Modeling Future Crime

New Mexico

Supercomputing Challenge

Final Report

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Team Number 103

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Executive Summary

The purpose of our project is to create a program that can calculate the most likely location of future crime in a replica simulation of a city and model it over time. This will assist the effort of governing bodies trying to lower crime rates, increase the security of the city's residents, enhance the efficiency of undermanned police patrols, and attract new citizens.

We began by creating our model with Java using NetBeans. We constructed a 5x4 grid with 20 intersections, giving a total of eighty "object" sites and 9 roadways to represent the model city. The user then populates the sites with objects ranging from "bank" to "high school" using dropdown menus, chooses which roads are main streets using checkboxes, and chooses an initial day of the week. Each site object emits an assigned "crime gravity" (based on many factors), which either attracts or repels crime. When the program is initiated, a gravity algorithm compiles all of the site gravities in relation to each other to find gravity hot spots, or places that theoretically have the highest chance of crime. These hot spots are then painted red to mark their location, and are assigned gravities. After running the simulation over and over, a general image of the city's crime profile develops, revealing where police force should be concentrated.

To analyze the accuracy of our program, we modeled Socorro, NM and created its crime profile. We then compared the results of the simulation with a marked map of crimes committed in Socorro in the past 6 months. Our model and the map matched over 70% of the same hot spots, proving the effectiveness of our program.

Problem Statement

Crime has always been a major menace to society. Even with all the advances of today's technology, predicting exactly where a criminal might strike next is still out of reach. Shortages of personnel have also led to police departments stretching patrols thin. Due to these deficiencies in law enforcement, crime rates have gone up. To help alleviate this condition, we thought of developing an accurate technique for modeling future crime trends. If we can model crime, police patrols could be efficiently concentrated on certain areas and preventative measures could be implemented. So, in our project, we created a simulator using Java that enables the computer to calculate the most probable locations of crime in a model city and plot them over time. We hope that in pursuing this project we do our part in making the world a safer place by lowering crime rates and increasing the security of taxpaying citizens.

Procedure

Description

To begin with, we wanted a view of crime's distribution in a typical city, so we took a map of Socorro, NM and marked the location of crimes that occurred in a 6 month period. We discovered that crime tends to crowd around other crime, towards some areas and not others, and near main streets. That led us to develop a theory of "crime gravity", that objects either attract or repel crime. With further research, we discovered that others had proof of this, such as a research paper that said more than 50% of crimes committed were in the direct vicinity one or two main streets or highways [1]. Based on our findings, we concluded that objects (buildings, highways/ main streets) each have their own "gravity" towards the location of crime, either negative (repelling) or positive (attracting). From our map, we also realized a large generator of gravity is the economic status of the area, with 66% of crimes being committed in low income neighborhoods. Days of the week also influence gravities, i.e. banks close on Sundays, voiding their crime gravities. All that was needed now was to implement gravities into the program.

We began by developing initial gravities for the objects. Initial gravities were determined based on the average number of crimes committed around their object on crime maps; i.e. schools rarely had crime committed around them, but generally had crime occur inside of them. Days of the week themselves have no gravity, but alter gravities, as in the example of a bank on Sunday. Main streets/highways also increase attraction many times.

Initial gravity is not the sole factor in the crime model. In order for the simulation to be life-like, the gravities must interact and alter each other. After

scrutinizing carefully, we decided that the gravities affect each other in a ripple-like effect, where each one affects only the nearby ones, until the whole city is changed. This is comparable to magnets placed around each other, with their magnetic fields representing gravity.

Assumptions

- Initial gravities are correct for the city being simulated.
- The user accurately models the real world into the program.
- "Crime gravity" affects other gravities in the vicinity of one block.
- Immediate access is defined as one block away.
- Crime attracts other crime.
- Random, unforeseen events (factoids) occur that change the chance of a crime occurring (car crash, fire)

Method

We decided to create our model with Java using NetBeans. We constructed a 5x4 grid with 20 intersections, giving a total of eighty "object" sites and 9 roadways to represent the model city. The user then populates the sites with objects ranging from "bank" to "high school" using dropdown menus, chooses which roads are main streets/highways using checkboxes, and chooses an initial day of the week. When the program is initiated, a gravity algorithm compiles all of the site gravities, street gravities, day of the week, and randomly produced (if any) factoids in the aforementioned ripple effect, to find gravity hot spots, or places

that theoretically have the highest chance of crime. These hot spots are then painted red to mark their location, and are assigned gravities (it is these newly assigned gravities and the progression of the day of the week that constantly change the output of the program). After running the simulation over and over, the general image of the city's crime profile develops, revealing the areas that have a high chance crime and, ergo, where police force should be concentrated.

To test the integrity of our simulator, we modeled Socorro, NM in the program and ran it to see if it matched the physical crime map.

Results

The simulator effectively crime profiled Socorro within 70% similarity of the actual map.

Conclusion

It is possible to use modeling to calculate the approximate locations of future crime within an acceptable margin.

Materials

Software

Net Beans IDE 5.5 - Windows XP SP/2 - Mozilla Firefox 1.5

PreCog 4.0

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Data

Our research indicated that:
Crimes are 9 times more likely to occur near a highway /main street, as this allows easy get-away.
Over 2/3 of residential crime is committed in low-class neighborhoods.
The days of the week only slightly affected the number of crimes committed per day, with Sunday having the most and Monday and Friday the least.
High class neighborhoods repelled crime 2 times better than the police station, which seemed to have little, to no effect.

Significant Original Achievement

Our most significant original achievement was the creation of a program that is unbiased in helping people be and feel more secure while increasing the efficiency of the justice system.

Acknowledgements

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