

GPU Computing

Parallel implementation of Dijkstra's Algorithm

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Abstract

The purpose of this paper is to describe the implementation and benchmarking of various parallel implementations of Dijkstra's Algorithm to solve the shortest path problem.

Contents

1	Introduction	1
2	Dijkstra's algorithm	2
2.1	Sequential Version	3
2.2	Basic parallel version	3
2.3	Improved parallel version	3
3	Implementation details	3
3.1	Data structures	3
4	Benchmarking	3
4.1	Sequential vs Parallel	3

1 Introduction

The problem of shortest path in a graph consists in finding the path, from node A to node B, which minimizes the sum of edges weights of which the path is composed.

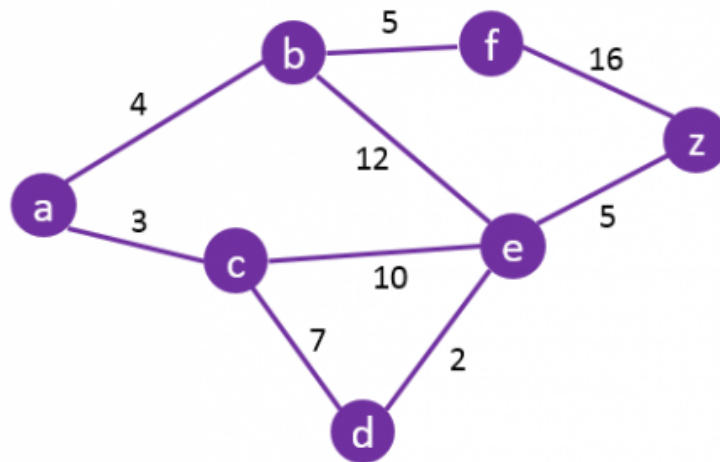


Figure 1: Graph with edge weights

In particular, the algorithm used for this document aim to solve the all-pairs shortest path problem, which consists of finding the lenght of the shortest path for all the pairs of nodes.

The algorithm assumes that there are not negative weights and that the graph is undirected without isolated parts.

This problem is tackled in a lot of practical applications, like road networks path-finding, telecommunication routing and robot navigation.

2 Dijkstra's algorithm

To solve the problem introduced before, it was decided to implement the Dijkstra's algorithm, using the paper [1] as a guidance.

The first version implemented was basically a parallel extension of the sequential algorithm, then a more advanced approach has been taken for the improved version.

2.1 Sequential Version

2.2 Basic parallel version

2.3 Improved parallel version

3 Implementation details

3.1 Data structures

4 Benchmarking

4.1 Sequential vs Parallel

References

- [1] Vivek Sarkar. *Parallel Graph Algorithms*. 2008. URL: <https://www.cs.rice.edu/~vs3/comp422/lecture-notes/comp422-lec24-s08-v2.pdf>.