

## Chapter 80

# Sentiment Analysis in Business Intelligence: A Survey

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### ABSTRACT

*Sentiment Analysis is a novel and broad area of Natural Language Processing (NLP) aiming to understand people's sentiments and opinions about a given topic. In particular, this chapter focuses on the application of Sentiment Analysis to automatically evaluate online products and services reviews. Undoubtedly, the information in customer reviews is of great interest to both companies and consumers. Companies and organizations spend a huge amount of money to find customers' opinions and sentiments, since this information is useful to exploit their marketing-mix in order to affect consumer satisfaction. Individuals are interested in others' experiences when purchasing a product or hiring a service. Moreover, online opinions clearly influence the companies' reputation. For this reason, Sentiment Analysis is expected to become a key component of Customer Relationship Management (CRM) solutions. However, the task of mining opinions in text, as any other NLP task, is a very challenging one. The objective of this chapter is to present the reader the main ideas of Sentiment Analysis and its practical applications in business intelligence. It also discussed the approaches and techniques used so far, and the corpora and resources most widely used in the development of sentiment-driven systems.*

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## INTRODUCTION

Consumers' opinions provide valuable information for companies. First, they help to understand how their products and services are perceived. They yield clues about customers' satisfaction and expectations that can be used to determine their current and future needs and preferences. Second, they may be of help in understanding what product dimensions or attributes are important to each consumer segment, and even to discover new segments based on groups of consumers concerned about the same attributes. Third, customers' opinions on the products offered by competitors provide essential information to accomplish a successful competitor analysis.

However, seeking consumers' opinions has traditionally been a difficult and time-consuming task, which usually involves hiring expensive consulting firms to conduct surveys on representative groups of customers. The results of these surveys are restricted to a very limited sample of customers and need to be extrapolated from the sample to the population. Moreover, these surveys are only valid for a short time period, since customers' opinions change fast nowadays, and frequently due to things that are completely out of the companies' control.

With the growth of the WWW and the popularization of review sites, forums, blogs and discussion groups, consumer's information is not limited to the word of mouth, since they may easily share their experiences and opinions, positive or negative, regarding any product or service, so that the cost of gathering information for the purchase decision process is low. In fact, according to two surveys (Hitlin & Rainie, 2004; ComScore, 2007), 81% of Internet users have done online research on a product at least once; and, among readers of online reviews of restaurants, hotels, and various services (e.g., travel agencies or doctors), between 73% and 87% report that reviews had a significant influence on their purchase (Pang & Lee, 2008). Thus, it seems clear that the influence of online

reviews on the purchase decision and the companies' reputation should not be neglected.

However, the huge amount of online reviews that are generated every day makes any kind of manual processing unfeasible. The challenge is, therefore, the development of new technologies to efficiently process this information and produce useful knowledge for the company. But, as stated in Liu (2010), monitoring opinions on the Web is a very difficult task and the understanding and knowledge of the problem and its solution are still preliminary.

The information in online reviews and forums (commonly referred to as *user-generated content*) is usually presented as non-structured free-text so that automatically extracting users' opinions requires using advanced Natural Language Processing (NLP) techniques. In particular, a discipline within the NLP has emerged to deal with the computational treatment of opinions, sentiments and subjectivity in text, called Sentiment Analysis and sometimes referred to as Opinion Mining. Sentiment Analysis, in turn, involves different research tasks, such as subjectivity detection, polarity recognition, emotional intensity classification, opinion reason mining, product comparison and opinion summarization. Subjectivity detection aims to discover subjective or neutral terms, phrases or sentences, and it is frequently used as a previous step in polarity and intensity classification with the aim of separating subjective information from opinionated one (Wiebe, Bruce & O'Hara, 1999; Pang & Lee, 2004; Kim & Hovy, 2004). Polarity recognition attempts to classify texts into positive or negative (Pang, Lee & Vaithyanathan, 2002; Turney, 2002; Esuli & Sebastiani, 2006). The emotional intensity classification (or rating inference) task goes a step further and tries to identify different degrees of positivity and negativity, e.g. *strongly-negative*, *weakly-negative*, *fair*, *weakly-positive* and *strongly-positive* (Esuli & Sebastiani, 2006; Brooke, 2009; Wilson, Wiebe & Hoffman, 2009; Carrillo de Albornoz, Plaza & Gevas, 2010).

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