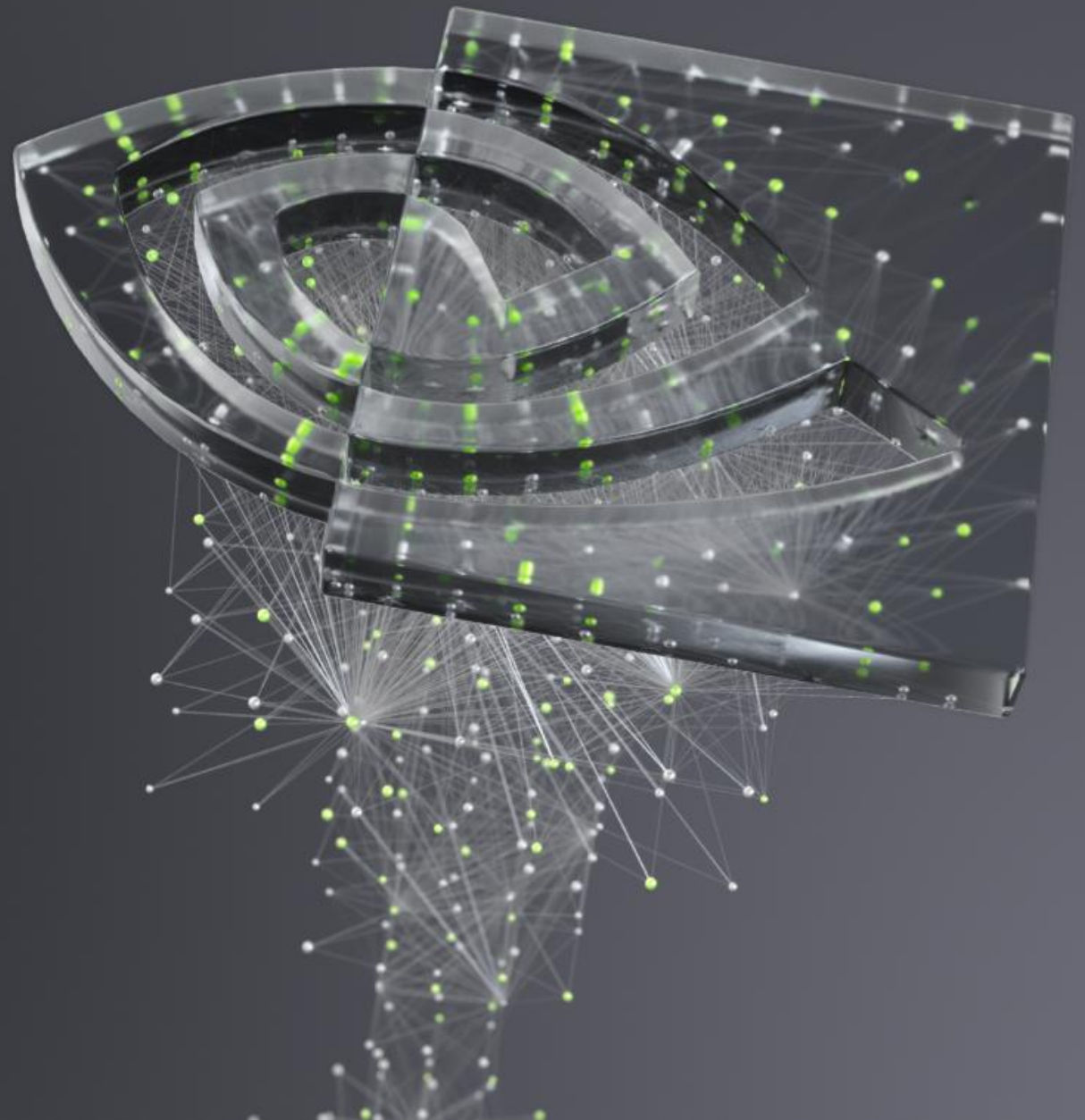

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AI DevRel | EMEA

@alisonblowndes

Happy December 2020

NVIDIA AI BREAKTHROUGHS IN GRAPHICS

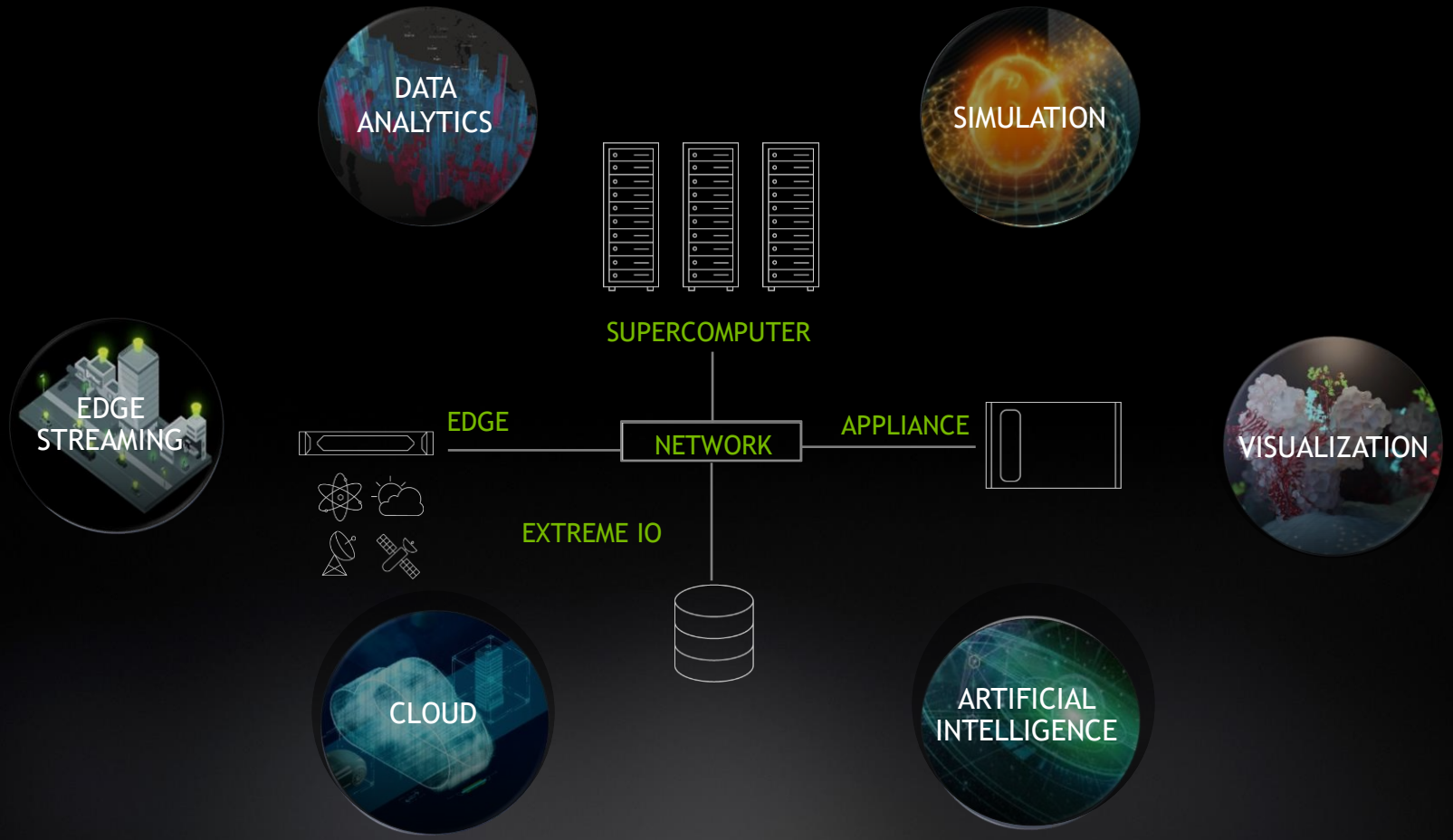
PROJECT SOL:
A Showcase for the Power of NVIDIA RTX

MINECRAFT RTX:
Real-time Ray Tracing in the World's Most Popular Game

OMNIVERSE:
A Powerful Collaboration Platform for 3D Design

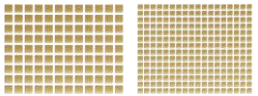
NASA MARS LANDER:
Visualizing NASA's Supercomputer Simulations

EXPANDING UNIVERSE OF SCIENTIFIC COMPUTING

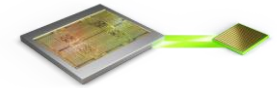


ANNOUNCING NVIDIA A100 80GB

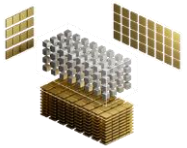
Supercharging The World's Highest Performing AI Supercomputing GPU



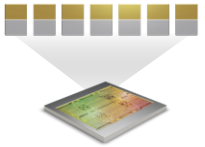
80GB HBM2e
For largest datasets and models



2TB/s +
World's highest memory bandwidth to feed the world's fastest GPU

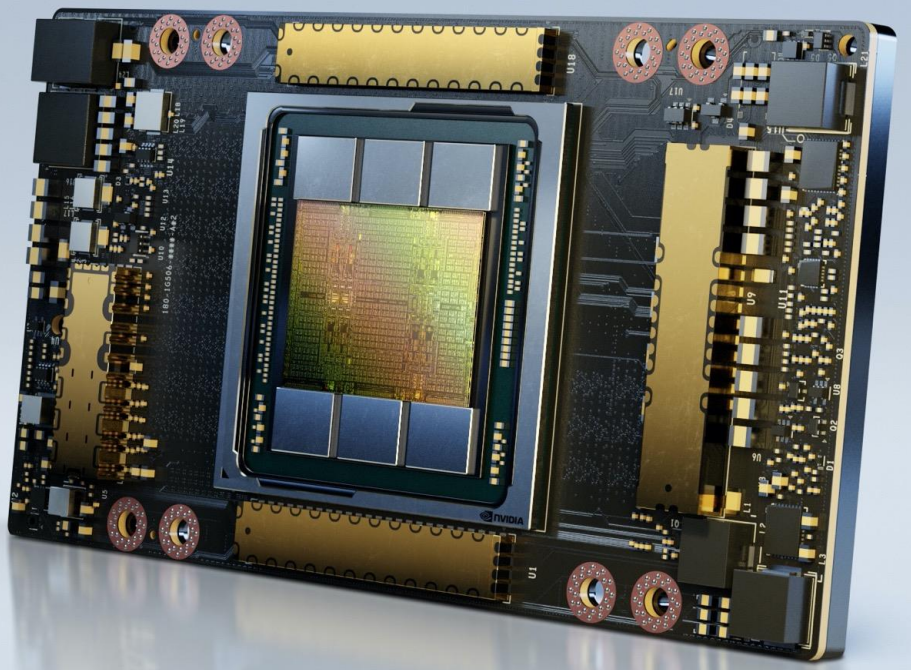


3rd Gen Tensor Core

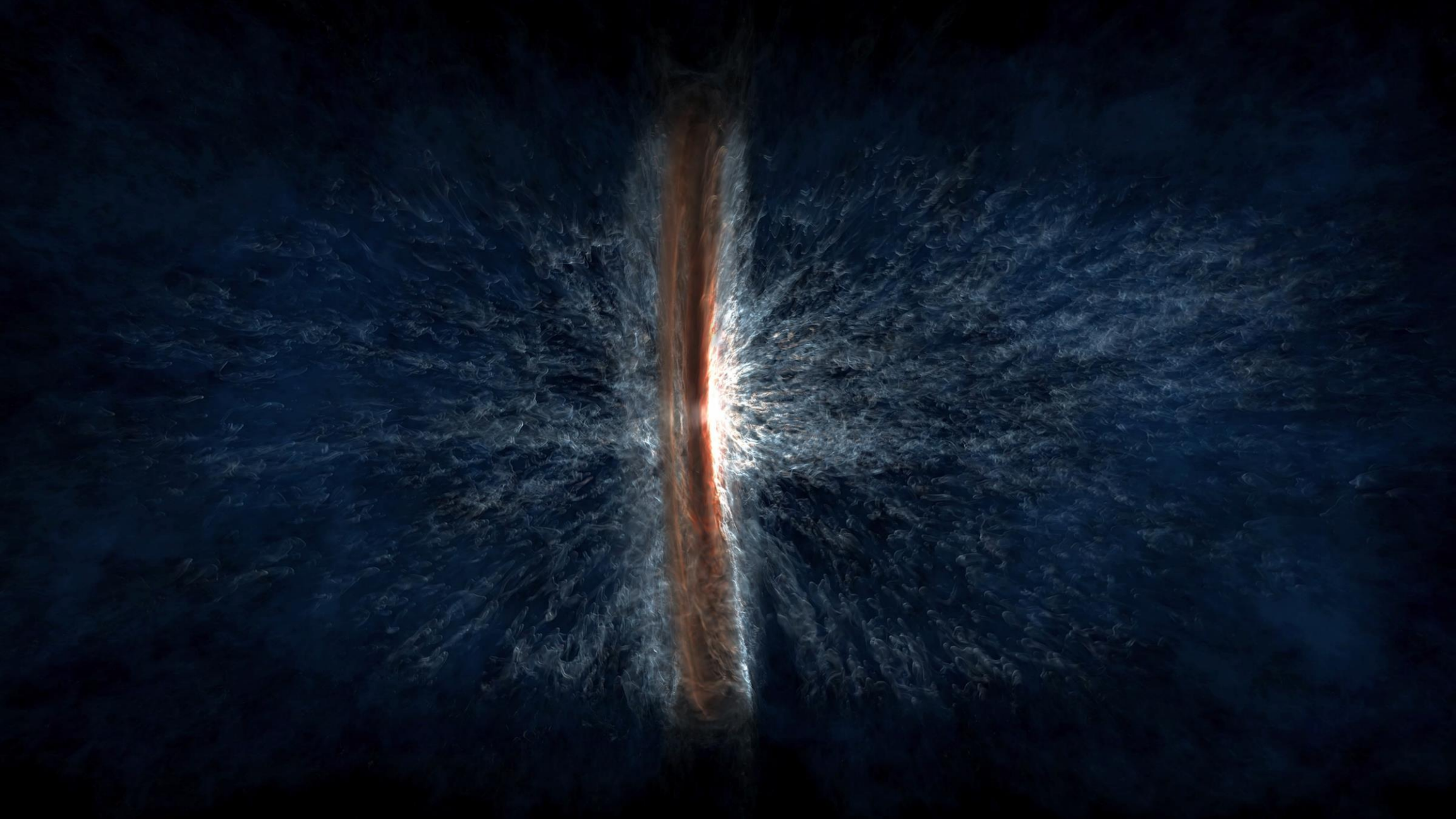


Multi-Instance GPU

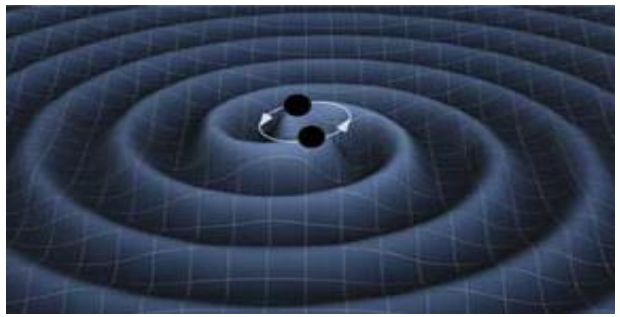
3rd Gen NVLink




NVIDIA SELENE
Now Featuring NVIDIA DGX A100 640GB
4,480 A100 GPUs
560 DGX A100 system
850 Mellanox 200G HDR switches
14 PB of high-performance storage
2.8 EFLOPS of AI peak performance
63 PFLOPS HPL @ 24GF/W
NVIDIA
NVIDIA



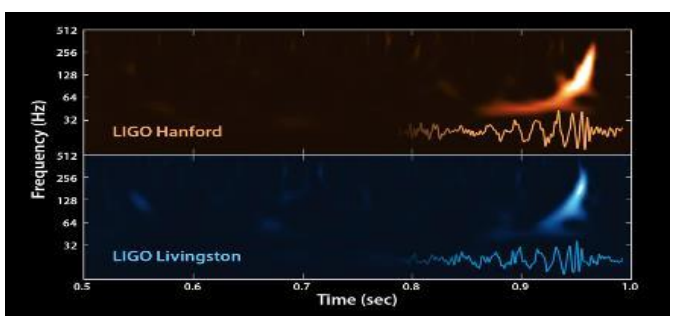
GRAVITATIONAL WAVE DETECTION



Gravitational wave due to black hole collide and merge

To be observed

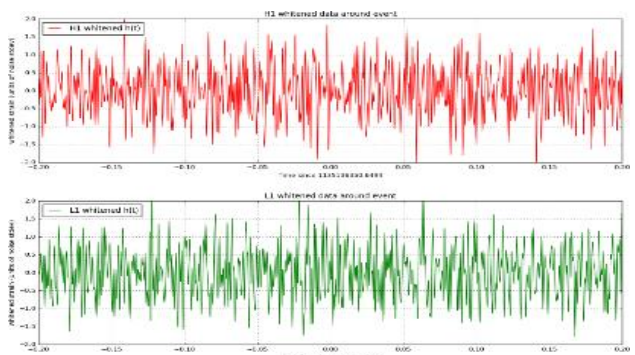
LIGO facility



Actual Signal Caused by Gravitational Wave

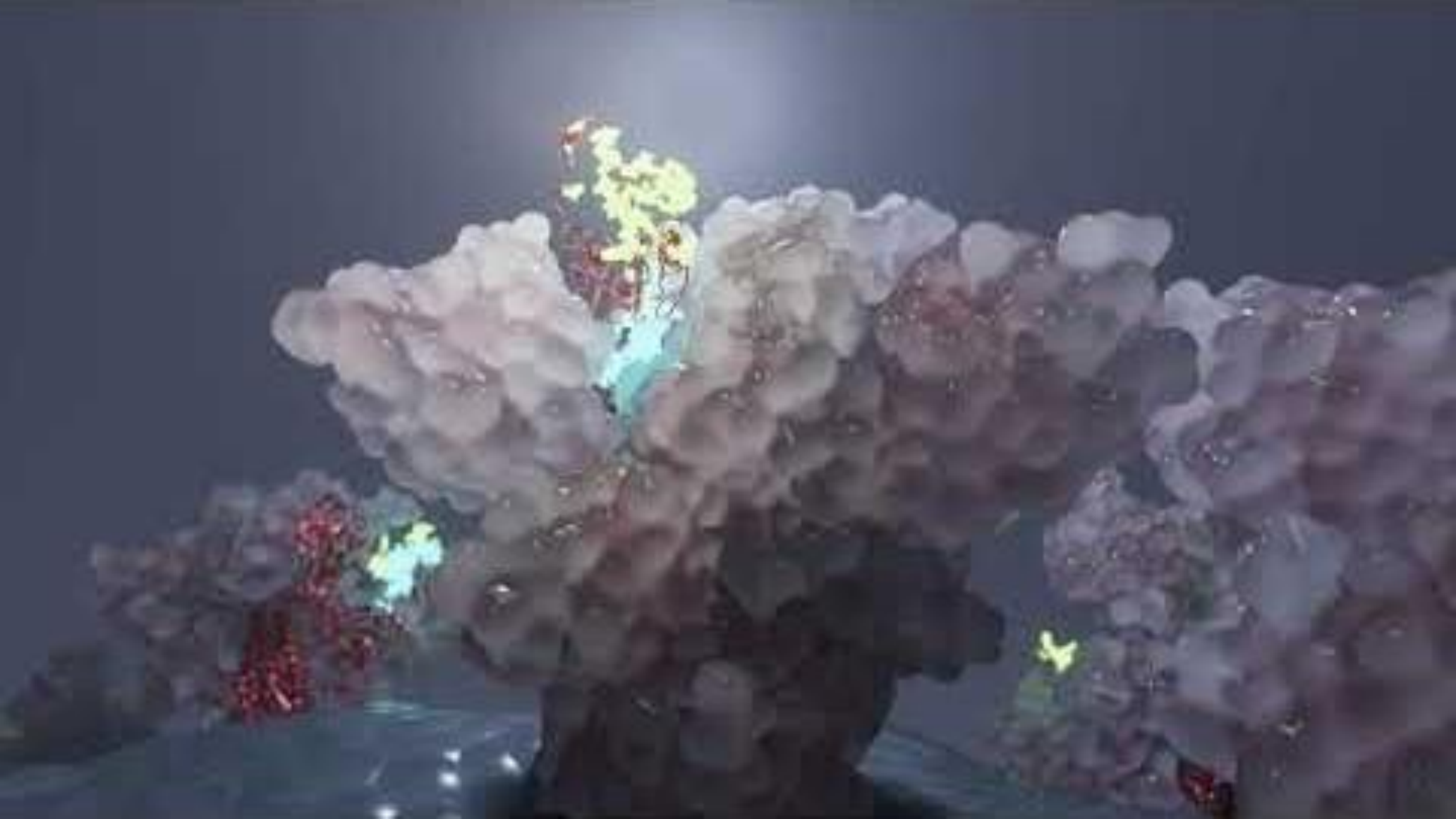
How to find The signal???

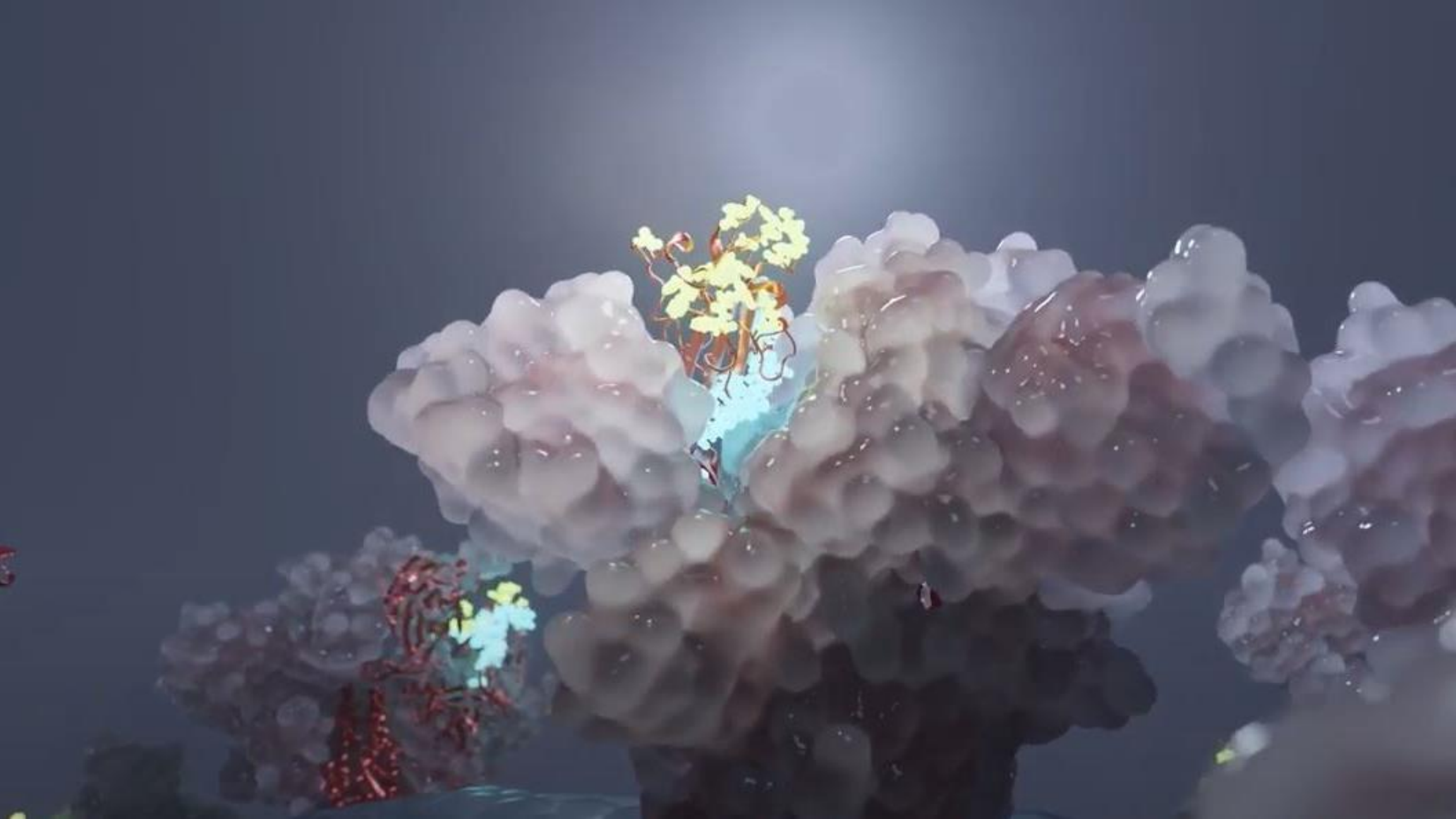
Deep Learning



Actual observed data

https://arxiv.org/abs/1701.00008





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LAB

NASA

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ARTIFICIAL INTELLIGENCE RESEARCH FOR SPACE SCIENCE, EXPLORATION & ALL HUMANKIND

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FDL EUROPE 2020

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esa Google Cloud NVIDIA · SCAN IBM AIRBUS planet. IWMI International Water Management Institute CATAPULT Satellite Applications UNIVERSITY OF OXFORD TRILLIUM ACCELERATED RESEARCH LAB

EARTH-SYSTEM MODELS

Simulating the Earth

LARGE SCALE DYNAMICS

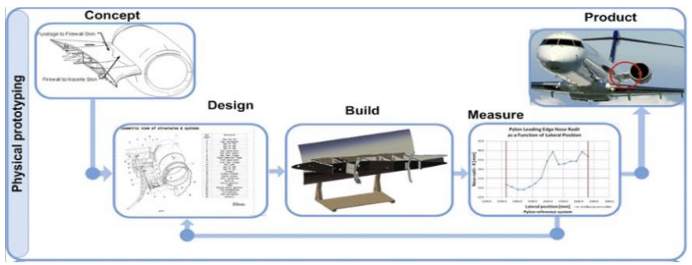
Rotational Fluid Dynamics,
Confined to Sphere
Compressible Atmosphere
Chaotic Internal Variability

SMALL SCALE PHYSICS

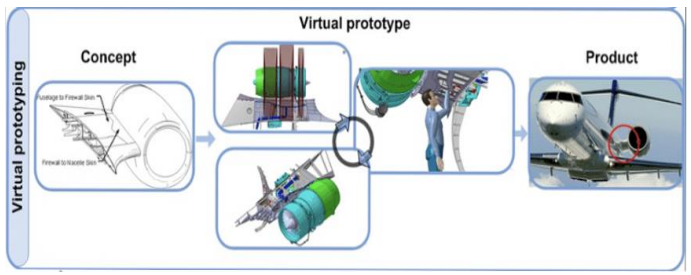
Long-wave and short-wave radiation
Cloud macro and micro-physics
Deep and shallow convection
Planetary boundary layer
Turbulent mountain stress
Gravity wave drag
Surface fluxes
Aerosols
Chemistry

SIMNET: AI BASED SIMULATION

Physical Prototyping



Traditional Simulations



AI based Techniques

Past | Present | Future

Physical Prototyping is iterative, time consuming, costly and not optimized for material and characteristics

Traditional numerical solvers work on one problem at a time making design process time consuming, do not address real-time simulations, data assimilation, inverse problems

Data driven NN require data, are oblivious to physics laws, suffer from interpolation/extrapolation errors and are not generalizable

developer.nvidia.com/simnet

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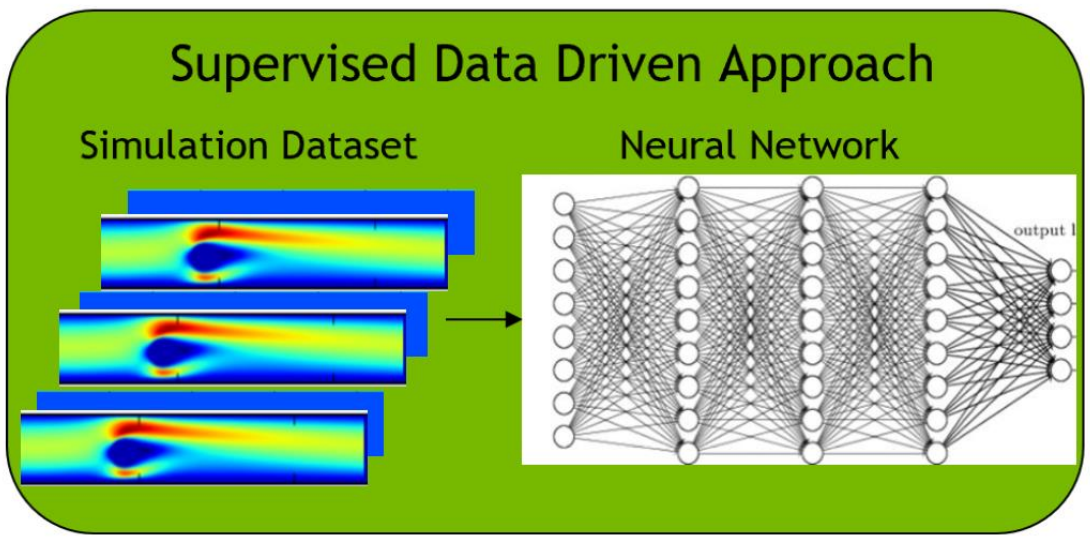
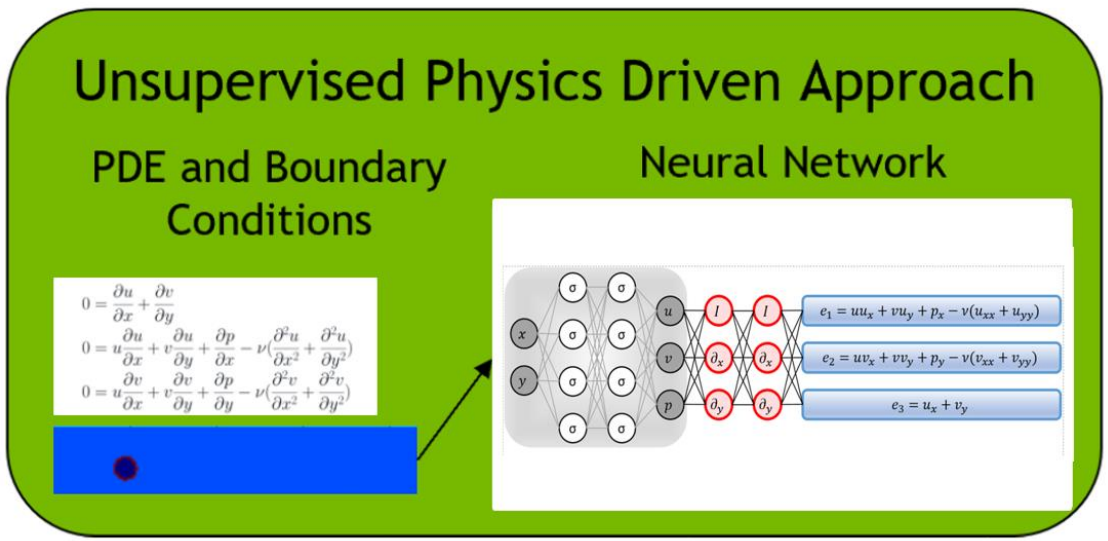
SOLVING PDES WITH NEURAL NETWORKS

A **Data Driven Neural Network** requires training data

A **Physics Driven Neural Network** solver does **NOT** require training data



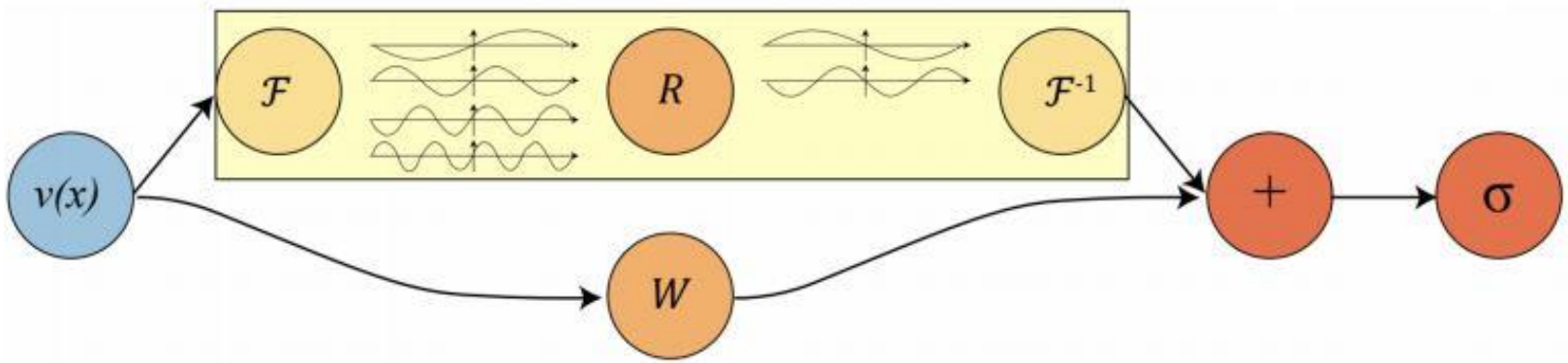


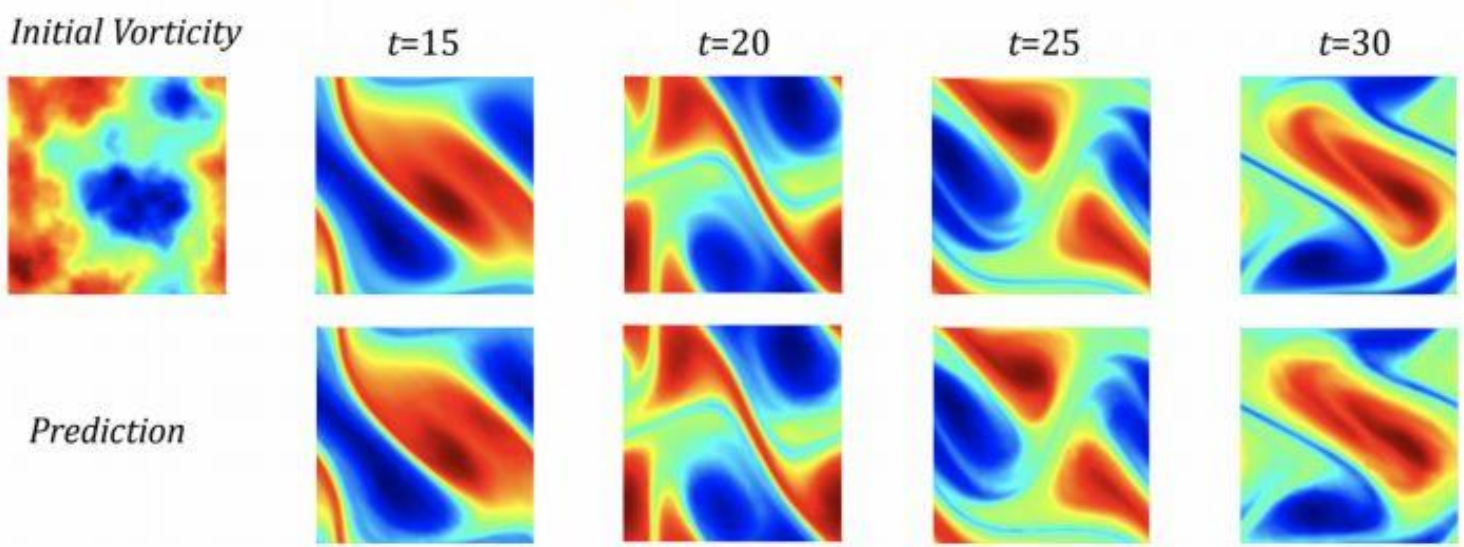
N layers

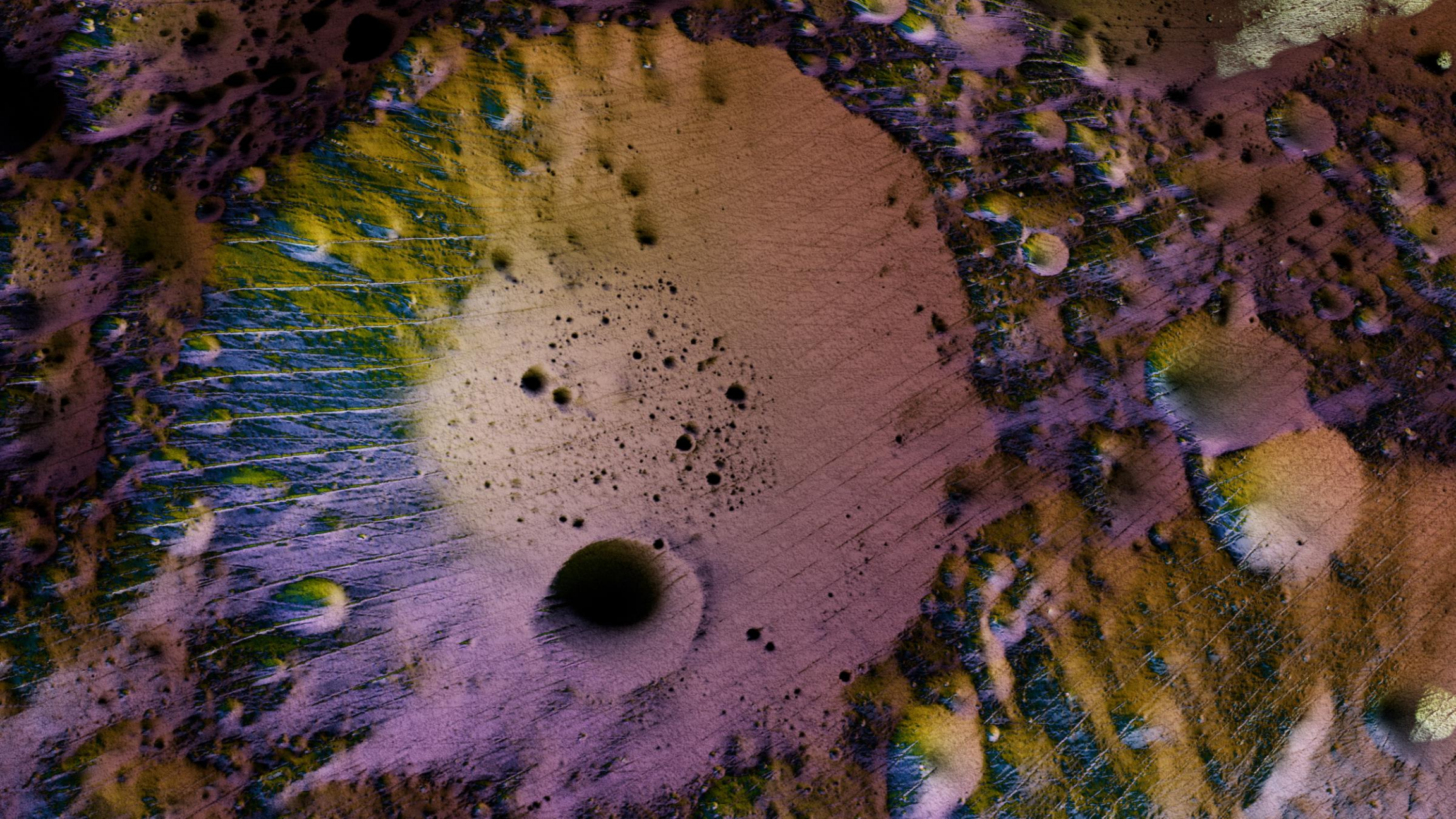
m*N layers (for mth order PDE)

FOURIER NEURAL OPERATORS

https://arxiv.org/pdf/2010.08895.pdf



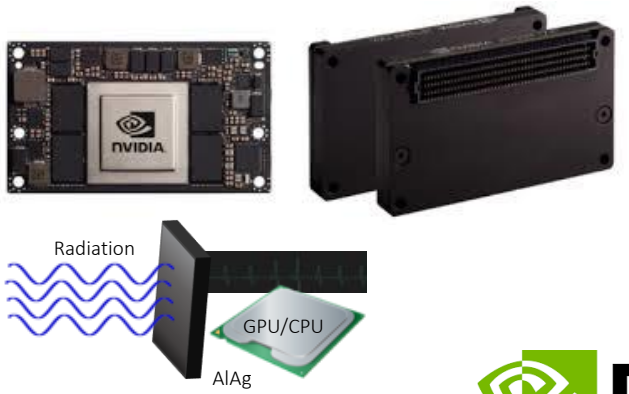




Embedded Solutions for Space and TX2i Platform

The NVIDIA® Jetson™ TX2i module's rugged design, small form factor, and reduced power envelope make it ideal for high-performance edge computing.

- NVIDIA Jetson TX2i:
  - GPU NVIDIA Pascal™, 256 CUDA cores, 1.3 TFLOPS [FP16]
  - CPU: HMP Dual Denver 2/2 MB L2 and Quad ARM® A57/2 MB L2
  - Memory: 8 GB 128-bit LPDDR4 59.7 GB/s
  - Operating temperature: -40C - 85C
  - Storage temperature: -40C - 85C
  - Humidity: 95%RH, -10C to 65C (non-condensing)
  - Vibration: 5 G RMS 10 to 500 Hz (random/sinusoidal)
  - Shock: 140 G, half sine 2 ms duration
  - Voltage input: 9V - 19.6V DC
  - Module power: 10W - 20W
- Connect Tech Inc Orbbity Carrier Board:
  - Size: 87mm x 50mm (3.425" x 1.968")
  - I/O: 1x GbE, USB 3.0, USB 2.0, 1x HDMI, 1x MicroSD, 2x 3.3V UART, I2C, 4x GPIO
  - Power: +9V to +14V DC Nominal (+19V Peak)
  - Temperature Range: -40°C to +85°C



- LM Applications:
  - Deep Learning RF/Radar/Lidar Identification & Classification.
  - Deep Learning EO Target Recognition and Tracking
  - Multi-Sensor Fusion
  - UAV/UGV control (Machine Learning Applications)
  - Cross BA (Space, Aero, RMS, ATL, & MFC)

- Three key objectives:
  - Establish an AI/ML enabled embedded platform
  - Port an existing and future LM software onto the platform
  - Shield the platform from radiation

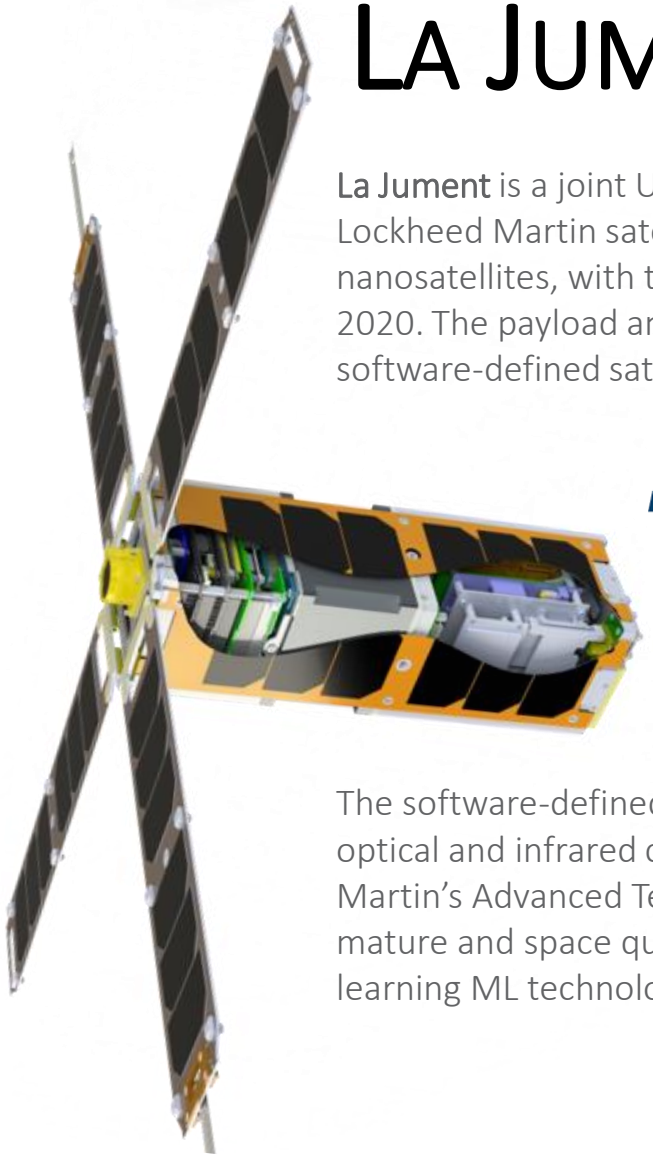
AI Summit

NVIDIA

Connect Tech Inc.
Embedded Computing Experts

La Jument

Bleeding-edge Technologies for early, go fast flight demos



La Jument is a joint University of Southern California-Lockheed Martin satellite program that includes four nanosatellites, with the first launching at the end of 2020. The payload and bus will use our SmartSat™ software-defined satellite architecture.

LOCKHEED MARTIN

The software-defined payload houses advanced optical and infrared cameras utilized by Lockheed Martin's Advanced Technology Center to further mature and space qualify AI and machine learning ML technologies.

SmartSat Software as Open Architecture

SmartSat tech allows for dynamic loading of Open Standard compliant applications and Ground to Space rapid deployment/integration

Leveraging NVidia Partnership for AI/ML

Powerful NVidia CPUs/GPUs enable on-board AI/ML processing

Rapid On-Orbit Demonstration Capability

Providing a pathway to demonstrate future looking Lockheed Martin capabilities with assets in space

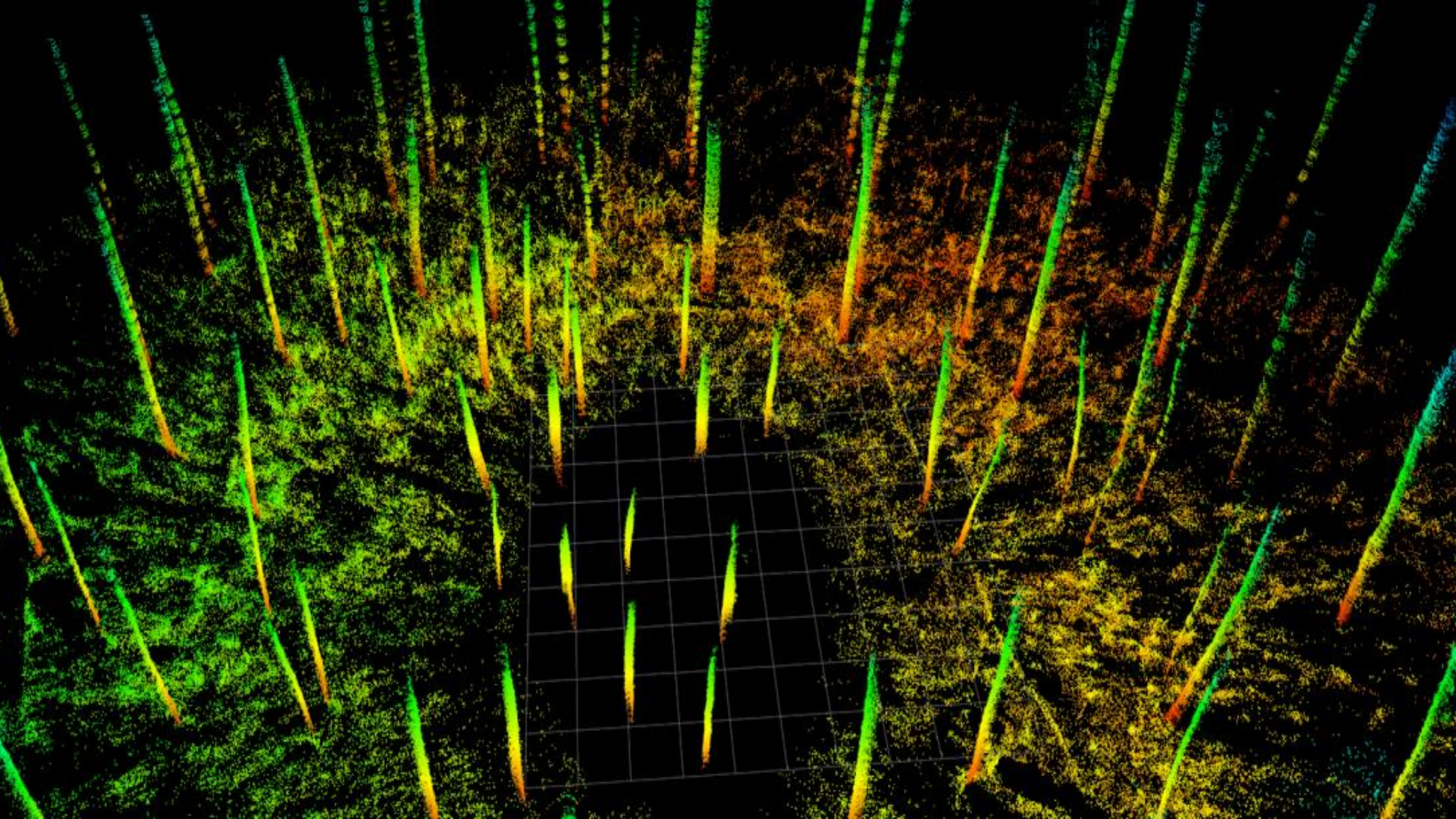
STEM Outreach & University Engagement

Providing access to the world class talent and capabilities of LM Space to multiple Universities for Bus Integration and Command/Control

Creating a Cost Competitive In-House Solutions

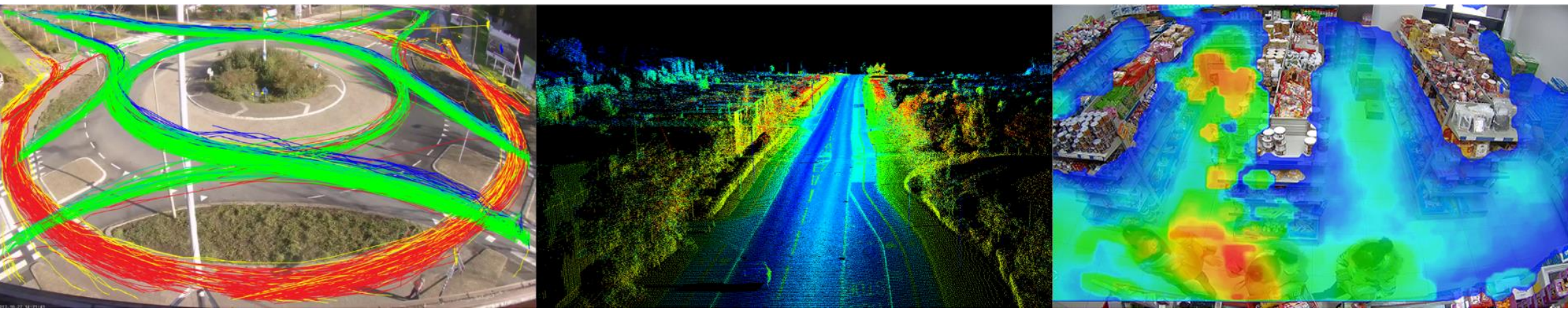
Utilizing LM Space's core advantages (Expertise and Technologies) to develop small form factor solutions

AI Summit



GEOSPATIAL

cuSpatial



Example Notebook:

https://github.com/wkelongws/trajectory_clustering_with_cuspatial

NGC – ACCELERATING TIME TO SOLUTION

Build AI Faster, Deploy Anywhere

NGC Catalog

CONTAINERS	TRAINED MODELS	INDUSTRY APP FRAMEWORKS	HELM CHARTS	COLLECTIONS
				
100+	30+	End-to-End AI Workflows	ML, Inference	Curated Software Assets

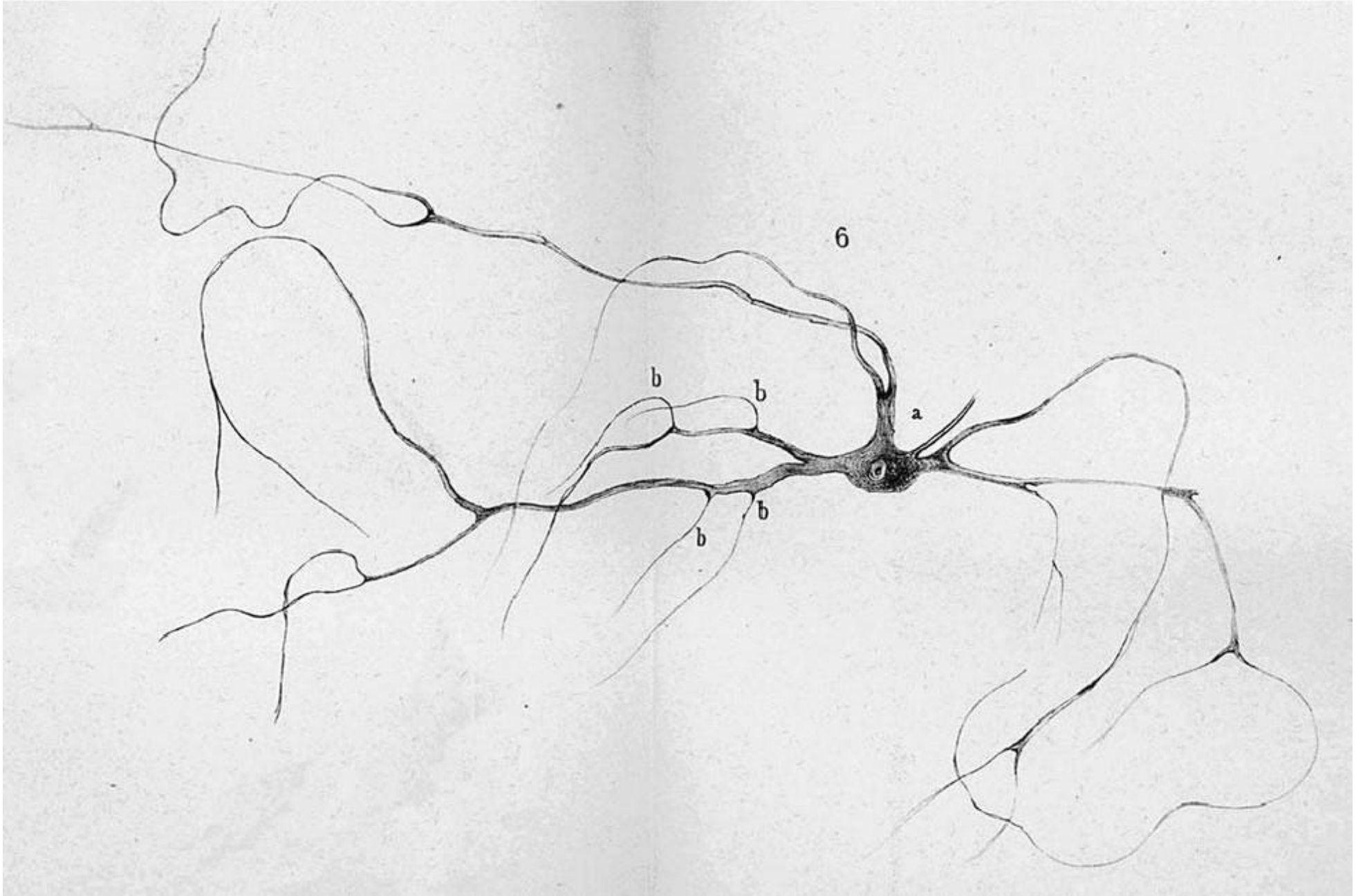
x86 | ARM | POWER


CLOUD


ON-PREM


HYBRID CLOUD


EDGE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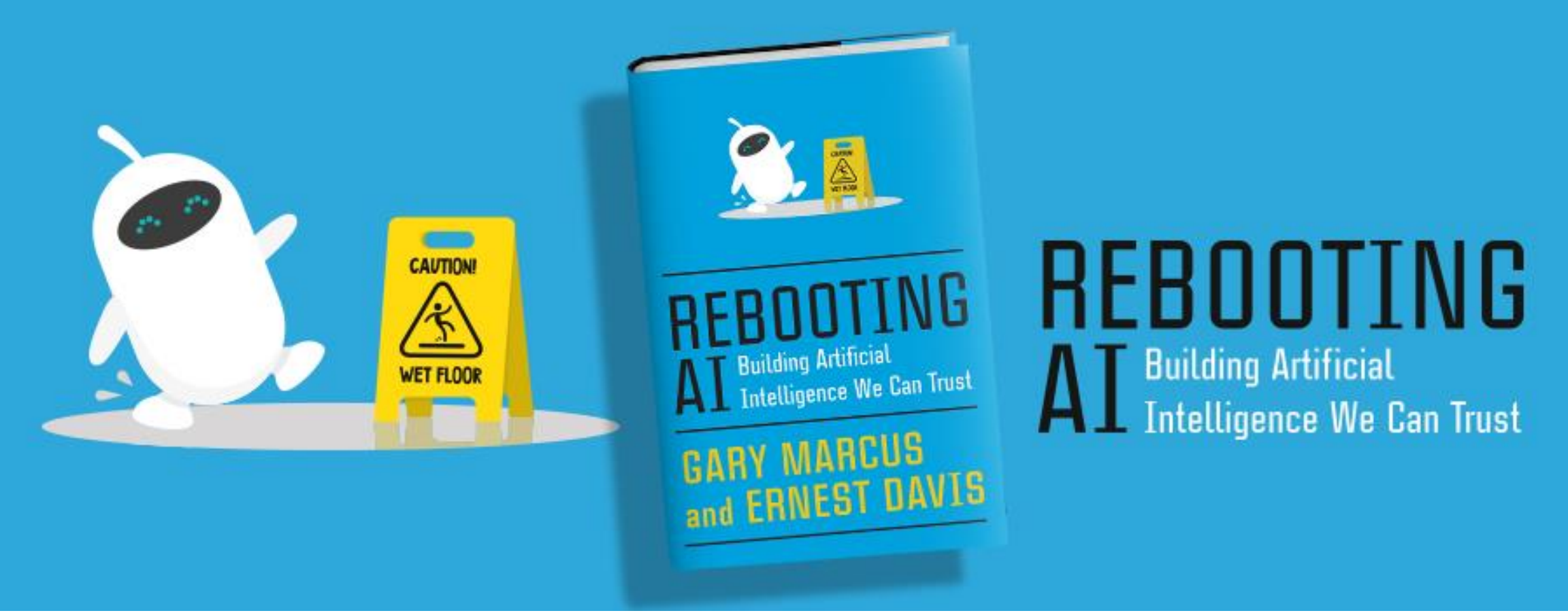


www.Robust.ai

Gray Marcus, Rodney Brooks, Steven Pinker et al

“it is biblical in its power”

https://arxiv.org/pdf/2003.08536.pdf

Enhanced POET: Open-Ended Reinforcement Learning through Unbounded Invention of Learning Challenges and their Solutions

Rui Wang [1] Joel Lehman [1] Aditya Rawal [1] Jiale Zhi [1] Yulun Li [1] Jeff Clune [*2] Kenneth O. Stanley [*1]

Abstract

Creating *open-ended algorithms*, which generate their own never-ending stream of novel and appropriately challenging learning opportunities, could help to automate and accelerate progress in machine learning. A recent step in this direction is the Paired Open-Ended Trailblazer (POET), an algorithm that generates and solves its own challenges, and allows solutions to *goal-switch* between challenges to avoid local optima. However, the original POET was unable to demonstrate its full creative potential because of limitations of the algorithm itself and because of external issues including a limited problem space and lack of a universal progress measure. Importantly, both limitations pose impediments not only for POET, but for the pursuit of open-endedness in general. Here we introduce and empirically validate two new innovations to the original algorithm, as well as two external innovations designed to help elucidate its full potential. Together, these four advances enable the most open-ended algorithmic demonstration to date. The algorithmic innovations are (1) a domain-general measure of how meaningfully novel new challenges are, enabling the system to potentially create and solve *interesting* challenges endlessly, and (2) an efficient heuristic for determining when agents should goal-switch from one problem to another (helping open-ended search better scale). Outside the algorithm itself, environmental challenges, many of which cannot be solved through other means. It takes a step towards producing AI-generating algorithms, which could one day bootstrap themselves from simple initial conditions to powerful cognitive machines, potentially helping with the long-term, grand ambitions of AI research.

1. Introduction

The progress of machine learning so far mostly relies upon a series of challenges and benchmarks that are manually conceived by the community (e.g. MNIST (LeCun et al., 1998), ImageNet (Deng et al., 2009), pole balancing (Anderson, 1989), and Atari (Bellemare et al., 2013)). Once a learning algorithm converges, or solves a task, there is nothing to gain by running it longer in that domain. Sometimes, learned parameters are transferred between challenges (Yosinski et al., 2014). However, in such cases a human manually chooses which task to transfer from and to, slowing the process and limiting the opportunities to harness such transfer to cases where humans recognize its value.

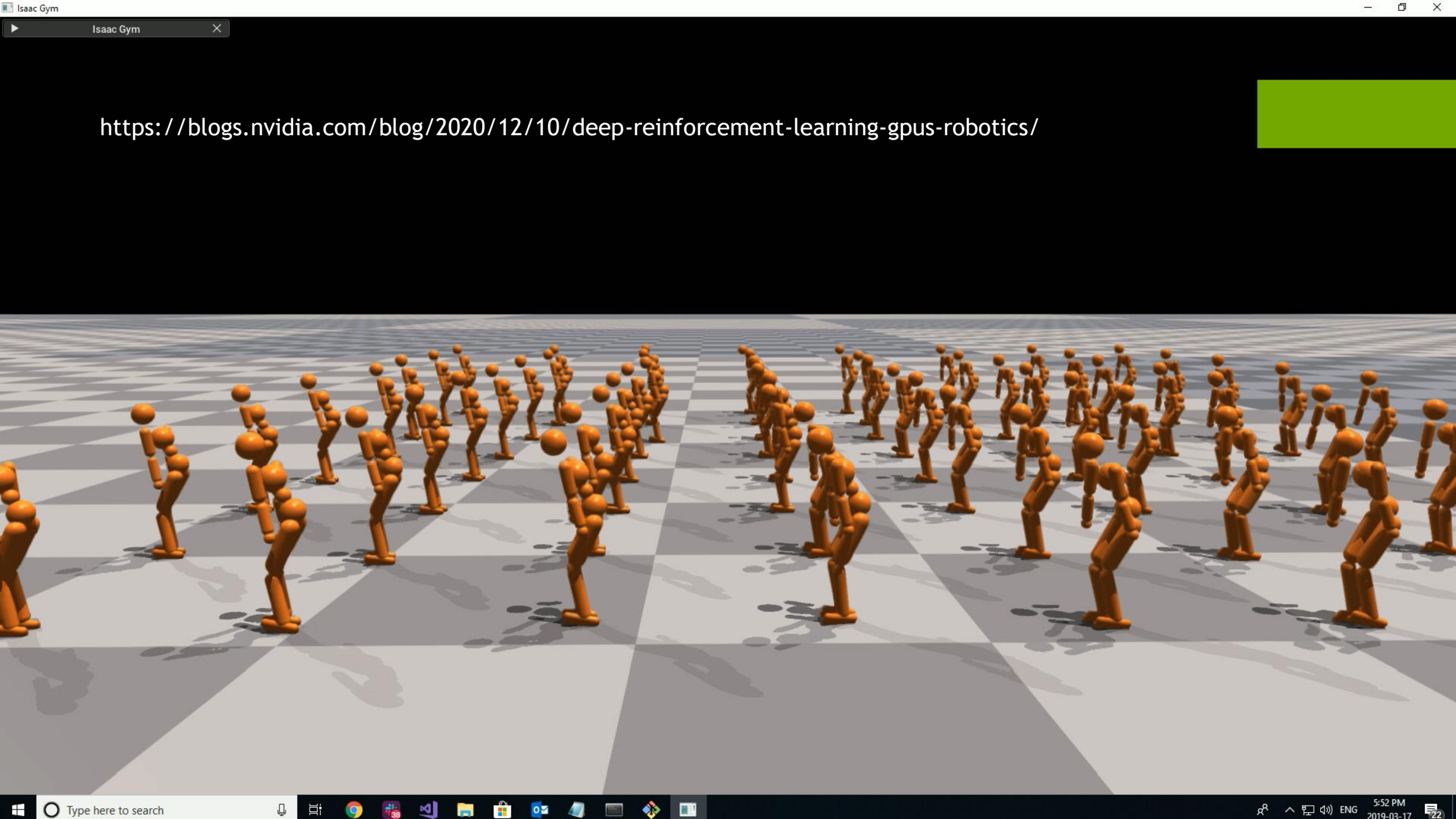
A fundamentally different approach is to create *open-ended* algorithms (Bedau, 2008; Forestier et al., 2017; Langdon, 2005; Schmidhuber, 2013; Standish, 2003a; Stanley et al., 2017; Taylor et al., 2016) that propel *themselves* forward by conceiving simultaneously *both* challenges and solutions, thereby creating a never-ending stream of learning opportunities across expanding and sometimes circuitous webs of stepping stones. Such an algorithm also need not rely on

GoodAI talk by Kenneth Stanley (OpenAI) https://youtu.be/AwlLrugFcOc

METAVERSE ORIGINS







Isaac Gym
Isaac Gym
https://blogs.nvidia.com/blog/2020/12/10/deep-reinforcement-learning-gpus-robotics/
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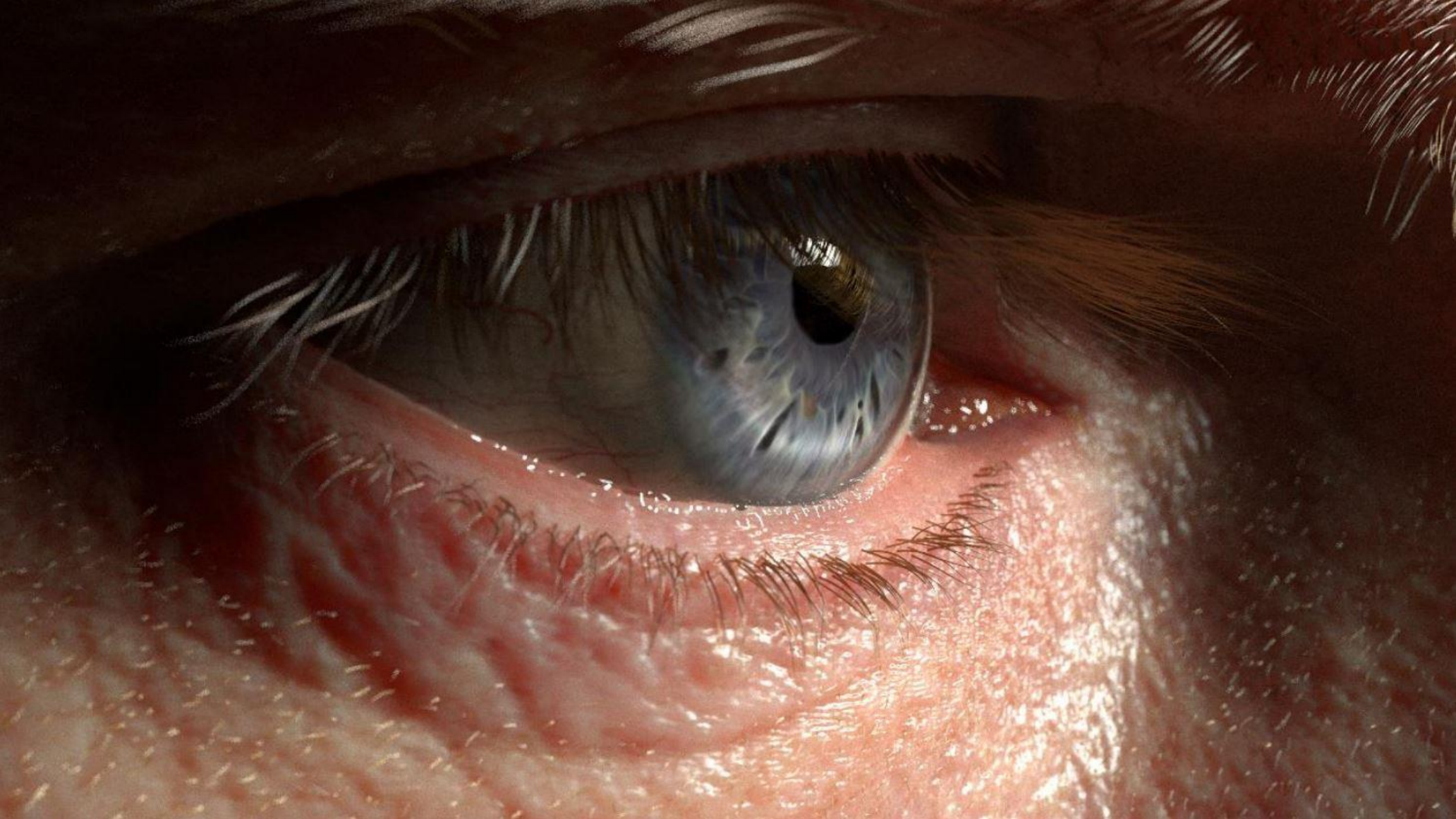
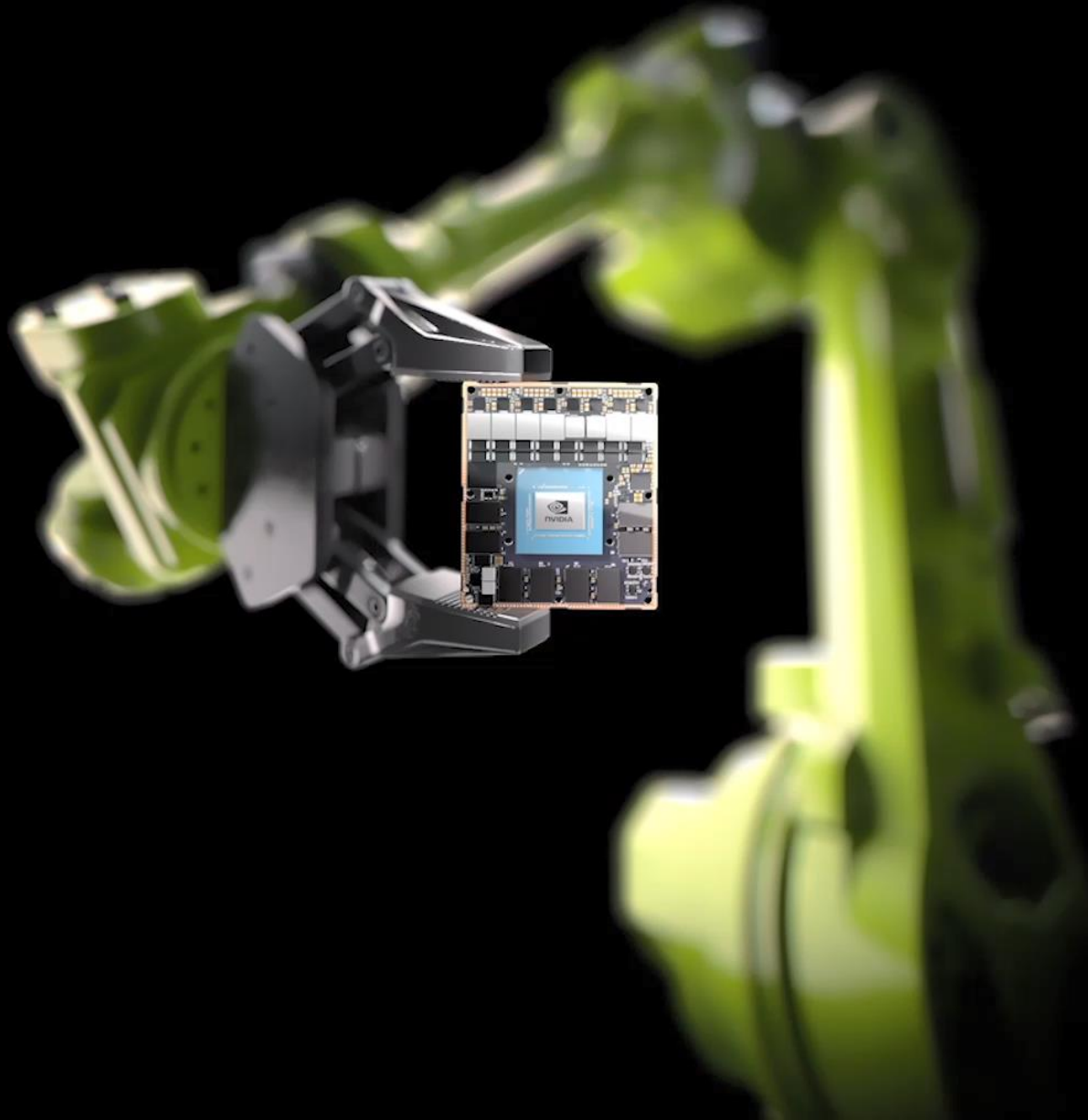
2019-03-17




BOXES
M - O
06
BOXES
P - R
FRAGILE
CAUTION
WET FLOOR
CUIDADO
PISO
MOJADO
NVIDIA


KEEP CLEAR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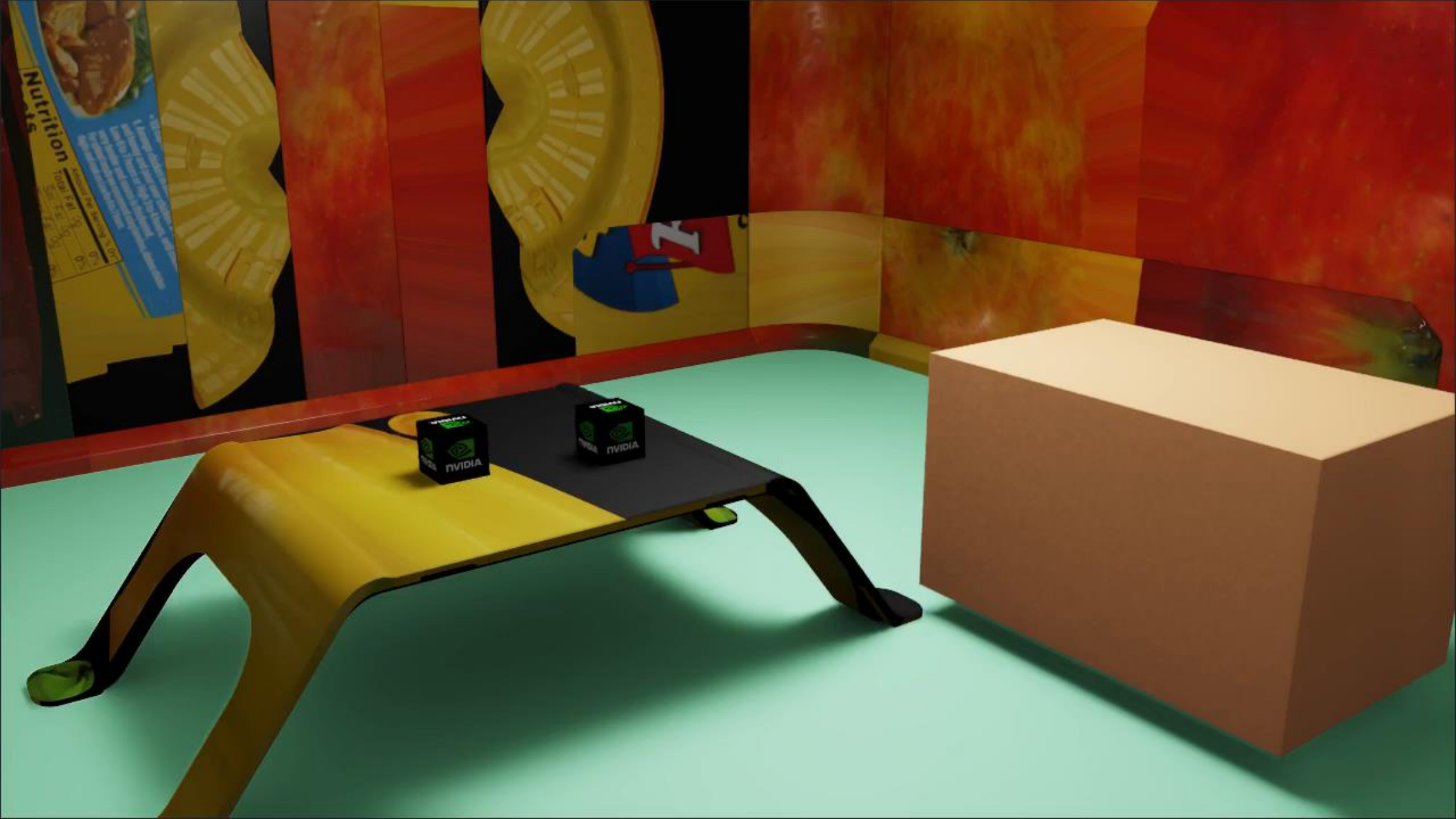
Adding Physics to USD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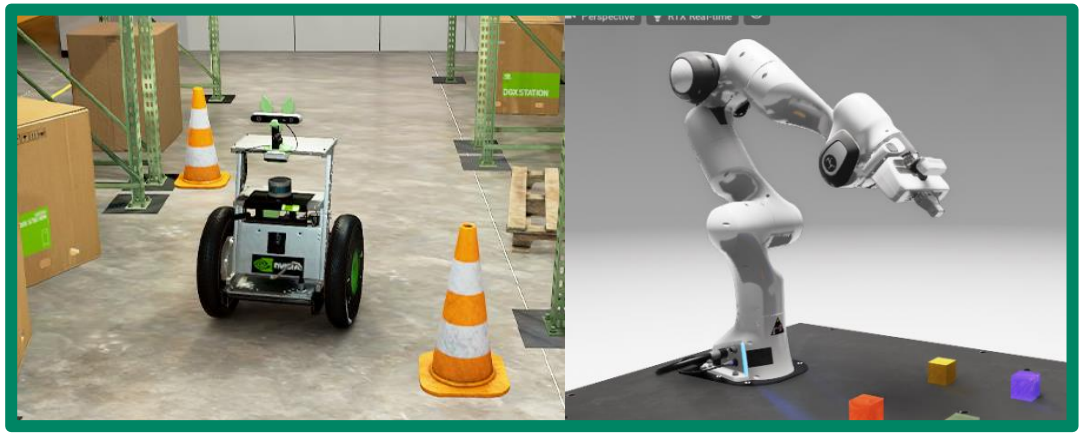
ISAAC PLATFORM FOR ROBOTICS

www.nvidia.com/en-gb/deep-learning-ai/industries/robotics/

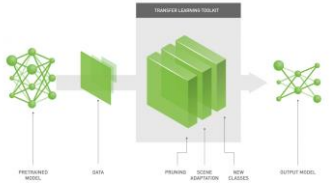


DESIGN SIMULATE

TensorRT

TensorFlow

TRANSFER LEARNING TOOLKIT



PyTorch

TRAIN DEPLOY

ISAAC Apps

CARTER (Indoor Robot)	Kaya (Getting Started)	Tutorials and Samples	Custom Applications

ISAAC GEMS

Multi-class Segmentation DNN	3D Object Pose Estimation	Object Detection DNN	Stereo Depth
Stereo Visual Inertial Odometry	Superpixels	AprilTags	2D Skeleton Pose Estimation DNN
DeepStream for Robotics	ORB Feature Tracker	Sensor Drivers	Planning and Control
Image Warping	Navigation	Text to Speech and Keyword Detection DNNs	... and more

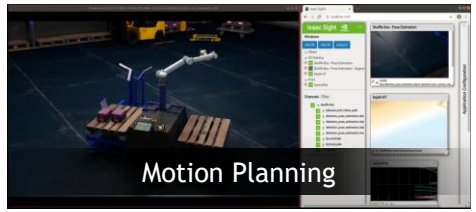
ISAAC Engine

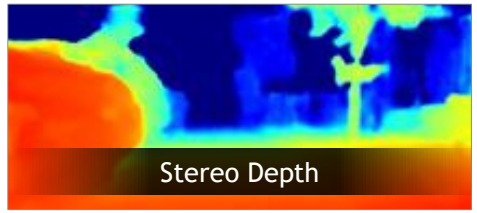
Computational Graph & CUDA Messaging	Visualization Tools	Advanced Build system & C API

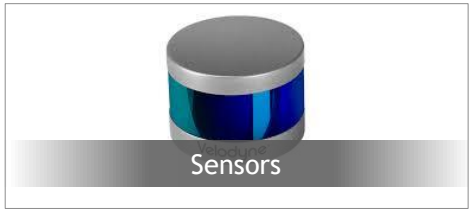
JETSON XAVIER

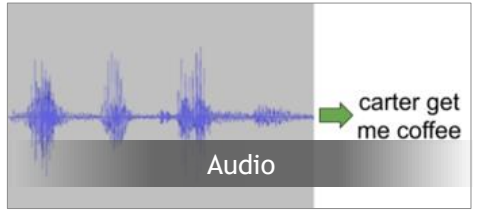
MUCH MORE WITH ISAAC SOFTWARE

GPU Accelerated Algorithms/DNNs (GEMs)



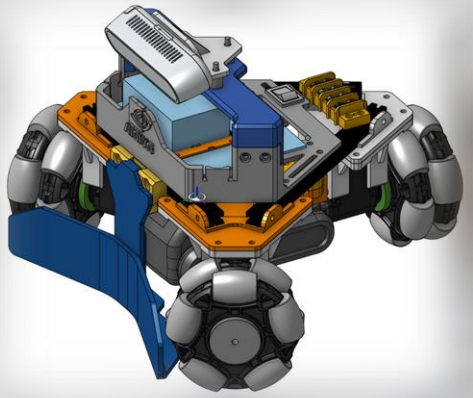






And more…

KAYA — A ROBOT FOR MAKERS



Low-cost platform to get started with robotics

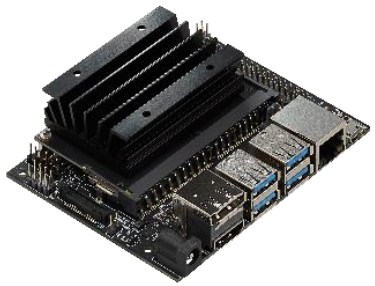
Follow Me App

Object Detection DNN

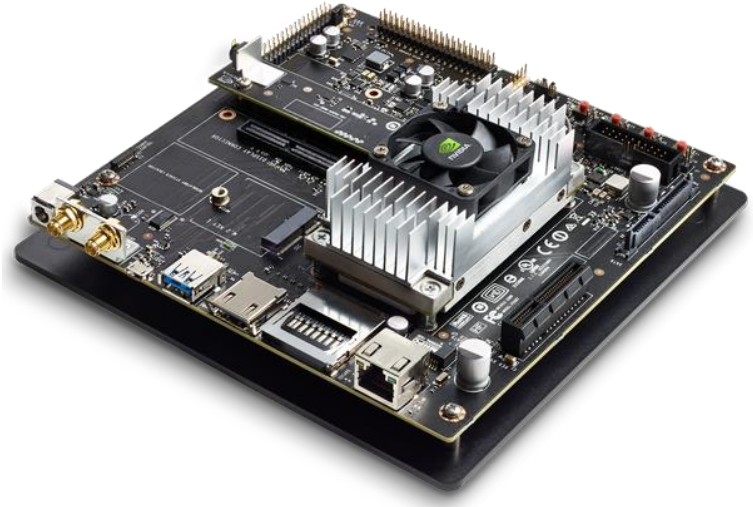
NVIDIA Jetson Nano

JETSON DEVELOPER KITS

For Engineers, Makers, and Learners



JETSON NANO
5W | 10W
0.5 TFLOPS (FP16)
$99



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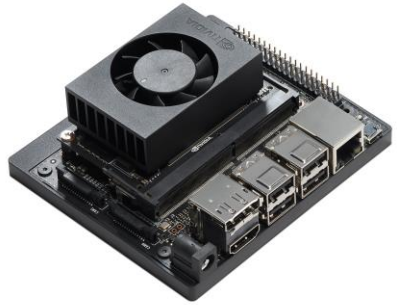

JETSON XAVIER NX
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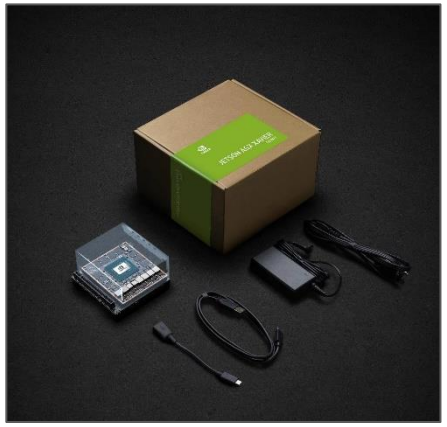

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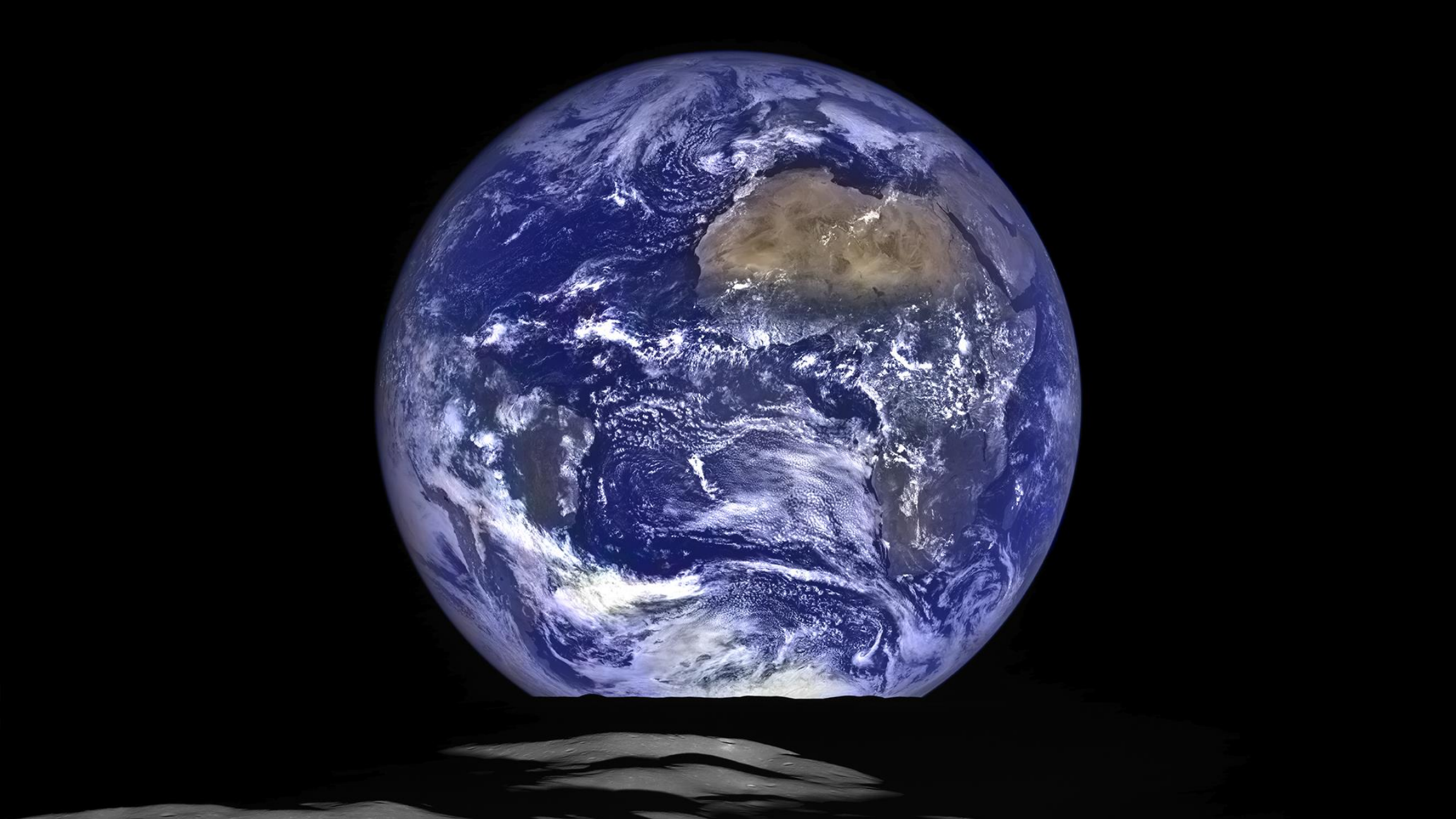


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