



Predicting the helpfulness of online product reviews: A multilingual approach



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ABSTRACT

Identifying helpful reviews from massive review data has been a hot topic in the past decade. While existing research on review helpfulness estimation and prediction is primarily sourced from English reviews, non-English reviews may also provide useful consumer opinion information and should not be neglected. In this study, we propose a review helpfulness prediction framework that processes and uses multilingual sources of reviews to generate relevant business insights. Adopting a design science research approach, we design, implement, evaluate and deliver an IT artifact (i.e., our framework) that predicts the helpfulness of a review and accounts for non-English reviews. Our evaluations suggest that we achieve better performance on review helpfulness prediction and classification by including the variables generated by our instantiated multilingual system. By demonstrating the feasibility of our proposed framework for multilingual business intelligence applications, we contribute to the literature on business intelligence and provide important practical implications to practitioners.

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1. Introduction

Recent years have witnessed a rapid growth of the Internet and Web 2.0 applications, which sprout numerous online product related world-of-mouth (WOM) communities that provide an abundance of user-generated content (UGC) (e.g., online product reviews) in a convenient and low-cost manner (Ghose and Ipeirotis, 2011). Reviewers on these platforms devote time and effort to writing online reviews, generating a wealth of information that assists prospective consumers in product quality evaluation and informed purchase decision making (Zhao et al., 2013; Zhu and Zhang, 2010). According to recent surveys, eighty-eight percent of respondents consulted online reviews to determine the quality of local businesses (Anderson, 2014) and ninety percent of respondents said that their purchase decisions were influenced by positive online reviews (Gesenhues, 2013). The popularity of online WOM hence underscores the importance of mining online WOM for vendor companies' business intelligence activities so as to understand consumer preferences and compete in such a more transparent age (Deloitte, 2007).

The explosive growth and expansion of online WOM communities, however, have created a number of challenges for vendor companies (e.g., retailers and manufacturers) to conduct business intelligence in an effective and efficient manner. Reviewers have their full autonomy to express their opinions and judgments on the online WOM platforms, resulting in varying quality, style and usefulness of reviews. For instance, some reviews might contain succinct information on product features and express more about reviewers' general evaluations while others might provide detailed descriptions of each product feature (Pan and Zhang, 2011). The reviews on a single product might even come in different languages¹. Therefore, reviews' diversities in format and contents have imposed great difficulties for vendor companies to extract useful information and mine in-depth and useful insights for their future product designs and marketing. Thus, filtering out useful and quality reviews from the excessive number of online reviews has become imperative for retailers and manufacturers to reduce their costs associated with efficient and effective business intelligence activities.

As a response to such need, online WOM platforms have explored effective ways to identify helpful reviews from the

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¹ Users all over the world can write reviews in their own language on a same product on online WOM platforms. For instance, Yelp allows users to write reviews in different languages. It even allows users to sort reviews by languages. See <https://www.yelp.com/biz/pierre-hermé-paris-10>. TripAdvisor allows for similar functionalities.

massive online product-related reviews. One popular design is the “peer voting” functionality that sources “the wisdom of the crowd” by allowing consumers to vote the “helpfulness” of a review. Nonetheless, this functionality only shows an overall voting score without incorporating any textual aspect of reviews, hence providing scant insights for vendor companies to gain a deeper understanding of each product offering (Ghose and Ipeirotis, 2011). Prior academic studies have examined factors that determine the helpfulness of reviews (Hong et al., forthcoming). Researchers have also employed natural language processing (NLP) and text mining techniques to estimate and predict review helpfulness (Cao et al., 2011; Hu et al., 2017; Kim et al., 2006; Liu et al., 2008, 2013; Mudambi and Schuff, 2010; Ngo-Ye and Sinha, 2014; Otterbacher, 2009; Pan and Zhang, 2011; Qazi et al., 2016; Singh et al., 2017; Zhang and Varadarajan, 2006). Nonetheless, to the best of our knowledge, the literature mainly uses text mining techniques on data from English-based contexts. With the intensive globalization, worldwide consumers can assess a same product online and write reviews on it in their own languages. Thus, a product on online WOM platforms might receive reviews in multiple languages. The non-English reviews might provide equally useful consumer opinion information as the English reviews. Nevertheless, past review helpfulness prediction models have failed to provide an effective and systematic framework to incorporate reviews from different languages, which is likely to result in undesirable consequences. For instance, without proper helpful review detection strategies that account for multilingual review sources, vendor companies might rely on existing methods that overlook review content information. Past studies have demonstrated the critical role of review content information in improving the detection of helpful reviews (Ghose and Ipeirotis, 2011). Thus, omitting the rich review content information may compromise on the performance of review helpfulness prediction. Furthermore, companies may even mistakenly use English-based prediction models to process all multilingual reviews blindly, casting doubts on the accuracy and reliability of prediction results. Thus, to ensure effectiveness and correctness, the implementation of a multilingual review helpfulness identification strategy that can overcome the language constraints and incorporate reviews from different languages for in-depth consumer opinion mining is in need.

Drawing insights from multilingual NLP and text mining literature, our study hence proposes a novel review helpfulness prediction framework that accounts for multilingual sources of reviews. Adopting a design science research approach (Hevner et al., 2004), we develop and evaluate an IT artifact, which is an instantiation of our proposed multilingual framework in this study. Specifically, our study (1) proposes a framework to predict the helpfulness of a review that accounts for non-English reviews, (2) defines a workable approach to applying the model in practice, and (3) evaluates the performance of our model. Our findings suggest the feasibility of our proposed framework in aid of multilingual business intelligence and consumer opinion mining applications. Specifically, through evaluating our framework in the context of restaurants’ online reviews, we demonstrate performance improvement on review helpfulness prediction and classification by including the variables generated by the multilingual text processing programs. Theoretically, we contribute to the literature on business intelligence by demonstrating the potential of multilingual reviews and the feasibility of our proposed framework for multilingual business intelligence applications. Practically, our original framework serves as an early attempt to provide a workable approach to incorporating multilingual reviews for business intelligence applications in an effective and reliable manner.

The rest of the paper is organized as follows. Section 2 reviews relevant literature on review helpfulness prediction as well as opinion mining and sentiment analysis. In Section 3, we show

the intuition and overview of our proposed framework. In Sections 4 and 5, we describe an instantiation of our framework and evaluate its efficacy. Section 6 discusses and concludes the paper.

2. Literature review

2.1. Online WOM and review helpfulness prediction

The prevalence of online WOM communities has drawn researchers’ attention to examining the impact of online WOM from various angles. Prior literature has investigated the economic values of online WOM, such as the impact of online reviews on product sales (Chevalier and Mayzlin, 2006; Dellarocas et al., 2007; Duan et al., 2008a,b; Lin, 2014), consumer evaluation (Kumar and Benbasat, 2006) and purchase decisions (Goh et al., 2013; Zhang et al., 2013). Another stream of research has explored the moderating role of product and consumer-related characteristics on the impacts of online WOM, including product involvement, reviewer self-disclosure and reviewer shared location (Forman et al., 2008; Gu et al., 2012; Zhu and Zhang, 2010). In addition to the impacts of online reviews, researchers have also examined the motivations of community members that contribute to the online communication communities (Dellarocas and Narayan, 2006; Jarvenpaa and Leidner, 1998; Spears and Lea, 1992).

With regards to the benefits and influence of online WOM, predicting the usefulness or helpfulness of reviews is also gradually garnering more attention from researchers in various disciplines. Researchers in the NLP field have employed several text mining techniques in response to the task of predicting review helpfulness (Kim et al., 2006; Liu et al., 2008; Otterbacher, 2009; Tsur and Rappoport, 2009; Zhang and Varadarajan, 2006). In the field of information systems, there are also studies that estimate the helpfulness and economic impact using a combination of several approaches. For instance, Ghose and Ipeirotis (2011) examined the factors that affect consumers’ perception of review usefulness in a two-level study through an explanatory econometric analysis and a designed predictive model. Liu et al. (2013) conducted a survey to identify factors of reviews that matter to product designers and then model review helpfulness using a design science method. Hao et al. (2009) investigated what affects a review to be unrated. Marketing researchers have also explored moderating effects including product type, review structural and content factors (Pan and Zhang, 2011). Predicting the helpfulness of a review is also closely related to determining the quality of a post or review in the online WOM communities (Liu et al., 2007; Weimer and Gurevych, 2007; Weimer et al., 2007). Unlike predicting review helpfulness that normally uses the “votes” to operationalize the helpfulness indicators, post quality prediction employs more operationalization methods (e.g. clickstream data) (Ghose and Ipeirotis, 2011).

Despite the burgeoning number of studies to forecast review helpfulness, to the best of our knowledge, most studies have neglected reviews from multilingual sources and only predict the helpfulness of reviews using English reviews’ data. Prior studies either used reviews from English-based WOM communities, such as IMDB, Amazon.com and BN.com, or other English forums, to train and test their models. Unfortunately, we posit that this is not enough in the current globalization era. A same product might be sold in different countries and a local business might be experienced by travelers around the world. Thus, worldwide reviewers can concurrently generate reviews in their own languages. On one hand, neglecting reviews from non-English sources might restrict companies from obtaining and mining consumer opinions from customer segments in non-English cultural settings. On the other hand, misusing English-based business intelligence systems for multilingual contents might result in misleading or irrelevant

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