

Proposal of Bachelorarbeit — B.Sc. Informatik

Proposal of Subject

Juli 2015

Wintersemester 2015/2016

Fernando Bombardelli da Silva — 364924

Exchange student of double degree from UFRGS (Porto Alegre / Brazil)

Introduction

This document has the objective of presenting a proposal of subject for the bachelor's thesis in the course of computer science (*Informatik*) of the *Technische Universität Berlin* by the student **Fernando Bombardelli da Silva** (*Matrikelnummer* 364924) to be written in the winter semester 2015/2016.

The proposed theme lies in the area of theoretical computer science, more precisely combinatorial optimization.

The student comes originally from the *Universidade Federal do Rio Grande do Sul* in Brazil and participates from an exchange program of dual degree, which consists of attending to three semesters of lectures at the TU Berlin including the *Bachelorarbeit*.

Context

The theme of the bachelor's thesis consists basically in the problem of defining a set of public transportation lines of a city, or alternatively, a set of railway lines in a region.

The approach to handle the issue would be seeing this as an optimization problem. It means, given the maps of the streets (or rails) and the stations, and additionally also the data of the transport demands, which shows for each station how many people travel to each other station on the map, both in graph representations, one could define a cost function for the operation of public transport lines subjected to the constraints of attending the demand and then minimize these costs.

Keywords: Operations research, combinatorial optimization, computational complexity, meta-heuristics, heuristics, graph theory, artificial intelligence, network design problem, ant colony optimization.

Objectives

Some of the objectives of the work are:

- investigate the features of such problem (cost function, constraints, etc.);
- build a robust and scalable model for the optimization problem;
- study the literature;
- investigate meta-heuristics in order to solve the problem;
- implement a solver;
- evaluate the results.

Time Schedule

Month	1				2				3				4			
Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Literature study	•	•	•	•							•	•				
Problem definition			•	•	•						•					
Collect data					•	•										
Implementation						•	•	•	•		•	•	•	•		
Experiments								•	•	•			•	•	•	
Evaluation									•	•				•	•	•
Document writing										•				•	•	•

References

- [1] VITINS, Basil J.; AZHAUSEN, Kay W. **Optimization of Large Transport Networks Using the Ant Colony Heuristic**. 7th Swiss Transport Research Conference (2007). Available at: http://www.strc.ch/conferences/2007/2007_vitins.pdf
- [2] YU, Bin; YANG, Zhongzhen; CHENG, Chuntian; LIU, Chong. **Optimizing Bus Transit Network With Parallel Ant Colony Algorithm**. Proceedings of the Eastern Asia Society for Transportation Studies (2005). Available at: http://www.easts.info/on-line/proceedings_05/374.pdf
- [3] **Artificial Intelligence Applications to Critical Transportation Issues** (2012). Available at: <http://onlinepubs.trb.org/onlinepubs/circulars/ec168.pdf>
- [4] MOLINA, Martin. **An Intelligent Assistant for Public Transport Management** (2005). Available at: <http://core.ac.uk/download/pdf/12001339.pdf>

- [5] WELLMAN, Michael P. **Transportation Applications of Artificial Intelligence (Extended Abstract)**. AAAI Workshop on AI in Intelligent-Vehicle Highway Systems (1993). Available at: <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.47.4817&rep=rep1&type=pdf>
- [6] LIU, Chao-Lin; PAI, Tun-Wen; CHANG, Chun-Tien; HSIEH, Chang-Ming. **Path-Planning Algorithms for Public Transportation Systems**. The Fourth International Ieee Conference On Intelligent Transportation Systems, Oakland, California, USA (2001). Available at: <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.12.1259&rep=rep1&type=pdf>
- [7] CRESCENZI, Pierluigi; KANN, Viggo. **A compendium of NP optimization problems** (1998). Available at: <ftp://ftp.nada.kth.se/Theory/Viggo-Kann/compendium.pdf>
- [8] SCHRIJVER, Alexander. **A Course in Combinatorial Optimization** (2013). Available at: <http://homepages.cwi.nl/~lex/files/dict.pdf>