

ECE277 Final Project Proposal

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GPU accelerated 2D matrix multiplication with Pybind11

My plan is to make a simple console/terminal frontend in Python where the user can specify the dimensions of two 2D matrices, and if desired the user can also specify the elements of the matrices. It is very important that the matrix dimensions are configurable during runtime, to make the code more flexible to use. Python will thereafter make the matrices using NumPy, and do a call to a binded C++ function, which will be binded using Pybind11. The binding will only consist of one C++ module with one C++ function. This call will pass the matrices along with information about the matrix dimensions from Python to C++. The C++ function will then allocate the needed memory on the device using CUDA, and then transfer the data to the device. After that it will invoke the CUDA kernel. Since the matrix multiplication is of 2D matrices, the dimension of both the grid and thread-blocks will be arranged in 2D. The kernel then does the matrix multiplication via shared memory, to speed up the multiplication by reducing the amount of global memory accesses. If time allows I will also try to utilize the shared memory to avoid uncoalesced memory accesses. After that, the data is transferred back to the host, and the memory on the device is deallocated. The Python function can then read the new matrix, and the result will be printed to the simple GUI.