Chapter 19
On the Use of Bayesian Network in Crime Suspect Modelling and Legal Decision Support

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ABSTRACT

Predictive policing (Pp) relates to identifying potentially related offences, similar criminal attributes and potential criminal activity, in order to take actionable measures in deterring crime. Similarly, Legal Decision Making Process (LDMP) considers some level of probabilistic reasoning in deriving logical evidence from crime incidents. Bayesian Networks (BN) have great potential in contributing to the area of Pp and LDMP. Being based on probabilistic reasoning, they can assess uncertainty in crime related attributes and derive useful evidence based on crime incident observations or evidential data. For example, in a particular context of crime investigation, BN based inference could help collect useful evidence about a crime scenario or incident. Such evidence promotes effective legal decision making process and can assist public safety and security agencies in allocating resources in an optimal fashion. This chapter reports on various application areas of BN in the crime domain, highlights the potential of BN and presents "thought experiments" on how offender characteristics could be modelled for decision support in legal matters. The chapter further reports on the performance of empirical analysis in the legal decision support process, in order to elucidate the practical relevance and challenges of using BN in the crime domain.

1. INTRODUCTION

The foundation and motivation for repeat victimisation study (RVS) relates to the fact that repeat crime is much more likely to happen in a short interval of time after the first incident, and often within a close proximity (Evett et al., 2006 & Riesen et al., 2009). RVS is also associated with the notion that crime is mostly initiated and perpetuated "where and when" there is a "conducive" environment for a potential offender and the presence of a suitable (vulnerable) target victim. This notion is corroborated by the long-established routine activity theory (RAT) in criminology depicted in Figure 1 (Clarke et al, 1993), which stipulates that a crime can only be committed when three specific criteria are involved. These criteria are that there must be a motivated offender, a suitable target or vulnerable victim (available at an appropriate location and time), as well as the absence of a capable guardian. RAT is a sub-field of crime opportunity theory that focuses on situations or circumstances of crimes. Jury members also consider such circumstances when probing crime scenarios, in order to justify the legal decision process.

Furthermore, judges or jury members often make legal decisions based on their instinct and/or experience (Milgram A., 2013). Such legal decision making process considers some level of probabilistic reasoning in deriving logical evidence, although the mathematical rigour for such probabilistic evidence is sometimes ignored or ill-defined.

One aspect that stimulates interest is whether a crime *X* that previously occurred or repeatedly happens in location *K* is committed by the same individual suspect in that location, another location of close proximity or geographically close domestic dwellings, given observations of certain exculpatory or incriminating evidence or findings. For example, exculpatory or incriminating evidence could be footwear or footprint marks found at both points of entry of the crime scenes, particular items recovered from the points of entry at both crime scenes, type of victim information repeatedly reported and Modus Operandi (MO) involved. The degree of similarity between the evidence in two crimes can further motivate a number of research questions:

1.   How does the evidence transfer between previous and current crimes?
2.   To what extent can we attribute the crime observations or offender characteristics in the current crime to the previous one, for example in terms of MO reported?

Figure 1. A model of routine activity theory

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