A lower bound for the quickest path problem

Gianpaolo Ghiani, Emanuela Guerriero

PII: S0305-0548(14)00106-3
DOI: http://dx.doi.org/10.1016/j.cor.2014.04.015
Reference: CAOR3556

www.elsevier.com/locate/caor

To appear in: *Computers* & *Operations Research*

Cite this article as: Gianpaolo Ghiani, Emanuela Guerriero, A lower bound for the quickest path problem, *Computers* & *Operations Research,* http://dx.doi.org/10.1016/j.cor.2014.04.015

A Lower Bound for the Quickest Path Problem

Gianpaolo Ghiani[a], Emanuela Guerriero[a,*]

[a] *Department of Engineering, Università del Salento*
Via Monteroni 73100 Lecce, Italy

Abstract

The point-to-point quickest path problem is a classical network optimization problem with numerous applications, including that of computing driving directions. In this paper, we define a lower bound on the time-to-target which is both accurate and fast to compute. We show the potential of this bound by embedding it into an A^* algorithm. Computational results on three large European metropolitan road networks, taken from the *OpenStreetMap* database, show that the new lower bound allows to achieve an average reduction of 14.36%. This speed-up is valuable for a typical web application setting, where a server needs to answer a multitude of quickest path queries at the same time. Even greater computing time reductions (up to 28.06%) are obtained when computing paths in areas with moderate speeds, e.g. historical city centers.

Keywords: Quickest path problem, Dijkstra's algorithm, A* algorithm

1. Introduction

The determination of shortest or quickest paths on road networks is the basic ingredient of driving directions computation as well as of logistic planning and traffic simulation. In this paper we study one the most common variant of the problem, where the goal is to determine a least duration point-to-point path in a directed graph.

*Corresponding author
Email address: emanuela.guerriero@unisalento.it (Emanuela Guerriero)