Málaga, June 2013

Executive Summary

TITLE: **Realistic traffic network instances: Andalusia benchmark tests.**

PAPERS RELATED:

- A.C. Olivera, J.M. García-Nieto, and E. Alba, Reducing vehicle emissions and fuel consumption in the city by using particle swarm optimization, *Applied Intelligence*, pp. 1–17, 2014.
- D. H. Stolfi, and E. Alba, Red Swarm: Reducing travel times in smart cities by using bio-inspired algorithms, *Applied Soft Computing*, vol. 24, no. 0, pp. 181–195, Nov. 2014.

ABSTRACT: In the first work, a Swarm Intelligence approach is proposed for the optimal scheduling of traffic lights timing programs in metropolitan areas. By doing so, the traffic flow of vehicles can be improved with the final goal global target of reducing their fuel consumption and gas emissions (CO and NOx). In this work we optimize the traffic lights timing programs and analyze their effect in pollution by following the standard HBEFA as the traffic emission model. Specifically, we focus on two large and heterogeneous urban scenarios located in the cities of Malaga and Seville (in Spain). When compared to the traffic lights timing programs designed by experts close to real ones, the proposed strategy obtains significant reductions in terms of the emission rates (23.3 % CO and 29.3 % NOx) and the total fuel consumption. In the second work, we present an innovative approach to solve one of the most relevant problems related to smart mobility: the reduction of vehicles' travel time. Our original approach, called Red Swarm, suggests a potentially customized route to each vehicle by using several spots located at traffic lights in order to avoid traffic jams by using V2I communications. That is quite different from other existing proposals, as it deals with real maps and actual streets, as well as several road traffic distributions. We propose an Evolutionary Algorithm (later efficiently parallelized) to optimize our case studies which have been imported from OpenStreetMap into SUMO as they belong to a real city. We have also developed a Rerouting Algorithm which accesses the configuration of the Red Swarm and communicates the route chosen to vehicles, using the spots (via WiFi link). Moreover, we have developed three competing algorithms in order to compare their results to those of Red Swarm and have observed that Red Swarm not only achieved the best results, but also outperformed the experts' solutions in a total of 60 scenarios tested, with up to 19 % shorter travel times.

GOALS:

1. Build realistic traffic network instances.
2. Simulation of the scenarios.
3. Evaluation of new cycle programs of traffic lights.

CONCLUSIONS:

1. We have modelled different scenarios corresponding to cities of Andalusia.
2. We have simulated the scenarios and obtained results related to traffic light optimization.
3. We have reduced the travel times, greenhouse gas emissions, and fuel consumption of vehicles travelling throughout these cities.