

COMPSCI 2XB3:Computer Science Practice and Experience: Binding Theory to Practice
Project Proposal Template

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| Project Title: | <i>StepSafe</i> |
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By virtue of submitting this document I electronically sign and date that the work being submitted is my own individual work.

Abstract

Every year millions of crimes are documented by local police departments across the globe. These databases are commonly released to the public via distribution websites such as Kaggle. However, despite this stockpile of information there is currently no mobile application on the market today to help commuters avoid high crime areas on their commute by analysing historic crime rates. SafeStep aims to do exactly this by utilizing massive public databases as well as up to date police recordings. While not all crimes are an immediate danger to the public, these databases will be sorted to identify exactly which crimes pose the greatest threat to commuters as they navigate modern cities.

1. Objective

This project aims to track historic crime data of major cities and generate commuting routes that will avoid high crime areas while reducing trip durations. Areas avoided will consists of crimes that are frequent, violent, and severe.

2. Motivation

Today's transit applications focus on getting users from point A to point B as fast as possible but have no provisions for doing so as safely as possible. Travelling to a city or urban centre can be stressful for those who are unfamiliar with the area. It's not uncommon to blindly follow a GPS to your desired location. If the fastest route is through a high crime area, users should have the ability to decide between safety and efficiency. StepSafe will generate safe and efficient travel routes from a user's current location to their desired destination. This application can be used by anyone who is looking to take extra precautions as they travel to their desired destination regardless of age, technical ability, gender, ethnicity, or economic status. Every commuter has a right to safe and efficient travel.

3. Prior Work

Currently on the market there are real time crime tracking applications that allow users to see marked crime locations on a map so they can factor currently occurring crimes into their commuting decisions. This is useful information when on the move but when trying to plan a safe route in advance one needs to consider an area's history of crime, not just single occurrences. These applications have the same goal as StepSafe but go about providing their service in very different ways. The key difference between StepSafe and anything available on the market is the analysis of crime statistics. The issue with avoiding crime is that the location of the offence is unknown until it occurs. For this reason, analysing an area's history of crime and at what times they occur will provide users with a more accurate understanding. The

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two most significant applications in this field are RedZone and Citizen. Much research has been conducted in the field of crime prediction. In the academic resources cited below, “Crime Hotspot” is a term commonly used to refer to an area where crime is common and consistent. This document will adopt this term to indicate areas to be avoided.

4. Input/output and proposed solutions

1. Dataset
 - Title: Crimes in Boston
 - Size: 328k entries
 - URL: <https://www.kaggle.com/ankkur13/boston-crime-data>
 - Description: This dataset tracks crimes in Boston from 2015-2018. To start out this dataset will be used to build and test crime avoidance algorithms that can be implemented around the globe.
2. StepSafe will generate safe and efficient travel routes from a user’s current location to their desired destination. Crime rates in given areas will also be analysed based on the hour in the day, day of the week, and month that previous crimes have occurred at.
3. StepSafe will be trained with multiple years of historic crime data supplied by police departments of major cities to recognize high crime risk areas in a given geographic region. This data will contain new entries via live feed from police reports to stay up to date. For the end user, all of this takes place behind the scenes. When using StepSafe, an individual enters a destination they wish to travel to and receive back directions. This differs from an ordinary GPS in the fact that final suggestion incorporates the user’s safety by avoiding crime hotspots. Route calculations will differ to reflect the transportation method of the user. Individuals walking or taking public transit are more vulnerable to street crime and therefore have a higher motive to choose safer travel routes. The two application previously mentioned highlight areas of crime for end user to see. SafeStep on the other hand, will discretely guide users away from high crime hotspots without indicating them specifically. This will ensure neighbourhoods are not subject to prejudice or portrayed in a negative light as the other applications were criticized for doing.

5. Algorithmic challenges:

There are two algorithms that will be necessary for this project. Firstly, a sorting algorithm will be used to group the relevant data into categories based on the nature of the crimes committed. This will measure for characteristics of the offence that could be considered dangerous to bystanders and should be avoided by the public. The second, and more interesting algorithm, will be used for graphing crime hotspots. In a report from the International Journal of Computational Intelligence Systems titled “*Crime Hotspot Detection and Monitoring Using Video Based Event Modeling and Mapping Techniques*” several methods are discussed for collecting and mapping crime statistics. Among the topics discussed are implementing a video-based concept recognition method, evaluating and comparing existing events recognition methods, modeling a Neuro-Fuzzy System for crime prediction, using crime indicator events for wide area hotspot analysis and integrating video event recognition, neuro-fuzzy inference and mapping techniques in a single framework for crime hotspot detection and monitoring. However, the most interesting topic discussed here is Kernel Density Estimation. One key difference between this study and SafeStep is that the data used for creating SafeStep’s route suggestions comes from well documented police reports rather than video surveillance.

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6. Project plan

Week 1: Collect and clean relevant datasets and information necessary for developing algorithms.

Week 2-4: Develop and implement incident classification system to create groupings of crime based on potential harm to bystanders.

Week 4-6: Plot and map relations between high hotspots.

Week 6-10: Develop algorithm for efficient travel while avoiding crime hotspots.

References

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