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A rule-based approach for the correlation of alarms to support Disaster and Emergency Management

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The importance of recognition of emergency's typology to control the critical situation for security of citizens has been always recognized. It follows this aspect is very important for proper management of a hazardous event. In this work we present a solution for the recognition of emergency's typology adopted by an Italian research project, called CI6 (Centro Integrato per Servizi di Emergenza Innovativi).
In our approach, CI6 receives alarms by citizen or people involved in the work (for example: police, operator of 112, and so on).
CI6 represents any alarm by a set of information, including a text that describes it and obtained when the user points out the danger, and a pair of coordinates for its location.
The system realizes an analysis of text and automatically infers information on the type of emergencies by means a set of parsing rules and rules of inference applied by a independent module: a correlator of events based on their log and called Simple Event Correlator (SEC).
SEC, integrated in CI6's platform, is an open source and platform independent event correlation tool. SEC accepts input both files and text derived from standard input, making it flexible because it can be matched to any application that is able to write its output to a file stream.
The SEC configuration is stored in text files as rules, each rule specifying an event matching condition, an action list, and optionally a Boolean expression whose truth value decides whether the rule can be applied at a given moment. SEC can produce output events by executing user-specified shell scripts or programs, by writing messages to files, and by various other means. SEC has been successfully applied in various domains like network management, system monitoring, data security, intrusion detection, log file monitoring and analysis, etc; it has been used or integrated with many application as CiscoWorks, HP OpenView NNM and Operation, BMC Patrol, etc.

Analysis of text of an alarm can detect some keywords that allow to classify the particular event. The inference rules were developed by means an analysis about news regard real emergency found by web reaserches. We have seen that often a kind of emergency is characterized by more keyword.
Keywords are not uniquely associated with a specific emergency, but they can be shared by different types of emergencies (such as. keyword l̈andslidec̈an be associated both emergency l̈andslideänd emergency F̈lood̈).
However, the identification of two or more keywords associated with a particular type of emergency identified in most cases the correct type of emergency.
So, for example, if text contains words as "water", "flood", "overflowing", "landslide" o other words belonging to the set of defined keywords or words that have some root of keywords, the system "decides" that this alarm belongs to specific typology, in this case "flood typology".
The system has the memory of this information, so if a new alarm is reported and belongs to one of the typology already identified, it proceeds with the comparison of coordinates.
The comparison between the centers of the alarms allows to see if they describe an area inscribed in an ideal circle that has centered on the first alarm and radius defined by the typology above mentioned.

If this happens the system CI6 creates an emergency that has centered on the centre of that area and typology equal to that of the alarms. It follows that an emergency is represented by at least two alarms.

Thus, the system suggests to manager (CI6's user) the possibility that most alarms can concern same events and makes a classification of this event.
It is important to stress that CI6 is a system of decision support, hence also this service is limited to providing advice to the user to facilitate his task, leaving him the decision to accept it or not.

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