

GPU-Based Influence Regions Optimization

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Abstract. In this paper we introduce an optimization problem, that arises in the competitive facility location area, which involves the maximization of the weighted area of the region where a new facility has influence. We consider a finite set of points S in a bounded polygonal region domain D subdivided into several non-negative weighted regions according to a weighted domain partition P . For each point in S we define its k -nearest/farthest neighbor influence region as the region containing all the points of D having the considered point as one of their k -nearest/farthest neighbors in S . We want to find a new point s in D whose k -influence region is maximal in terms of weighted area according to the weighted partition P . We present a GPU parallel approach, designed under CUDA architecture, for approximately solving the problem and we also provide experimental results showing the efficiency and scalability of the approach.

1 Introduction

The main objective of single-facility location problems is to place a new facility with respect to a given set of customers optimizing a certain objective function [22]. Facilities can be attractive or desirable, in the sense that customers wish them as close as possible, like supermarkets and hospitals, or obnoxious or undesirable, so that customers wish to push them as far as possible, like garbage dumps and chemical plants. In the context of competitive facility location, the new facility competes with pre-existing facilities. Competitive location models have been studied in several disciplines such as geography, economics, marketing and operations research [22].

Next we present two motivational examples of the class of single competitive facility location problems that we want to solve:

Example 1. Suppose that we want to find the optimal location for a new opening restaurant so that it takes over as many customers as possible from the existing competitors. If we assume that clients, that are not equally distributed, out of one of their k nearest restaurants, the new restaurant will be best located at the point having the biggest number of people living/working in the region having the new restaurant among their k -nearest restaurants.

* Work partially supported by the Spanish Ministerio de Ciencia e Innovación under grant TIN2010-20094-CO2-02.

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