The Medical Ecosystem – Personalised Event-based Surveillance

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Abstract

Early detection and early response is a strategy for circumventing devastating public health events. Traditional systems for identification of potential health threats can be used to recognise long-term trends, but mostly fail in urgent cases and are of less use for unknown diseases. In this paper, the Medical Ecosystem (M-Eco) is presented, which is a framework that integrates processing resources for unofficial sources such as user generated content and traditional sources for the early detection of emerging health threats. M-Eco will emphasize adaptivity and personalised filtering so that relevant signals can be detected for targeting the needs of public health officials who have to synthesize facts, assess risks and react to public health threats.

Keywords:

Epidemic intelligence, Medicine 2.0, Public health event detection

Introduction

Early detection and early response is a strategy for circumventing devastating public health events. Faced with the limitations of traditional approaches, there is a need to complement them with additional approaches which are also targeted for the early detection of emerging threats. We introduce the Medical Ecosystem (M-Eco), a framework that goes beyond traditional and existing event-based surveillance systems, by (1) exploiting more sophisticated event detection technologies, (2) using additional data sources including multimedia data, and (3) providing personalised access to detected events.

Methods

The following aspects are considered within M-Eco:

Content Analysis in the M-Eco system deals with the collection of data from the different sources, and their semantic filtering and extraction. Sources include various kinds of social media content (e.g., movie clips uploaded to YouTube, Weblogs, podcasts, twitter messages) and media data that deal with medicine and health collected from radio broadcast, TV broadcasts. Multi media content is transformed into text transcripts using automatic speech recognition technologies. The resulting text is pre-processed which includes tokenization, stemming or lemmatization, part-of-speech tagging and chunking. Content is semantically annotated through named entity tags (location, person, etc.).

Event Detection of public health events. To detect events, meaningful language-specific semantic phrases are extracted from the pre-processed text. These phrases are mined to extract relevant entities such as medical concepts or geographical location that form the basis for mining events. Entities are specified by event templates with slots for location, disease, severity etc. filled with extracted information.

Personalisation and Adaptation strategies are exploited to provide personalised access and presentation of information or detected events, respectively. Public health officials must process a large amount of information to assess risks. An appropriate level of filtering is essential in reducing the burden placed on these users. One challenge with personalisation for the public health event domain is providing an appropriate level of filtering without loss of essential information required for supporting decision making and risk assessment.

The final M-Eco system provides a set of services that base upon the previously described methodologies: A **Data Service** provides event data export capabilities for different users to obtain portions of the data of interest to them in a standard format. This can be used to support corroboration and further integration with other systems. The **Signal Notification Service** provides personalised notification capabilities for individuals to receive signals that have been detected by the system. A **Validation and Explanation Service**, designed to be used in conjunction with the Signal Notification Service, will provide reasoning support for explaining system-generated signals. An **Adaptation Service** will provide personalised views and adaptive interaction with the portal.

Through a web-based platform - the M-Eco Portal - the detected events will be made accessible to the user. A first integration is planned with the SurvNet@RKI system, an indicator-based system for surveillance and MedISys, an event-based surveillance system that relies upon news articles only.

Future Work

In the future, the proposed framework will be enriched with the appropriate technologies. In order to follow a user-centric approach of development, user requirements will be determined. Then, technologies from the event detection community are adapted to fit our scenario of epidemic intelligence.