Installing TensorFlow on Ubuntu 16.04 with an Nvidia GPU

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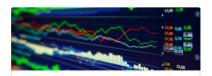
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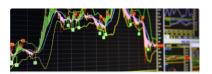
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By **QuantStart Team**
November 30th, 2017

→ Installing TensorFlow on the latest Ubuntu is not straightforward

→ To utilise a GPU it is necessary to install CUDA and CuDNN libraries before compiling TensorFlow

Any serious quant trading research with machine learning models necessitates the use of a framework that abstracts away the model implementation from the model specification.

This is particularly crucial for deep learning techniques as production-grade models require training on GPUs to make them computationally tractable. However, direct programming of GPUs requires knowledge of proprietary languages like Nvidia CUDA or abstraction layers such as OpenCL. Either way, experience with C, C++ or Fortran is a must.

Hence a framework that removes the low-level implementation details of execution, while providing a high-level API for straightforward model specification—without sacrificing execution accuracy or the ability to scale computation—is very attractive to quant researchers. TensorFlow is such a framework.

However it has a reputation for being difficult to install. Up until recently this reputation was warranted. Indeed it can still be challenging to get working on certain systems.

There are many ways to install TensorFlow, such as making use of a ready-made machine image for a cloud server. An example is Amazon's Deep Learning AMI, which comes preinstalled with all necessary dependencies and deep learning software. It can be accessed remotely at a competitive hourly rate.

However, this article describes the installation procedure for TensorFlow on a modern Linux desktop system with an affordable, up-to-date consumer-grade GPU, such as those found within Nvidia's GeForce series.

We will begin by outlining the advantages of the TensorFlow library along with a few words of caution on the potential difficulty of its intallation. We will then consider an optimal choice for operating system and install the necessary Python research environment. The discussion will then turn towards installing TensorFlow against both a CPU and a GPU. We will also take a look at the common problems that can occur and how to troubleshoot them.

Recently I discussed the advantages and disadvantages of using a desktop deep learning research system versus renting one in the cloud.

Why TensorFlow?

The focus of this article is not on why framework X is superior to framework Y. The intent is simply to describe the installation of TensorFlow, which is emerging as one of the strongest contenders for deep learning model implementation.

It has been chosen for all subsequent deep learning articles on QuantStart for the following pragmatic reasons:

- **Popularity** - With popularity comes a large community and thus more likelihood of solving errors when they crop up, as well as a larger base of tutorials and textbooks from which to learn.

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