MICROSOFT COGNITIVE TOOLKIT

Release Notes

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Chapter 1.
MICROSOFT COGNITIVE TOOLKIT OVERVIEW

The NVIDIA Deep Learning SDK accelerates widely-used deep learning frameworks such as the Microsoft® Cognitive Toolkit™ , formerly referred to as CNTK.

The Microsoft Cognitive Toolkit empowers you to harness the intelligence within massive datasets through deep learning by providing uncompromised scaling, speed and accuracy with commercial-grade quality and compatibility with the programming languages and algorithms you already use.

See **`/workspace/README.md`** inside the container for information on customizing your the DGX-1 image. For more information about the Microsoft Cognitive Toolkit, including tutorials, documentation, and examples, see the Microsoft Cognitive Toolkit wiki.

This document describes the key features, software enhancements and improvements, any known issues, and how to run this container.

Chapter 2.
PULLING A CONTAINER

Before you can pull a container from the NGC container registry, you must have Docker installed. For DGX users, this is explained in Preparing to use NVIDIA Containers Getting Started Guide.

For users other than DGX, follow the NVIDIA® GPU Cloud™ (NGC) container registry installation documentation based on your platform.

You must also have access and logged into the NGC container registry as explained in the NGC Getting Started Guide.

There are four repositories where you can find the NGC docker containers.

`nvcr.io/nvidia`

The deep learning framework containers are stored in the **`nvcr.io/nvidia`** repository.

`nvcr.io/hpc`

The HPC containers are stored in the **`nvcr.io/hpc`** repository.

`nvcr.io/nvidia-hpcvis`

The HPC visualization containers are stored in the **`nvcr.io/nvidia-hpcvis`** repository.

`nvcr.io/partner`

The partner containers are stored in the **`nvcr.io/partner`** repository. Currently the partner containers are focused on Deep Learning or Machine Learning, but that doesn't mean they are limited to those types of containers.

Chapter 3.
RUNNING MICROSOFT COGNITIVE TOOLKIT

Before you can run an NGC deep learning framework container, your Docker environment must support NVIDIA GPUs. To run a container, issue the appropriate command as explained in the Running A Container chapter in the *NVIDIA Containers And Frameworks User Guide* and specify the registry, repository, and tags.

On a system with GPU support for NGC containers, the following occurs when running a container:

▶ The Docker engine loads the image into a container which runs the software.

▶ You define the runtime resources of the container by including additional flags and settings that are used with the command. These flags and settings are described in Running A Container.

▶ The GPUs are explicitly defined for the Docker container (defaults to all GPUs, can be specified using **NV_GPU** environment variable).

The method implemented in your system depends on the DGX OS version installed (for DGX systems), the specific NGC Cloud Image provided by a Cloud Service Provider, or the software that you have installed in preparation for running NGC containers on TITAN PCs, Quadro PCs, or vGPUs.

1. Issue the command for the applicable release of the container that you want. The following command assumes you want to pull the latest container.

```
docker pull nvcr.io/nvidia/cntk:18.08
```

2. Open a command prompt and paste the pull command. The pulling of the container image begins. Ensure the pull completes successfully before proceeding to the next step.

3. Run the container image. A typical command to launch the container is:

```
docker run --gpus all -it --rm -v local_dir:container_dir
nvcr.io/nvidia/cntk:<xx.xx>
```

a) When running on a single GPU, the Microsoft Cognitive Toolkit can be invoked using a command similar to the following:

```
cntk configFile=myscript.cntk ...
```

b) When running on multiple GPUs, run the Microsoft Cognitive Toolkit through MPI. The following example uses 4 GPUs, numbered 0..3, for training:

```
export OMP_NUM_THREADS=10
    export CUDA_DEVICE_ORDER=PCI_BUS_ID
    export CUDA_VISIBLE_DEVICES=0,1,2,3
    mpirun --allow-run-as-root --oversubscribe --npernode 4 \
        -x OMP_NUM_THREADS -x CUDA_DEVICE_ORDER -x
 CUDA_VISIBLE_DEVICES \
        cntk configFile=myscript.cntk ...
```

c) When running with all 8 GPUs together, it is even more simple:

```
export OMP_NUM_THREADS=10
    mpirun --allow-run-as-root --oversubscribe --npernode 8 \
        -x OMP_NUM_THREADS cntk configFile=myscript.cntk ...
```

> You can vary the number of GPUs with the option `--npernode X` where `X` is the number of GPUs. For the DGX-1™ this is a maximum of 8 GPUs per node. For the DGX Station™ it is a maximum of 4 GPUs. For NVIDIA® GPU Cloud™ (NGC) the number of GPUs depends upon the instance type that you have selected.

You might want to pull in data and model descriptions from locations outside the container for use by Microsoft Cognitive Toolkit or save results to locations outside the container. To accomplish this, the easiest method is to mount one or more host directories as Docker data volumes.

> In order to share data between ranks, NVIDIA® Collective Communications Library™ (NCCL) may require shared system memory for IPC and pinned (page-locked) system memory resources. The operating system's limits on these resources may need to be increased accordingly. Refer to your system's documentation for details.
>
> In particular, Docker® containers default to limited shared and pinned memory resources. When using NCCL inside a container, it is recommended that you increase these resources by issuing:
>
> ```
> --shm-size=1g --ulimit memlock=-1
> ```
>
> in the command line to:
>
> ```
> docker run --gpus all
> ```

Chapter 4.
MICROSOFT COGNITIVE TOOLKIT RELEASE 18.08

The NVIDIA container image of Microsoft Cognitive Toolkit, release 18.08, is available.

Contents of the Microsoft Cognitive Toolkit

This container image contains the source files that are used to build the Microsoft Cognitive Toolkit in the **/opt/cntk** directory. The Microsoft Cognitive Toolkit binaries are pre-built and installed into the **/usr/local/cntk** directory.

A Python 3.6 Conda environment (including the Microsoft Cognitive Toolkit module) is installed in the **/opt/conda/envs/cntk-py36** directory. This is included in **PATH**, so by default the **python** command executes a Python 3.6 interpreter. To use the base Ubuntu Python 2.7 binary, you can either adjust **PATH** or explicitly call **/usr/bin/python**.

This image of the Microsoft Cognitive Toolkit 2.5, is built with the following options enabled:

▸ Async SGD
▸ Python 3 API
▸ OpenCV
▸ Kaldi

The container also includes the following:

▸ Ubuntu 16.04 including Python 3.6 environment
▸ NVIDIA CUDA 9.0.176 (see Errata section and 2.1) including CUDA® Basic Linear Algebra Subroutines library™ (cuBLAS) 9.0.425
▸ NVIDIA CUDA® Deep Neural Network library™ (cuDNN) 7.2.1
▸ NCCL 2.2.13 (optimized for NVLink™)
▸ OpenMPI™ 3.0.0

Driver Requirements

Release 18.08 is based on CUDA 9, which requires NVIDIA Driver release 384.xx.

Key Features and Enhancements

This Microsoft Cognitive Toolkit release includes the following key features and enhancements.

▸ Microsoft Cognitive Toolkit container image version 18.08 is based on Microsoft Cognitive Toolkit 2.5.
▸ Latest version of cuDNN 7.2.1.
▸ Ubuntu 16.04 with July 2018 updates

Announcements

We are continuing to incorporate monthly Microsoft Cognitive Toolkit upstream changes as well as upgrade NVIDIA libraries, such as cuDNN, cuBLAS, NCCL, and the Ubuntu OS. However, we will be discontinuing container updates once the next major CUDA version is released.

Known Issues

There are no known issues in this release.

Chapter 5.
MICROSOFT COGNITIVE TOOLKIT RELEASE 18.07

The NVIDIA container image of Microsoft Cognitive Toolkit, release 18.07, is available.

Contents of the Microsoft Cognitive Toolkit

This container image contains the source files that are used to build the Microsoft Cognitive Toolkit in the **/opt/cntk** directory. The Microsoft Cognitive Toolkit binaries are pre-built and installed into the **/usr/local/cntk** directory.

A Python 3.6 Conda environment (including the Microsoft Cognitive Toolkit module) is installed in the **/opt/conda/envs/cntk-py36** directory. This is included in **PATH**, so by default the **python** command executes a Python 3.6 interpreter. To use the base Ubuntu Python 2.7 binary, you can either adjust **PATH** or explicitly call **/usr/bin/python**.

This image of the Microsoft Cognitive Toolkit 2.5, is built with the following options enabled:

▸ Async SGD
▸ Python 3 API
▸ OpenCV
▸ Kaldi

The container also includes the following:

▸ Ubuntu 16.04 including Python 3.6 environment
▸ NVIDIA CUDA 9.0.176 (see Errata section and 2.1) including CUDA® Basic Linear Algebra Subroutines library™ (cuBLAS) 9.0.425
▸ NVIDIA CUDA® Deep Neural Network library™ (cuDNN) 7.1.4
▸ NCCL 2.2.13 (optimized for NVLink™)
▸ OpenMPI™ 3.0.0

Driver Requirements

Release 18.07 is based on CUDA 9, which requires NVIDIA Driver release 384.xx.

Key Features and Enhancements

This Microsoft Cognitive Toolkit release includes the following key features and enhancements.

▸ Microsoft Cognitive Toolkit container image version 18.07 is based on Microsoft Cognitive Toolkit 2.5.

▸ Latest version of CUDA® Basic Linear Algebra Subroutines library™ (cuBLAS) 9.0.425.

▸ Ubuntu 16.04 with June 2018 updates

Known Issues

There are no known issues in this release.

Chapter 6.
MICROSOFT COGNITIVE TOOLKIT RELEASE 18.06

The NVIDIA container image of Microsoft Cognitive Toolkit, release 18.06, is available.

Contents of the Microsoft Cognitive Toolkit

This container image contains the source files that are used to build the Microsoft Cognitive Toolkit in the `/opt/cntk` directory. The Microsoft Cognitive Toolkit binaries are pre-built and installed into the `/usr/local/cntk` directory.

A Python 3.6 Conda environment (including the Microsoft Cognitive Toolkit module) is installed in the `/opt/conda/envs/cntk-py36` directory. This is included in `PATH`, so by default the `python` command executes a Python 3.6 interpreter. To use the base Ubuntu Python 2.7 binary, you can either adjust `PATH` or explicitly call `/usr/bin/python`.

This image of the Microsoft Cognitive Toolkit 2.5, is built with the following options enabled:

▶ Async SGD
▶ Python 3 API
▶ OpenCV
▶ Kaldi

The container also includes the following:

▶ Ubuntu 16.04 including Python 3.6 environment
▶ NVIDIA CUDA 9.0.176 (see Errata section and 2.1) including CUDA® Basic Linear Algebra Subroutines library™ (cuBLAS) 9.0.333 (see section 2.3.1)
▶ NVIDIA CUDA® Deep Neural Network library™ (cuDNN) 7.1.4
▶ NCCL 2.2.13 (optimized for NVLink™)
▶ OpenMPI™ 3.0.0

Driver Requirements

Release 18.06 is based on CUDA 9, which requires NVIDIA Driver release 384.xx.

Key Features and Enhancements

This Microsoft Cognitive Toolkit release includes the following key features and enhancements.

▸ Microsoft Cognitive Toolkit container image version 18.06 is based on Microsoft Cognitive Toolkit 2.5.
▸ Ubuntu 16.04 with May 2018 updates

Known Issues

There are no known issues in this release.

Chapter 7.
MICROSOFT COGNITIVE TOOLKIT RELEASE 18.05

The NVIDIA container image of Microsoft Cognitive Toolkit, release 18.05, is available.

Contents of the Microsoft Cognitive Toolkit

This container image contains the source files that are used to build the Microsoft Cognitive Toolkit in the **/opt/cntk** directory. The Microsoft Cognitive Toolkit binaries are pre-built and installed into the **/usr/local/cntk** directory.

A Python 3.6 Conda environment (including the Microsoft Cognitive Toolkit module) is installed in the **/opt/conda/envs/cntk-py36** directory. This is included in **PATH**, so by default the **python** command executes a Python 3.6 interpreter. To use the base Ubuntu Python 2.7 binary, you can either adjust **PATH** or explicitly call **/usr/bin/python**.

This image of the Microsoft Cognitive Toolkit 2.5, is built with the following options enabled:

▸ Async SGD
▸ Python 3 API
▸ OpenCV
▸ Kaldi

The container also includes the following:

▸ Ubuntu 16.04 including Python 3.6 environment
▸ NVIDIA CUDA 9.0.176 (see Errata section and 2.1) including CUDA® Basic Linear Algebra Subroutines library™ (cuBLAS) 9.0.333 (see section 2.3.1)
▸ NVIDIA CUDA® Deep Neural Network library™ (cuDNN) 7.1.2
▸ NCCL 2.1.15 (optimized for NVLink™)
▸ OpenMPI™ 3.0.0

Driver Requirements

Release 18.05 is based on CUDA 9, which requires NVIDIA Driver release 384.xx.

Key Features and Enhancements

This Microsoft Cognitive Toolkit release includes the following key features and enhancements.

▸ Microsoft Cognitive Toolkit container image version 18.05 is based on Microsoft Cognitive Toolkit 2.5.

▸ Incorporated all upstream GitHub Microsoft Cognitive Toolkit code as of Microsoft Cognitive Toolkit 2.5.

▸ Ubuntu 16.04 with April 2018 updates

Known Issues

1-bit SGD is now built by default since it is now part of Microsoft Cognitive Toolkit. There is a known error when running OpenMPI 3.0. If using 1-bit SGD, downgrade your OpenMPI version to 1.10.

Chapter 8.
MICROSOFT COGNITIVE TOOLKIT RELEASE 18.04

The NVIDIA container image of Microsoft Cognitive Toolkit, release 18.04, is available.

Contents of the Microsoft Cognitive Toolkit

This container image contains the source files that are used to build the Microsoft Cognitive Toolkit in the **/opt/cntk** directory. The Microsoft Cognitive Toolkit binaries are pre-built and installed into the **/usr/local/cntk** directory.

A Python 3.6 Conda environment (including the Microsoft Cognitive Toolkit module) is installed in the **/opt/conda/envs/cntk-py36** directory. This is included in **PATH**, so by default the **python** command executes a Python 3.6 interpreter. To use the base Ubuntu Python 2.7 binary, you can either adjust **PATH** or explicitly call **/usr/bin/python**.

This image of the Microsoft Cognitive Toolkit 2.4, is built with the following options enabled:

▸ Async SGD
▸ Python 3 API
▸ OpenCV
▸ Kaldi

The container also includes the following:

▸ Ubuntu 16.04 including Python 3.6 environment
▸ NVIDIA CUDA 9.0.176 (see Errata section and 2.1) including CUDA® Basic Linear Algebra Subroutines library™ (cuBLAS) 9.0.333 (see section 2.3.1)
▸ NVIDIA CUDA® Deep Neural Network library™ (cuDNN) 7.1.1
▸ NCCL 2.1.15 (optimized for NVLink™)
▸ OpenMPI™ 3.0.0

Driver Requirements

Release 18.04 is based on CUDA 9, which requires NVIDIA Driver release 384.xx.

Key Features and Enhancements

This Microsoft Cognitive Toolkit release includes the following key features and enhancements.

▸ Microsoft Cognitive Toolkit container image version 18.04 is based on Microsoft Cognitive Toolkit 2.4.

▸ Incorporated all upstream GitHub Microsoft Cognitive Toolkit code as of Microsoft Cognitive Toolkit 2.4.

▸ Latest version of NCCL 2.1.15

▸ Ubuntu 16.04 with March 2018 updates

Known Issues

There are no known issues in this release.

Chapter 9.
MICROSOFT COGNITIVE TOOLKIT RELEASE 18.03

The NVIDIA container image of Microsoft Cognitive Toolkit, release 18.03, is available.

Contents of the Microsoft Cognitive Toolkit

This container image contains the source files that are used to build the Microsoft Cognitive Toolkit in the **/opt/cntk** directory. The Microsoft Cognitive Toolkit binaries are pre-built and installed into the **/usr/local/cntk** directory.

A Python 3.6 Conda environment (including the Microsoft Cognitive Toolkit module) is installed in the **/opt/conda/envs/cntk-py36** directory. This is included in **PATH**, so by default the **python** command executes a Python 3.6 interpreter. To use the base Ubuntu Python 2.7 binary, you can either adjust **PATH** or explicitly call **/usr/bin/python**.

This image of the Microsoft Cognitive Toolkit 2.4, is built with the following options enabled:

- ▸ Async SGD
- ▸ Python 3 API
- ▸ OpenCV
- ▸ Kaldi

The container also includes the following:

- ▸ Ubuntu 16.04 including Python 3.6 environment
- ▸ NVIDIA CUDA 9.0.176 (see Errata section and 2.1) including CUDA® Basic Linear Algebra Subroutines library™ (cuBLAS) 9.0.333 (see section 2.3.1)
- ▸ NVIDIA CUDA® Deep Neural Network library™ (cuDNN) 7.1.1
- ▸ NCCL 2.1.2 (optimized for NVLink™)
- ▸ OpenMPI™ 3.0.0

Driver Requirements

Release 18.03 is based on CUDA 9, which requires NVIDIA Driver release 384.xx.

Key Features and Enhancements

This Microsoft Cognitive Toolkit release includes the following key features and enhancements.

▸ Microsoft Cognitive Toolkit container image version 18.03 is based on Microsoft Cognitive Toolkit 2.4.

▸ Added support for Python 3.6. Python 3.4 is now deprecated.

▸ Added support for FP16 natively with Microsoft Cognitive Toolkit upstream version 2.4.

▸ Latest version of cuBLAS 9.0.333

▸ Latest version of cuDNN 7.1.1

▸ Ubuntu 16.04 with February 2018 updates

Known Issues

There are no known issues in this release.

Chapter 10.
MICROSOFT COGNITIVE TOOLKIT RELEASE 18.02

The NVIDIA container image of Microsoft Cognitive Toolkit, release 18.02, is available.

Microsoft Cognitive Toolkit container image version 18.02 is based on Microsoft Cognitive Toolkit 2.3.1.

Contents of the Microsoft Cognitive Toolkit

This container image contains the source files that are used to build the Microsoft Cognitive Toolkit in the **/opt/cntk** directory. The Microsoft Cognitive Toolkit binaries are pre-built and installed into the **/usr/local/cntk** directory.

A Python 3.4 Conda environment (including the Microsoft Cognitive Toolkit module) is installed in the **/opt/conda/envs/cntk-py34** directory. This is included in **PATH**, so by default the **python** command executes a Python 3.4 interpreter. To use the base Ubuntu Python 2.7 binary, you can either adjust **PATH** or explicitly call **/usr/bin/python**.

This image of the Microsoft Cognitive Toolkit 2.3.1, is built with the following options enabled:

▸ Async SGD
▸ Python 3 API
▸ OpenCV
▸ Kaldi

The container also includes the following:

▸ Ubuntu 16.04 including Python 3.4 environment
▸ NVIDIA CUDA 9.0.176 including:

  ▸ CUDA® Basic Linear Algebra Subroutines library™ (cuBLAS) 9.0.282 Patch 2 which is installed by default

- ‣ cuBLAS 9.0.234 Patch 1 as a debian file. Installing Patch 1 by issuing the **`dpkg -i /opt/cuda-cublas-9-0_9.0.234-1_amd64.deb`** command is the workaround for the known issue described below.
- ‣ NVIDIA CUDA® Deep Neural Network library™ (cuDNN) 7.0.5
- ‣ NCCL 2.1.2 (optimized for NVLink™)
- ‣ OpenMPI™ 3.0.0

Driver Requirements

Release 18.02 is based on CUDA 9, which requires NVIDIA Driver release 384.xx.

Key Features and Enhancements

This Microsoft Cognitive Toolkit release includes the following key features and enhancements.

- ‣ Latest version of cuBLAS
- ‣ Ubuntu 16.04 with January 2018 updates

Known Issues

cuBLAS 9.0.282 regresses RNN seq2seq FP16 performance for a small subset of input sizes. This issue should be fixed in the next update. As a workaround, install cuBLAS 9.0.234 Patch 1 by issuing the **`dpkg -i /opt/cuda-cublas-9-0_9.0.234-1_amd64.deb`** command.

Chapter 11.
MICROSOFT COGNITIVE TOOLKIT RELEASE 18.01

The NVIDIA container image of Microsoft Cognitive Toolkit, release 18.01, is available.

Microsoft Cognitive Toolkit container image version 18.01 is based on Microsoft Cognitive Toolkit 2.3.1.

Contents of the Microsoft Cognitive Toolkit

This container image contains the source files that are used to build the Microsoft Cognitive Toolkit in the `/opt/cntk` directory. The Microsoft Cognitive Toolkit binaries are pre-built and installed into the `/usr/local/cntk` directory.

A Python 3.4 Conda environment (including the Microsoft Cognitive Toolkit module) is installed in the `/opt/conda/envs/cntk-py34` directory. This is included in `PATH`, so by default the `python` command executes a Python 3.4 interpreter. To use the base Ubuntu Python 2.7 binary, you can either adjust `PATH` or explicitly call `/usr/bin/python`.

This image of the Microsoft Cognitive Toolkit 2.3.1, is built with the following options enabled:

▸ Async SGD
▸ Python 3 API
▸ OpenCV
▸ Kaldi

The container also includes the following:

▸ Ubuntu 16.04 including Python 3.4 environment
▸ NVIDIA CUDA 9.0.176 including CUDA® Basic Linear Algebra Subroutines library™ (cuBLAS) 9.0.282
▸ NVIDIA CUDA® Deep Neural Network library™ (cuDNN) 7.0.5
▸ NCCL 2.1.2 (optimized for NVLink™)

▸ OpenMPI™ 3.0.0

Driver Requirements

Release 18.01 is based on CUDA 9, which requires NVIDIA Driver release 384.xx.

Key Features and Enhancements

This Microsoft Cognitive Toolkit release includes the following key features and enhancements.

▸ Preview mixed precision training support and ResNet-50 ImageNet example
▸ Latest version of cuBLAS
▸ Latest version of cuDNN
▸ Latest version of NCCL
▸ Ubuntu 16.04 with December 2017 updates

Known Issues

cuBLAS 9.0.282 regresses RNN seq2seq FP16 performance for a small subset of input sizes. As a workaround, revert back to the 11.12 container.

Chapter 12.
MICROSOFT COGNITIVE TOOLKIT RELEASE 17.12

The NVIDIA container image of Microsoft Cognitive Toolkit, release 17.12, is available.

Microsoft Cognitive Toolkit container image version 17.12 is based on Microsoft Cognitive Toolkit 2.2.

Contents of the Microsoft Cognitive Toolkit

This container image contains the source files that are used to build the Microsoft Cognitive Toolkit in the **/opt/cntk** directory. The Microsoft Cognitive Toolkit binaries are pre-built and installed into the **/usr/local/cntk** directory.

A Python 3.4 Conda environment (including the Microsoft Cognitive Toolkit module) is installed in the **/opt/conda/envs/cntk-py34** directory. This is included in **PATH**, so by default the **python** command executes a Python 3.4 interpreter. To use the base Ubuntu Python 2.7 binary, you can either adjust **PATH** or explicitly call **/usr/bin/python**.

This image of the Microsoft Cognitive Toolkit 2.2, is built with the following options enabled:

- ▸ Async SGD
- ▸ Python 3 API
- ▸ OpenCV
- ▸ Kaldi

The container also includes the following:

- ▸ Ubuntu 16.04
- ▸ NVIDIA CUDA 9.0.176 including CUDA® Basic Linear Algebra Subroutines library™ (cuBLAS) 9.0.234
- ▸ NVIDIA CUDA® Deep Neural Network library™ (cuDNN) 7.0.5
- ▸ NCCL 2.1.2 (optimized for NVLink™)

▶ OpenMPI™ 3.0.0

Driver Requirements

Release 17.12 is based on CUDA 9, which requires NVIDIA Driver release 384.xx.

Key Features and Enhancements

This Microsoft Cognitive Toolkit release includes the following key features and enhancements.

▶ Latest version of CUDA
▶ Latest version of cuDNN
▶ Latest version of NCCL
▶ Ubuntu 16.04 with November 2017 updates

Known Issues

There are no known issues in this release.

Chapter 13.
MICROSOFT COGNITIVE TOOLKIT RELEASE 17.11

The NVIDIA container image of Microsoft Cognitive Toolkit, release 17.11, is available.

Microsoft Cognitive Toolkit container image version 17.11 is based on Microsoft Cognitive Toolkit 2.2.

Contents of the Microsoft Cognitive Toolkit

This container image contains the source files that are used to build the Microsoft Cognitive Toolkit in the `/opt/cntk` directory. The Microsoft Cognitive Toolkit binaries are pre-built and installed into the `/usr/local/cntk` directory.

A Python 3.4 Conda environment (including the Microsoft Cognitive Toolkit module) is installed in the `/opt/conda/envs/cntk-py34` directory. This is included in `PATH`, so by default the `python` command executes a Python 3.4 interpreter. To use the base Ubuntu Python 2.7 binary, you can either adjust `PATH` or explicitly call `/usr/bin/python`.

This image of the Microsoft Cognitive Toolkit 2.2, is built with the following options enabled:

- ▸ Async SGD
- ▸ Python 3 API
- ▸ OpenCV
- ▸ Kaldi

The container also includes the following:

- ▸ Ubuntu 16.04
- ▸ NVIDIA CUDA 9.0.176 including CUDA® Basic Linear Algebra Subroutines library™ (cuBLAS) 9.0.234
- ▸ NVIDIA CUDA® Deep Neural Network library™ (cuDNN) 7.0.4
- ▸ NCCL 2.1.2 (optimized for NVLink™)

‣ OpenMPI™ 3.0.0

Driver Requirements

Release 17.11 is based on CUDA 9, which requires NVIDIA Driver release 384.xx.

Key Features and Enhancements

This Microsoft Cognitive Toolkit release includes the following key features and enhancements.

‣ The version of MPI included in the container was bumped from 1.10 to 3.0.0 in order to correct a bug in which GPU memory exhaustion could cause the framework to hang.
‣ Latest version of CUDA
‣ Latest version of cuDNN
‣ Latest version of NCCL
‣ Ubuntu 16.04 with October 2017 updates

Known Issues

There are no known issues in this release.

Chapter 14.
MICROSOFT COGNITIVE TOOLKIT RELEASE 17.10

The NVIDIA container image of Microsoft Cognitive Toolkit, release 17.10, is available.

Microsoft Cognitive Toolkit container image version 17.10 is based on Microsoft Cognitive Toolkit 2.2.

Contents of the Microsoft Cognitive Toolkit

This container image contains the source files that are used to build the Microsoft Cognitive Toolkit in the **/opt/cntk** directory. The Microsoft Cognitive Toolkit binaries are pre-built and installed into the **/usr/local/cntk** directory.

A Python 3.4 Conda environment (including the Microsoft Cognitive Toolkit module) is installed in the **/opt/conda/envs/cntk-py34** directory. This is included in **PATH**, so by default the **python** command executes a Python 3.4 interpreter. To use the base Ubuntu Python 2.7 binary, you can either adjust **PATH** or explicitly call **/usr/bin/python**.

This image of the Microsoft Cognitive Toolkit 2.2, is built with the following options enabled:

▶ Async SGD
▶ Python 3 API
▶ OpenCV
▶ Kaldi

The container also includes the following:

▶ Ubuntu 16.04
▶ NVIDIA CUDA® 9.0
▶ NVIDIA CUDA® Deep Neural Network library™ (cuDNN) 7.0.3
▶ NCCL 2.0.5 (optimized for NVLink™)

Driver Requirements

Release 17.10 is based on CUDA 9, which requires NVIDIA Driver release 384.xx.

Key Features and Enhancements

This Microsoft Cognitive Toolkit release includes the following key features and enhancements.

- Auto padding for convolutional layers correctly accounts for dilation
- Latest version of CUDA
- Latest version of cuDNN
- Latest version of NCCL
- Ubuntu 16.04 with September 2017 updates

Known Issues

There are no known issues in this release.

Chapter 15.
MICROSOFT COGNITIVE TOOLKIT RELEASE 17.09

The NVIDIA container image of Microsoft Cognitive Toolkit, release 17.09, is available.

Microsoft Cognitive Toolkit container image version 17.09 is based on Microsoft Cognitive Toolkit 2.1.

Contents of the Microsoft Cognitive Toolkit

This container image contains the source files that are used to build the Microsoft Cognitive Toolkit in the **/opt/cntk** directory. The Microsoft Cognitive Toolkit binaries are pre-built and installed into the **/usr/local/cntk** directory.

A Python 3.4 Conda environment (including the Microsoft Cognitive Toolkit module) is installed in the **/opt/conda/envs/cntk-py34** directory. This is included in **PATH**, so by default the **python** command executes a Python 3.4 interpreter. To use the base Ubuntu Python 2.7 binary, you can either adjust **PATH** or explicitly call **/usr/bin/python**.

This image of the Microsoft Cognitive Toolkit 2.1, is built with the following options enabled:

▸ Async SGD
▸ Python 3 API
▸ OpenCV
▸ Kaldi

The container also includes the following:

▸ Ubuntu 16.04
▸ NVIDIA CUDA® 9.0
▸ NVIDIA CUDA® Deep Neural Network library™ (cuDNN) 7.0.2
▸ NCCL 2.0.5 (optimized for NVLink™)

Driver Requirements

Release 17.09 is based on CUDA 9, which requires NVIDIA Driver release 384.xx.

Key Features and Enhancements

This Microsoft Cognitive Toolkit release includes the following key features and enhancements.

- ▸ Latest version of CUDA
- ▸ Latest version of cuDNN
- ▸ Latest version of NCCL
- ▸ Ubuntu 16.04 with August 2017 updates

Known Issues

There are no known issues in this release.

Chapter 16.
MICROSOFT COGNITIVE TOOLKIT RELEASE 17.07

The NVIDIA container image of Microsoft Cognitive Toolkit, release 17.07, is available.

Microsoft Cognitive Toolkit container image version 17.07 is based on Microsoft Cognitive Toolkit 2.0.

Contents of the Microsoft Cognitive Toolkit

This container image contains the source files that are used to build the Microsoft Cognitive Toolkit in the **/opt/cntk** directory. The Microsoft Cognitive Toolkit binaries are pre-built and installed into the **/usr/local/cntk** directory.

A Python 3.4 Conda environment (including the Microsoft Cognitive Toolkit module) is installed in the **/opt/conda/envs/cntk-py34** directory. This is included in **PATH**, so by default the **python** command executes a Python 3.4 interpreter. To use the base Ubuntu Python 2.7 binary, you can either adjust **PATH** or explicitly call **/usr/bin/python**.

This image of the Microsoft Cognitive Toolkit 2.0, is built with the following options enabled:

- ▸ 1-bit SGD
- ▸ Async SGD
- ▸ Python 3 API
- ▸ OpenCV
- ▸ Kaldi

The container also includes the following:

- ▸ Ubuntu 16.04
- ▸ NVIDIA CUDA® 8.0.61.2 including CUDA® Basic Linear Algebra Subroutines library™ (cuBLAS) Patch 2
- ▸ NVIDIA CUDA® Deep Neural Network library™ (cuDNN) 6.0.21

‣ NCCL 2.0.3 (optimized for NVLink™)

Key Features and Enhancements

This Microsoft Cognitive Toolkit release includes the following key features and enhancements.

‣ Ubuntu 16.04 with June 2017 updates

Known Issues

There are no known issues in this release.

Chapter 17.
MICROSOFT COGNITIVE TOOLKIT RELEASE 17.06

The NVIDIA container image of Microsoft Cognitive Toolkit, release 17.06, is available.

Microsoft Cognitive Toolkit container image version 17.06 is based on Microsoft Cognitive Toolkit 2.0.

Contents of the Microsoft Cognitive Toolkit

This container image contains the source files that are used to build the Microsoft Cognitive Toolkit in the **/opt/cntk** directory. The Microsoft Cognitive Toolkit binaries are pre-built and installed into the **/usr/local/cntk** directory.

A Python 3.4 Conda environment (including the Microsoft Cognitive Toolkit module) is installed in the **/opt/conda/envs/cntk-py34** directory. This is included in **PATH**, so by default the **python** command executes a Python 3.4 interpreter. To use the base Ubuntu Python 2.7 binary, you can either adjust **PATH** or explicitly call **/usr/bin/python**.

This image of the Microsoft Cognitive Toolkit 2.0, is built with the following options enabled:

▸ 1-bit SGD
▸ Async SGD
▸ Python 3 API
▸ OpenCV
▸ Kaldi

The container also includes the following:

▸ Ubuntu 16.04
▸ NVIDIA CUDA® 8.0.61
▸ NVIDIA CUDA® Deep Neural Network library™ (cuDNN) 6.0.21
▸ NCCL 1.6.1 (optimized for NVLink™)

Key Features and Enhancements

This Microsoft Cognitive Toolkit release includes the following key features and enhancements.

▶ Improved distributed Python validation performance by avoiding unnecessary NCCL initializations.

▶ Ubuntu 16.04 with May 2017 updates

Known Issues

There are no known issues in this release.

Chapter 18.
MICROSOFT COGNITIVE TOOLKIT RELEASE 17.05

The NVIDIA container image of Microsoft Cognitive Toolkit, release 17.05, is available.

Microsoft Cognitive Toolkit container image version 17.05 is based on Microsoft Cognitive Toolkit 2.0.rc2.

Contents of the Microsoft Cognitive Toolkit

This container image contains the source files that are used to build the Microsoft Cognitive Toolkit in the **/opt/cntk** directory. The Microsoft Cognitive Toolkit binaries are pre-built and installed into the **/usr/local/cntk** directory.

A Python 3.4 Conda environment (including the Microsoft Cognitive Toolkit module) is installed in the **/opt/conda/envs/cntk-py34** directory. This is included in **PATH**, so by default the **python** command executes a Python 3.4 interpreter. To use the base Ubuntu Python 2.7 binary, you can either adjust **PATH** or explicitly call **/usr/bin/python**.

This image of the Microsoft Cognitive Toolkit 2.0.rc2, is built with the following options enabled:

- ▸ 1-bit SGD
- ▸ Async SGD
- ▸ Python 3 API
- ▸ OpenCV
- ▸ Kaldi

The container also includes the following:

- ▸ Ubuntu 16.04
- ▸ NVIDIA CUDA® 8.0.61
- ▸ NVIDIA CUDA® Deep Neural Network library™ (cuDNN) 6.0.21
- ▸ NCCL 1.6.1 (optimized for NVLink™)

Key Features and Enhancements

This Microsoft Cognitive Toolkit release includes the following key features and enhancements.

- ▶ Latest cuDNN release
- ▶ Ubuntu 16.04 with April 2017 updates

Known Issues

There are no known issues in this release.

Chapter 19.
MICROSOFT COGNITIVE TOOLKITRELEASE 17.04

The NVIDIA container image of Microsoft Cognitive Toolkit, release 17.04, is available.

Microsoft Cognitive Toolkit container image version 17.04 is based on Microsoft Cognitive Toolkit 2.0.beta15.0.

Contents of the Microsoft Cognitive Toolkit

This container image contains the source files that are used to build the Microsoft Cognitive Toolkit in the **/opt/cntk** directory. The Microsoft Cognitive Toolkit binaries are pre-built and installed into the **/usr/local/cntk** directory.

A Python 3.4 Conda environment (including the Microsoft Cognitive Toolkit module) is installed in the **/opt/conda/envs/cntk-py34** directory. This is included in **PATH**, so by default the **python** command executes a Python 3.4 interpreter. To use the base Ubuntu Python 2.7 binary, you can either adjust **PATH** or explicitly call **/usr/bin/python**.

This image of the Microsoft Cognitive Toolkit, 2.0beta15.0, is built with the following options enabled:

▸ 1-bit SGD
▸ Async SGD
▸ Python 3 API
▸ OpenCV
▸ Kaldi

The container also includes the following:

▸ Ubuntu 16.04
▸ NVIDIA CUDA® 8.0.61
▸ NVIDIA CUDA® Deep Neural Network library™ (cuDNN) 6.0.20
▸ NCCL 1.6.1 (optimized for NVLink™)

Key Features and Enhancements

This Microsoft Cognitive Toolkit release includes the following key features and enhancements.

- ▸ Dilated convolution support (carried over from 17.03)
- ▸ Fixed major bug from Microsoft Cognitive Toolkit 2.0 beta 15 affecting multi-GPU training with NCCL
- ▸ Fixed minor bug in end-of-sweep detection
- ▸ Ubuntu 16.04 with March 2017 updates

Known Issues

There are no known issues in this release.

Chapter 20.
MICROSOFT COGNITIVE TOOLKIT RELEASE 17.03

The NVIDIA container image of Microsoft Cognitive Toolkit, release 17.03, is available.

Microsoft Cognitive Toolkit container image version 17.03 is based on Microsoft Cognitive Toolkit 2.0.beta12.0.

Contents of Microsoft Cognitive Toolkit

This container image contains the source files that are used to build the Microsoft Cognitive Toolkit in the **/opt/cntk** directory. The Microsoft Cognitive Toolkit binaries are pre-built and installed into the **/usr/local/cntk** directory.

A Python 3.4 Conda environment (including the Microsoft Cognitive Toolkit module) is installed in the **/opt/conda/envs/cntk-py34** directory. This is included in **PATH**, so by default the **python** command executes a Python 3.4 interpreter. To use the base Ubuntu Python 2.7 binary, you can either adjust **PATH** or explicitly call **/usr/bin/python**.

This image of the Microsoft Cognitive Toolkit, 2.0beta12.0, is built with the following options enabled:

- ▸ 1-bit SGD
- ▸ Async SGD
- ▸ Python 3 API
- ▸ OpenCV
- ▸ Kaldi

The container also includes the following:

- ▸ Ubuntu 16.04
- ▸ NVIDIA CUDA® 8.0.61
- ▸ NVIDIA CUDA® Deep Neural Network library™ (cuDNN) 6.0.20
- ▸ NCCL 1.6.1 (optimized for NVLink™)

Key Features and Enhancements

This Microsoft Cognitive Toolkit release includes the following key features and enhancements.

- Dilated convolution support (carried over from 17.02)
- GPU memory consumption optimizations
- NCCL integration for MASGD Solver
- Fixes in provided example and tutorial scripts
- Ubuntu 16.04 with February 2017 updates

Known Issues

There is a known issue in 17.03 that causes corruption in networks incorporating residual connections, such as ResNet. As a result, they fail to train to full accuracy.

Chapter 21.
MICROSOFT COGNITIVE TOOLKIT RELEASE 17.02

The NVIDIA container image of Microsoft Cognitive Toolkit, release 17.02, is available.

Microsoft Cognitive Toolkit container image version 17.02 is based on Microsoft Cognitive Toolkit 2.0.beta9.0.

Contents of the Microsoft Cognitive Toolkit

This container image contains the source files that are used to build the Microsoft Cognitive Toolkit in the **/opt/cntk** directory. The Microsoft Cognitive Toolkit binaries are pre-built and installed into the **/usr/local/cntk** directory.

A Python 3.4 Conda environment (including the Microsoft Cognitive Toolkit module) is installed in the **/opt/conda/envs/cntk-py34** directory. This is included in **PATH**, so by default the **python** command executes a Python 3.4 interpreter. To use the base Ubuntu Python 2.7 binary, you can either adjust **PATH** or explicitly call **/usr/bin/python**.

This image of the Microsoft Cognitive Toolkit, 2.0beta9.0, is built with the following options enabled:

▸ 1-bit SGD
▸ Async SGD
▸ Python API
▸ OpenCV
▸ Kaldi

The container also includes the following:

▸ Ubuntu 14.04
▸ NVIDIA CUDA® 8.0.61
▸ NVIDIA CUDA® Deep Neural Network library™ (cuDNN) 6.0.13
▸ NCCL 1.6.1 (optimized for NVLink™)

Key Features and Enhancements

This Microsoft Cognitive Toolkit release includes the following key features and enhancements.

- ▸ Dilated convolution support added to new features
- ▸ Ubuntu 14.04 with January 2017 updates

Known Issues

The Microsoft Cognitive Toolkit 17.02 container has a known issue in which the **v2librarytest TrainSequenceToSequenceTranslator** unit test fails due to a bug in the Microsoft Cognitive Toolkit C++ Library API's `TextFormatMinibatchSource` object.

The Microsoft Cognitive Toolkit 2.0 Beta9 introduced **RandomArea** cropping. This is useful for Inception style networks. To avoid confusion, the **Random** crop mode available in previous releases was renamed to **RandomSide**. Users will need to update **BrainScripts** accordingly.

Chapter 22.
MICROSOFT COGNITIVE TOOLKIT RELEASE 17.01

The NVIDIA container image of Microsoft Cognitive Toolkit, release 17.01, is available.

Microsoft Cognitive Toolkit container image version 17.01 is based on Microsoft Cognitive Toolkit 2.0.beta5.0.

Contents of the Microsoft Cognitive Toolkit

This container image contains the source files that are used to build Microsoft Cognitive Toolkit in the `/opt/cntk` directory. The Microsoft Cognitive Toolkit binaries are pre-built and installed into the `/usr/local/cntk` directory.

A Python 3.4 Conda environment (including the Microsoft Cognitive Toolkit module) is installed in the `/opt/conda/envs/cntk-py34` directory. This is included in `PATH`, so by default the `python` command executes a Python 3.4 interpreter. To use the base Ubuntu Python 2.7 binary, you can either adjust `PATH` or explicitly call `/usr/bin/python`.

This image of the Microsoft Cognitive Toolkit, 2.0beta5.0, is built with the following options enabled:

- 1-bit SGD
- Async SGD
- Python API
- OpenCV
- Kaldi

The container also includes the following:

- Ubuntu 14.04
- NVIDIA CUDA® 8.0.54
- NVIDIA CUDA® Deep Neural Network library™ (cuDNN) 6.0.10
- NCCL 1.6.1 (optimized for NVLink™)

Key Features and Enhancements

This Microsoft Cognitive Toolkit release includes the following key features and enhancements.

▸ Ubuntu 14.04 with December 2016 updates

Known Issues

There are no known issues with this release.

Chapter 23.
MICROSOFT COGNITIVE TOOLKIT RELEASE 16.12

The NVIDIA container image of Microsoft Cognitive Toolkit, release 16.12, is available.

Microsoft Cognitive Toolkit container image version 16.12 is based on Microsoft Cognitive Toolkit 2.0.beta5.0.

Contents of the Microsoft Cognitive Toolkit

This container image contains the source files that are used to build the Microsoft Cognitive Toolkit in the **/opt/cntk** directory. The Microsoft Cognitive Toolkit binaries are pre-built and installed into the **/usr/local/cntk** directory.

A Python 3.4 Conda environment (including the Microsoft Cognitive Toolkit module) is installed in the **/opt/conda/envs/cntk-py34** directory. This is included in **PATH**, so by default the **python** command executes a Python 3.4 interpreter. To use the base Ubuntu Python 2.7 binary, you can either adjust **PATH** or explicitly call **/usr/bin/python**.

This image of the Microsoft Cognitive Toolkit, 2.0beta5.0, is built with the following options enabled:

- ▸ 1-bit SGD
- ▸ Async SGD
- ▸ Python API
- ▸ OpenCV
- ▸ Kaldi

The container also includes the following:

- ▸ Ubuntu 14.04
- ▸ NVIDIA CUDA® 8.0.54
- ▸ NVIDIA CUDA® Deep Neural Network library™ (cuDNN) 6.0.5
- ▸ NCCL 1.6.1 (optimized for NVLink™)

Key Features and Enhancements

This Microsoft Cognitive Toolkit release includes the following key features and enhancements.

▶ Supports FP32 arithmetic and storage
▶ Optimized multi-GPU training

 ▶ NCCL integration for improved multi-GPU scaling
 ▶ Supports quantized (1-bit) communication

▶ Supports recurrent neural networks

 ▶ Supports cuDNN recurrent neural networks (RNN) layers

> 💬 Requires explicit use by model script

▶ BrainScript (text file), Python, and C++ frontends
▶ Ubuntu 14.04 with November 2016 updates

Known Issues

There are no known issues with this release.

Notice

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