CS267
Class Project Suggestions

Spring 2019

Class project suggestions

- Many kinds of projects
  - Reflects broad scope of field and of students, from many departments
- Need to do one or more of design / program / measure some parallel application / kernel / software tool / hardware
- Can work alone or in teams
  - HW0 posted to help identify possible teammates based on interest
- What you need to do (more details on website)
  - Project proposal (< 2 pages) due Mar 22 (10% of project grade)
    - Many old project posters/videos posted on class web page
  - Feedback from instructors (ongoing conversations)
  - Poster presentations Apr 30 (11-2) and May 2 (11-12:30) in Woz
  - Final report writeups due May 8, at most 10 pages

How to Organize A Project Proposal (1/2)

- Parallelizing/comparing implementations of an Application
- Parallelizing/comparing implementations of a Kernel
- Building /evaluating a parallel software tool
- Evaluating parallel hardware

How to Organize A Project Proposal (2/2)

- What is the list of tasks you will try?
  - Sorted from low-hanging fruit to harder
- What existing tools you will use, compare to?
  - Don't reinvent wheels, ok to compare to existing wheels to evaluate pros and cons
  - For applications, consider using frameworks (eg Chombo, PETSC, Trilinos etc)
  - For applications, identify computational and structural patterns you plan to use
- What are your success metrics
  - Get application X up on Cori, solve problem Y
  - Get motif Z to run W times faster on GPU, other platform
  - Collect data V to evaluate/compare approaches

A few sample CS267 Class Projects

all posters and video presentations on class web page

- Content based image recognition
  - "Find me other pictures of the person in this picture"
- Faster molecular dynamics, applied to Alzheimer's Disease
- Better speech recognition through a faster "inference engine"
- Faster algorithms to tolerate errors in new genome sequencers
- Faster simulation of marine zooplankton population
- Sharing cell-phone bandwidth for faster transfers
- Real time forest fire simulation, for fire-fighters

More Prior Projects

1. High-Throughput, Accurate Image Contour Detection
2. CUDA-based rendering of 3D Minkowski Sums
3. Parallel Particle Filters
4. Scaling Content Based Image Retrieval Systems
5. Towards a parallel implementation of the Growing String Method
6. Optimization of the Poisson Operator in CHOMBO
7. Sparse-Matrix-Vector-Multiplication on GPUs
8. Parallel RI-MP2

More Prior Projects

1. Parallel FFTs in 3D: Testing different implementation schemes
2. Replica Exchange Molecular Dynamics (REMD) for Amber's Particle-Mesh Ewald MD (PMEMD)
3. Creating a Scalable HMM based Inference Engine for Large Vocabulary Continuous Speech Recognition
4. Using exponential integrators to solve large stiff problem
5. Clustering overlapping reads without using a reference genome
6. An AggreGATE Network Abstraction for Mobile Devices
7. Parallel implementation of multipole-based Poisson-Boltzmann solver
8. Finite Element Simulation of Nonlinear Elastic Dynamics using CUDA

Still more prior projects

1. Parallel Groebner Basis Computation using GASNet
2. Accelerating Mesoscale Molecular Simulation using CUDA and MPI
3. Modeling and simulation of red blood cell light scattering
4. NURBS Evaluation and Rendering
5. Performance Variability in Hadoop's Map Reduce
6. Utilizing Multiple Virtual Machines in Legacy Desktop Applications
7. How Useful are Performance Counters, Really? Profiling Chombo Finite Methods Solver and Parsec Fluids Codes on Nehalem and SiCortex
8. Energy Efficiency of MapReduce
9. Symmetric Eigenvalue Problem: Reduction to Tridiagonal
10. Parallel POPCycle Implementation

Project suggestions on website/piazza