Epidemic Intelligence: For the Crowd, by the Crowd

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Abstract. Event Based Epidemic Intelligence (e-EI) encompasses activities related to early warnings and their assessments as part of the outbreak investigation task. Recently, modern disease surveillance systems have started to also monitor social media streams, with the objective of improving their timeliness in detecting disease outbreaks, and producing warnings against potential public health threats.

In this tutorial we show how social media analysis can be exploited for two important stages of e-EI, namely: (i) Early Outbreak Detection, and (ii) Outbreak Analysis and Control. We discuss techniques and methods for detecting health-related events from unstructured text and outline approaches, as well as the challenges faced in social media-based surveillance. In particular, we will show how using Twitter can help us to find early cases of an outbreak, as well as, understand the potential causes of contamination and spread from the perspective of the field practitioners.

1 Introduction

Social Media streams, such as Twitter and other real-time media are now seen as a valuable source of temporally and spatially relevant information. Applications that rely upon social media streams include trend detection [6, 10]; and intelligence gathering for applications such as: natural disaster detection [7, 9] or flu outbreak tracking [1–3, 8].

In this tutorial, we focus on the application of social media streams for Event-Based Epidemic Intelligence (e-EI). e-EI encompasses activities related to early warnings and their assessment as part of the outbreak investigation task. The tutorial is divided into two parts, in each, we take up an important aspect of e-EI. In Part I: Early Outbreak Detection, we discuss both supervised and unsupervised techniques for detecting health-related events from unstructured text. We also outline the approaches for detecting relevant disease-reporting entities; such as affected organisms, medical condition, location and temporal mentions and address the problem of disambiguating semantic relations which contain these entities. Next we discuss the approaches and challenges of generating early warnings from relevant semantic relations, for domain experts [4].

In Part II: Outbreak Analysis and Control, we focus on two types of support for helping domain experts with the problem of information overload when assessing the risk associated with system generated warnings; namely, ranking of early warning alerts [5] and appropriate visualization services. As a case study, we show how using Twitter can help us to find early cases of an outbreak, as well as, understand the potential causes of contamination and spread from the perspective of the field practitioners. Throughout the tutorial, we present practical lessons that have been learned within the context of the M-Eco project (<http://www.meco-project.eu/>) and numerous results from field practitioners assessments; finally we conclude with an outlook for the domain of e-EI.

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