To turn potential into reality, Dell has developed Data Science Workstations (DSWs), a curated set of Precision workstations pre-bundled with hardware and software, tailored for Machine Learning and Deep Learning developers.

Those in the know are fully aware that for Machine Learning to truly be successful and barriers removed, developers need access to the highest levels of computation power. Dell's Precision workstations deliver the power to deploy and manage cognitive technology platforms, including Machine Learning (ML), Artificial Intelligence (AI) and Deep Learning (DL).

Therefore, Dell's DSW systems are built with the latest NVIDIA® Quadro RTX™ GPUs (RTX™ 8000/6000/5000), Intel® Xeon® CPUs, ECC memory, and advanced storage solutions, all available on the Dell website.

Backed by Dell's turnkey approach to IT, and allowing developers to hit the ground running, these solutions are certified and listed as supported "NVIDIA® NGC-Ready" platforms on the NVIDIA® site.

NGC-Ready system validation includes tests of:

- High volume, low latency inference using NVIDIA® TensorRT, TensorRT Inference Server, and DeepStream
- Data Science ML using RAPIDS and XGBoost
- Application development using the CUDA Toolkit

Albert Einstein is widely credited as saying, “The definition of insanity is doing the same thing over and over again, but expecting different results.” Converse to that, the beauty of machine learning is that it allows hardware to learn from previous computations to produce reliable, repeatable decisions and results. But of what use is that, if the process still has to rely on human guidance and intervention?

In fact, these GPU-accelerated DSWs are designed to get the developer working on AI/ML/DL datasets the same day the DSW arrives from the Dell factory. With that on the table, the power is in the developer’s hands to experiment, prepare data, and train AI/ML/DL models orders of magnitude faster than possible on CPU-only AI development platforms. It couldn’t be simpler.

Theory is one thing, practice is another, so Dell has created this step-by-step installation manual, designed to help customers easily install the “NVIDIA® Data Science Software, powered by RAPIDS” onto the DSW received from the Dell factory pre-loaded with a custom Ubuntu 18.04 LTS image. A manual that will prove incredibly useful in instructing users on how to install the NVIDIA® Data Science Software onto a user-installed Ubuntu 18.04 LTS OEM image provided by Dell.

The intent of this short guide is to help users quickly set up the OS and the NVIDIA® Data Science Software specifically on Dell DSWs. It is also intended to help them overcome the three time-consuming hurdles to getting started as a data science developer. These are:

1. Configuring a system with the right hardware components.
2. Installing an OS that assures support for all devices out-of-the box.
3. Compiling a curated software stack with all the necessary GPU-accelerated libraries and machine learning and deep learning frameworks.

To get developers started using their Data Science Workstation as quickly as possible, we offer NVIDIA® NGC-Ready Dell Precision workstation configurations validated for the NVIDIA® Data Science Software.
1. The way forward – Configurations for ML/DL

Power is nothing without control, or direction. As such, Table 1 below includes recommended configurations of Dell Precision mobile and tower Data Science Workstations that are suitable for ML/DL.

The list ranges from mobile workstations and mid-sized towers to larger tower workstations with multiple GPUs & CPUs.

These configurations are suitable for data preparation, all types and sizes of ML/DL model training, and running the resulting inference engines. But that’s not the end. Find more configuration information by visiting the Dell Precision Workforce Solutions webpage.

Precisely developed for your needs

**Precision 7920 Tower:** Handles learning model training and larger solution frameworks with ease. Features NVIDIA® Quadro RTX™ 6000 or 8000 graphic cards.

**Precision 7740:** Dell’s most powerful Precision mobile workstation is AI ready, featuring the NVIDIA® Quadro RTX™ 5000 graphic card.

**Precision 7540:** Dell’s most powerful 15” mobile workstation is AI ready, featuring the NVIDIA® Quadro RTX™ 5000 graphic card.

**Precision 5820 Tower:** Ideal for cognitive solution development and inference applications. Features NVIDIA® Quadro RTX™ 6000 or 8000 graphic cards.
Solve practical machine learning and deep learning problems with any one of these Dell Precision workstations with extensive memory, outstanding CPU and GPU processors, and performance storage to power advanced cognitive solutions.

Dell Precision DSW systems ship with Ubuntu 18.04 LTS preinstalled, so already have an OS image pre-configured to support the hardware out-of-the-box and “Secure Boot” disabled by default.

2. Getting things started – OS image and installation

Need to reinstall your PC’s operating system? First you will need to confirm that “Secure Boot” is disabled in the system BIOS/UEFI before proceeding. The NVIDIA® Data Science Software installation requires Secure Boot to be disabled to support LINUX kernel updates.

Dell Precision DSW systems ship with Ubuntu 18.04 LTS preinstalled, so already have an OS image pre-configured to support the hardware out-of-the-box and “Secure Boot” disabled by default.

If you choose to manually install or reinstall the Dell OEM image for Ubuntu 18.04 LTS on your system, simply download the images for your Dell Precision workstation by following the instructions provided in this article titled, “Use the Dell OS Recovery Tool to create a USB recovery drive that you can use to reinstall the version of Linux that came with your PC.”

<table>
<thead>
<tr>
<th>Dell Precision Workstation</th>
<th>CPU</th>
<th>System Mem</th>
<th>Drives (1TB-3TB)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Precision 7920 Tower</strong></td>
<td>Dual Xeon® Platinum/Gold</td>
<td>192GB-384GB ECC RDIMM</td>
<td>NVMe PCIe Class 50 SSD</td>
</tr>
<tr>
<td><strong>Precision 5820 Tower</strong></td>
<td>Single W-2245/W-2255/W-2275</td>
<td>64GB-256GB ECC RDIMM</td>
<td>NVMe PCIe Class 50 SSD</td>
</tr>
<tr>
<td><strong>Precision 7740</strong></td>
<td>Single E-2286</td>
<td>64GB-128GB ECC RDIMM</td>
<td>NVMe PCIe Class 50 SSD</td>
</tr>
<tr>
<td><strong>Precision 7540</strong></td>
<td>Single E-2276</td>
<td>64GB-128GB ECC RDIMM</td>
<td>NVMe PCIe Class 50 SSD</td>
</tr>
</tbody>
</table>

When equipped with Intel® Xeon® E-2286M, 8-core Xeon®, 128 GB RAM, NVIDIA® Quadro RTX™ 5000 graphics. Based on Dell internal analysis, May 2019.
To ensure that you are extracting every last drop of power out of your Dell Precision workstation, we recommend the following optimizations to increase the performance and usability of the system for Machine Learning and Deep Learning workloads.

3. Powering up your performance – Setup and Optimizations (optional)

3.1 Disable idle user power management configuration

To complete this action, we recommend disabling power management settings for Idle User case, since in most cases during installation and development, the machine will download the software/dataset over the internet or run ML/DL workflow unattended for an extended period of time.

Disable power management settings with the command below.

```
/usr/bin/gsettings set org.gnome.settings-daemon.plugins.power sleep-inactive-ac-timeout 0
```

3.2 Disable Hibernate settings

There is no advantage in enabling “hibernate” on Dell Data Science Workstations, quite simply because it is unnecessary and consumes valuable storage space. Disable it as per below.

```
sudo systemctl mask hibernate.target
```

3.3 Remove swap file

In addition, we recommend removing the “swap file”. Swap file sizes are typically 1.5x the size of installed RAM. On large RAM systems this can be a prohibitive amount of SSD storage

```
3.4 Is swap active?
sudo swapon --show

If it is, it will show something similar to the below

<table>
<thead>
<tr>
<th>NAME</th>
<th>TYPE</th>
<th>SIZE</th>
<th>USED</th>
<th>PRIO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swapfile</td>
<td>file</td>
<td>215.3G</td>
<td>0B</td>
<td>-2</td>
</tr>
</tbody>
</table>

3.5 Deactivate the swap

```
sudo swapoff -v /swapfile
```

3.6 Remove it from /etc/fstab

```
sudo sed -i '/^\swapfile/d' /etc/fstab
```

3.7 Delete the actual file

```
sudo rm /swapfile
```
4. Tool up – Installing the NVIDIA® Data Science Stack v2.2.x

The NVIDIA® Data Science Software Stack is a set of tools that makes it easier to set up your Dell Data Science Workstation and manage NVIDIA®’s curated software stack for GPU accelerated Data Science workloads.

The current version of the NVIDIA® Data Science Stack is v2.2.2 and has been tested by Dell. The version numbers used throughout this section of this guide may vary as new revisions are released by NVIDIA®.

NOTE: The NVIDIA® Data Science Software installer will update your GPU driver as required.

Download the NVIDIA® “data-science-stack-2.2.2.tar.gz” package or the most recent version from NVIDIA®, and follow the README file to create the install using the data-science-stack tool on your system.

Unpack and change to the directory:

```
tar zxvf data-science-stack-2.2.2.tar.gz
cd data-science-stack-2.2.2
```

Use the “data-science-stack” script to install the data science development environment with the following commands:

```
./data-science-stack setup-system
./data-science-stack setup-user
```

4.1 Now either choose to create a container with the data science development environment or install it natively on your system. Alternatively, do both.

Based on your choice, follow the instructions below:

- Build a container:
  ```
  ./data-science-stack build-container
  ```
  (this creates the container, nvidia-data-science:2.2.2)

- Create a Conda environment for NVIDIA® data science distro:
  ```
  ./data-science-stack build-conda-env
  ```
  (this will create nvidia-dsd-2.2.2 Conda environment)

Then log out and log in again for the changes to take effect.

4.2 Once installation is complete, perform the following tests to verify success:

a. To verify containerized environment, run:

```
./data-science-stack run-container
```

If any of the scripts run successfully, then the installation was successful.

b. To verify conda environment, run:

```
./data-science-stack run-jupyter
```

If any of the scripts run successfully, then the installation was successful.

And that is it. Your Dell Precision Data Science Workstation is ready for use. It’s now time to move your business forward by being able to power amazing outcomes.