Chapter XIV

Mining Critical Infrastructure Information from Municipality Data Sets: A Knowledge-Driven Approach and Its Applications

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Abstract

An essential task in critical infrastructure protection is the assessment of critical infrastructure vulnerabilities. The use of scenario sets is widely regarded as the best form for such assessments. Unfortunately, the construction of scenario sets is hindered by a lack in the public domain of critical infrastructure information as
such information is commonly confidential, proprietary, or business sensitive. At the same time, there is a wealth of municipal data in the public domain that is pertinent to critical infrastructures. However, to date, there are no reported studies on how to extract only the most relevant CI information from these municipal sources, nor does a methodology exist that guides the practice of CI information mining on municipal data sets. This problem is particularly challenging as these data sets are typically voluminous, heterogeneous, and even entrapping. In this chapter, we propose a knowledge-driven methodology that facilitates the extraction of CI information from public domain, that is, open source, municipal data sets. Under this methodology, pieces of deep, though usually tacit, knowledge acquired from CI domain experts are employed as keys to decipher the massive sets of municipal data and extract the relevant CI information. The proposed methodology was tested successfully on a municipality in the Southeastern United States. The methodology is considered a viable choice for CIP professionals in their efforts to gather CI information for scenario composition and vulnerability assessment.

Introduction

A critical infrastructure (CI) is an array of assets and systems that, if disrupted, would threaten national security, economy, public health and safety, and way of life. These include, but are not limited to, utilities, medical facilities, public transportation, telecommunication networks, landmarks, buildings, and public spaces. In recent years, unfortunately, critical infrastructures have become symbolic targets as well as the mass casualty opportunities for terrorist attacks (Bolz, Dudonis, & Schulz, 2002). For instance, the World Trade Center is a symbol of America’s capitalism and economic influence, the Pentagon is a symbol of America’s military strength, and the railway station in Madrid represents a node in a geo-political network. Many critical infrastructures promote the congregation of people, which increases their attractiveness to terrorist acts. Because of the dual identity of critical infrastructures and the high level of vulnerability they bear, critical infrastructure protection (CIP) has topped the list of priorities in the practice of homeland security planning in the United States (Terner, Sutton, Hebert, Bailey, Gilbert, & Jacqz, 2004; Thieman, 2004). Since the tragic events of September 11, 2001, CIP drills have become an integral part of every counter-terrorism exercise across the country (Thieman, 2004).

An essential task in critical infrastructure protection (CIP) planning is the assessment of CI vulnerability with respect to the threat of potential terrorist attacks. For such a task, a set of scenarios is widely regarded in both academic and professional communities to be the best form for such assessments (Garrick, 2002). Unlike predictions which project critical infrastructure (CI) vulnerability with probability, a scenario set bounds the range of vulnerabilities by connecting initiating event,
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