Implementing GPU computations in Octave and statistical applications

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Abstract

GNU Octave\textsuperscript{1} is a free software targeting scientific computing with focus on numerics and linear algebra. To some extent it shares its syntax with MATLAB, a commercial tool widely used in science and engineering. During the last years parallel computing has become more and more affordable, not only but to a large extent by the advent of end user programmable GPU hardware providing hundreds or even thousands of specialized computing cores. Such a parallel computing hardware is provided by NVidia with its CUDA architecture.

Soon after the availability of the CUDA SDK some parallel processing toolboxes for MATLAB became popular (GPUmat\textsuperscript{2} and more recent the Parallel Computing Toolbox\textsuperscript{3}). For Octave only a small proof-of-concept implementation exists (MMGPUOctave, see \cite{1}), lacking all the comfortable features of its MATLAB counterparts. We present an extension of this work which tries to fill this gap, providing the end user with a special GPU matrix class where all relevant operations like multiplication and inversion are executed in parallel on the GPU. This works mainly by providing an interface to cuBLAS\textsuperscript{4}, a GPU accelerated implementation of the standard BLAS operations.

We will show how this new data type can help to speed up operations in statistical applications involving a large number of linear algebra operations. The examples are taken from hyper-spectral imaging and pollution dispersion modelling.

Literatur


\begin{thebibliography}{9}
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\textsuperscript{1}http://octave.org
\textsuperscript{2}http://sourceforge.net/projects/gpumat/
\textsuperscript{3}https://developer.nvidia.com/cuBLAS