Computational Models for Analysis of Illicit Activities

Abstract

Numerous illicit activities happen in our society, which, from time to time affect the population by harming individuals directly or indirectly. Researchers from different disciplines have contributed to developing strategies to analyze such activities, in order to help law enforcement agents devise policies to minimize them. These activities include cybercrimes, terrorist attacks or violent actions in response to certain world issues. Beside such activities, there are several other related activities worth analyzing, for which computational models have been presented in this thesis. These models include a model for analyzing evolution of terrorist networks; a text classification model for detecting suspicious text and identification of suspected authors of anonymous emails; and a semantic analysis model for news reports, which may help analyze the illicit activities in certain area, because news are of immense utility to the analyst. With this analysis, the authors are able to extract critical events or concepts which describe an illicit activity in the news along with the entities involved in the events. These entities include important actors of the event or concept, along with location and temporal information. For the network evolution, the hierarchical agglomerative clustering approach has been applied to terrorist networks as case studies. The networks' evolutions show that how individual actors who are initially isolated from each other are converted in small groups, which result in a fully evolved network. This method of network evolution can help intelligence security analysts to understand the structure of the network. For suspicious emails detection and email author identification, a cluster-based text classification model has been proposed. The model outperformed traditional models for both of the tasks. Apart from these globally organized crimes and cybercrimes, there happen specific world issues which affect geographic locations and take the form of bursts of public violence. These kinds of issues have received little attention by the academicians. These issues have been explored in this thesis by considering them as epidemic-like processes. A mathematical model has been developed based on differential equations, which studies the dynamics of the issues from the very beginning until the issues cease. This study extends classical models of the spread of epidemics to describe the phenomenon of contagious public outrage, which eventually leads to the spread of violence following a disclosure of some unpopular political decisions and/or activity. The results shed a new light on terror activity and provide some hint on how to curb the spreading of violence within population globally sensitive to specific world issues. The models discuss the dynamics of population in response to such issues. All the models presented in the thesis can be combined for a systematic analysis of illicit activities.