TENSORFLOW FOR JETSON PLATFORM

Installation Guide
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Chapter 1.
OVERVIEW

TensorFlow on Jetson Platform

**TensorFlow™** is an open-source software library for numerical computation using data flow graphs. Nodes in the graph represent mathematical operations, while the graph edges represent the multidimensional data arrays (tensors) that flow between them. This flexible architecture lets you deploy computation to one or more CPUs or GPUs in a desktop, server, or mobile device without rewriting code.

**Jetson AGX Xavier**

The NVIDIA Jetson AGX Xavier developer kit for Jetson platform is the world’s first AI computer for autonomous machines. The Jetson AGX Xavier delivers the performance of a GPU workstation in an embedded module under 30W.

**Jetson Nano**

NVIDIA Jetson Nano is a small, powerful computer for embedded AI systems and IoT that delivers the power of modern AI in a low-power platform. The Jetson Nano is targeted to get started fast with the NVIDIA Jetpack SDK and a full desktop Linux environment, and start exploring a new world of embedded products.

**Jetson TX2**

The Jetson TX2 Developer Kit enables a fast and easy way to develop hardware and software for the Jetson TX2 AI supercomputer on a module. It exposes the hardware capabilities and interfaces of the developer board, comes with design guides and other documentation, and is pre-flashed with a Linux development environment. The Jetson TX2 also supports NVIDIA Jetpack—a complete SDK that includes the BSP, libraries for deep learning, computer vision, GPU computing, multimedia processing, and much more.
1.1. Benefits of TensorFlow on Jetson Platform

Installing TensorFlow for Jetson Platform provides you with the access to the latest version of the framework on a lightweight, mobile platform without being restricted to TensorFlow Lite.
Chapter 2.
PREREQUISITES AND DEPENDENCIES

Before you install TensorFlow for Jetson Platform, ensure you:

1. Install JetPack on your Jetson device.
2. Install system packages as required by TensorFlow:
   
   ```sh
   sudo apt-get install libhdf5-serial-dev hdf5-tools libhdf5-dev zlib1g-dev
   zip libjpeg8-dev
   ```
3. Install and upgrade pip3.
   
   ```sh
   sudo apt-get install python3-pip
   sudo pip3 install -U pip
   ```
4. Install the following Python packages:
   
   ```sh
   sudo pip3 install -U numpy grpcio absl-py py-cpuinfo psutil portpicker six
   mock requests gast h5py astor termcolor protobuf keras-applications keras-
   preprocessing wrapt google-pasta setuptools testresources
   ```
Chapter 3.
INSTALLING TENSORFLOW

Install TensorFlow using the `pip3` command. This command will install the latest version of TensorFlow.

```
$ sudo pip3 install --pre --extra-index-url https://developer.download.nvidia.com/compute/redist/jp/v42 tensorflow-gpu
```

If you want to install a specific version of TensorFlow, issue the following command:

```
$ sudo pip3 install --extra-index-url https://developer.download.nvidia.com/compute/redist/jp/v42 tensorflow-gpu==${TF_VERSION}+nv${NV_VERSION}
```

Where:

- **TF_VERSION**
  The released version of TensorFlow, for example, `1.12.0`.

- **NV_VERSION**
  The monthly NVIDIA container version of TensorFlow, for example, `19.01`.

For example, to install TensorFlow 19.01, the command would look similar to the following:

```
$ sudo pip3 install --extra-index-url https://developer.download.nvidia.com/compute/redist/jp/v42 tensorflow-gpu==1.12.0+nv19.1
```

### 3.1. Installing Multiple TensorFlow Versions

If you want to have multiple versions of TensorFlow available at the same time, this can be accomplished using virtual environments. See below.

**Set up the Virtual Environment**

First, install the `virtualenv` package and create a new Python 3 virtual environment:

```
$ sudo apt-get install virtualenv
$ python3 -m virtualenv -p python3 <chosen_venv_name>
```
Activate the Virtual Environment

Next, activate the virtual environment:

$ source <chosen_venv_name>/bin/activate

Install the desired version of TensorFlow and its dependencies:

$ pip3 install -U numpy grpcio absl-py py-cpuinfo psutil portpicker six mock requests gast h5py astor termcolor protobuf keras-applications keras-preprocessing wrapt google-pasta setuptools testresources
$ pip3 install --extra-index-url https://developer.download.nvidia.com/compute/redist/jp/v42 tensorflow-gpu==$TF_VERSION+nv$NV_VERSION

Deactivate the Virtual Environment

Finally, deactivate the virtual environment:

$ deactivate

Run a Specific Version of TensorFlow

After the virtual environment has been set up, simply activate it to have access to the specific version of TensorFlow. Make sure to deactivate the environment after use:

$ source <chosen_venv_name>/bin/activate
$ <Run the desired TensorFlow scripts>
$ deactivate

3.2. Upgrading TensorFlow

To upgrade to a more recent release of TensorFlow, if one is available, run the install command with the ‘upgrade’ flag:

$ sudo pip3 install --upgrade --extra-index-url https://developer.download.nvidia.com/compute/redist/jp/v42 tensorflow-gpu
Chapter 4.

VERIFYING THE INSTALLATION

To verify that TensorFlow has been successfully installed on Jetson AGX Xavier, you’ll need to launch a Python prompt and import TensorFlow.

1. From the terminal, run:

   $ python3

2. Import TensorFlow:

   >>> import tensorflow

   If TensorFlow was installed correctly, this command should execute without error.
Chapter 5.
BEST PRACTICES

Performance model

It is recommended to choose the right performance mode to get the best possible performance given energy usage limitations. There is a command line tool (`nvpmode`) that can be used to change the performance mode. In order to check the current performance mode, issue:

```
$ sudo nvpmode -q --verbose
```

To change the mode to MAX-N, issue:

```
$ sudo nvpmode -m 0
```

For more information, see:

- How do you switch between max-q and max-p?
- Jetson/Performance
- Two cores disabled

Swap space on Jetson Xavier

On Jetson Xavier, certain applications could run out of memory (16GB shared between CPU and GPU). This problem can be resolved by creating a swap partition on the external memory. Typically 4GB of swap space is enough.
Chapter 6. UNINSTALLING

TensorFlow can easily be uninstalled using the `pip3 uninstall` command, as below:

```
$ pip3 uninstall -y tensorflow-gpu
```
Join the NVIDIA Jetson and Embedded Systems community to discuss Jetson Platform-specific issues.
Chapter 8.
SUPPORT

TensorFlow

For more information about TensorFlow, see:

- TensorFlow tutorials
- TensorFlow API
- Install TensorFlow on Ubuntu
- NVIDIA TensorFlow documentation

Jetson Platform

For more information about Jetson Platform, see:

- NVIDIA Jetson AGX Xavier Developer Kit
- NVIDIA Jetson Nano Developer Kit
- Jetson software documentation

NVIDIA SDK Manager

- See NVIDIA SDK Manager for more information.
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