ComputerScience

CS591 L1: Data Mechanics

BOSTON UNIVERSITY

Optimizing Locations for Hospitals and EMS Stations

Chloe Fortuna, Takumi House, Shahrez Jan, Ka ram Yang

Introduction

Motor vehicle accidents are an inevitable part of living in a busy city such as Boston. The number of accidents that occur throughout the year account for a lot of traffic in the emergency rooms of hospitals close to the site of impact. Since thousands of accidents occur each year but there are only 24 hospitals in Boston that are able to take in patients of such events, we need to determine how to direct the ambulances to the nearest hospital using the most optimal route. These ideas prompted us to ask these questions: How do we determine the most optimal location for a hospital in relation to crash sites so that it takes the least amount of time to get the patient the care they require? Given a specific crash site, is there an EMS station within a reasonable distance of the crash that will get the victims the care they need as soon as possible?

The Data Sets

Boston Hospitals : Set of all hospitals in Boston

Car Crashes in Boston : Set of all car crashes and the locations that they occurred in Boston

EMS Stations in Boston : Set of all EMS Stations throughout Boston

The Methodology

In order to determine the optimal hospital and optimal EMS station locations, we ran the k-means algorithm on two different sets. We determined the optimal hospital location using the car crash data and the hospitals data, and calculated the coordinates for the optimal EMS station using the car crash data and EMS stations data. In order to do the mapping of each data point on the map and show the routes, we used the Google Maps API and D3.js.

Conclusion

From our analyses of the locations of hospitals and EMS stations throughout Boston in relation to the car crash locations, we have concluded that the current locations of these hospitals and EMS stations are not optimal. When we averaged the travel time and distances of a route from an existing EMS station to a car crash, and then the same from the crash site to an existing hospital, the average time and distance tended to be higher than when routed from our calculated optimal locations.

Figure 1 : *Graph of all the car crash location clusters*

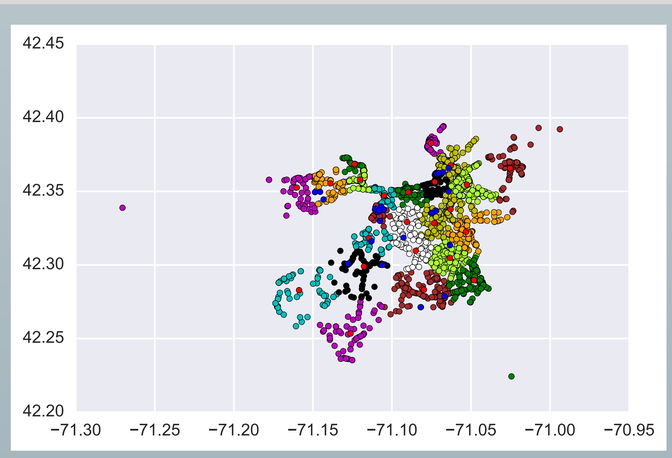


Figure 2 : *The optimal and existing hospital locations*

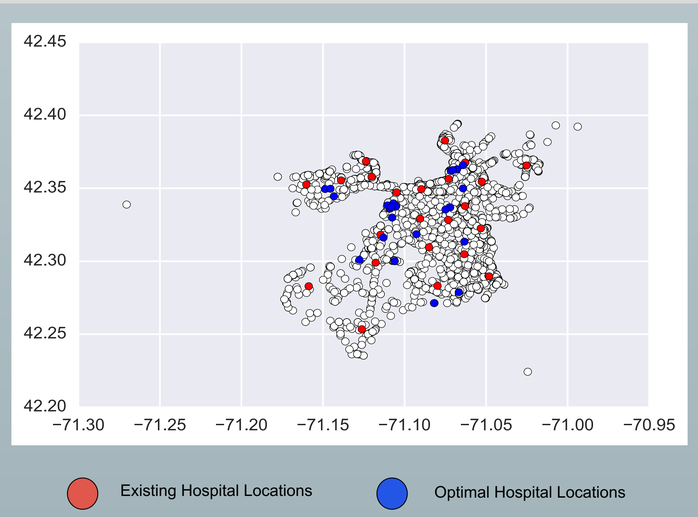


Figure 3: *The optimal vs existing hospital locations*

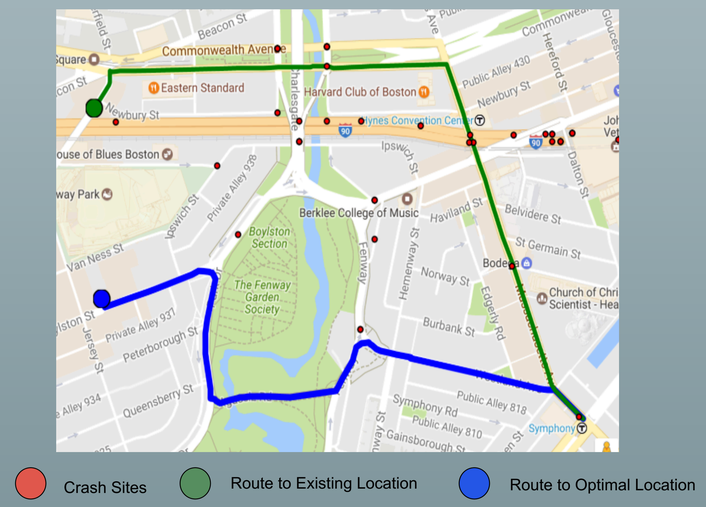
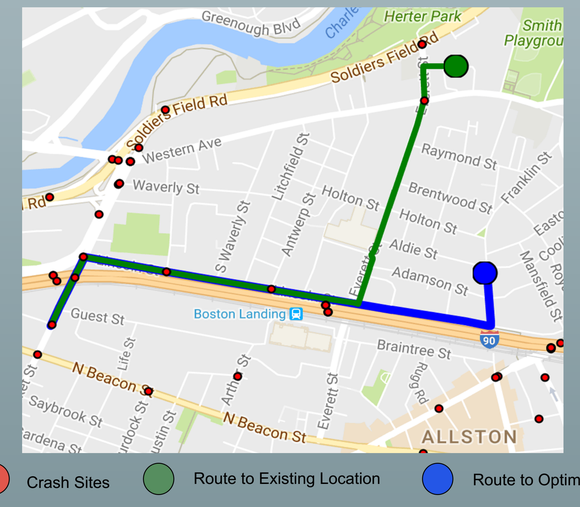


Figure 4 : *The optimal vs existing EMS Station locations*



Future Work

Our next steps would be to take in consideration other factors to determine the optimal locations instead of using only car crash sites data in our algorithm. Some factors we would have liked to use in our analysis of the optimal locations are factors such as health conditions, population size, average income of area, traffic, and ease of access through public transportation. Using these additional factors, we could attempt to put hospitals in locations that have dense populations, have more frequent cases of illnesses, and can be accessed easily even by those without access to private transportation. Traffic data can be used to determine where the optimal EMS stations should be placed by analyzing locations with less congestion during peak accident times, so ambulances can easily get to crash locations and transport their patients as soon as possible. We can also use the average income data to determine if the hospitals and EMS stations will have enough funding to be developed in these areas.

@BUCompSci