Chapter 3
Intelligent Tool for Decision Making Associated With Hospitalization and Sandstorms for the Optimization of Ambulances

Estrella D. Molina-Herrera  
University of Texas at El Paso, USA

Luis Ernesto Cervera-Gómez  
El Colegio de Chihuahua, Mexico

Carlos Herrera  
University of Texas at El Paso, USA & El Paso VA Health Care System, USA

ABSTRACT

The shortest path problem is a typical problem of optimization. This chapter presents an innovative model associated with the use of case-based reasoning to solve a problem of routing vehicles in a Hospital of El Paso, United States. In this chapter, diverse components are described to characterize this problem through the use of a knowledge system. The algorithm was developed in Java, thus obtaining a tool which determines the best tracks to the vehicles associated with ambulances. An experiment was realized to probe the validations; the results were used to compare it with the Dijkstra algorithm and determine the quality of the results. The future research of this intelligent tool is to determine an innovative perspective related to episodic knowledge applied to resolution of diverse ambulances, and as this topic is determinative to find and remember the best solutions quickly, additionally the authors compare it with a code from other postgraduate students trying to implement an algorithm similar to logistics but using a shuffled frog leap algorithm.

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**INTRODUCTION**

Dust storms are recurring weather effects in a BW climate in the Köppen climate classification, where the city of El Paso, in Texas, is located and affects about one million people, in a database obtained by DSHS and associated with 387500 records compiled in different events of seven years. Each patient hospitalized in the main hospital of the city of El Paso is linked to at least 127 diseases associated with this type of weather events; it is crucial to know this for the current research project. Each of the scenarios that occur each time a dust storm happens, in order to adequately link a requirement of a set of ambulances for the population at risk during this climatological event, is recurrent during the minus seven months of the year.

Nowadays, digital maps are increasingly common to greatly improve the optimization of evacuations performed by emergency vehicles such as ambulances or fire trucks. With the progress that has been made in technology, these maps are becoming more sophisticated, in the way that they are able to find specific locations, draw routes and so forth (Rahaman, Mei, Hamilton & Salim, 2017). Another thing that is noteworthy is that they show how the information has improved dramatically, as they changed from traditional maps to maps with real images taken from the air, satellite, or even a hybrid version of these two. The motivation of this project is specifically focused on the use of this increased interaction nowadays, in order to achieve an improvement in the logistics after a huge dust storm which affects many people and determine what is the best way to organize the ambulances to move patients to diverse hospitals (van Barneveld, Bhulai & van der Mei, 2016). The objective of this work is to develop a system to help create routes on the basis of the emergencies given in El Paso, Texas, through the use of a system of neighborhoods of ants that allows them to create routes to take care of patients affected by a dust storm or other types of emergencies in a quick way. This is important because the life of the people is at risk. In the United States, to minimize the arrival time to the place of the accident, they do a comparison according to three possible emergencies at the same time and require other vehicles to respond to them. To provide assistance to citizens, paramedics in an ambulance need a route to arrive as quickly as possible to the place of the incident (Talarico, Meisel & Sörensen, 2015). If there are many emergencies, they are classified in order of importance: Hospitalization related to a dust storm, Rescue, and Prevention Action on public hazard. In all these activities, the time is vital because with a timely arrival the effect of the damage in a dust storm can be decreased to prevent an explosion in the leak case and find alive persons, among others. The bio-inspired algorithms are a technique of artificial intelligence focused on the solution of different problems, especially optimization problems. One of these algorithms is the swarm intelligence algorithm, where we can find the algorithm of the ant colony (ACO), particle swarm optimization (PSO), bees and so on (Şimşek and Kara, 2018). The proposed algorithm to solve the routing problem in El Paso city is an Ant Colony System.

**DESCRIPTIONS OF THE MODEL COMPONENTS**

In this section, we offer details of each component related to the application domain that is involved in the problem, in our case we solve a Logistics problem related to the El Paso Health System’s Hospitals using a bioinspired algorithm to create routes of vehicles to attend emergencies.