Crime Pattern Detection Using Data Mining

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Abstract

Can crimes be modeled as data mining problems? We will try to answer this question in this paper. Crimes are a social nuisance and cost our society dearly in several ways. Any research that can help in solving crimes faster will pay for itself. Here we look at use of clustering algorithm for a data mining approach to help detect the crimes patterns and speed up the process of solving crime. We will look at k-means clustering with some enhancements to aid in the process of identification of crime patterns. We will apply these techniques to real crime data from a sheriff's office and validate our results. We also use semi-supervised learning technique here for knowledge discovery from the crime records and to help increase the predictive accuracy. We also developed a weighting scheme for attributes here to deal with limitations of various out of the box clustering tools and techniques. This easy to implement machine learning framework works with the geo-spatial plot of crime and helps to improve the productivity of the detectives and other law enforcement officers. It can also be applied for counter terrorism for homeland security.

Keywords: *Crime-patterns, clustering, data mining, k-means, law-enforcement, semi-supervised learning*

1. Introduction

Historically solving crimes has been the prerogative of the criminal justice and law enforcement specialists. With the increasing use of the computerized systems to track crimes, computer data analysts have started helping the law enforcement officers and detectives to speed up the process of solving crimes. Here we will take an inter-disciplinary approach between computer science and criminal justice to develop a data mining paradigm that can help solve crimes faster. More specifically, we will use clustering based models to help in identification of crime patterns[1].

We will discuss some terminology that is used in criminal justice and police departments and compare and contrast them relative to data mining systems. Suspect refers to the person that is believed to have committed the crime. The suspect may be identified or unidentified. The suspect is not a convict until proved guilty. The victim is the person who is the target of the crime. Most of the time the victim is identifiable and in most cases is the person reporting the crime. Additionally, the crime may have some witnesses. There are other words commonly used such as homicides that refer to manslaughter or killing someone. Within homicides there may be categories like infanticide, eldercide, killing intimates and killing law enforcement officers. For the purposes of our modeling, we will not need to get into the depths of criminal justice but will confine ourselves to the main kinds of crimes.

Cluster (of crime) has a special meaning and refers to a geographical group of crime, i.e. a lot of crimes in a given geographical region. Such clusters can be visually represented using a geo-spatial plot of the crime overlayed on the map of the police jurisdiction. The densely populated group of crime is used to visually locate the "hot-spots" of crime. However, when we talk of clustering from a data-mining standpoint, we refer to similar kinds of crime in the given geography of interest. Such clusters are useful in identifying a crime pattern or a crime spree. Some well-known examples of crime patterns are the DC sniper, a serial-rapist or a serial killer. These crimes may involve single suspect or may be committed by a group of suspects. The below figure shows the plot of geo-spatial clusters of crime.

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