# Table of Contents

Chapter 1. Installing cuDNN on Linux.............................................................................................................. 1

1.1. Prerequisites .................................................................................................................................................. 1

1.1.1. Installing NVIDIA Graphics Drivers ................................................................................................... 1

1.1.2. Installing the CUDA Toolkit for Linux ............................................................................................. 1

1.1.3. Installing Zlib ............................................................................................................................................ 1

1.2. Downloading cuDNN for Linux .................................................................................................................. 2

1.3. Installing on Linux ........................................................................................................................................... 2

1.3.1. Tar File Installation ................................................................................................................................... 2

1.3.2. Debian Local Installation ....................................................................................................................... 2

1.3.3. RPM Local Installation ........................................................................................................................... 3

1.3.4. Package Manager Installation ............................................................................................................ 3

1.3.4.1. Ubuntu/Debian Network Installation .......................................................................................... 3

1.3.4.2. RHEL Network Installation ........................................................................................................... 4

1.4. Verifying the Install on Linux ...................................................................................................................... 5

1.5. Upgrading from cuDNN 7.x.x to cuDNN 8.x.x .................................................................................... 5

1.6. Troubleshooting ................................................................................................................................................. 5

Chapter 2. Installing cuDNN on Windows........................................................................................................... 6

2.1. Prerequisites .................................................................................................................................................. 6

2.1.1. Installing NVIDIA Graphic Drivers ..................................................................................................... 6

2.1.2. Installing the CUDA Toolkit for Windows........................................................................................ 6

2.2. Downloading cuDNN for Windows .......................................................................................................... 6

2.3. Installing on Windows .................................................................................................................................... 7

2.4. Upgrading cuDNN ............................................................................................................................................. 8

2.5. Troubleshooting ................................................................................................................................................. 8

Chapter 3. Building a cuDNN Dependent Program......................................................................................... 9

3.1. Including cuDNN’s Dependencies ............................................................................................................ 9

3.2. cuDNN’s Inter-Library Dependencies ...................................................................................................... 9

Chapter 4. Cross-Compiling cuDNN Samples................................................................................................. 11

4.1. Linux AArch64 SBSA .................................................................................................................................... 11

4.1.1. Installing the CUDA Toolkit for Linux AArch64 SBSA .................................................................. 11

4.1.2. Installing cuDNN for Linux AArch64 SBSA .................................................................................. 11

4.1.3. Cross-Compiling cuDNN Samples for Linux AArch64 SBSA ....................................................... 12

Chapter 5. Appendix ............................................................................................................................................. 13

5.1. ACKNOWLEDGEMENTS .............................................................................................................................. 13
Chapter 1. Installing cuDNN on Linux

1.1. Prerequisites

For the latest compatibility software versions of the OS, NVIDIA CUDA, the CUDA driver, and the NVIDIA hardware, refer to the NVIDIA cuDNN Support Matrix.

1.1.1. Installing NVIDIA Graphics Drivers

Install up-to-date NVIDIA graphics drivers on your Linux system.

1. Go to: NVIDIA download drivers
2. Select the GPU and OS version from the drop-down menus.
3. Download and install the NVIDIA graphics driver as indicated on that web page. For more information, select the ADDITIONAL INFORMATION tab for step-by-step instructions for installing a driver.
4. Restart your system to ensure that the graphics driver takes effect.

1.1.2. Installing the CUDA Toolkit for Linux

Refer to the following instructions for installing CUDA on Linux, including the CUDA driver and toolkit: NVIDIA CUDA Installation Guide for Linux.

1.1.3. Installing Zlib

For Ubuntu users, to install the zlib package, run:

```
sudo apt-get install zlib
```

For RHEL users, to install the zlib package, run:

```
sudo yum install zlib
```
1.2. Downloading cuDNN for Linux

In order to download cuDNN, ensure you are registered for the NVIDIA Developer Program.

1. Go to: NVIDIA cuDNN home page.
2. Click Download.
3. Complete the short survey and click Submit.
4. Accept the Terms and Conditions. A list of available download versions of cuDNN displays.
5. Select the cuDNN version that you want to install. A list of available resources displays.

1.3. Installing on Linux

The following steps describe how to build a cuDNN dependent program. Choose the installation method that meets your environment needs. For example, the tar file installation applies to all Linux platforms. The Debian package installation applies to Debian 11, Ubuntu 18.04, Ubuntu 20.04, and 22.04. The RPM package installation applies to RHEL7, RHEL8, and RHEL9.

In the following sections:

‣ your CUDA directory path is referred to as /usr/local/cuda/
‣ your cuDNN download path is referred to as <cudnnpath>

1.3.1. Tar File Installation

Before issuing the following commands, you must replace X.Y and v8.x.x.x with your specific CUDA and cuDNN versions and package date.

1. Navigate to your <cudnnpath> directory containing the cuDNN tar file.
2. Unzip the cuDNN package.

   $ tar -xvf cudnn-linux-$arch-v8.x.x_x-cudaX.Y-archive.tar.xz

   Where ${arch} is x86_64, sbse, or ppc64le.

3. Copy the following files into the CUDA toolkit directory.

   $ sudo cp cudnn-*archive/include/cudnn*.h /usr/local/cuda/include
   $ sudo cp -P cudnn-*archive/lib/libcudnn* /usr/local/cuda/lib64
   $ sudo chmod a+r /usr/local/cuda/include/cudnn*.h /usr/local/cuda/lib64/libcudnn*

1.3.2. Debian Local Installation

Download the Debian local repository installation package. Before issuing the following commands, you must replace X.Y and v8.x.x.x with your specific CUDA and cuDNN versions.

1. Navigate to your downloads directory containing the cuDNN Debian local installer file.
2. Enable the local repository.
   ```
sudo dpkg -i cudnn-local-repo-${distro}-8.x.x.1-0-1_amd64.deb
   
or
   sudo dpkg -i cudnn-local-repo-${distro}-8.x.x.1-0-1_arm64.deb
   ```
   Where `${distro}` is `ubuntu1804`, `ubuntu2004`, `ubuntu2204`, or `debian11`.

3. Import the CUDA GPG key.
   ```
sudo cp /var/cudnn-local-repo-*/cudnn-local-*/keyring.gpg /usr/share/keyrings/
   ```

4. Refresh the repository metadata.
   ```
sudo apt-get update
   ```

5. Install the runtime library.
   ```
sudo apt-get install libcudnn8=8.x.x.x-1+cudaX.Y
   ```

6. Install the developer library.
   ```
sudo apt-get install libcudnn8-dev=8.x.x.x-1+cudaX.Y
   ```

7. Install the code samples.
   ```
sudo apt-get install libcudnn8-samples=8.x.x.x-1+cudaX.Y
   ```

1.3.3. RPM Local Installation

Download the RPM local repository installation package. Before issuing the following commands, you must replace `X.Y` and `8.x.x.x` with your specific CUDA and cuDNN versions.

1. Navigate to your downloads directory containing the cuDNN RPM local installer file.
2. Enable the local repository.
   ```
sudo rpm -i cudnn-local-repo-${distro}-8.x.x.x-1.0-1.x86_64.rpm
   
or
   sudo rpm -i cudnn-local-repo-${distro}-8.x.x.x-1.0-1.aarch64.rpm
   ```
   Where `${distro}` is `rhel7`, `rhel8`, or `rhel9`.

3. Refresh the repository metadata.
   ```
sudo yum clean all
   ```

4. Install the runtime library.
   ```
sudo yum install libcudnn8=8.x.x.x-1.cudaX.Y
   ```

5. Install the developer library.
   ```
sudo yum install libcudnn8-devel=8.x.x.x-1.cudaX.Y
   ```

6. Install the code samples.
   ```
sudo yum install libcudnn8-samples=8.x.x.x-1.cudaX.Y
   ```

1.3.4. Package Manager Installation

The Package Manager installation interfaces with your system's package manager.

If the actual installation packages are available online, then the package manager will automatically download them and install them.

1.3.4.1. Ubuntu/Debian Network Installation

These are the installation instructions for Debian 11, Ubuntu 18.04, Ubuntu 20.04, and 22.04 users.
1. Enable the network repository. Perform the steps described in the NVIDIA CUDA Installation Guide for Ubuntu or the NVIDIA CUDA Installation Guide for Debian.

```
Note: For the $distro/$arch noted in the above links, refer to the NVIDIA cuDNN Support Matrix for the $distro/$arch supported versions, as cuDNN’s Support Matrix might differ from CUDA.
```

Where $distro/$arch should be replaced by one of the following:

- ubuntu1804/x86_64
- ubuntu2004/x86_64
- ubuntu2204/x86_64
- debian11/x86_64
- ubuntu2004/sbsa
- ubuntu2204/sbsa

2. Install the cuDNN library and cuDNN samples:

```
sudo apt-get install libcudnn8=${cudnn_version}-1+${cuda_version}
sudo apt-get install libcudnn8-dev=${cudnn_version}-1+${cuda_version}
sudo apt-get install libcudnn8-samples=${cudnn_version}-1+${cuda_version}
```

Where:

- ${cudnn_version} is 8.9.4.*
- ${cuda_version} is cuda12.2 or cuda11.8

### 1.3.4.2. RHEL Network Installation

These are the installation instructions for RHEL7, RHEL8, and RHEL9 users.

1. Enable the repository:

```
sudo yum clean all
```

Where ${distro}/${arch} should be replaced by one of the following:

- rhel7/x86_64
- rhel8/x86_64
- rhel9/x86_64
- rhel8/ppc64le
- rhel8/sbsa

2. Install the cuDNN library and cuDNN samples:

```
sudo yum install libcudnn8=${cudnn_version}-1.$(cuda_version)
sudo yum install libcudnn8-devel=${cudnn_version}-1.$(cuda_version)
sudo yum install libcudnn8-samples=${cudnn_version}-1.$(cuda_version)
```

Where:

- ${cudnn_version} is 8.9.4.*
1.4. Verifying the Install on Linux

To verify that cuDNN is installed and is running properly, compile the mnistCUDNN sample located in the /usr/src/cudnn_samples_v8 directory in the Debian file.

1. Copy the cuDNN samples to a writable path.
   
   ```
   $ cp -r /usr/src/cudnn_samples_v8/ $HOME
   ```

2. Go to the writable path.
   
   ```
   $ cd $HOME/cudnn_samples_v8/mnistCUDNN
   ```

3. Compile the mnistCUDNN sample.
   
   ```
   $ make clean && make
   ```

4. Run the mnistCUDNN sample.
   
   ```
   $ ./mnistCUDNN
   ```

If cuDNN is properly installed and running on your Linux system, you will see a message similar to the following:

```
Test passed!
```
Chapter 2. Installing cuDNN on Windows

2.1. Prerequisites

For the latest compatibility software versions of the OS, CUDA, the CUDA driver, and the NVIDIA hardware, refer to the NVIDIA cuDNN Support Matrix.

2.1.1. Installing NVIDIA Graphic Drivers

Install up-to-date NVIDIA graphics drivers on your Windows system.

1. Go to: NVIDIA download drivers
2. Select the GPU and OS version from the drop-down menus.
3. Download and install the NVIDIA driver as indicated on that web page. For more information, select the ADDITIONAL INFORMATION tab for step-by-step instructions for installing a driver.
4. Restart your system to ensure that the graphics driver takes effect.

2.1.2. Installing the CUDA Toolkit for Windows

Refer to the following instructions for installing CUDA on Windows, including the CUDA driver and toolkit: NVIDIA CUDA Installation Guide for Windows.

2.2. Downloading cuDNN for Windows

In order to download cuDNN, ensure you are registered for the NVIDIA Developer Program.

1. Go to: NVIDIA cuDNN home page.
2. Click Download.
3. Complete the short survey and click Submit.
4. Accept the Terms and Conditions. A list of available download versions of cuDNN displays.
5. Select the cuDNN version that you want to install. A list of available resources displays.
6. Download the cuDNN package for Windows (zip).

2.3. Installing on Windows

The following steps describe how to build a cuDNN dependent program.

You must replace 8.x and 8.x.y.z with your specific cuDNN version.

Package installation (zip)

In the following steps, the package directory path is referred to as <packagepath>.

1. Navigate to your <packagepath> directory containing the cuDNN package.
2. Unzip the cuDNN package.
3. Copy the following files from the unzipped package into the NVIDIA cuDNN directory.
   a). Copy bin\cudnn*.dll to C:\Program Files\NVIDIA\CUDNN\v8.x\bin.
   b). Copy include\cudnn*.h to C:\Program Files\NVIDIA\CUDNN\v8.x\include.
   c). Copy lib\cudnn*.lib to C:\Program Files\NVIDIA\CUDNN\v8.x\lib.
4. Set the following environment variable to point to where cuDNN is located. To access the value of the $(PATH) environment variable, perform the following steps:
   a). Open a command prompt from the Start menu.
   b). Type Run and hit Enter.
   c). Issue the control sysdm.cpl command.
   d). Select the Advanced tab at the top of the window.
   e). Click Environment Variables at the bottom of the window.
   f). Add the NVIDIA cuDNN bin directory path to the PATH variable:
      Variable Name: PATH
      Value to Add: C:\Program Files\NVIDIA\CUDNN\v8.x\bin
5. Add cuDNN to your Visual Studio project.
   a). Open the Visual Studio project, right-click on the project name in Solution Explorer, and choose Properties.
   b). Click VC++ Directories and append C:\Program Files\NVIDIA\CUDNN\v8.x\include to the Include Directories field.
   c). Click Linker > General and append C:\Program Files\NVIDIA\CUDNN\v8.x\lib to the Additional Library Directories field.
   d). Click Linker > Input and append cudnn.lib to the Additional Dependencies field and click OK.
2.4. **Upgrading cuDNN**

Navigate to the directory containing cuDNN and delete the old cuDNN bin, lib, and header files. Remove the path to the directory containing cuDNN from the $(PATH) environment variable. Reinstall a newer cuDNN version by following the steps in [Installing on Windows](#).

2.5. **Troubleshooting**

Join the [NVIDIA Developer Forum](#) to post questions and follow discussions.
Chapter 3. Building a cuDNN Dependent Program

3.1. Including cuDNN’s Dependencies

Because cuDNN uses symbols defined in external libraries, you need to ensure that the linker can locate these libraries while building a cuDNN dependent program. One way to achieve this is by explicitly specifying them on the linker command.

For linker dependencies for the dynamic cuDNN libs

Linux: Add `-lcublas -lcublasLt -lz` to the linker command.

Windows: Add `cublas.lib cublasLt.lib zlibwapi.lib` to the linker command.

Linker dependencies for the static cuDNN libs

Linux: Add `-lcublas_static -lcublasLt_static -lz -lcubios -lnvrtc_static -lnvrtc-builtins_static -lnvptxcompiler_static -lcudart_static` to the linker command.

Windows: Not applicable. Static cuDNN libs for Windows are not supported.

3.2. cuDNN’s Inter-Library Dependencies

Since cuDNN is split into several libraries, dependencies between them need to be taken into account.

For example, when statically linking `libcudnn_cnn_infer_static.a` into an application, `libcudnn_ops_infer_static.a` is also needed, in this order (a dependent library followed by its dependency). Specifically:

```
-static -Wl,--whole-archive ${CUDNN_PATH}/libcudnn_cnn_infer_static.a ${CUDNN_PATH}/libcudnn_ops_infer_static.a -Wl,--no-whole-archive
```
The chain of dependencies can be found in the NVIDIA cuDNN API Reference.
Chapter 4. Cross-Compiling cuDNN Samples

This section describes how to cross-compile cuDNN samples.

4.1. Linux AArch64 SBSA

Follow the steps in this section to cross-compile cuDNN samples on Linux AArch64. Linux AArch64 incorporates ARM® based CPU cores for Server Base System Architecture (SBSA).

4.1.1. Installing the CUDA Toolkit for Linux AArch64 SBSA

Before issuing the following commands, you must replace x-y with your specific CUDA version.

1. Download the Ubuntu package: cuda*ubuntu*_amd64.deb
2. Download the cross compile package: cuda*-cross-sbsa*_all.deb
3. Execute the following commands:
   
   sudo dpkg -i cuda*ubuntu*_amd64.deb
   sudo dpkg -i cuda-repo-cross-sbsa*_all.deb
   sudo apt-get update
   sudo apt-get install cuda-toolkit-x-y -y
   sudo apt-get install cuda-cross-sbsa* -y

4.1.2. Installing cuDNN for Linux AArch64 SBSA

1. Download the cuDNN Ubuntu package for your preferred CUDA toolkit version.

   cudnn-local-repo-*_amd64.deb

2. Download the cross compile package.

   cudnn-local-repo-cross-sbsa-*_all.deb

3. Execute the following commands:
Cross-Compiling cuDNN Samples

4. Install AArch64 host compiler.
   sudo apt install g++-aarch64-linux-gnu

4.1.3. Cross-Compiling cuDNN Samples for Linux AArch64 SBSA

1. Copy the cudnn_samples_v8 directory to your home directory:
   $ cp -r /usr/src/cudnn_samples_v8 $HOME

2. For each sample, execute the following commands:
   $ cd $HOME/cudnn_samples_v8/{each sample}
   $ sudo make TARGET_ARCH=aarch64 SBSA=1
Chapter 5. Appendix

5.1. ACKNOWLEDGEMENTS

NVIDIA would like to thank the following individuals and institutions for their contributions:

- This product includes zlib - a general purpose compression library https://zlib.net/ Copyright © 1995-2017 Jean-loup Gailly and Mark Adler
- This product includes zstr - a C++ zlib wrapper https://github.com/mateidavid/zstr Copyright © 2015 Matei David, Ontario Institute for Cancer Research
- This product includes RapidJSON - A fast JSON parser-generator for C++ with both SAX/DOM style API https://github.com/Tencent/rapidjson Copyright © 2015 THL A29 Limited, a Tencent company, and Milo Yip.
Notice

This document is provided for information purposes only and shall not be regarded as a warranty of a certain functionality, condition, or quality of a product. NVIDIA Corporation ("NVIDIA") makes no representations or warranties, expressed or implied, as to the accuracy or completeness of the information contained in this document and assumes no responsibility for any errors contained herein. NVIDIA shall have no liability for the consequences or use of such information or for any infringement of patents or other rights of third parties that may result from its use. This document is not a commitment to develop, release, or deliver any Material (defined below), code, or functionality.

NVIDIA reserves the right to make corrections, modifications, enhancements, improvements, and any other changes to this document, at any time without notice.

Customer should obtain the latest relevant information before placing orders and should verify that such information is current and complete.

NVIDIA products are sold subject to the NVIDIA standard terms and conditions of sale supplied at the time of order acknowledgement, unless otherwise agreed in an individual sales agreement signed by authorized representatives of NVIDIA and customer ("Terms of Sale"). NVIDIA hereby expressly objects to applying any customer general terms and conditions with regards to the purchase of the NVIDIA product referenced in this document. No contractual obligations are formed either directly or indirectly by this document.

NVIDIA products are not designed, authorized, or warranted to be suitable for use in applications where failure or malfunction of the NVIDIA product can reasonably be expected to result in personal injury, death, or property or environmental damage. NVIDIA accepts no liability for inclusion and/or use of NVIDIA products in such equipment or applications and therefore such inclusion and/or use is at customer's own risk.

NVIDIA makes no representation or warranty that products based on this document will be suitable for any specified use. Testing of all parameters of each product is not necessarily performed by NVIDIA. It is customer's sole responsibility to evaluate and determine the applicability of any information contained in this document, ensure the product is suitable and fit for the application planned by customer, and perform the necessary testing for the application in order to avoid a default of the application or the product. Weaknesses in customer's product designs may affect the quality and reliability of the NVIDIA product and may result in additional or different conditions and/or requirements beyond those contained in this document. NVIDIA accepts no liability related to any default, damage, costs, or problem which may be based on or attributable to: (i) the use of the NVIDIA product in any manner that is contrary to this document or (ii) customer product designs.

No license, either expressed or implied, is granted under any NVIDIA patent right, copyright, or other NVIDIA intellectual property right under this document. Information published by NVIDIA regarding third-party products or services does not constitute a license from NVIDIA to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property rights of the third party, or a license from NVIDIA under the patents or other intellectual property rights of NVIDIA.

Reproduction of information in this document is permissible only if approved in advance by NVIDIA in writing, reproduced without alteration and in full compliance with all applicable export laws and regulations, and accompanied by all associated conditions, limitations, and notices.

THIS DOCUMENT AND ALL NVIDIA DESIGN SPECIFICATIONS, REFERENCE BOARDS, FILES, DRAWINGS, DIAGNOSTICS, LISTS, AND OTHER DOCUMENTS (TOGETHER AND SEPARATELY, "MATERIALS") ARE BEING PROVIDED "AS IS." NVIDIA MAKES NO WARRANTIES, EXPRESSED, IMPLIED, STATUTORY, OR OTHERWISE WITH RESPECT TO THE MATERIALS, AND EXPRESSLY DISCLAIMS ALL IMPLIED WARRANTIES OF NONINFRINGEMENT, MERCHANTABILITY, AND FITNESS FOR A PARTICULAR PURPOSE. TO THE EXTENT NOT PROHIBITED BY LAW, IN NO EVENT WILL NVIDIA BE LIABLE FOR ANY DAMAGES, INCLUDING WITHOUT LIMITATION ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, CONSEQUENTIAL, OR CONSEQUENTIAL DAMAGES, HOWEVER CAUSED AND REGARDLESS OF THE THEORY OF LIABILITY, ARISING OUT OF ANY USE OF THIS DOCUMENT, EVEN IF NVIDIA HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. NOTwithstanding any damages that customer might incur for any reason whatsoever, NVIDIA's aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the Terms of Sale for the product.

Arm

Arm, AMBA and Arm Powered are registered trademarks of Arm Limited. Cortex, MPCore and Mali are trademarks of Arm Limited. "Arm" is used to represent Arm Holdings plc; its operating company Arm Limited; and the regional subsidiaries Arm inc.; Arm KK; Arm Korea Limited; Arm Taiwan Limited; Arm France SAS; Arm Consulting (Shanghai) Co. Ltd.; Arm Germany GmbH; Arm Embedded Technologies Pvt. Ltd.; Arm Norway, AS and Arm Sweden AB.

HDMI

HDMI, the HDMI logo, and High-Definition Multimedia Interface are trademarks or registered trademarks of HDMI Licensing LLC.

Blackberry/QNX

Copyright © 2020 BlackBerry Limited. All rights reserved.

Trademarks, including but not limited to BLACKBERRY, EMBLEM Design, QNX, AVIAGE, MOMENTICS, NEUTRINO and QNX CAR are the trademarks or registered trademarks of BlackBerry Limited, used under license, and the exclusive rights to such trademarks are expressly reserved.

Google

Android, Android TV, Google Play and the Google Play logo are trademarks of Google, Inc.