Project Proposal for CS564 - Computational Geometry
Mehmet Basaran
Fouad Amira

Implementation of Computational Geometry Algorithms in Parallel

With the recent advancements in microporocessing technology, we have been involved with parallel computing for the last two decades. This was not a practical route to take, but it was a mandatory one indeed. To take advantage of parallel architectures (there are many different types, such as, distributed systems, network on chips - NoC, general purpose computing on graphical processing unit - GPGPU), one has to modify, or in some cases, re-design sequential algorithms from scratch. While doing so, one has to deal with problems of different nature. Integrity issues, task decomposition, communication volume, data locality are namely a few of them.

Past years not only witnessed great leaps in processing technology but also introduced problems that are harder to tackle into that they are much bigger in their sheer size. Most of these problems include huge volumes of data that has to be processed in a real time environment to make critical decisions. Consequently, parallel computing techniques have been used to accelerate such applications so that time constraints are satisfied.

Computational geometry is an area in which geometric algorithms are designed and analyzed. These algorithms have many uses in different branches of computer science, such as, computer graphics, robotics, statistics, database systems, and machine learning. Some of which needs real time solutions. Parallelizing existing efficient computational geometry algorithms seems to be the best option for overcoming performance related predicaments.

As a project for CS564 course, We would like to implement 4 known computational geometry algorithms in parallel (idea is taken from Prof. Dr. Ugur Gudukbay’s project list). We will implement them for four different platforms, namely multicore processors that employs a shared memory infrastructure (using OpenMP), and GPGPU (using either OpenCL or NvidiaCuda libraries). We will provide

- an elaborate complexity analysis of my parallel implementations and
- measure/compare their practical performance in terms of running time and memory consumption.

Materials

1. Prof. Dr. Ugur Gudukbay’s CS564 lecture notes.