A Coordinated Tiling and Batching Framework for Efficient GEMM on GPUs

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A Artifact Appendix

A.1 Abstract

This section is mainly the guideline to perform artifact evaluation for this paper. We first describe the directory tree of our code, which contains the code of both related work and our work. Then, we present the check-list for the evaluation. Finally, experiment workflow shows how to access the source code and how to use the scripts to perform detailed validation.

A.2 Description

The following is the directory tree of the code, which contains eight sub-directories as follows:

- **data.** In this sub-directory, we provide a `gen_data` binary to generate the data-set used in the following evaluation.
- **include.** This sub-directory contains a header file for CUDA run-time, cuBLAS and cuDNN error check.
- **default.** This sub-directory contains the source code for default execution.
- **cke.** This sub-directory contains the source code for concurrent kernel execution using stream interface.
- **magma.** This sub-directory contains the source code of the batched GEMM implementation proposed in MAGMA paper.

- **tiling.** This sub-directory contains the source code of the tiling engine proposed in our paper.
- **batching.** This sub-directory contains the source code of the batched GEMM implementation incorporating both of the tiling engine and batching engine in our paper.
- **google-net_cudnn.** This sub-directory contains the source code of a Google-Net inference framework built by cuDNN APIs and our batched GEMM techniques.

A.3 Artifact check-list

- **Algorithm:** Multiple variations of batched-GEMM on GPUs.
- **Program:** CUDA and C/C++ code.
- **Compilation:** `nvcc 9.0` with `-O3` flag.
- **Binary:** CUDA executable.
- **Data set:** random matrix size and batch size.
- **Run-time environment:** Ubuntu 16.04 with CUDA SDK 9.0 installed.
- **Hardware:** Any GPUs with compute capability ≥ 5.0 (Recommended GPU: NVIDIA V100 GPU.)
- **How much disk space required (approximately)?:** $\leq 10\text{Mb}$
- **How much time is needed to prepare workflow (approximately)?:** ≤ 30 minutes
- **How much time is needed to complete experiments (approximately)?:** ≤ 30 minutes
- **Publicly available?:** Yes.

A.4 Experiment workflow

For the convenience of the artifact evaluation, we only provide a few simple scripts in each sub-directory. Below are the steps to download our code, run the experiments, and observe the results.

A.4.1 Download the code.

We provide two methods to obtain the code.

`$git clone ppopp_ar@scc.eescer.com:/pub/tiling_batching_gemm.git`

The password is 123456. Note that there is no dot in the password.

A.4.2 Build and Run the experiments.

Comparison. There are five variants: `default`, `cke`, and `magma` in related works, as well as `tiling` and `batching` in our paper. In these five sub-directories, they all contain a `run.sh` script and you can run it to obtain the results.

Google-net Real-world case study. We provide two different baseline implementations. We can compare the baseline version with

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convolution based on batched-GEMM proposed in this paper. They can be switched by modifying the variable *USE_MULTI_STREAM* in Makefile.