



DALI

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Installation Guide



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Chapter 1.

OVERVIEW

Deep learning applications involve increasingly complex, multi-stage pre-processing data pipelines, with compute-intensive steps that are mainly carried out on the CPU. For instance, steps such as load data from disk, decode, crop, random resize, color and spatial augmentations and format conversions are carried out on the CPUs, limiting the performance and scalability of training and inference tasks. In addition, the deep learning frameworks today have multiple data pre-processing implementations, resulting in challenges such as portability of training and inference workflows and code maintainability.

NVIDIA[®] Data Loading Library[™] (DALI) is a collection of highly optimized building blocks and an execution engine to accelerate input data pre-processing for deep learning applications. DALI provides both performance and flexibility of accelerating different data pipelines, as a single library, that can be easily integrated into different deep learning training and inference applications.

Key highlights of DALI include:

- ▶ Full data pipeline accelerated from reading disk to getting ready for training/inference
- ▶ Flexibility through configurable graphs and custom operators
- ▶ Support for image classification and segmentation workloads
- ▶ Ease of integration through direct framework plugins and open source bindings
- ▶ Portable training workflows with multiple input formats - JPEG, PNG (fallback to CPU), TIFF (fallback to CPU), BMP (fallback to CPU), raw formats, LMDB, RecordIO, TFRecord
- ▶ Extensible for user specific needs through open source license

Chapter 2.

DALI AND NGC

DALI is pre-installed in the [NVIDIA GPU Cloud TensorFlow, PyTorch, and MXNet containers](#) in version 18.07 and later.

Chapter 3.

INSTALLING DALI

DALI can be installed either directly using a pre-built binary or by compiling the sources from GitHub.

3.1. Installing Prebuilt DALI Packages

3.1.1. Prerequisites

Ensure you meet the following minimum requirements:

- ▶ Linux x64
- ▶ **NVIDIA Driver** (384.xx or later driver releases) supporting **CUDA 9.0** or later
- ▶ One or more of the following deep learning frameworks:
 - ▶ **MXNet 1.3** or later
 - ▶ **Version 1.3** from the Python package with the following command:

```
pip install mxnet-cu90==1.3.0
```
 - ▶ **PyTorch 0.4**
 - ▶ **TensorFlow 1.7** or later.

3.1.2. Binary Installation

1. Install DALI using **pip**:

```
pip install --extra-index-url  
https://developer.download.nvidia.com/compute/redist nvidia-dali
```

2. Install DALI Tensorflow plugin

The **nvidia-dali** package contains prebuilt versions of the dali tensorflow plugin for several versions of tensorflow. Since release 0.6.1 there is also a possibility to install dali tensorflow plugin for the currently installed version of tensorflow, thus allowing forward compatibility:

```
pip install --extra-index-url https://developer.download.nvidia.com/compute/
redist nvidia-dali-tf-plugin
```

3. Install `nvidia-dali-tf-plugin` package

Installing this package will install `nvidia-dali` and its dependencies if not already installed. The package `tensorflow-gpu` must be installed before attempting to install `nvidia-dali-tf-plugin`.

The package `nvidia-dali-tf-plugin` has a strict requirement with `nvidia-dali` as its exact same version. Thus, installing `nvidia-dali-tf-plugin` at its latest version will replace any older `nvidia-dali` versions already installed with the latest. To work with older versions of DALI, please provide the version explicitly to the pip install command.

```
OLDER_VERSION=0.6.1
pip install --extra-index-url https://developer.download.nvidia.com/compute/
redist nvidia-dali-tf-plugin==$OLDER_VERSION
```

3.2. Compiling DALI From Source

3.2.1. Prerequisites

Ensure that you meet the below minimum requirements:

- ▶ Linux x64.
- ▶ [GCC 4.9.2](#) or later.
- ▶ [NVIDIA CUDA 9.0](#) (CUDA 8.0 compatibility is provided *unofficially*¹).
- ▶ [nvJPEG library](#) (This can be *unofficially* disabled¹).
- ▶ [protobuf](#) version 2 or later (version 3 or later is required for TensorFlow TFRecord file format support).
- ▶ [CMake 3.5](#) or later.
- ▶ [FFmpeg 3.4.2](#) recommend using version 3.4.2 compiled with the instructions provided in this document.
- ▶ [libjpeg-turbo 1.5.x](#) or later (This can be *unofficially* disabled¹).
- ▶ [OpenCV 3](#) or later (OpenCV 2.x compatibility is provided *unofficially*¹).
- ▶ [liblmbd 0.9.x](#) or later.
- ▶ One or more of the following deep learning frameworks:
 - ▶ [MXNet 1.3](#) or later
 - ▶ [Version 1.3](#) from the Python package with the following command:


```
pip install mxnet-cu90==1.3.0
```
 - ▶ [PyTorch 0.4](#)
 - ▶ [TensorFlow 1.7](#) or later.

¹ Items marked *unofficial* are community contributions that are believed to work but not officially tested or maintained by NVIDIA.

3.2.2. GitHub Installation

1. Download the DALI source package from GitHub.

```
git clone --recursive https://github.com/NVIDIA/dali
cd dali
```

2. Create the build directory.

```
mkdir build
cd build
```

3. Compile DALI.


- a) To build DALI without LMDB support, issue the following command:

```
cmake ..
make -j"${nproc}"
```

- b) To build DALI with LMDB support, issue the following command:

```
cmake -DBUILD_LMDB=ON ..
make -j"${nproc}"
```

- c) To build DALI using Clang, issue the following command:

 **Caution** This build is experimental, meaning it is not maintained and tested like the default configuration, therefore, it's not guaranteed to work. We recommend using GCC for production builds.

```
cmake -DCMAKE_CXX_COMPILER=clang++ -DCMAKE_C_COMPILER=clang ..
make -j"${nproc}"
```

3.2.2.1. CMake Build Parameters

You can use the following optional CMake build parameters when configuring DALI:

BUILD_PYTHON

Use this parameter to build Python bindings. The default is **ON**.

BUILD_TEST

Use this parameter to include building the test suite. The default is **ON**.

BUILD_BENCHMARK

Use this parameter to include building benchmarks. The default is **ON**.

BUILD_LMDB

Use this parameter to build with support for LMDB. The default is **OFF**.

BUILD_NVTX

Use this parameter to build with NVTX profiling enabled. The default is **OFF**.

BUILD_TENSORFLOW

Use this parameter to build the TensorFlow plugin. The default is **OFF**.

WERROR

Treats all build warnings as errors. The default is **OFF**.

BUILD_JPEG_TURBO(*unofficial*)

Use this parameter to build with libjpeg-turbo. The default is **ON**.²

² Items marked *unofficial* are community contributions that are believed to work but not officially tested or maintained by NVIDIA.

BUILD_NVJPEG (*unofficial*)

Use this parameter to build with nvJPEG. The default is **ON**.³

3.2.3. Installing Python Bindings

Issue the `pip install dali/python` command to install Python bindings.

³ Items marked *unofficial* are community contributions that are believed to work but not officially tested or maintained by NVIDIA.

Chapter 4.

EXECUTING RESNET-50 INPUT PIPELINE

After you've installed DALI, you can run a pre-configured, ResNet-50 model accelerated by DALI, on MXNet, PyTorch, and TensorFlow frameworks for image classification training. Each of the following samples offload image loading and augmentation operations onto GPUs.

You can use Python toolchain from the command shell or Jupyter notebook to start the ResNet-50 training session.

The DALI integrated ResNet-50 Python samples are located:

- ▶ [MXNet](#)
- ▶ [PyTorch](#)
- ▶ [TensorFlow](#)

Chapter 5.

FFMPEG

This software uses code of [FFmpeg](#) licensed under the [LGPLv2.1](#) and its source can be downloaded [here](#).

FFmpeg was compiled using the following command line:

```
./configure \  
--prefix=/usr/local \  
--disable-static \  
--disable-all \  
--disable-autodetect \  
--disable-iconv \  
--enable-shared \  
--enable-avformat \  
--enable-avcodec \  
--enable-avfilter \  
--enable-protocol=file \  
--enable-demuxer=mov,matroska \  
--enable-bsf=h264_mp4toannexb,hevc_mp4toannexb  
./make
```

Chapter 6.

UNINSTALLING DALI

Uninstall DALI.

```
pip uninstall -y nvidia-dali
```

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