GPU Computing with MATLAB

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Agenda

- MATLAB on The CPU (PCT & DCS)
- Why compute on a GPU?
- MATLAB and GPU Computing
- Some Benchmarks
- Demo (If time permits)
Introduction

• **MATLAB** (matrix laboratory) is a high-level technical computing language with an interactive numerical computing environment. Developed by Mathworks, MATLAB allows matrix manipulations, plotting of functions and data, implementation of algorithms, creation of user interfaces, and interfacing with programs written in other languages, including C, C++, and Fortran.

• Built around the MATLAB scripting language

• Command window used as an interactive shell for executing MATLAB code

• Over 2 million users worldwide (2017)

• Widely used in a number of fields
MATLAB @ UAB

- Over 2000 individual users on the UAB TAH license.
MATLAB on the CPU
(PCT & DCS)
Why compute on a GPU?

CPU + GPU

Courtesy: NVIDIA & LLNL
Small Changes -> Big Speed UP

Application Code

Rest of Sequential CPU Code

GPU

CPU

Compute-Intensive Functions

Use GPU to Parallelize

Courtesy: NVIDIA & LLNL
Advantages

• Faster Performance on Scientific Applications
  • Applications have seen between 3x -20x performance improvement

• Cost of computing is reduced
  • Perf/Watt especially if you scale up computing is prohibitive with the CPU
MATLAB and GPU Computing

- MATLAB makes GPU computing easy
  - Many functions support gpuArrays
- A large number of built-in functions are already optimized for the NVIDIA GPU
  - ~275 (at last count)
- Single precision/Double precision support
- Works well with PCT and the DCS
MATLAB GPU supported functions
MATLAB and GPU Computing

>> A = rand (1000,1000);
>> G = gpuArray(A); % push function to GPU
...
>> F_cpu = fft (A); % run fft on CPU
>> F_gpu = fft(G); % run fft on GPU
...
>> z = gather(F_gpu); % Bring output back from GPU
Some Benchmarks

**CPU – INTEL E5-2680 v3 @ 2.5 GZ – Total 24 cores**

**GPU – NVIDIA – K80**
Demo

• Run a simple piece of code on CPU & time it
• Convert it to run on the GPU & time it
• Discuss Speed-up, pitfalls, limitations
• PCT/DCS+GPU
• MATLAB GPU coder
• Conclusion
Special Thanks!

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