

**NVIDIA GPU Technology Conference 2019**  
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## Executive Summary

NVIDIA GTC 2019, as previous GTCs, was a memorable event, with the company emphasizing AI, Deep Learning, autonomous cars, and robots, and launching a slew of products, most notably the \$99 Jetson Nano. The event was a hotbed of innovation, teeming with case-study-after-case-study of applications of AI (Deep Learning, to be exact) in areas such as astrophysics, healthcare, high-performance computing, manufacturing and, of course, self-driving vehicles and robots of every kind. Over six thousand visionaries and practitioners converged for four days on sharing. We couldn't help wondering, what had these people seen, what world they lived in, and just how deep was their vision.

The company is definitely very focused, albeit still recovering from the "crypto-hangover" caused by the decline in cryptocurrency mining that cost over \$22 billion in its market capitalization.

## 1. Introduction

NVIDIA annual GTC is a never-miss event and this year was no exception. The highlight of the event, as always, was the CEO Jensen Huang's Keynote. Normally held at the San José Convention Center, this year it was held at the Event Center at San José State University to accommodate the 6,000-plus attendees.



Figure 1. Event Center at San José State University

## 2. Keynote

Attending the keynote and listening to and watching NVIDIA CEO Jensen Huang (Figure 2) reminded us of the scene in the intergalactic bar in the movie *Star Wars*, where Luke Skywalker and C3PO meet denizens of other stars and galaxies. The stories of their extravagant adventures create a pull in Luke Skywalker to have the same experiences.

Jensen is an extremely entertaining CEO, full of boundless energy. His Keynote, which can be viewed in its entirety [here](#), scheduled for 2 hours, lasted for 2 hours and 40 minutes. Jensen was cool and full of energy even after his long keynote. Known for introducing exciting new products in AI and graphics, this year he delved into an array of fairly small announcements.

The most notable was the new \$99 Jetson Nano (Figures 3 and 4) which enables the development of small, low-power AI systems. The Jetson Nano has an NVIDIA 128-core, Maxwell GPU and a Quad-core ARM Cortex -A57 CPU

and comes with 4 GB memory, and 16 GB Flash memory. It is aimed at embedded IoT applications, including entry-level Network Video Recorders (NVRs), home robots, and intelligent gateways with full analytics capabilities

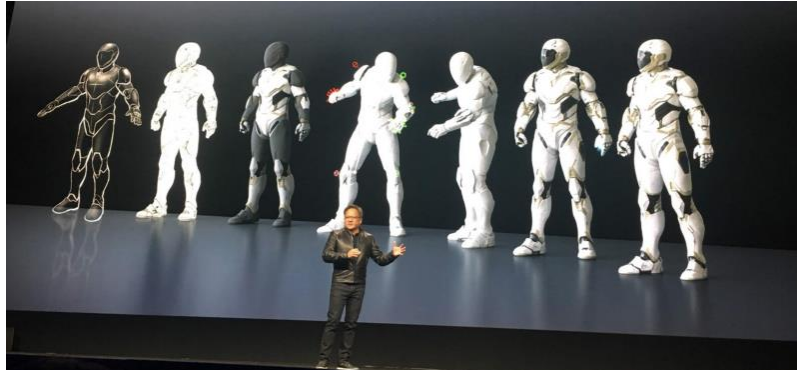


Figure 2. CEO Jensen Huang and NVIDIA GPU-Generated Graphics

NVIDIA’s datacenter revenue for fiscal 2019 increased by 52% compared with fiscal 2018, and its effort for deeper penetration into the enterprise datacenter was obvious by the fact that all the major hardware vendors—Cisco, Dell EMC, Fujitsu, HPE, Inspur, Lenovo, and Sugon—are introducing new servers with NVIDIA’s T4 GPUs.



Figure 3. Jetson Nano Module.

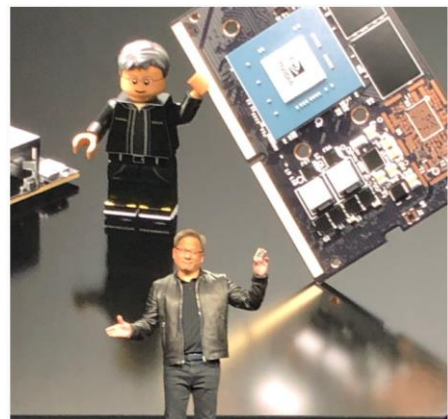


Figure 4. Jensen Huang holding the \$99 Jetson Nano.

More than just hardware and CPUs, the company offers a comprehensive and robust software architecture (Figure 4). We believe no other vendor today comes close to match NVIDIA’s offerings.

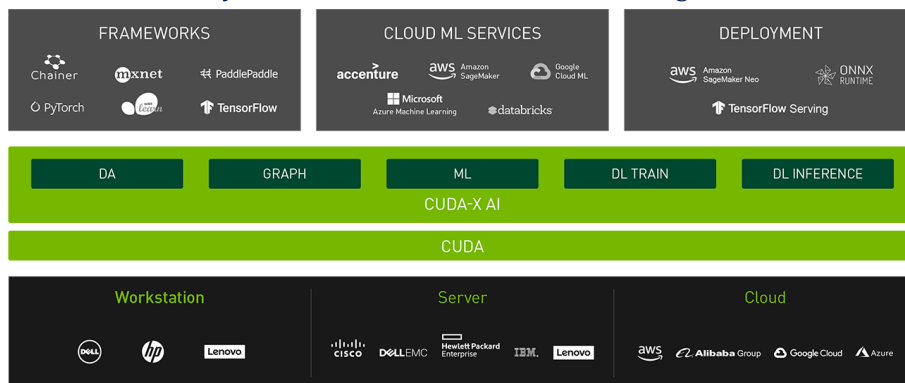


Figure 4. NVIDIA CUDA-X AI Ecosystem

### 3. Companies and Products

Over sessions and on the exhibits floor we met with numerous companies that are leveraging GPUs for Deep Learning for their innovative use cases. Below is a sampling of some, in no particular order of importance, by industry.

#### Manufacturing

Japan-based [Musashi Engineering](#) is using AI with cameras and NVIDIA's GPUs to detect defects in manufacturing bevels in gears (Figure 5). They achieved 92% accuracy in detection of defects, which matches human accuracy rates. Who knew that humans were not perfect!



Figure 5. Automated Bevel Inspection using Cameras and GPUs

A major European car company has deployed the same concept of automated inspection for vehicles at the end of an automotive assembly line. In 73 seconds, this OEM can ensure that they will deliver a defect-free car to its customers (Figure 6).

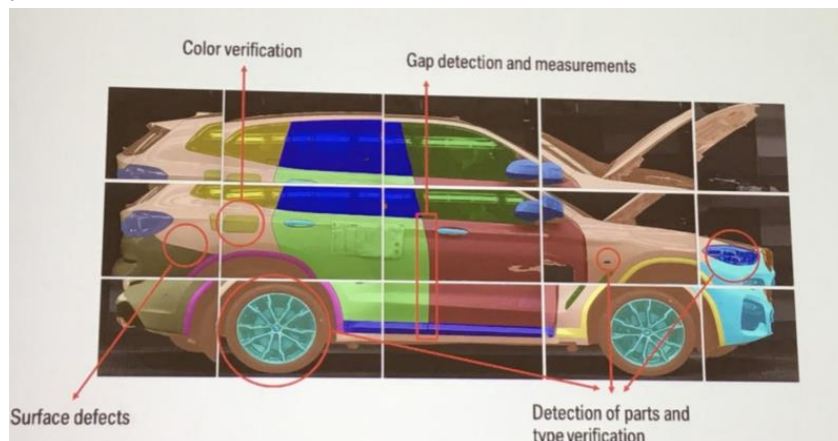


Figure 6. Automated Vehicle Inspection Using Cameras and GPUs

## Retail

San Francisco-based [Motionloft](#) is using NVIDIA Jetson for retail shopper count applications. The company builds ViMo motion sensors and installs them in retail stores and other public locations, and currently has 200+ installations around the world.



Figure 7. Detecting Wait Time for Customers at a Rental Car Agency

To tackle consumer privacy, it processes data in real time on the sensor itself, using Deep Learning models on an NVIDIA Jetson TX2 Module, and then discards the image. It dumps data in 32 milliseconds and only sends the aggregated or metadata to its servers. The company claims an accuracy of shopper counts of above 90%.

## Self-Driving Vehicles

There was ample proof that Level 3 self-driving vehicles are here and now.

Chinese company [TuSimple](#), headquartered in San Diego, demonstrated its self-driving delivery truck with nine cameras, two LIDARs, and one radar cruising on highways.



Figure 8. TuSimple Truck Planning on A Long-Range Merge

Another China-headquartered, Silicon Valley-founded company [WeRide](#) went further and showcased its Level 4 autonomous vehicles driving on their own in busy streets in China! Seeing is believing.



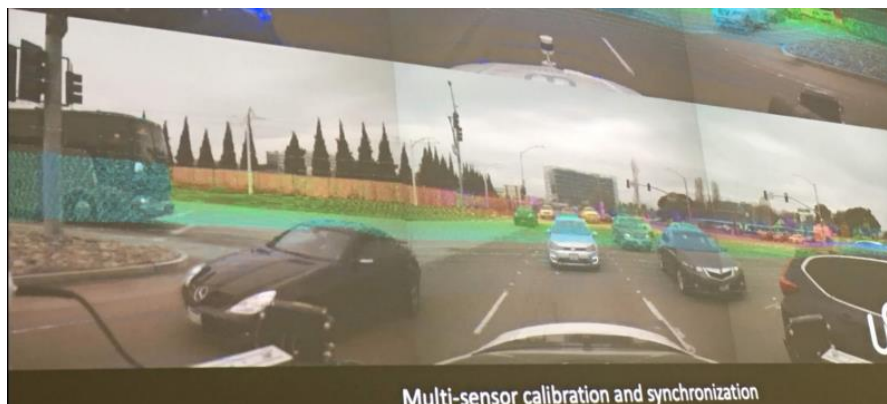


Figure 9. WeRide's Multi-sensor Calibration Approach Helps It Drive in Crowded Urban Streets

Jensen Huang, CEO of Nvidia, summed up the experience when he said that at GTC “we do things which others believe to be magic.”

Visiting the various Chinese AI vendors' booths leads one to wonder if China indeed is leading the U. S. in this field, although a [report](#) from the United Nations highlights a dominance by China and the U. S. in the race to artificial intelligence supremacy. It's [noteworthy](#) Chinese organizations make up 17 of the top 20 academic players in AI patenting, as well as 10 of the top 20 in AI-related scientific publications.

From smart cities to streaming games and ray tracing for animation, there were countless other innovations at GTC 2019. In our view, it was the most focused conference on AI anywhere in the world.

### How to Participate in The AI Revolution

NVIDIA's strategy is to make its software open sourced and freely available, so they can sell more of their GPU-based hardware for accelerating computing for all application domains. For independent developers and startups, it means that top-curated algorithms and tools are available at no cost. For instance, NVIDIA is sharing all its models for image processing for medical applications through its accelerator called Clara. Clara is a computational platform that makes it easy for developers to build, manage, and deploy intelligent medical imaging workflows and instruments. You just need to bring your imagination and start leveraging.

### Steps to Start Using NVIDIA AI

1. Sign up as an NVIDIA Developer. <https://developer.nvidia.com/developer-program>. This is a prerequisite.
2. Sign up to use Nvidia Clara at <http://developer.nvidia.com/clara>.
3. Request access for CLARA early access <ngc.nvidia.com/containers>.
4. Pick transfer learning model for various classifications.

And you, too, can help make a better world through AI!

### Miscellaneous

Jensen did admit that the company's interest in going after the crypto-currency market was a distraction. Also, when asked about his thoughts on some startups building a single, massive-core chip that does both training AND inference (e. g., [Graphcore IPU](#)), he responded (and we are paraphrasing it): Yes, there are almost 50 startups doing it and most of them will go out of business since we are already shipping such GPUs.

We can't wait for NVIDIA GTC 2020! 😊