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Chapter

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Fuzzy Decision Fusion and Multiformalism Modelling in Physical Security Monitoring

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Abstract

Modern smart-surveillance applications are based on an increasingly large number of heterogeneous sensors that greatly differ in size, cost and reliability. System complexity poses issues in its design, operation and maintenance since a large number of events needs to be managed by a limited number of operators. However, it is rather intuitive that redundancy and diversity of sensors may be advantageously leveraged to improve threat recognition and situation awareness. That can be achieved by adopting appropriate model-based decision-fusion approaches on sensor-generated events. In such a context, the challenges to be addressed are the optimal correlation of sensor events, taking into account all the sources of uncertainty, and how to measure situation recognition trustworthiness. The aim of this chapter is twofold: it deals with uncertainty by enriching existing model-based event recognition approaches with imperfect threat modelling and with the use of different formalisms improving detection performance. To that aim, fuzzy operators are defined using the probabilistic formalisms of Bayesian Networks and Generalized Stochastic Petri Nets. The main original contributions span from support physical security system design choices to the demonstration of a multiformalism approach for event correlation. The applicability of the approach is demonstrated on the case-study of a railway physical protection system.

Keywords

Physical security Surveillance Multiformalism modelling Decision fusion Performance evaluation Fuzzy correlation

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