Málaga, nov, 2012

Informe Ejecutivo

Título: TRA-1.0-2012: Swarm intelligence for traffic light scheduling: Application to real urban areas

Resumen: En este informe se presenta el trabajo realizado en el marco del proyecto DIRICOM sobre la configuración óptima de programas de ciclos en semáforos en instancias de tráfico reales. Para esto utilizamos un algoritmo Particle Swarm Optimization, que junto al simulador de tráfico SUMO, es capaz de obtener programas de ciclos de semáforos optimizados para áreas urbanas extensas. Como casos de estudio, nos hemos centrado en las ciudades de Málaga y Sevilla. Los programas de ciclos resultantes tras una serie de experimentos obtienen reducciones significativas en términos de congestión de tráfico y en tiempo medio de viaje.

Objetivos:

1. Estrategia de optimización para la resolución del problema.
2. Experimentación y análisis respecto a la calidad de la solución (congestión de tráfico y tiempo de viaje).

Conclusiones:

1. Nuestra estrategia muestra un comportamiento satisfactorio en escenarios de tráfico extensos y de diseño realista. Para las dos instancias estudiadas, nuestro PSO obtiene resultados estadísticamente mejores que los otros dos algoritmos comparados: el generador de programas de ciclos de SUMO (SCPG) y el de Random Search (RANDOM).
2. Las soluciones finales obtenidas por PSO mejoran tanto en el número de vehículos que llegan a sus destinos como en la duración de viaje, para las dos instancias. En particular, para el caso de Málaga, la mejora obtenida ronda el 10.13 % en el número de viajes completados y el 15.7 % en la duración de dichos viajes, respecto a SCPG.

Relación con entregables:

CO: VANET-2.3-2011 (lectura recomendable)

PRE: VANET-2.1-2010 (anterior o necesario de leer)

PRE: VANET-1.3-2009 (anterior o necesario de leer)

Málaga, noviembre, 2012

Executive Summary

TITLE: TRA-1.0-2012: Swarm intelligence for traffic light scheduling: Application to real urban areas

ABSTRACT: In this report, the optimal programming cycles of traffic lights is tacked for real traffic scenario instances. For this task, we have used a Particle Swarm Optimization algorithm that, coupled with the microscopic traffic simulator SUMO, is able to obtain optimized traffic light schedules for large urban areas. As case study, we have focused on two metropolitan areas in the cities of Malaga and Seville (Spain). After a thorough experimentation, the resulting traffic light configurations obtain significant reductions in terms of traffic congestion, and concerning the global journey time.

GOALS:

1. Defining the optimization strategy with simulations.
2. Experimental analyses in terms of performance algorithmic performance and solution quality.

CONCLUSIONS:

1. The proposed PSO shows a successful performance in big realistic traffic scenarios. For the two instances, our proposal obtained results statistically better than the two other compared algorithms: the SUMO cycle programs generator (SCPG) and a Random Search algorithm (RANDOM).
2. The final solutions obtained by PSO can improve the number of vehicles that reach their destinations and the mean trip time, for the two instances. In particular, for Málaga, the improvement obtained is around 10.13 % in the number of completed trips and 15.7 % in the trip time, regarding SCPG.

RELATION WITH DELIVERABLES:

CO: VANET-2.3-2011 (advisable reading)

PRE: VANET-2.1-2010 (mandatory reading)

PRE: VANET-1.3-2009 (mandatory reading)

Swarm intelligence for traffic light scheduling: Application to real urban areas

DIRICOM

Nov 2012

1. Referencia del trabajo

J. García-Nieto and E. Alba, **Swarm intelligence for traffic light scheduling: Application to real urban areas**. *Engineering Applications of Artificial Intelligence*, Volume 25, Issue 2, March 2012, Pages 274–283
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1.1. Paper Abstract

Congestion, pollution, security, parking, noise, and many other problems derived from vehicular traffic are present every day in most cities around the world. The growing number of traffic lights that control the vehicular flow requires a complex scheduling, and hence, automatic systems are indispensable nowadays for optimally tackling this task. In this work, we propose a Swarm Intelligence approach to find successful cycle programs of traffic lights. Using a microscopic traffic simulator, the solutions obtained by our algorithm are evaluated in the context of two large and heterogeneous metropolitan areas located in the cities of Málaga and Sevilla (in Spain). In comparison with cycle programs predefined by experts (close to real ones), our proposal obtains significant profits in terms of two main indicators: the number of vehicles that reach their destinations on time and the global trip time.

2. Citas en la actualidad

D. McKenney, T. White, D. Adaptive traffic signal control within a realistic traffic simulation, *Engineering Applications of Artificial Intelligence*, Volume 26, Issue 1, January 2013, Pages 574-583,
ISSN 0952-1976, 10.1016/j.engappai.2012.04.008.

N. Filip, M. Moldovan, C. Golgot. Access optimization in an urban area: a case study. Transactions of the Wessex Institute collection. *Urban Transport XVIII: Urban Transport and the Environment in the 21st Century*, pp. 347-358. ISSN 1743-3509. DOI: 10.2495/UT120301

Miller, J.; Donat, W.; Harris, J., Signal timing for fleeting multiple intersecting roadways, 15th International IEEE Conference on Intelligent Transportation Systems (ITSC), 2012 , pp.602,607, 16-19 Sept. 2012 doi: 10.1109/ITSC.2012.6338855