NVIDIA Jetson AGX Orin Developer Kit User Guide

NVIDIA®

AGX Orin Developer Kit
User Guide

Next-Level AI Performance for Next-Gen Robotics

Contents

Introducing NVIDIA® Jetson AGX Orin™

NVIDIA Accelerated Computing has revolutionized the growth of the AI industry with high-performance GPUs, SoCs, and optimized software stacks that are widely used across industries spanning cloud, data centers, and edge computing. NVIDIA Jetson platform was specifically created to deliver the benefits of AI computing to embedded edge devices. The Jetson AGX Xavier launched in 2018 raised the bar on AI to compute performance by delivering up to 32 TOPS of AI performance and enabling new AI-powered edge applications. NVIDIA Jetson AGX Xavier, combined with NVIDIA's comprehensive, optimized, and scalable AI software stack, are powering many commercial autonomous robots used in food delivery, crop harvesting, warehouse goods movement, robot-assisted surgery, autonomous industrial inspections, and many more.

The strong performance of Jetson AGX Xavier coupled with the powerful NVIDIA AI software stack has resulted in the rapid growth of the Jetson developer community to over one million registered developers and has enabled over 6000 customers to develop and deploy NVIDIA Jetson-based AI solutions. The pace of development and deployment of AI-powered autonomous machines and robots continues to grow rapidly, and the next generation of applications requires tremendous AI compute performance to handle multi-modal AI applications that need to run concurrently in real-time. As human-robot interactions increase in retail spaces, food delivery, hospitals, warehouses, factory floors and other commercial applications, autonomous robots will need to concurrently perform 3D perception, natural language understanding, path planning, obstacle avoidance, pose estimation, and many more autonomous actions that not just require significant AI performance, but also highly accurate and trained neural models for each application.

The NVIDIA Jetson AGX Orin is the highest-performing and newest member of the NVIDIA Jetson family. It delivers tremendous performance, and class-leading energy efficiency, and is backed by the comprehensive NVIDIA AI software stack to power the next generation of demanding edge AI applications. The NVIDIA® Orin System-on-Chip (SoC) based on the NVIDIA Ampere GPU architecture with 2048 CUDA cores, 64 Tensor Cores, and 2 Deep Learning Accelerator (DLA) engines delivers up to 275 TOPS of raw AI performance. NVIDIA Jetson AGX Orin delivers the following key benefits:

- Up to 8X the raw AI compute performance and up to 2X the energy efficiency of Jetson AGX Xavier
- Same pin-out and footprint as the Jetson AGX Xavier, enabling customers to easily upgrade existing designs to Jetson AGX Orin
- Industry-leading AI performance enabling significant speedups for real-world computer vision and conversational AI workloads
- Powerful NVIDIA AI software stack with support for SDKs such as NVIDIA JetPack, NVIDIA RIVA, NVIDIA DeepStream, NVIDIA Isaac, NVIDIA TAO, and others.

The Jetson AGX Orin Developer Kit contains everything needed for developers to get up and running quickly. The Jetson AGX Orin Developer Kit is priced at $1999 and is available for purchase through NVIDIA authorized distributors worldwide.

Developer kit contents

- Jetson AGX Orin module with heat sink and reference carrier board
- 802.11ac/abgn Wireless Network Interface Controller
- Power adapter and USB Type-C cord
- USB Type-C to USB Type-A cord
- Quick Start and Support Guide

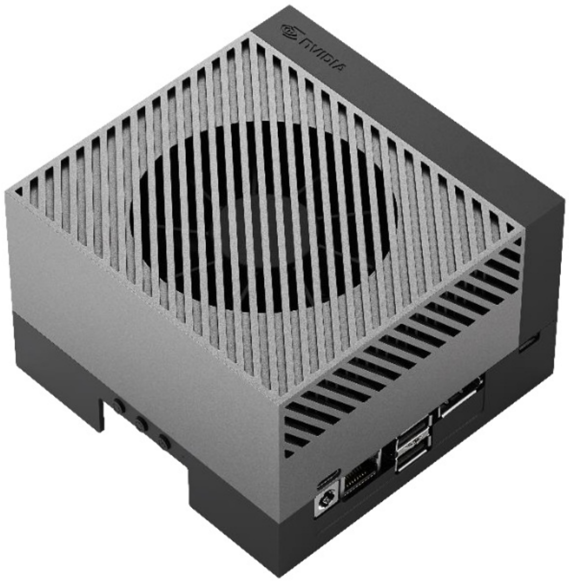


Figure 1 Jetson AGX Orin Developer Kit

Jetson AGX Orin Developer Kit features

MODULE:	
GPU	NVIDIA Ampere architecture with 2048 NVIDIA® CUDA® cores
CPU	12-core Arm Cortex-A78AE v8.2 64-bit CPU 3MB L2 + 6MB L3
DL Accelerator	2x NVDLA v2
Vision	PVA v2.0
Memory	32GB 256-bit LPDDR5204.8 GB/s
Storage	64GB eMMC 5.1
Power	15W to 60W

Table 1 Jetson AGX Orin Developer Kit Module Specs

REFERENCE CARRIER BOARD:	
Camera	16-lane MIPI CSI-2 connector
PCIe	x16 PCIe slot supporting
M.2 Key M	x4 PCIe Gen 4
M.2 Key E	x1 PCIe Gen 4, USB 2.0, UART, I2S
USB	Type C: 2x USB 3.2 Gen2 with USB-PD support
Networking	RJ45 (up to 10 GbE)
Display	DisplayPort 1.4a (+MST)
microSD slithers	UHS-1 cards up to SDR104 mode 12-pin automation header 10-pin audio panel header 10-pin JTAG header 4-pin fan header 2-pin RTC battery backup connector DC power jack Power, Force Recovery, and Reset buttons
Dimensions	40-pin header (I2C, GPIO, SPI, CAN, I2S, UART, DMIC)

Table 2 Jetson AGX Orin Developer Kit Carrier Board Specs

Best in Class Performance

Up to 8X Higher AI Performance

The power-efficient Jetson AGX Orin System-on-Module (SoM) delivers up to 275 TOPS 1 of AI performance within a 60-Watt power budget, an 8X improvement over the 32 TOPS delivered by Jetson AGX Xavier. For designs requiring lower power profiles, customers can tune their designs for power profiles ranging from 15W to 60W. Jetson AGX Orin also delivers up to 9X the DLA performance of Xavier providing even higher energy efficiency for inferencing applications that purely run on the DLA cores. Jetson AGX Orin also delivers up to 1.5X higher CPU performance and up to 1.5X higher DRAM bandwidth which helps to reduce bottlenecks and latencies when running multiple concurrent inferencing applications.

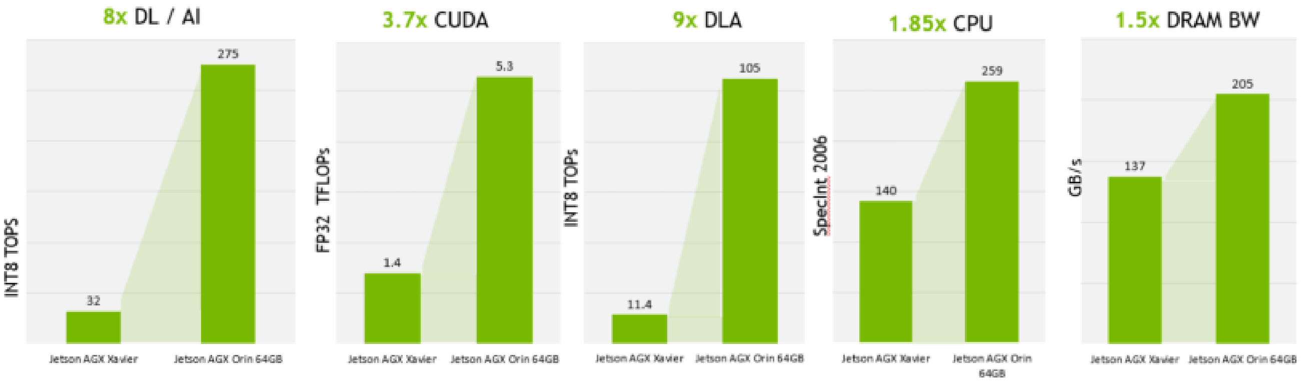


Figure 2 Jetson AGX Orin delivers 8x the AI performance of Jetson AGX Xavier

Significant Performance Speedups for Real-world AI Workloads

NVIDIA Jetson AGX Orin delivers significant performance speedups for various real-world AI workloads as measured by industry-accepted benchmarks and performance on widely used neural networks. The industry standard MLPerf benchmark defined by a consortium of industry leaders including NVIDIA, Google, Meta and others measures performance on common AI tasks for image classification, object detection and natural language processing using widely used neural networks such as ResNet50, Mobilenet-v2, and GNMT. NVIDIA Jetson AGX Xavier is current at the top of the leaderboard for this benchmark, beating the competition by significant margins. Read the blog here NVIDIA Jetson AGX Orin will further increase this lead and even beat the current leader, Jetson AGX Xavier by a significant margin. The results of this benchmark will be revealed on April 6 th after it is reviewed and confirmed by the MLPerf benchmark organization.

Jetson AGX Orin delivers almost 3.5X the performance of Jetson AGX Xavier on popular pre-trained neural networks that are used for object detection, action recognition, pose estimation, and others. The new Sparsity feature introduced in the Ampere GPU architecture and available on Jetson AGX Orin, will help further boost the performance advantage. The continual optimizations in the underlying JetPack software, neural networks, and the adoption of Sparse networks are expected to further improve the performance lead of Jetson AGX Orin in real-world workloads to up to 5X. Learn more about accelerating inferencing with sparsity here.

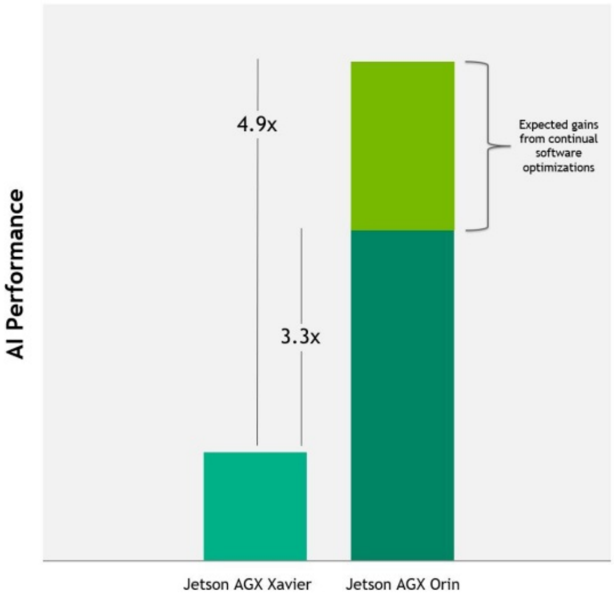
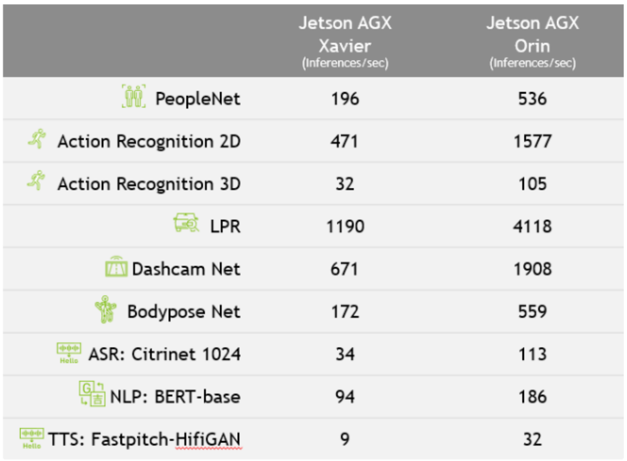


Figure 3 Jetson AGX Orin delivers more than 3x the AI performance of Jetson AGX Xavier[2]

[2] Relative performance gain represents the geometric mean of performance gains measured across a wide variety of production-ready pre-trained neural networks and inference models used in MLPerf.

Performance on Vision AI and Conversational AI Models



	Jetson AGX Xavier (Inferences/sec)	Jetson AGX Orin (Inferences/sec)
PeopleNet	196	536
Action Recognition 2D	471	1577
Action Recognition 3D	32	105
LPR	1190	4118
Dashcam Net	671	1908
Bodypose Net	172	559
ASR: Citrinet 1024	34	113
NLP: BERT-base	94	186
TTS: Fastpitch-HifiGAN	9	32

Table 3 Jetson AGX Orin Performance on widely used Vision and Conversational AI models

Instructions for running the above benchmarks on Jetson AGX Orin and Jetson AGX Xavier are available in Running Inference Benchmarks section of Appendix

Faster Development with the NVIDIA AI Software Platform

The class-leading performance and energy efficiency of Jetson AGX Orin are backed by the same powerful

NVIDIA AI platform that is deployed in GPU-accelerated data centers, hyper scale servers, and powerful AI workstations. The NVIDIA AI platform brings optimized AI tools, libraries, and NVIDIA SDKs such as CUDA, CuDNN, TensorRT, DeepStream, RIVA, TAO and Isaac to the Jetson platform, enabling developers to seamlessly train AI applications on powerful cloud GPUs and deploy trained networks on Jetson-powered AI edge devices. Tools like NVIDIA Omniverse Replicator for synthetic data generation help in creating high-quality datasets to boost model training, NVIDIA Train-Adapt-Optimize (TAO) and Pre-Trained Models (PTM) cut down development time by up to 10X and provide an easier and faster way to accelerate training and quickly create highly accurate production-ready models. SDKs that are deployed in powerful data centers, such as RIVA for accelerated conversational AI and Deepstream for accelerated vision AI, also run on the Jetson AGX Orin. NVIDIA Isaac SDK delivers GPU-accelerated solutions for Jetson-based robotic applications. Developers can quickly and easily build advanced robots such as the one showcased in the Orion demo video using the software tools available on the NVIDIA AI platform.

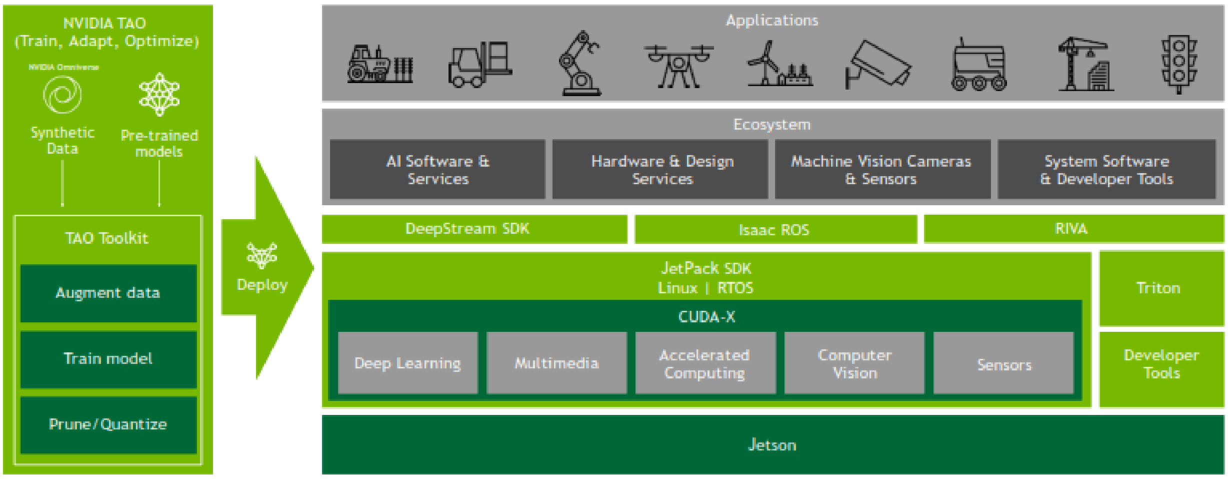


Figure 4 NVIDIA AI Software Stack for Jetson

NVIDIA JetPack is the foundational SDK for the Jetson edge AI platform. JetPack SDK provides a full development environment for hardware-accelerated AI-at-the-edge development. JetPack SDK provides a board support package, with a bootloader, Linux kernel, Ubuntu desktop environment, and a complete set of libraries for the acceleration of GPU computing, multimedia, graphics, and computer vision. Jetson AGX Orin is powered by our latest release of JetPack 5.0 whose highlights include:

- The latest compute stack with the latest versions of CUDA 11 and TensorRT 8
- Linux Kernel 5.10
- Ubuntu 20.04-based root file system
- UEFI for CPU bootloader
- OP-TEE for Trusted Execution Environment
- Hardware root of trust, Secure boot, Disk Encryption, Secure Storage and other security features
- Over-the-Air Updates to safely update any Jetson module deployed in the field

Please refer to the Booting up your Jetson AGX Orin Developer Kit section in the Appendix to set up your development kit with JetPack 5.0 SDK.

NVIDIA TAO (Train-Adapt-Optimize) is a framework that lets developers create custom, production-ready models, in hours rather than months, without AI expertise or large training datasets. The NVIDIA TAO Toolkit abstracts away the AI/deep learning framework complexity, letting you fine-tune on high-quality NVIDIA pre-trained AI models with only a fraction of the data compared to training from scratch. Customers can use the TAO Toolkit to fine-tune and optimize on a wide variety of use cases from computer vision and automatic speech recognition to speech synthesis and natural language understanding. Data collection and annotation is an expensive and laborious process. Simulation can help bridge the need for data. NVIDIA Omniverse Replicator uses simulation to generate synthetic data that is an order of magnitude faster and cheaper to create than real data. With Omniverse Replicator you can quickly create diverse, massive, and accurate datasets for training AI models.

We have provided you with a demo that will enable you to use TAO to train a model in the cloud and deploy the trained model on Jetson using DeepStream. Please refer to the NVIDIA TAO section in the Appendix for instructions on running the demo.

NVIDIA Isaac ROS GEMs are hardware-accelerated packages that make it easier for ROS developers to build high-performance solutions on NVIDIA hardware.

NVIDIA Isaac Sim, powered by Omniverse, is a scalable robotics simulation application. It includes Replicator – a tool to generate diverse synthetic datasets for training perception models. Isaac Sim is also a tool that powers photorealistic, physically accurate virtual environments to develop, test, and manage AI-based robots.

NVIDIA RIVA is an SDK for building GPU-accelerated conversational AI applications. RIVA includes state-of-the-art pre-trained models for Automatic Speech Recognition (ASR) and Text-To-Speech (TTS). These pre-trained models are highly accurate and can be easily customized using the TAO Toolkit to improve accuracy on desired domains, accents, languages, and use cases. NVIDIA RIVA speech models are optimized for TensorRT to deliver high inferencing performance and low latencies on Jetson AGX Orin. We have provided you with a RIVA ASR demo which is a dictation application that showcases the performance of Jetson AGX Orin and the accuracy of the pre-trained speech recognition neural networks. Please refer to the NVIDIA RIVA section in the Appendix for more details and instructions to run these demos.

DeepStream is an SDK for rapidly developing and deploying Vision AI applications and services. DeepStream offers hardware acceleration beyond inference as it offers hardware accelerated plugins for end-to-end AI pipeline acceleration. It offers state-of-the-art throughput. Developers can also bring their own TensorFlow, PyTorch, or ONNX models and deploy them using DeepStream.

NVIDIA Fleet Command™ is a cloud service that securely deploys, manages, and scales AI applications across distributed edge infrastructure. Purpose-built for AI, Fleet Command is a turnkey solution for AI lifecycle management. It removes the complexity of building and maintaining an edge software platform by offering streamlined deployments, OTA updates, and detailed monitoring capabilities. Layered security protocols protect intellectual property and application insights from cloud to edge. With Fleet Command, organizations can go from zero to AI in minutes. Fleet Command on Jetson is coming soon.

All the above software technologies combined with the performance of Jetson AGX Orin will enable developers to build multi-modal applications that run multiple concurrent neural networks for use cases such as personal assistant robots as demonstrated in this video. The video showcases the Orion robot built by NVIDIA on the Jetson AGX Orin platform using the neural networks and SDKs that are in the sample demos provided to you.

You can access this Reviewers Guide from **https://developer.nvidia.com/jetson-agx-orin-review**

Booting up your Jetson AGX Orin Developer Kit

The Jetson AGX Orin Developer Kit comes pre-flashed with Jetson Linux BSP. Just connect the power supply, keyboard, mouse, display and power on. Also, make sure to connect Jetson to the internet over the built-in Wi-Fi or ethernet before you proceed further. The first boot on this “private” preview pre-flashed image will take a couple of minutes to show the initial configuration dialogue. The developer kits made which will be available to the public after the announcement in GTC 2022 will have a release quality pre-flashed BSP image with a much faster first boot. Go through the simple initial setup process and skip installing the chromium web browser when asked. There is a known issue in this private preview image. Once the initial configuration is complete and the developer kit has booted to the desktop, you can install the latest BSP and JetPack components using the below command:

```
do add-apt-repository “deb https://repo.download.nvidia.com/jetson/jetson-50/t234 r34.0 main”
sudo add-apt-repository “deb https://repo.download.nvidia.com/jetson/jetson-50/common r34.0 main” Sudo apt dist-upgrade
```

During upgrade, the script will ask your choice few times, please enter “Y” for all choices.

Please do a hard reboot of the system by long pressing the power button OR by disconnecting the power supply and connecting it back again. After the system is rebooted and ou have logged into the desktop please install Jetpack components using: Sudo apt install Nvidia-jetpack

After installing JetPack components, reboot the system and boot into the latest JetPack.

Exploring the Developer Kit

The developer kit is running JetPack 5.0 (pre-release) which has the following components:

- CUDA 11.4
- cuDNN 8.3.2
- TensorRT 8.4.0
- OpenCV 4.5.4

- Vulkan 1.3
- VPI 2.0
- Night Systems 2021.5
- Night Graphics 2021.5

On top right of the desktop, there is a power profile selector. When clicked, it provides a drop-down menu of all software-defined power modes for the developer kit. For the purpose of reviewing the developer kit, running benchmarks and the provided sample demos, please confirm that Jetson is in the Maxx power profile.
JetPack comes with **multiple samples built in**. These samples provide a preview and capabilities of different JetPack components. JetPack includes the following samples which can be compiled on the developer kit. We encourage you to run these samples to learn about the JetPack components.

JetPack component	Sample locations on reference filesystem
TensorRT	/usr/src/tensor/samples/
cuDNN	/usr/src/cudnn_samples_v8/
CUDA	/usr/local/Cuda-11.4/samples/
MM API	/usr/src/jetson_multimedia_api
VPI	/opt/Nvidia/vpi2/samples/

Running Inference Benchmarks

Download the tarball named “benchmarks.tar.gz” required for this benchmarking from here and move it inside the Review Directory. And untar the tarball: mkdir HOME/Review cd $HOME/Review
Move benchmarks.tar.gz to inside the $HOME/Review and then untar it: tar -xvf benchmarks.tar.gz
Setup the requirements for running the benchmark by doing:cd benchmarks: bash installBenchmarks.sh
The above script will download additional content from the internet. Please make sure that the devkit is online when you run the script
For a clean measurement, please reboot the system and then start benchmarking.
Vision Model Benchmarking
Run Vision Model Benchmarks using:
bash launchVisionBenchmark.sh
You will get the output similar to below:

Model	Name
0	peoplenet
1	action_recog_2d
2	action_recog_3d
3	dashcamnet
4	bodyposenet
5	lpr_us

Conversational AI Model Benchmarking
Run Vision Model Benchmarks using: bash launchConvBenchmark.sh
You will get the output similar to below. Highlighted in yellow are the latencies of ASR, NLP, and TTS. You can

convert that latency to FPS using 1000/latency.
——————Starting ASR Benchmark
Loading eval dataset…
filename: /benchdata/1272-135031-0000.wav
Done loading 1 file
Latencies (ms):

Median	90th	95th	99
9.2084	9.3835	9.5279	14

Intermediate latencies (ms):

Median	90th	95th	99
9.2061	9.3615	9.4755	9.

Final latencies (ms):

Median	90th	95th	9
14.065	14.131	14.131	1

Run time: 54.441 sec.
Total audio processed: 54.425 sec.
Throughput: 0.99971 RTFX
——————Starting NLP Benchmark
Done sending 1000 requests
Done processing 1000 responses
Run time: 6.80158s
Total sequences processed: 1000
Throughput: 147.025 seq/sec
Latencies:

Median	90	95	99	Avg
3.39	3.49	3.51	3.57	3.45

——————Starting TTS Benchmark
Latencies:
First audio – average: 0.024089 (This is in seconds. Convert to milliseconds using 1000/latency in seconds)
First audio – P90: 0.0248866
First audio – P95: 0.0249044
First audio – P99: 0.0249245
Chunk – average: 0.00473509
Chunk – P90: 0.00488245
Chunk – P95: 0.00489093
Chunk – P99: 0.0058794
Throughput (RTF): 50.8159
At the end stop benchmarking using: bash top benchmark. sh

NVIDIA TAO

NVIDIA provides pre-trained, production-ready neural network models on the NVIDIA GPU Cloud (NGC). For each model, NVIDIA provides a deployable model and a trainable model. The deployable model is production ready and optimized to run on the inferencing pipeline while the trainable model is intended for fine tuning using custom data with NVIDIA TAO. In this demo, you will experience:

- Deploying production-ready high accuracy, optimized models on Jetson
- Using Train-Adapt-Optimize to train a trainable model on the cloud and then deploy the trained model on Jetson.

To setup, up the demo, Create a directory and name it as “Review” in your home directory if already not been created.

```
mkdir $HOME/Review
```

Download the tarball named “TAO-PTM.tar.gz” required for this demo from here and move it inside the Review Directory. And untar the tarball: cd $HOME/Review

Move “TAO-PTM.tar.gz” to inside the $HOME/Review and then untar it: tar -xvf TAO-PTM.tar.gz

```
cd $HOME/Review/TAO-PTM
bash installTAOPTM.sh
```

Installation will take a couple of minutes.

After installation is complete, start the jupyter-lab by following the commands below:

```
cd $HOME/Review/TAO-PTM/
export PATH=”$HOME/.local/bin/:$PATH”
jupyter-lab
```

Click on the link in the end of the output of the above command and it will open the Jupyter notebook on the browser.

Deploy Pre-Trained Models on Jetson

In this section, you will deploy the Peoplenet deployable model using DeepStream and see it in action. In the Jupyter notebook on the browser, navigate (navigation pane on the left) to the PreTrainedModel directory and open the notebook named peoplenet_workflow.ipynb. You can read about the PeopleNet model: the model architecture, training data, and accuracy in the notebook.

Train using NVIDIA TAO and Deploy on Jetson

In this section, you will start from a trainable PeopleNet model and train in the cloud for an additional detection class. After training, you will download the trained model to Jetson and deploy using DeepStream. In the Jupyter notebook on the browser, navigate (navigation pane on the left) to the TrainAdaptOptimize directory and open the notebook named tao_workflow.ipynb For your review, we have provided a minimal set of data for training and training for 500 epochs. The quality of detections benefits from the amount and quality of the dataset. Since we have kept the data set minimal in order to shorten the training time, the model generated will not be of production quality.

NVIDIA RIVA

In this demo, you will experience NVIDIA RIVA ASR in action. You will need a headset with a mic that has shipped to you in the reviewers package. Please connect the USB headset with the mic to the developer kit before starting on the demos below.

Create a directory and name it as “Review” in your home directory if already not been done.

```
mkdir $HOME/Review
```

Download the tar ball named “Riva.tar.gz” required for this demo from here and move it inside the Review Directory.

```
cd $HOME/Review
```

Move “Riva.tar.gz” to inside the $HOME/Review and then untar it: tax -xvf Riva.tar.gz

Install the demo using:

```
cd $HOME/Review/Riva
bash installRivaASR.sh
```

Once the installation is done, you can experience the following RIVA transcription demo:

Please remove the USB Camera and only have the USB Headset with mic connected. And then reboot.

We require this step since we have hard coded the demo to use the USB Headset with mic we have provided.

RIVA ASR Demo

First demo will showcase RIVA Automatic Speech Recognition (ASR) with a transcription use case. The demo uses Citrinet model architecture which is trained with ASR Set 3.0   16700 Hours dataset. The model is running totally locally on Jetson in this demo. Launch the demo using the below command:

cd $HOME/Review/Rivabash launchASR.sh

It will take approximately 3 minutes to load. Once loaded you will see a clear screen and at this point you can start talking. You will see the transcription happening in real time.

We encourage you to put our ASR to test by giving dictation to both RIVA ASR and a competing solution in the market and compare the accuracy and performance. After you re done, press ctrl-c to stop the transcription, and then execute the following command. bash stopRiva.shAdditional Resources

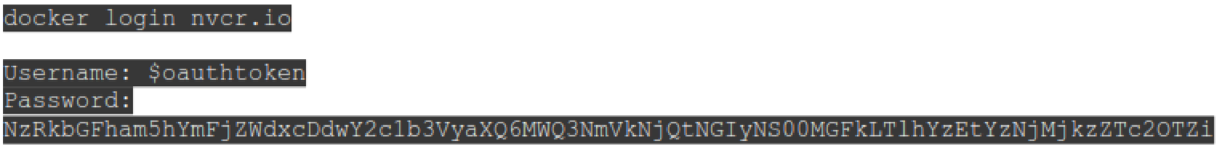
Pytorch Wheels

We have hosted Pytorch wheels here: https://nvidia.box.com/shared/static/19je2l0ppy1fpq4mw1a5gsbb5y9fopy7.whl

For installation, please do the following steps: **wget** https://nvidia.box.com/shared/static/19je2l0ppy1fpq4mw1a5gsbb5y9fopy7.whl -O
torch-1.10.0-cp38-cp38-linux_aarch64.whl
Sudo apt-get install python3-pip libopenblas-base libopenmpi-dev
pip3 install Cython
pip3 install NumPy torch-1.10.0-cp38-cp38-linux_aarch64.whl

Pytorch Container

Please pull the pytroch container by following the steps below:
Step 1: Log into Nvidia GPU Cloud
sudo docker login nvcr.io
User username as $oauthtoken and password as
“NzRkbGFham5hYmFjZWdxcDdwY2c1b3VyaXQ6MWQ3NmVkNjQtNGIyNS00MGFkLTlhYzEtYzNjMjkzZTc2
OTZi” like shown below.



```
docker login nvcr.io

Username: $oauthtoken
Password:
NzRkbGFham5hYmFjZWdxcDdwY2c1b3VyaXQ6MWQ3NmVkNjQtNGIyNS00MGFkLTlhYzEtYzNjMjkzZTc2OTZi
```

Step 2: Pull and start the container
sudo docker run -it –rm –runtime Nvidia –network host nvcr.io/ealinux4tegra/l4t-pytorch:r34.0.1-pth1.10-py3

NVIDIA Jetson AGX Orin Specs

	Jetson AGX Xavier	Jetson AGX Orin
AI Performance	32 TOPS (INT8)	275 TOPS (INT8 with Sparsity) |138 TOPS (INT8)
GPU	512-core NVIDIA Volta GPU with 64 Tensor Cores	2048-core NVIDIA Ampere GPU with 64 Tensor Cores
DL Accelerator	2x NVDLA	2x NVDLA v2
Vision Accelerator	2x PVA v1	PVA v2
CPU	8-core NVIDIA Carmel Arm®v8.2 64-bit CPU 8MB L2 + 4MB L3	12-core NVIDIA Arm® Cortex A78AE v8.2 64-bit CPU 3MB L2 + 6MB L3
Memory	Up to 64GB 256-bit LPDDR4x @ 2133MHz 137 GB/s	Up to 64 GB 256-bit LPDDR5 @ 3200MHz 204.8 GB/s
Storage	32GB eMMC 5.1	64 GB eMMC 5.1
Video Encode	4x 4K60 | 8x 4K30 | 16x 1080p60 | 32x 1080p30 (H.265) H.264, VP9	2x 4K60 | 4x 4K30 | 8x 1080p60 | 16x 1080p30 (H.265) H.264, AV1
Video Decode	2x 8K30 | 6x 4K60 | 12x 4K30 | 26x 1080p60 | 52x 1080p30 (H.265) H.264, VP9	1x 8K30 | 3x 4K60 | 7x 4K30 | 11x 1080p60| 22x? 1080p30 (H.265) H.264, VP9, AV1
Camera	16 lanes MIPI CSI-2 (36 Virtual Channels) | 8 lanes SLVS-EC| D-PHY 40Gbps / C-PHY 62 Gbps	16 lanes MIPI CSI-2 (16 Virtual Channels*) D-PHY 2.1 40Gbps / C-PHY 2.0 164Gbps
PCI Express	16 lanes PCIe Gen 4 1 x8 + 1 x4 + 1 x2 + 2 x1	22 lanes PCIe Gen 4 Up to 2 x8, 1 x4, 2 x1
Ethernet	1 Gbe RGMII	1 Gbe RGMII | 4x 10Gbe XFI
Mechanical	100mm x 87mm 699 pin connector	100mm x 87mm 699 pin connector
Power	10W to 30W	15W to 60W

Contact Information

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