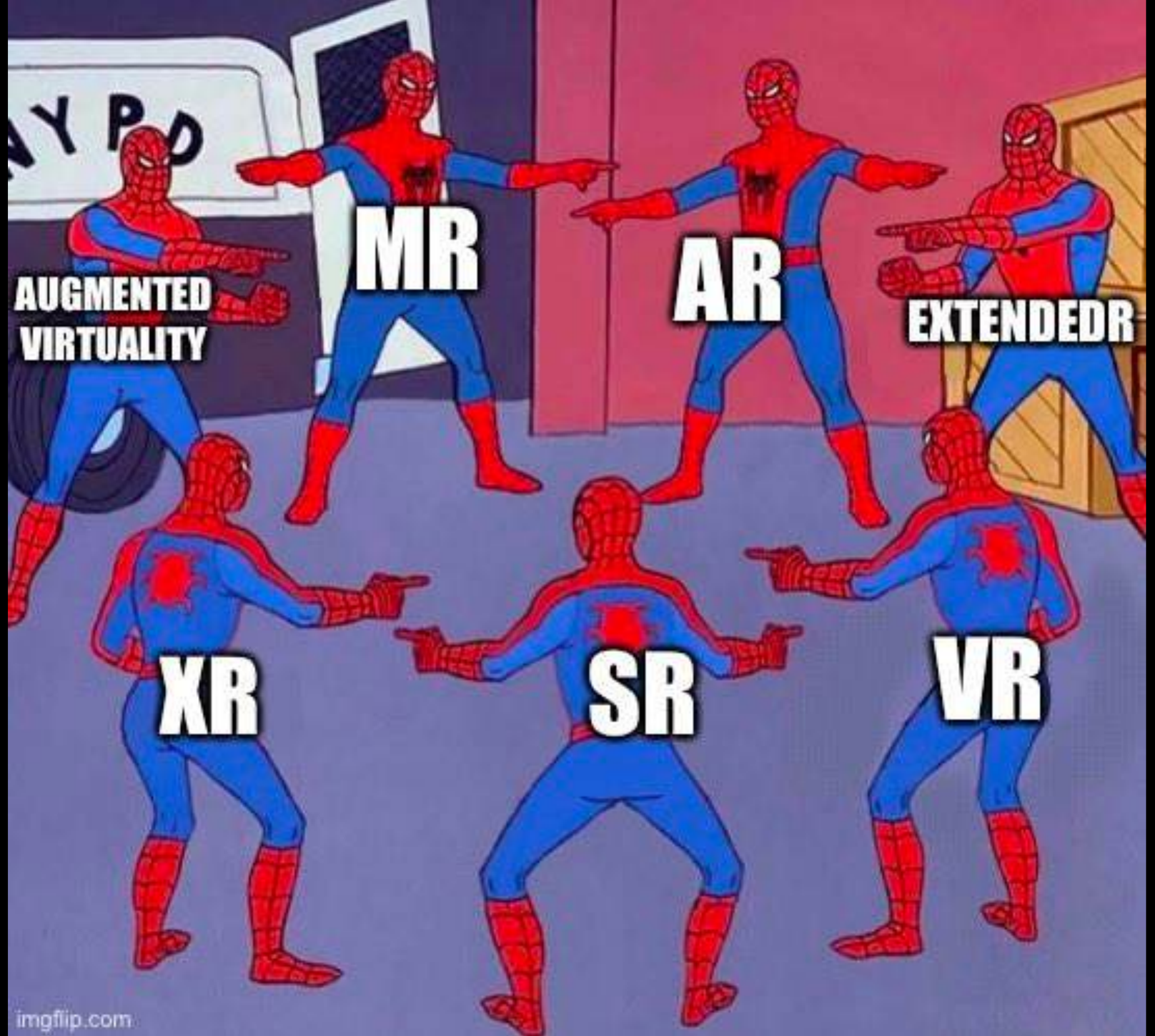
```
Starting MS-DOS...

C:\>_
```





The Next Great Computer Interface Is Emerging—But It Doesn't Have a Name Yet

By **Jason Dorrier** - May 21, 2017 11,510


AUGMENTED
VIRTUALITY
MR
AR
EXTENDEDR
XR
SR
VR
imgflip.com

Spatial Computing

ROAD TOVR

Bell Says Latest Helicopter was Designed 10 Times Faster With VR

By **Leslee Everett** - Nov 2, 2018 20

thyssenkrupp

oculus

VARJO

VUZIX

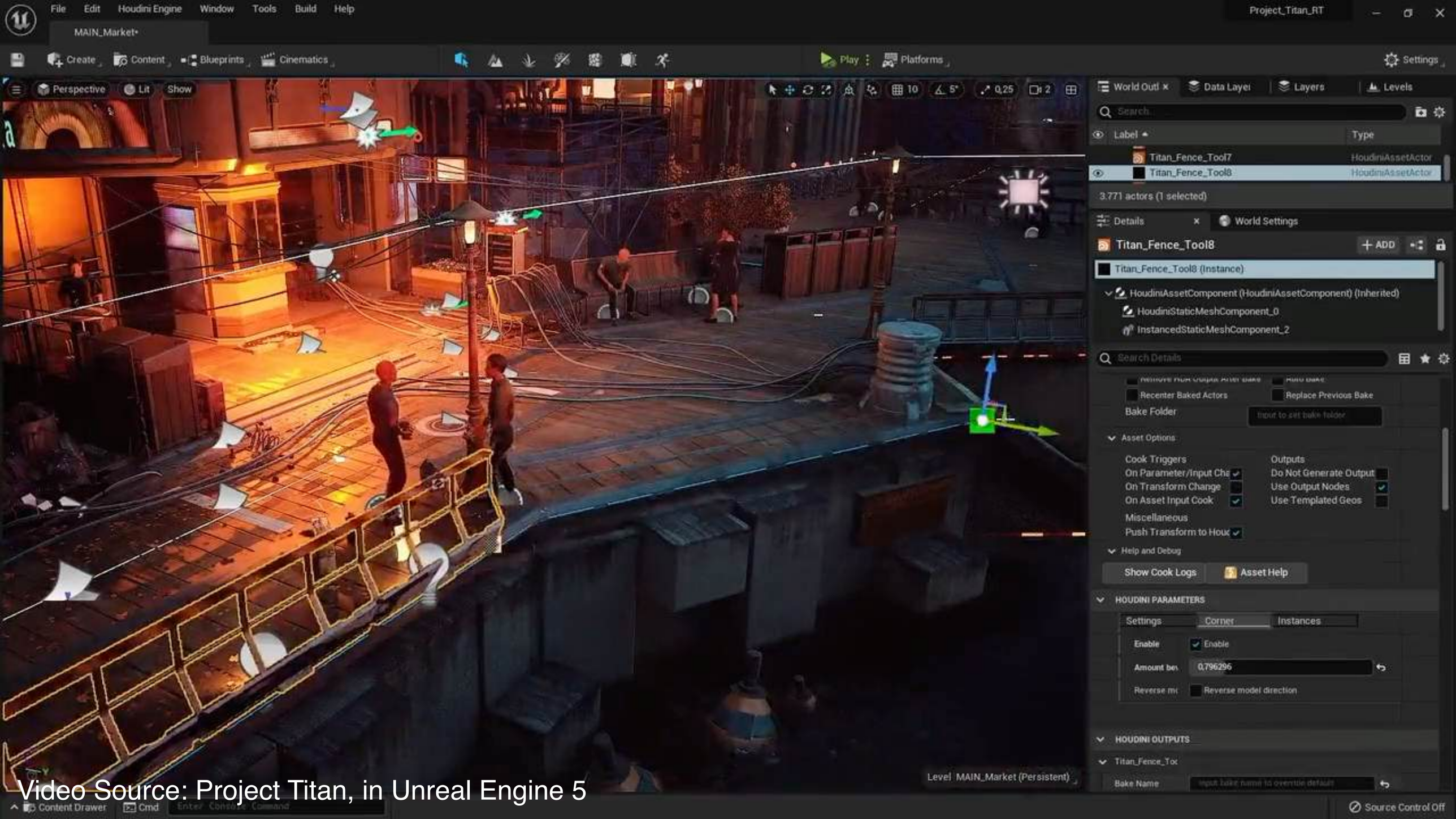
Android XR: The Gemini era comes to headsets and glasses

Dec 12, 2024
3 min read

In partnership with Samsung and Qualcomm, we announced Android XR, a platform to extend your reality to explore, connect and create in new ways.

Spatial Computing
Game Engines
Digital Environments
Virtual Economies

Game Engines



Video Source: Project Titan, in Unreal Engine 5

Rivian launches 2nd gen R1 electric vehicles using Unreal Engine for dashboard

Dean Takahashi

@deantak

June 6, 2024 9:00 AM

Digital Twins

Spatial Interface

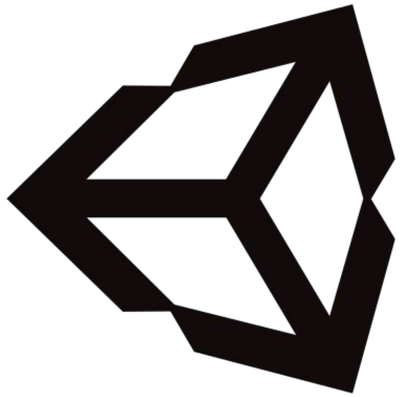
Live Data
(Sensors)

AI and Machine Learning

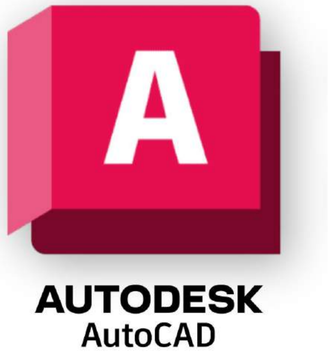
Spatial Interface

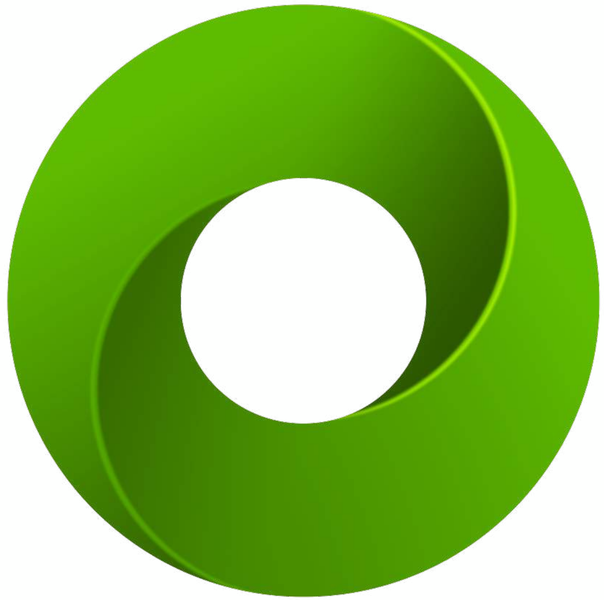
Video Source: Vouse, Changi Airport (Singapore) Digital Twin

UNREAL
ENGINE



unity



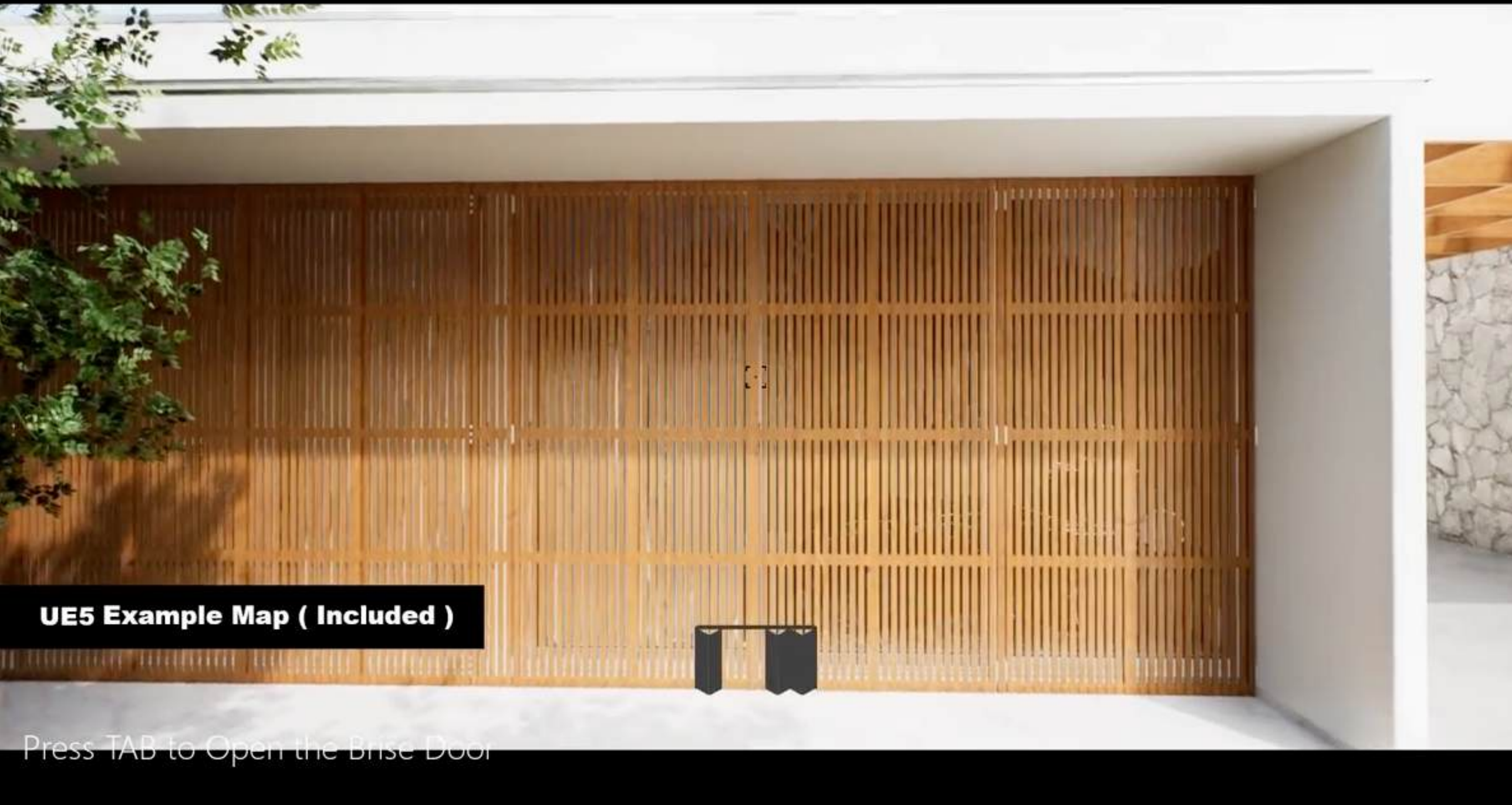


NVIDIA
OMNIVERSE™

AUTODESK®
MAYA®

LOWE'S
74
74
89
89
119
54

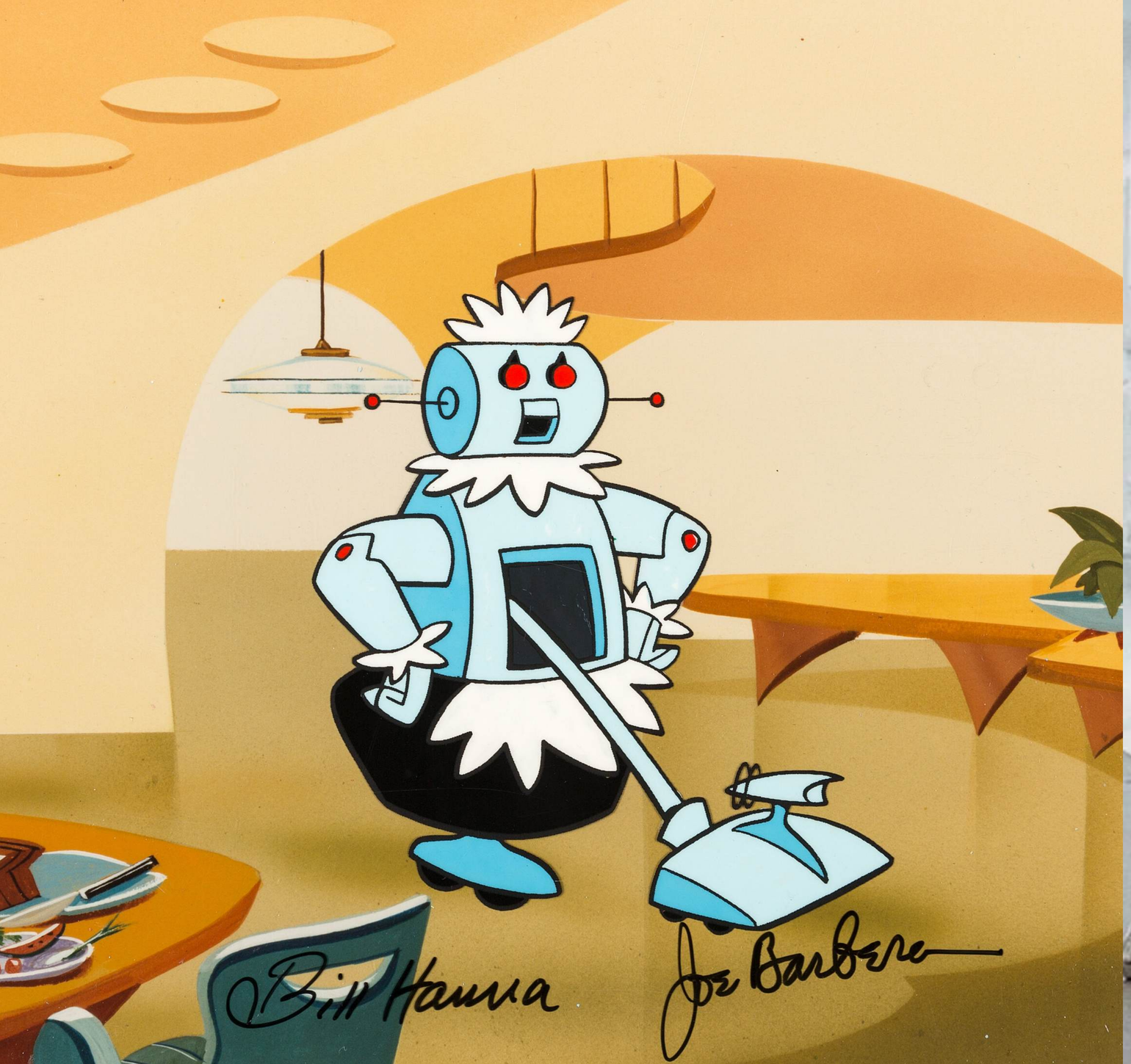
PROJECT SOURCE
Vanity Base
Base de tocador
Tops sold separately
279
349
$39
$39

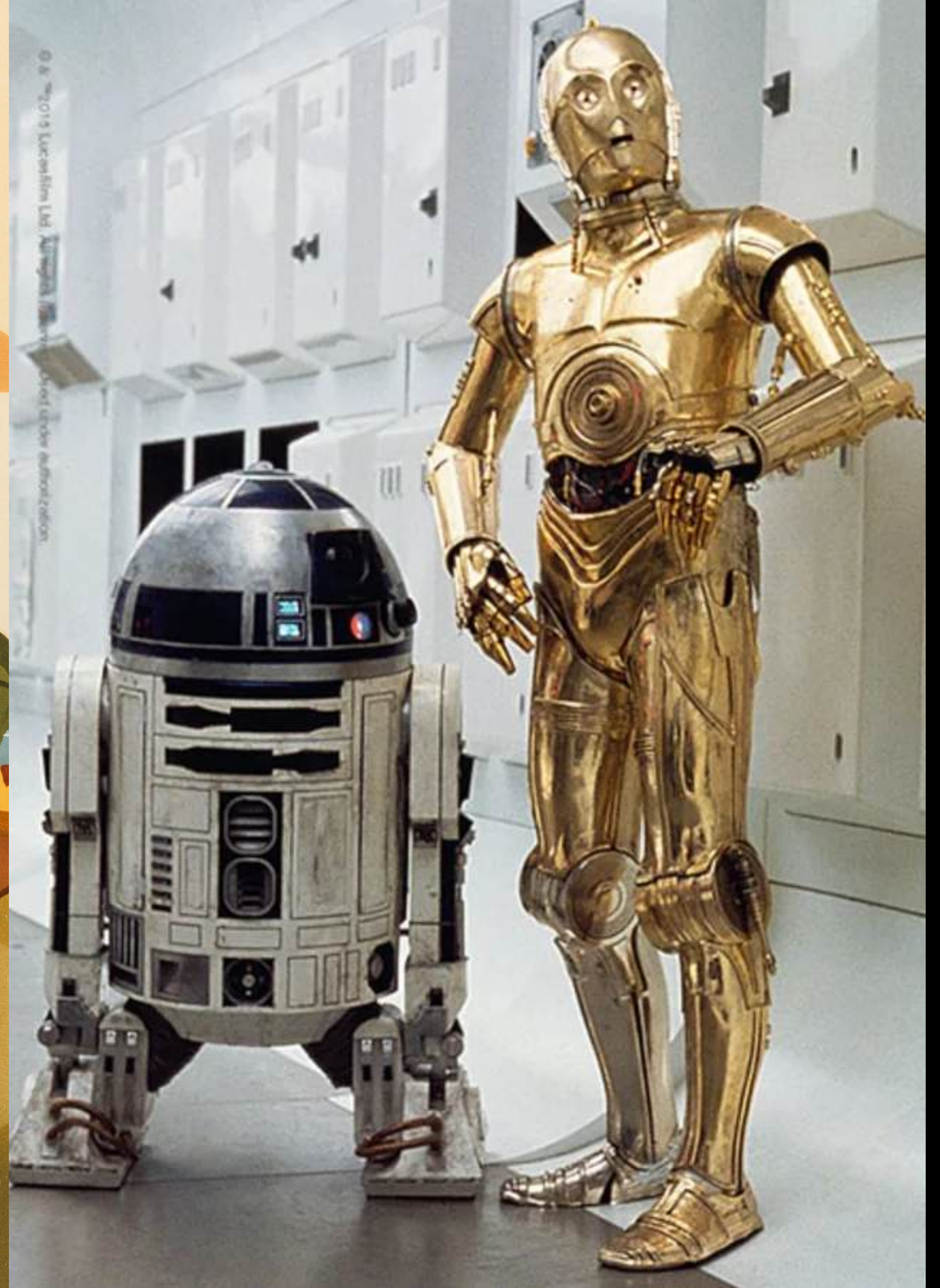

UE5 Example Map (Included)
Press TAB to Open the Brise Door

NVIDIA

NVIDIA DRIVE Sim

Powered By Omniverse


Bill Hanna
Joe Barbera



Computers that move

Agriculture

Autonomous Tractor

JOHN DEERE

Transportation

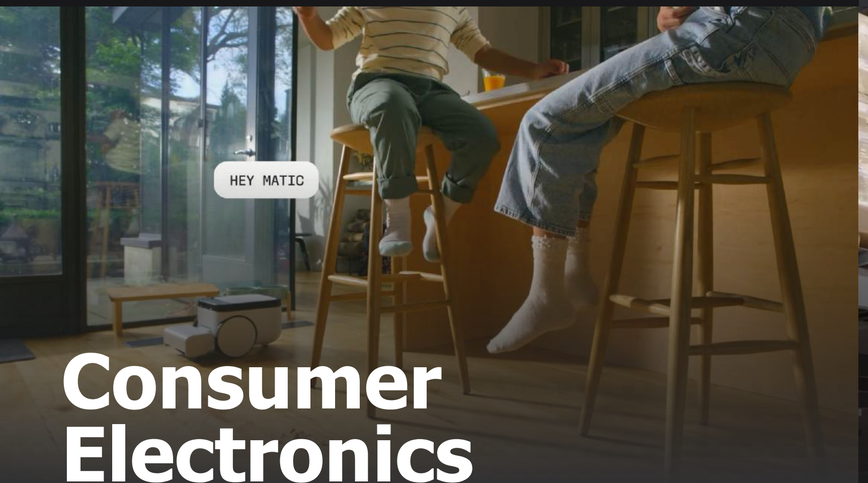
Flying Taxi

EHANG | 亿航

Automotive

Autonomous Vehicle

[redacted]



Consumer Electronics

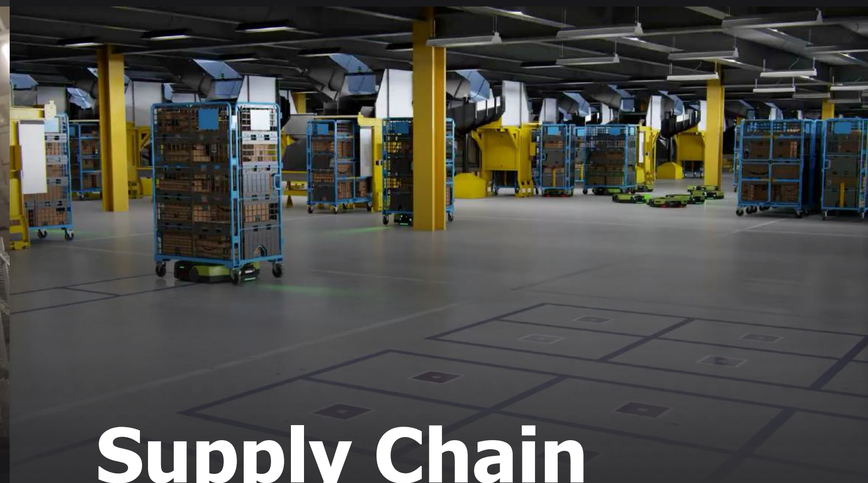
Vacuum Cleaner

Matic

Retail

Verity Inventory Drone

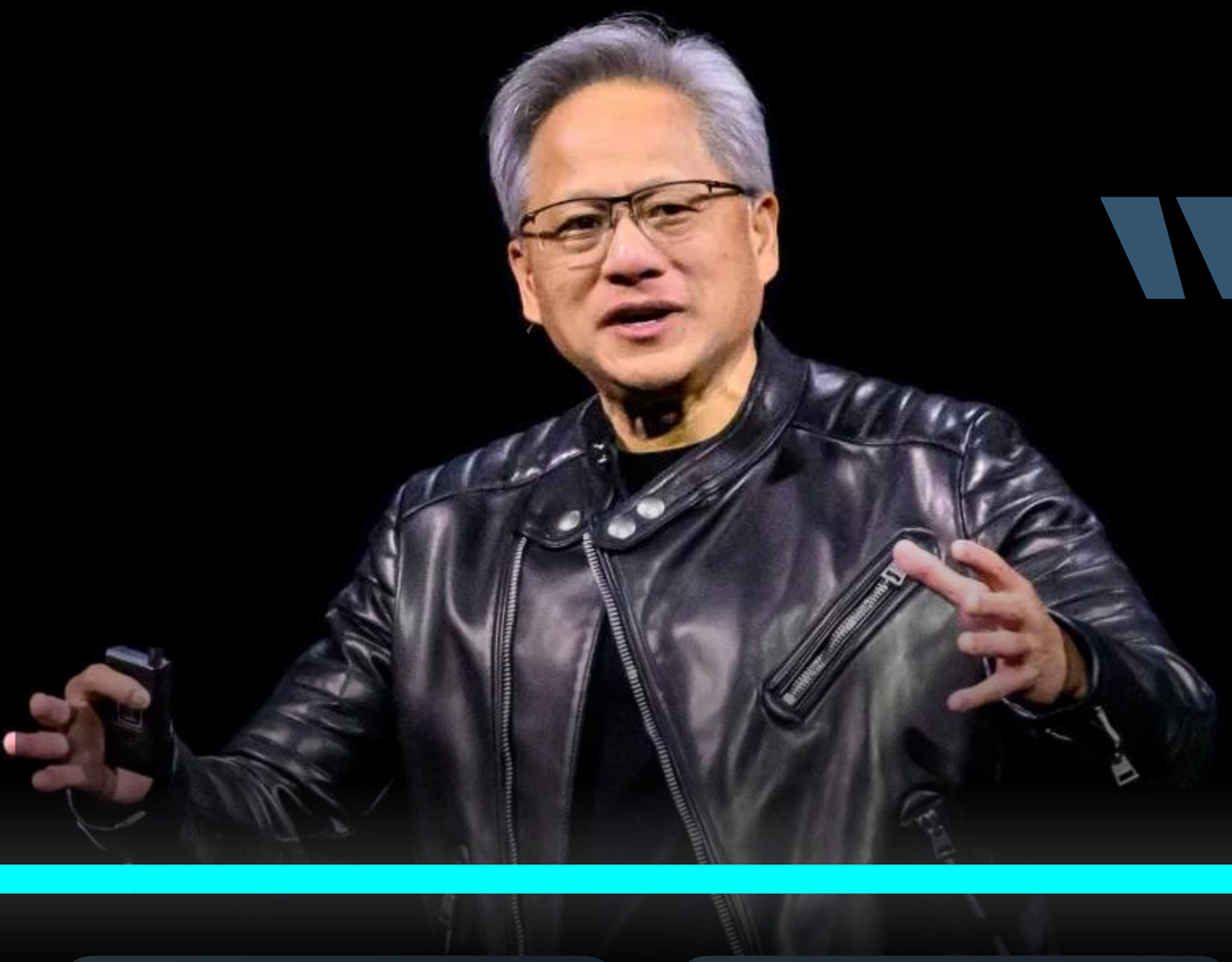
IKEA



Supply Chain

Warehouse AMR

amazon



In the Future, anything that moves will be autonomous.

Jensen Huang, CEO, NVIDIA

- Delivery Robots
- Farmerless Tractors
- Warehouse AMRs
- Industrial Robots
- Inventory Drones
- Autonomous Cars
- Humanoid Robots
- Guided Vehicles

bscribe and save 50%.

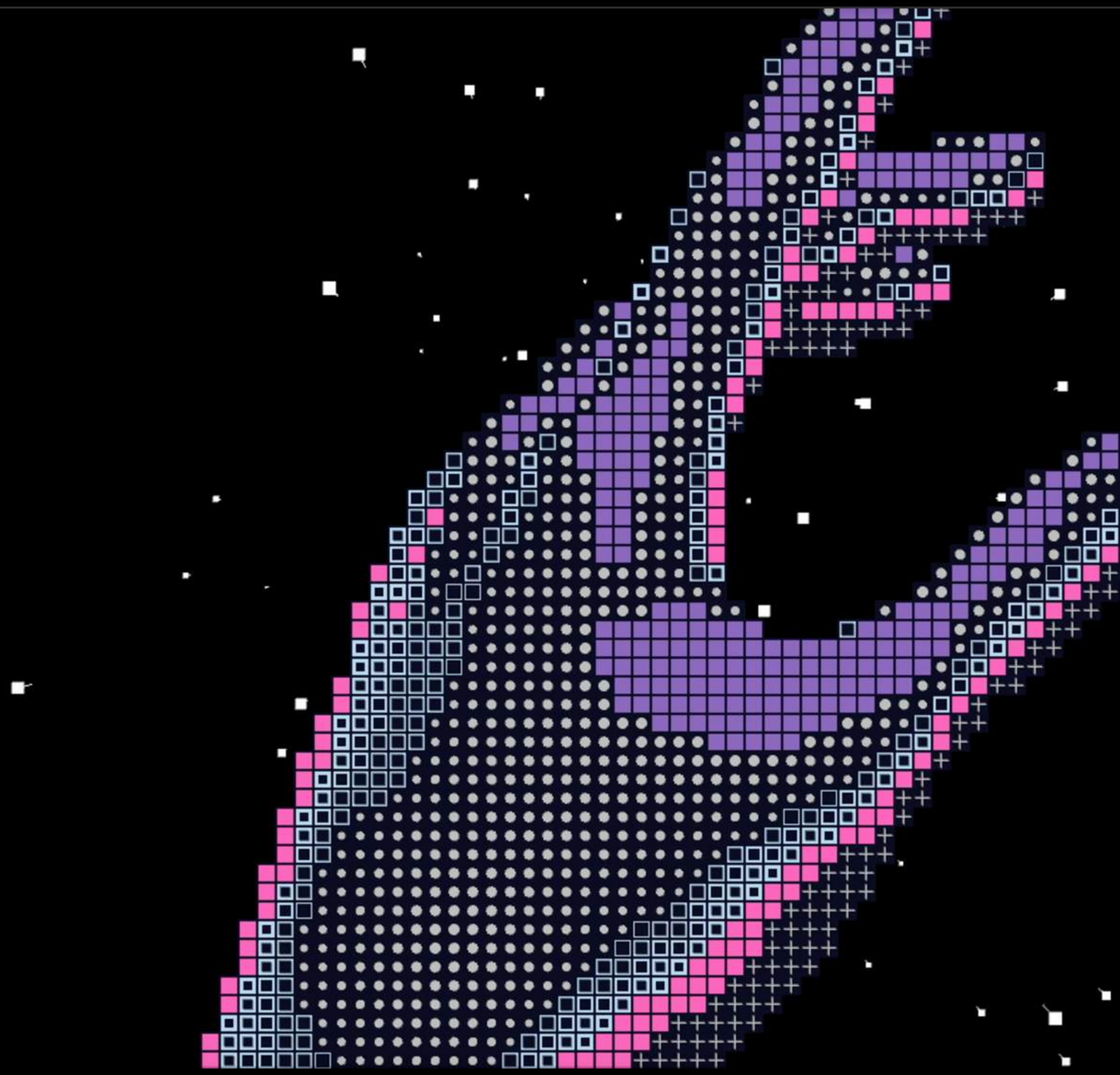
BRAVE NEW WORLD DEPT.

A REVOLUTION IN HOW ROBOTS LEARN

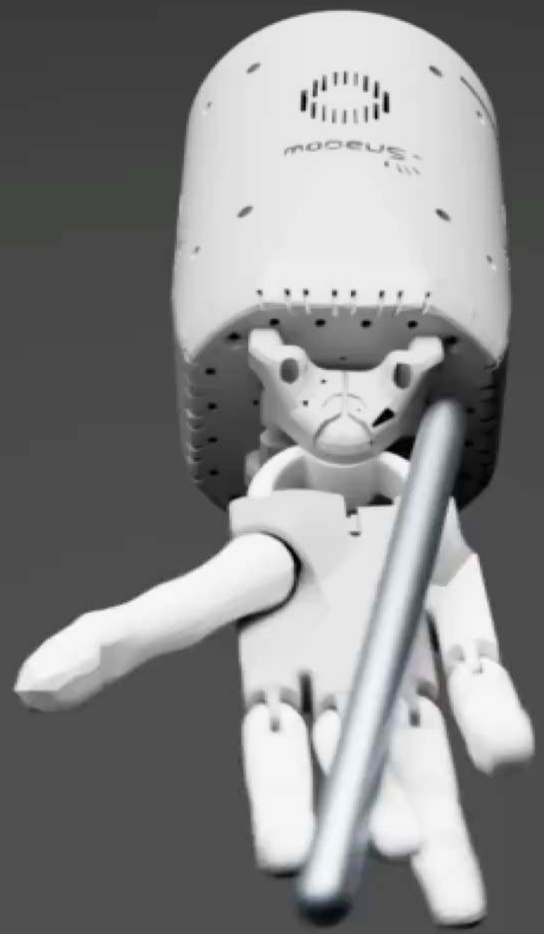
A future generation of robots will not be programmed to complete specific tasks. Instead, they will use A.I. to teach themselves.

By James Somers

November 25, 2024



Eureka



Environment Code

```
class ShadowHandPenSpin(VecTask):
  def compute_observations(self):
    self.obj_pose = ...
    self.obj_pos = ...
    self.obj_rot = ...
    self.obj_linvel = ...
    self.obj_angvel = ...

    self.tgt_pose = ...
    self.tgt_pos = ...
    self.tgt_rot = ...

    self.fingertip_state = ...
    self.fingertip_pos = ...

    self.compute_full_state()

  def compute_full_state(self):
    ...
```

Task Description

To make the shadow hand spin the pen to a target orientation

Environment Code

```
class ShadowHandPenSpin(VecTask):
  def compute_observations(self):
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    self.fingertip_pos = ...

    self.compute_full_state()

  def compute_full_state(self):
    ...
```

Task Description

To make the shadow hand spin the pen to a target orientation

Coding LLM (GPT 4)

Reward Candidate Sampling

```
def compute_reward(
  obj_rot, obj_angvel, ...
):
  ...
  # Angular velocity penalty
  av_norm = torch.norm(obj_angvel)
  av_penalty = torch.where(
    av_norm > 2.0,
    torch.exp(av_norm - 2.0)
  )
  ...
```

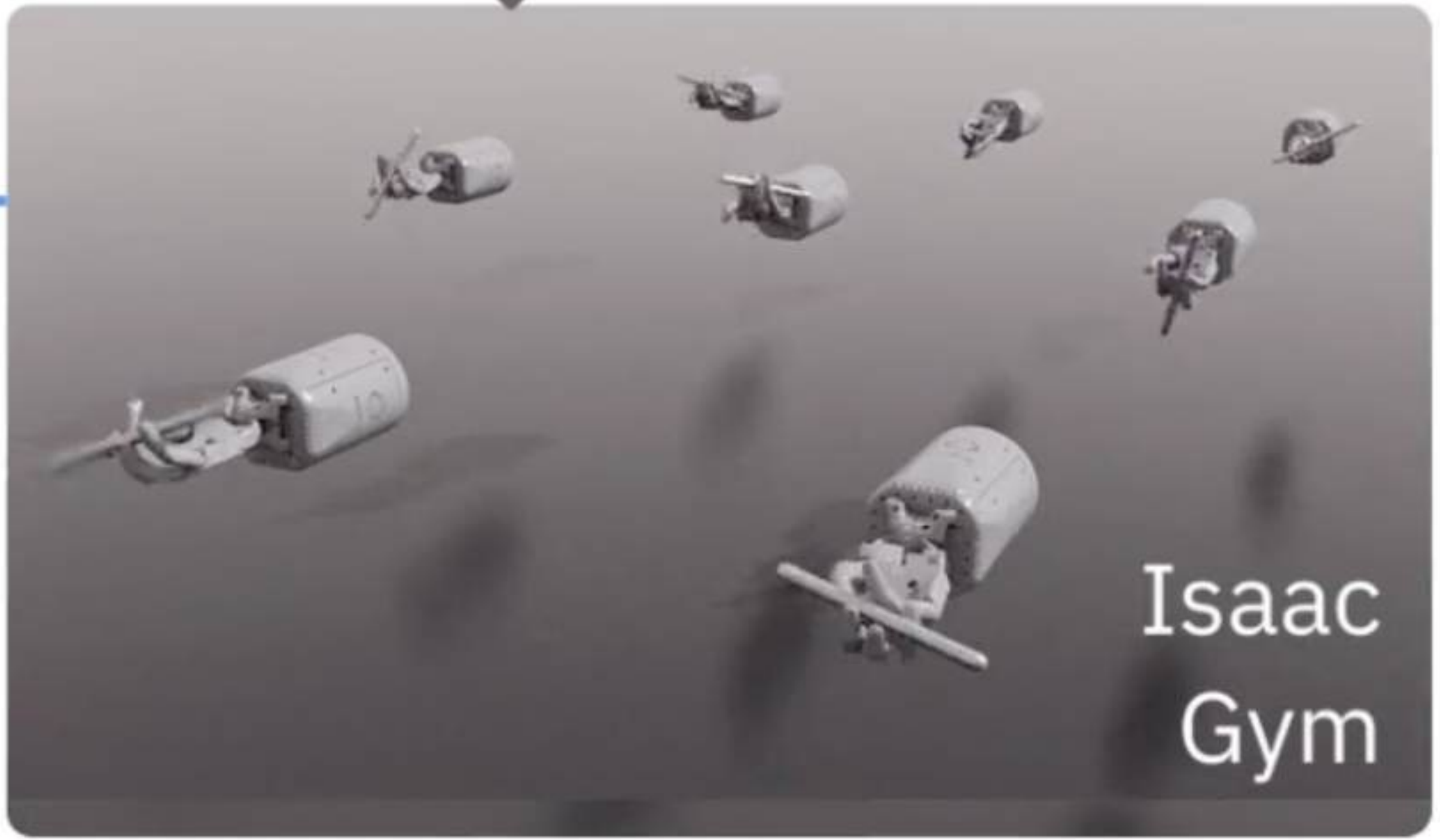
GPU-Accelerated RL

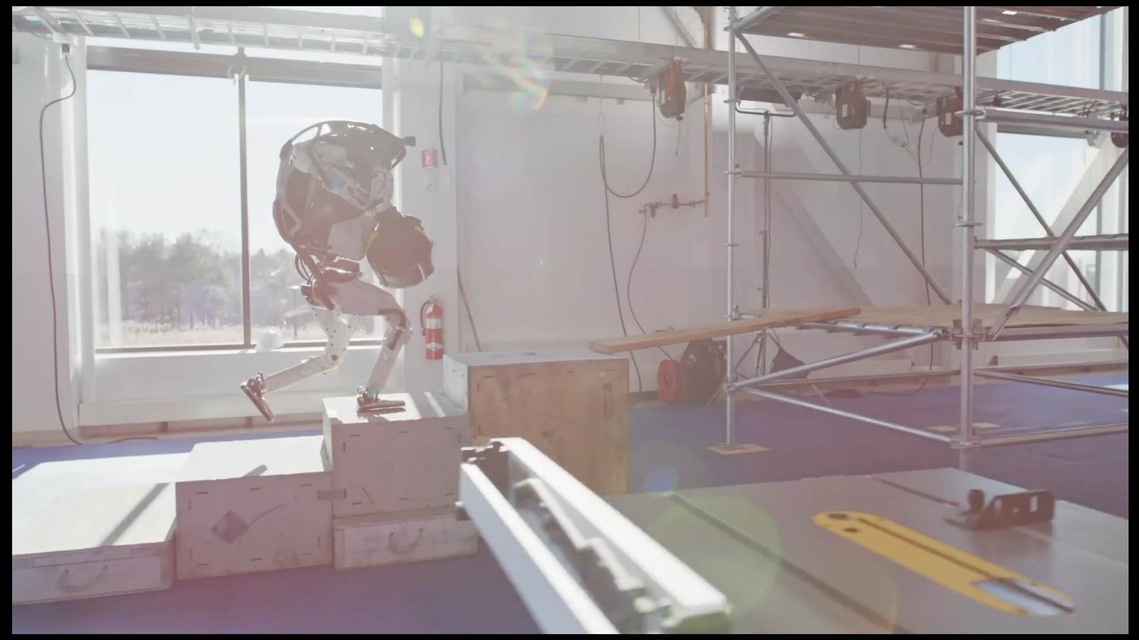
Reward Reflection

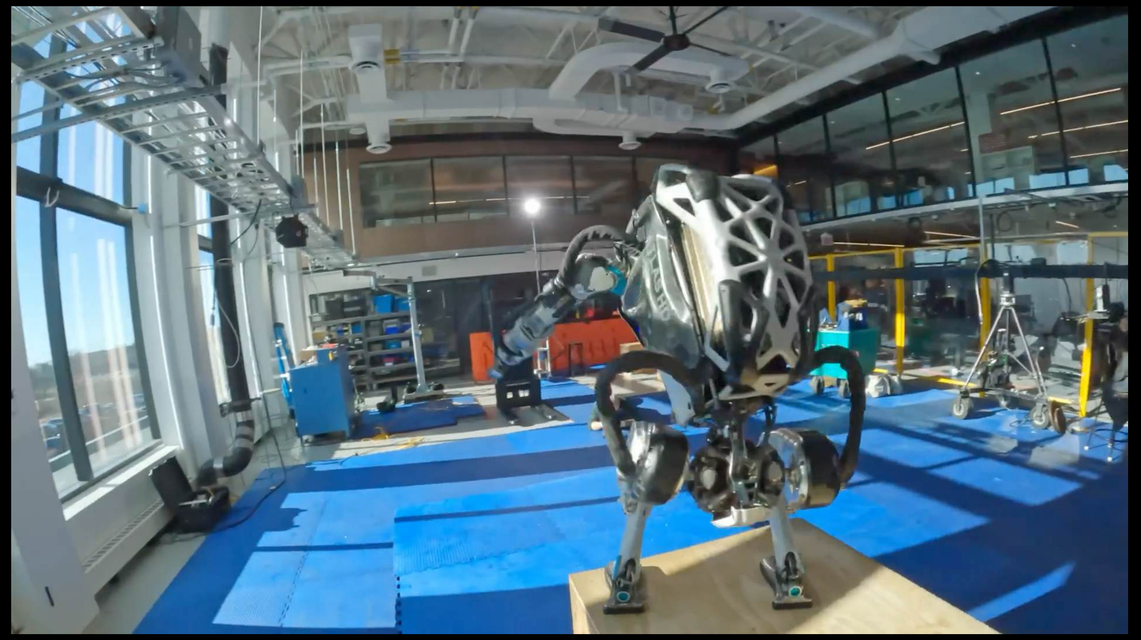
We trained a RL policy using the provided reward function code...
av_penalty: ['0.02', '0.05', '0.05', '0.04', '0.03', ...]
success_rate: ['0.00', '0.38', '1.57', '3.01', '3.95', ...]
Please carefully analyze the policy feedback and provide a new, improved reward function...

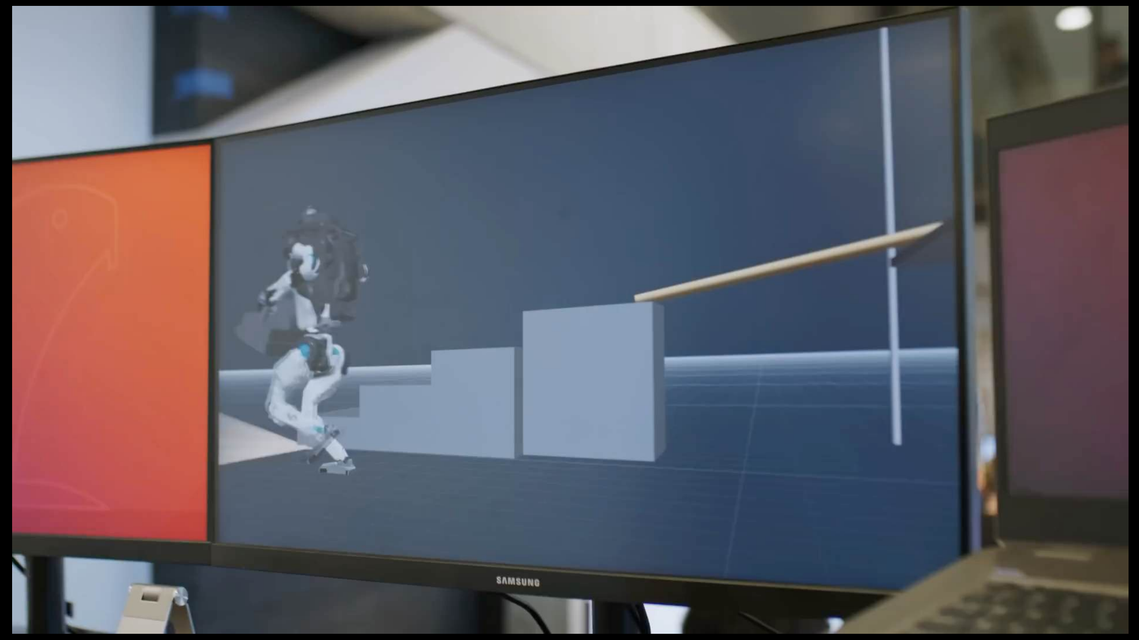
Query with Feedback

Eureka


Isaac
Gym





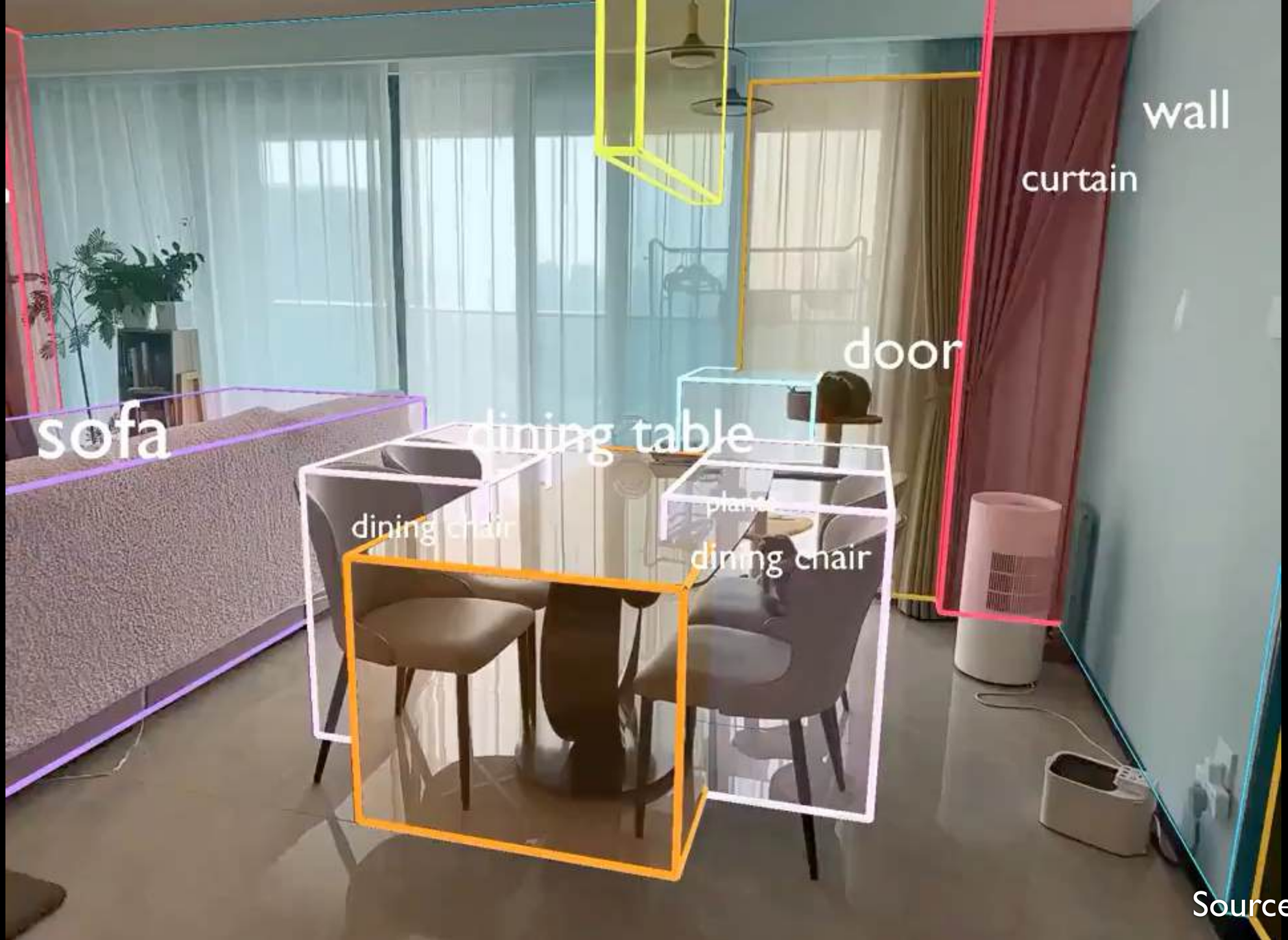


Source: Boston Dynamics

Fully Autonomous

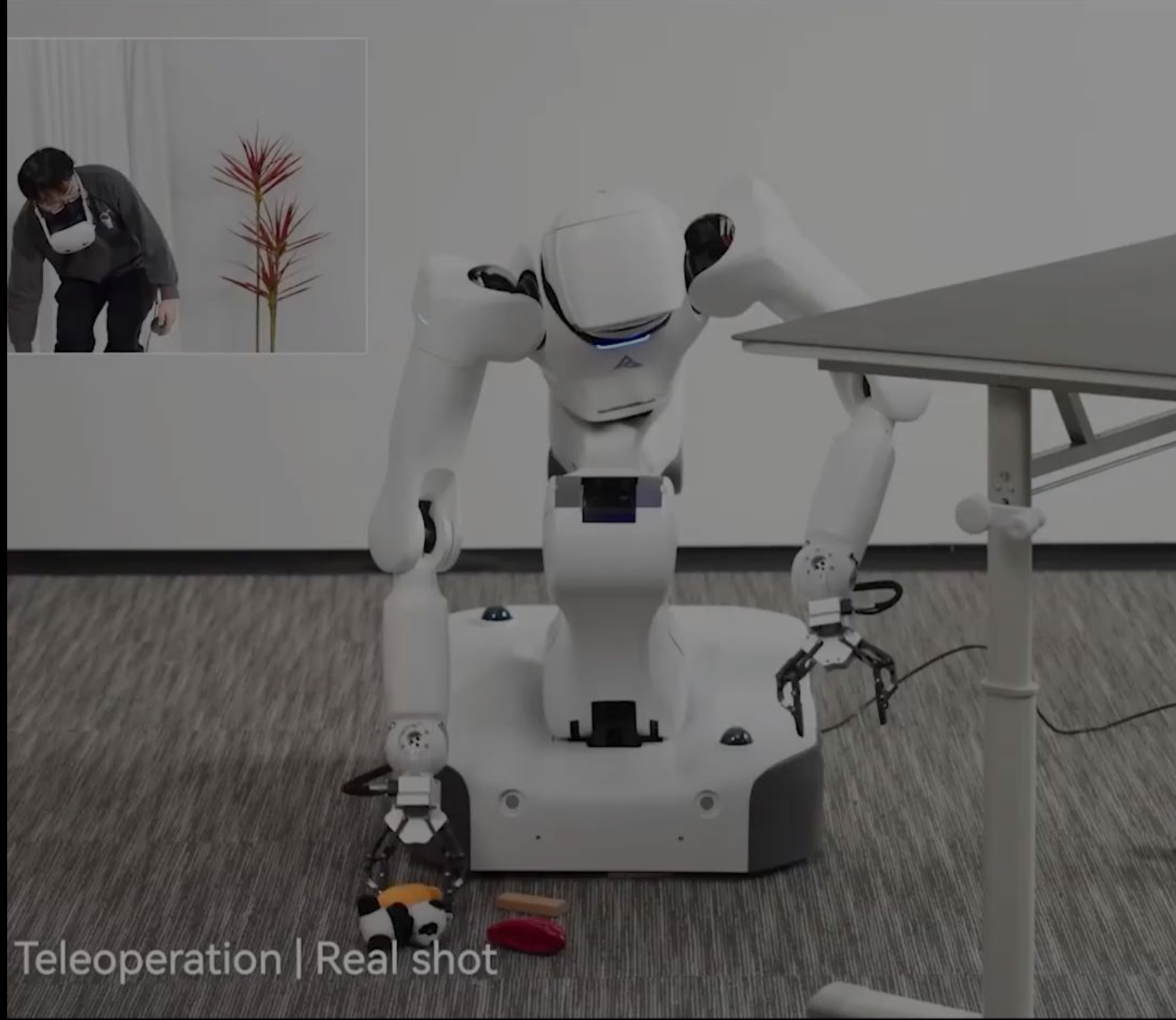
Source: Boston Dynamics

Spatial Intelligence



Source: SpatialLM

Imitation Learning



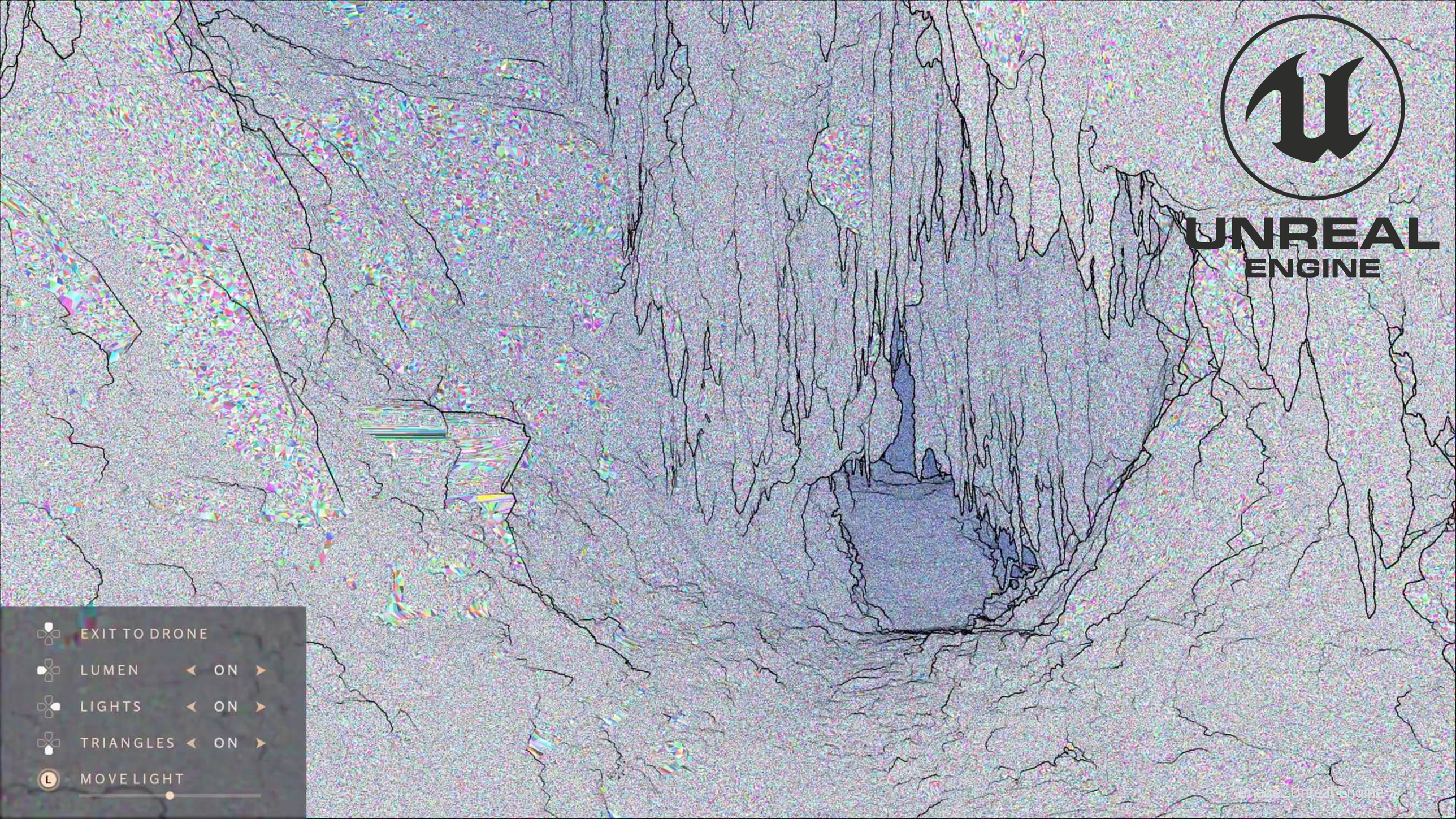
Source: Astribot

Image: TESLA

Reinforcement Learning

Image: NVIDIA, Isaac Gym

Source: Boston Dynamics


UNREAL
ENGINE
EXIT TO DRONE
LUMEN ON
LIGHTS ON
TRIANGLES ON
L MOVE LIGHT

unity lighting clinic

Ray Tracing

Monsters University, 2013

Real-Time

Ray Tracing

2018, NVIDIA, RTX Series GPUs

Image: Unreal Engine 5

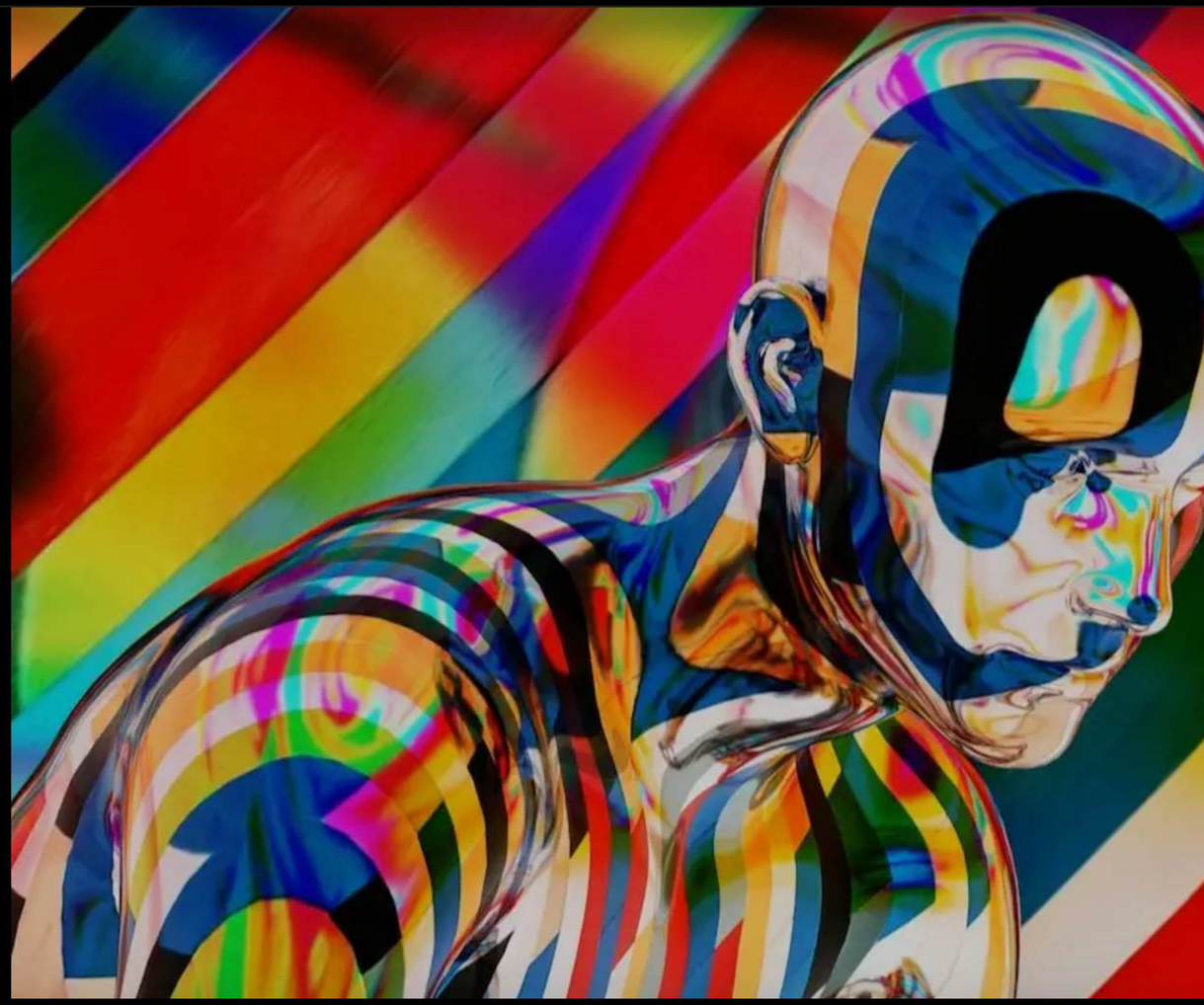
World Models

ROBOTICS

A ChatGPT Moment Is Coming for Robotics. AI World Models Could Help Make It Happen.

Robots need an internal representation of the world and its rules like ours.

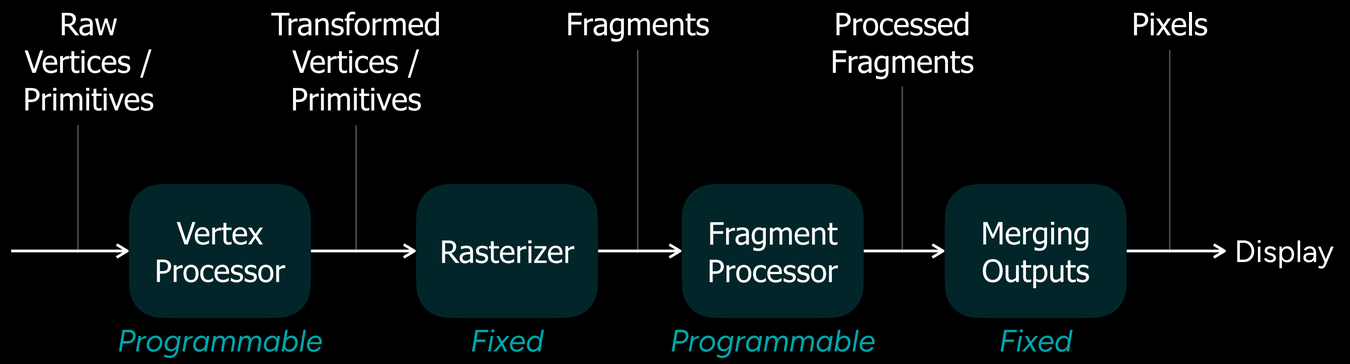
Aaron Frank • Jan 13, 2025



Every single pixel in a video game is going to be generated. Not rendered.

Jensen Huang, CEO, NVIDIA

rendered


Raw Vertices / Primitives
Transformed Vertices / Primitives
Fragments
Processed Fragments
Pixels
Vertex Processor
Rasterizer
Fragment Processor
Merging Outputs
Display
Programmable
Fixed
Programmable
Fixed

Every single pixel in a video game is going to be generated. Not rendered.

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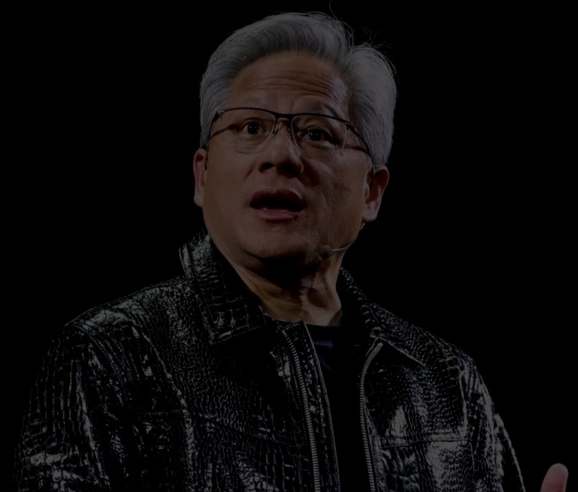
generated



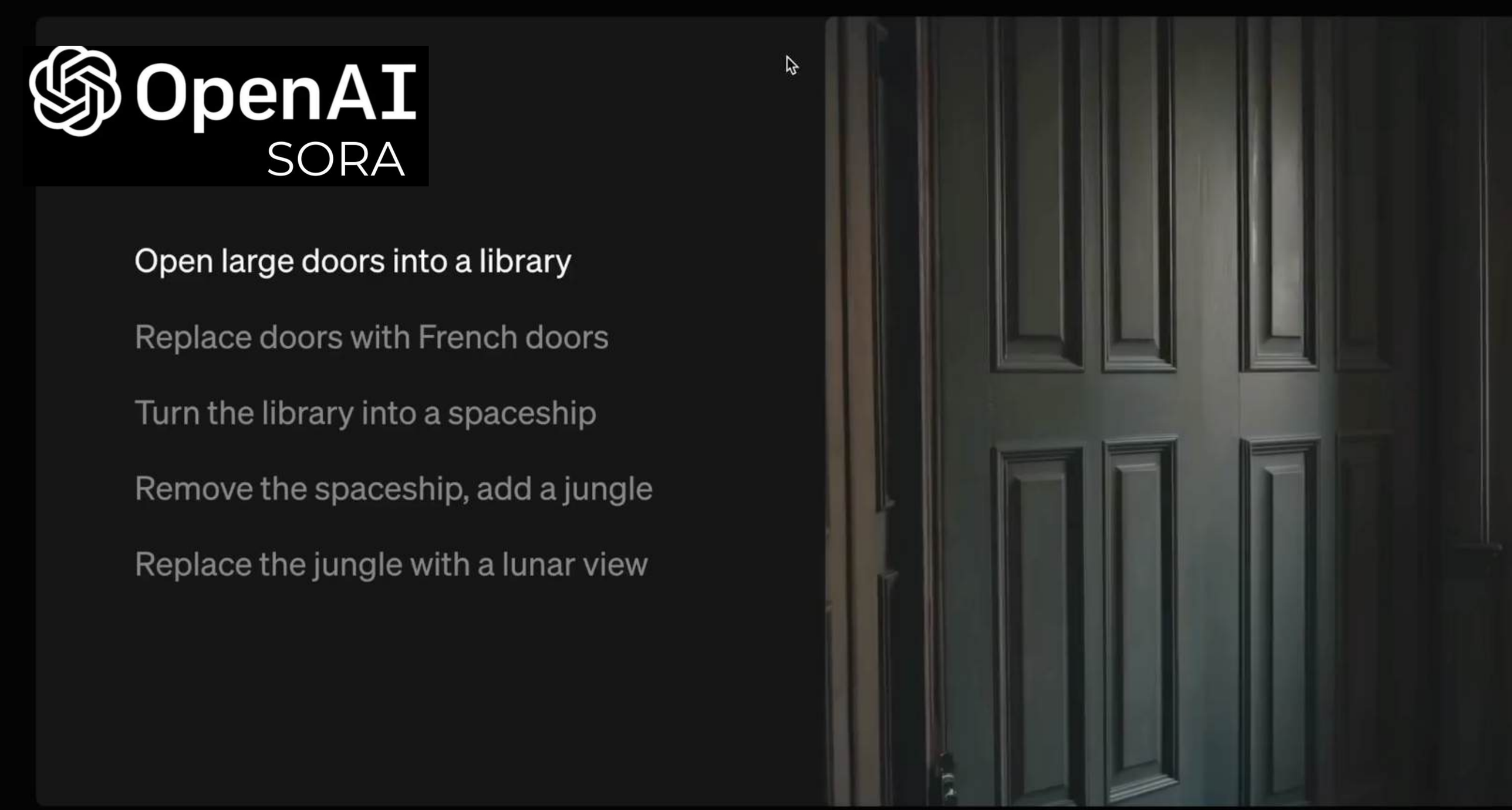


Image: Two Minute Papers

Q W E
A S D
↑
← ↓ →

Experience | Model Card

Input

World creation mode

Text-to-World
Generate a video using text prompts.

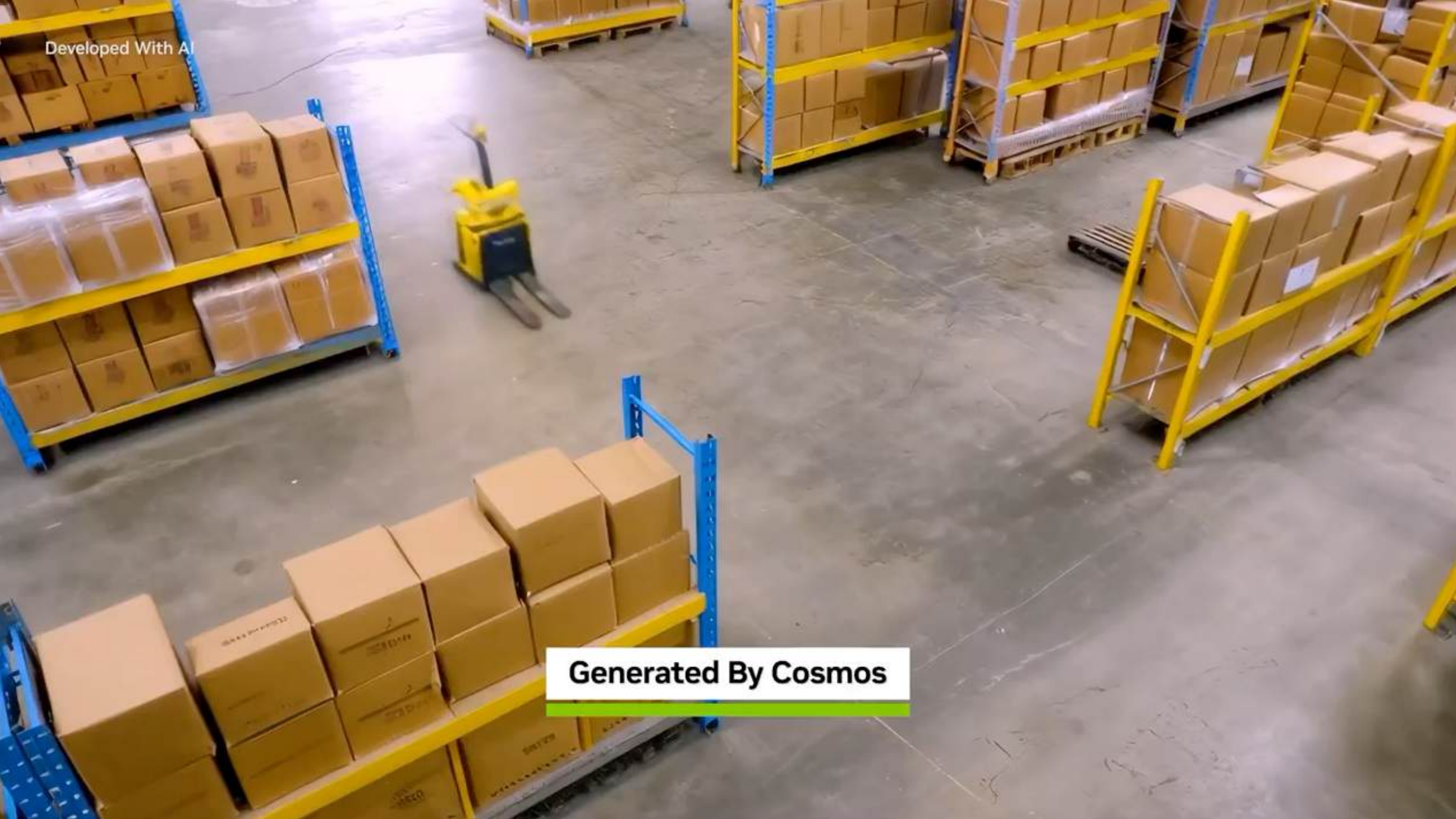
Image-to-World
Generate a video using text and image prompts.

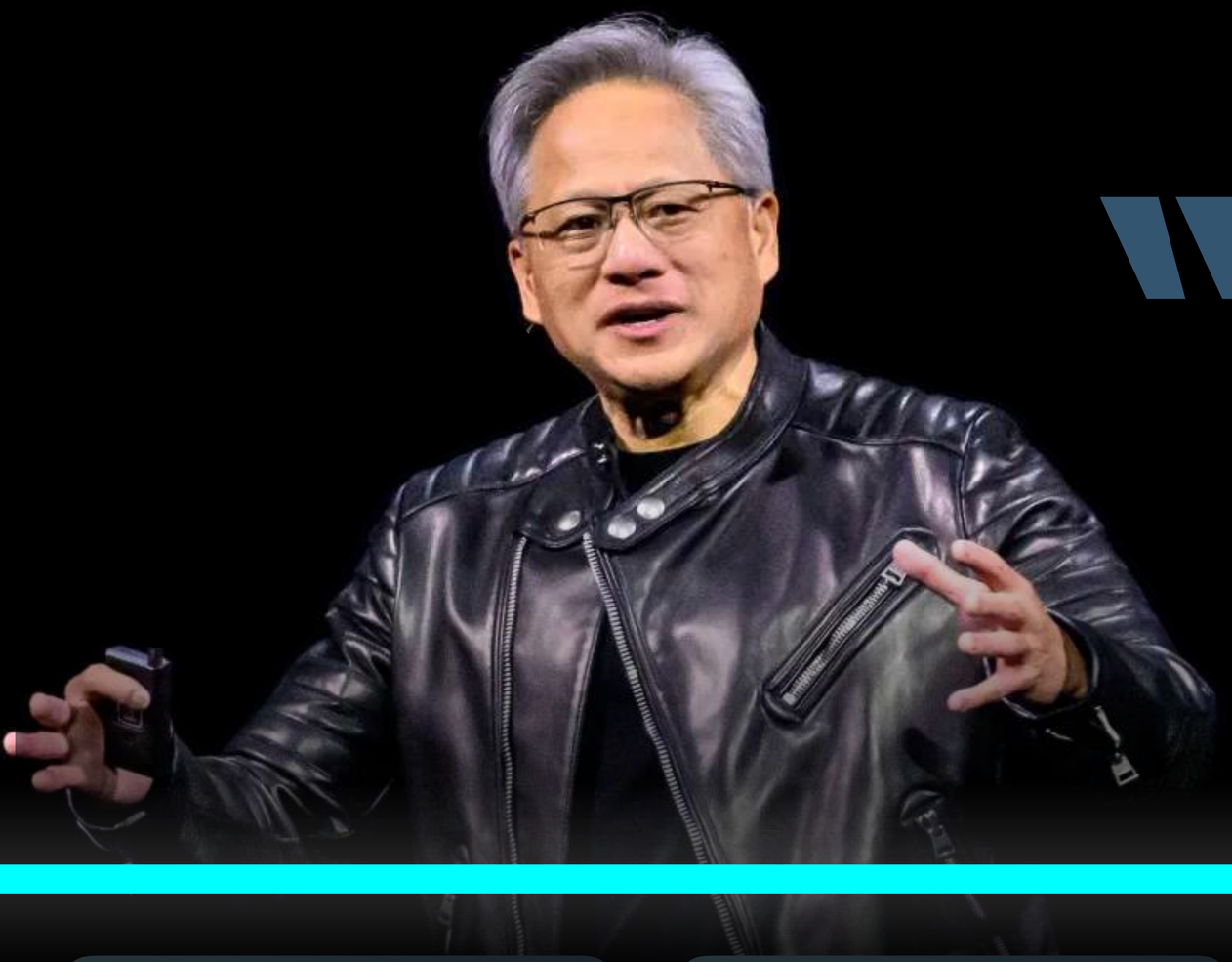
Prompt ⓘ View Examples

A first person view from the perspective from a human sized robot as it works in an old factory. The robot has many industrial machines nearby in the old factory. The floor is old, wooden, worn and full of rich texture. The camera pans right, at a height of 2m above the floor. Photorealistic

Reset Quit Task

48 / 50 requests remaining


Developed With AI
Generated By Cosmos



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- Delivery Robots
- Farmerless Tractors
- Warehouse AMRs
- Industrial Robots
- Inventory Drones
- Autonomous Cars
- Humanoid Robots
- Guided Vehicles

Things that Drive

Things that Fly

Things that Walk

Things that Drive

NVIDIA

NVIDIA DRIVE Sim

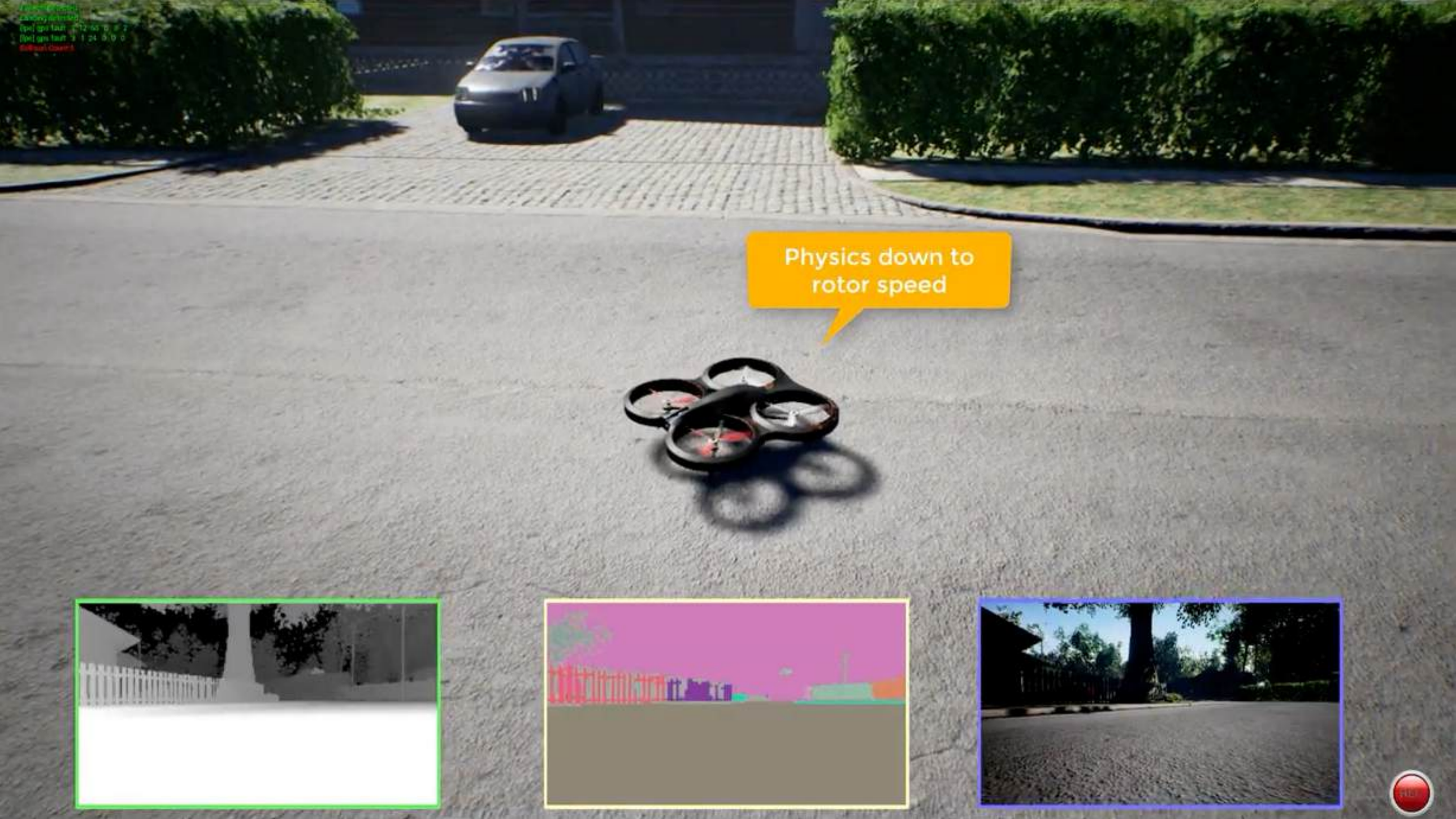
Powered By Omniverse

JOHN DEERE
JOHN DEERE
410
8R

Omniverse

HUAWEI
XCMG
AUTONOMOUS MINING TRUCK
徐工集团
055
035

Things that Fly


Physics down to
rotor speed

IKEA / TECH / DRONES

Ikea's stock-counting warehouse drones will fly alongside workers in the US

By Emma Roth, a news writer who covers the streaming wars, consumer tech, crypto, social media, and much more. Previously, she was a writer and editor at MUO.

Aug 16, 2024, 2:53 PM GMT+1

Image: Zipline

Image: Zipline Droneport, Mesquite Texas

Image: @TheGarretScott

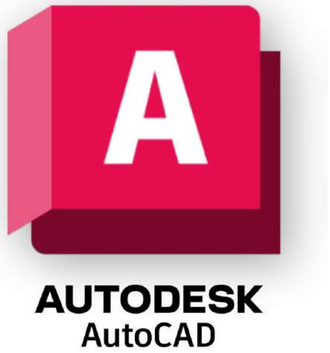
Image: Zipline

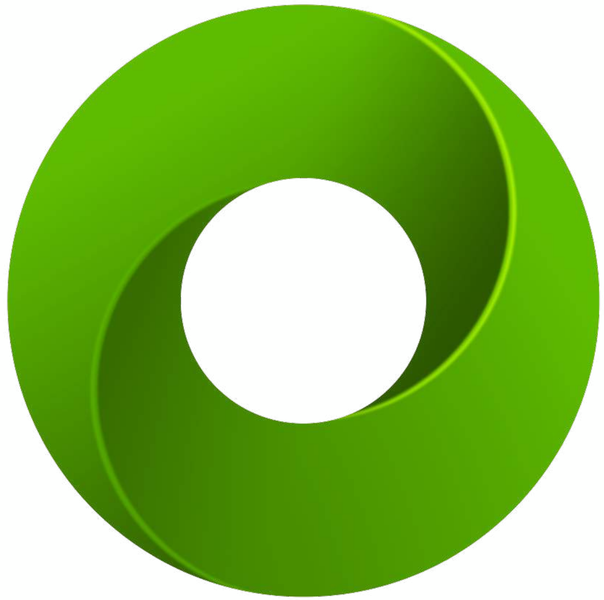
Things that Walk

Fully Autonomous

Source: Boston Dynamics

Image: Brian Roemmele





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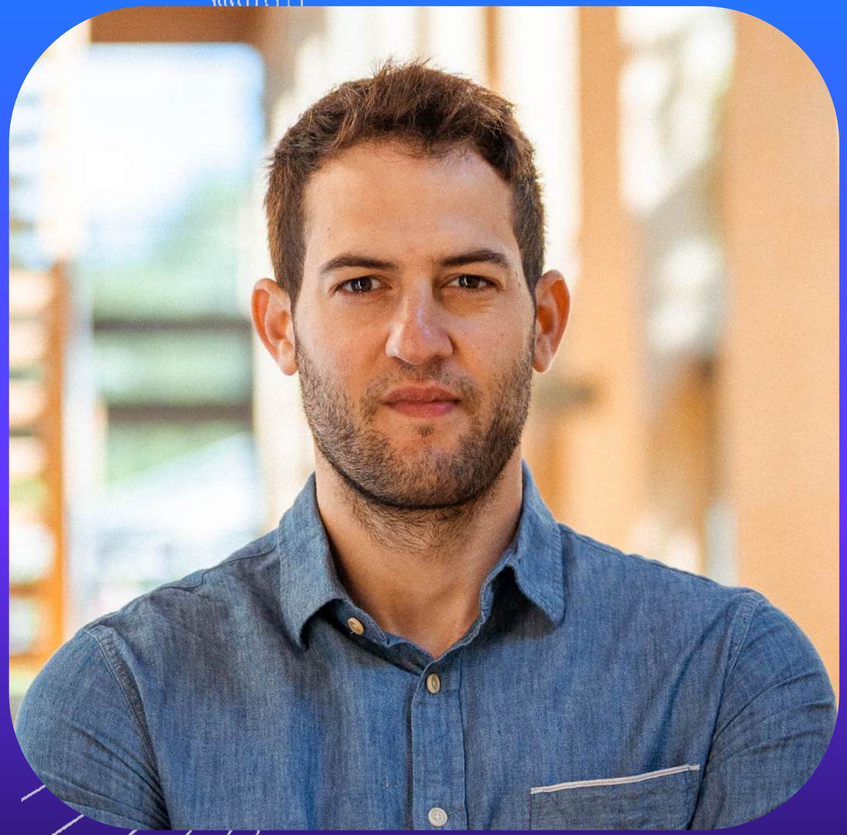
singularity

DEEP
Digital Experience for Executives Program

Thank you!



Aaron Frank

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