

Building Reputation and Trust Using Federated Search and Opinion Mining

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ABSTRACT

The term online reputation addresses trust relationships amongst agents in dynamic open systems. These can appear as ratings, recommendations, referrals and feedback. Several reputation models and rating aggregation algorithms have been proposed. However, finding a trusted entity on the web is still an issue as all reputation systems work individually. The aim of this project is to introduce a global reputation system that aggregates people's opinions from different resources (e.g. e-commerce websites, and review) with the help federated search techniques. A sentiment analysis approach is subsequently used to extract high quality opinions and inform how to increase trust in the search result.

Categories and Subject Descriptors

H.3.3 [Information Storage and Retrieval]: Information Search and Retrieval - *Information filtering*; I.2.7 [Artificial Intelligence]: Natural Language Processing - *Text analysis*

General Terms

Measurement, Documentation, Human Factors, Standardization.

Keywords

Reputation system, information retrieval, social media, opinion mining, federated search.

1. INTRODUCTION

Reputation has been defined as the “opinion or view of one about something” [11]. Reputation is also known a composite of rating, recommendation, referral, and feedback [9]. A reputation system collects these opinions over time and develops the behavior of an agent in the system. The purpose of this is to enable the user to make a decision based on the recommendation and opinions of other users. Ratings and feedback supply an effective way to create a trust relationship among similar objects in open environments [9]. Open environment refers to multiple peers where each of them provide an individual rating system [9]. Many online marketplaces have their own ranking and review systems in order to help shoppers to make a better choice in terms of relevancy, price, amongst other factors. Moreover, business directories offer a platform for businesses to list products and services to make it easier for customers to find them. These

directories often also supply a rating system for customers to leave feedback such as Yelp and Allinlondon.co.uk. In addition, in the last few years, there has been increasing concern about review systems that provide a platform for users to write their reviews and experiences about purchasing or using a product or service such as CNET and canyoutrustthem.com. However, the results of reputation systems are usually only accessible (and meaningful) within the systems' providers, whereas they are valuable resources and can improve the trust and quality in the search result. This rating content is often useful and relevant to the user's immediate information need but concurrently they are dispersed over the web and there is no connection or standardization between them. In fact, people's opinions usually have a significant role during the decision-making process. This scenario will raise several issues: first is recognizing reviews and opinions in various domains and collecting them, second is analyzing them to extract information particularly reputation information and finally building a trusted platform that integrates all information about an item from several resources.

Search techniques based on others' opinions can be different from classic search methods. Morris, et al. [10] looked into question asking behavior on social networking services by a survey. They reported people's motivations for using these services. They identified two search methods using social networks. Firstly, social search which refers to asking questions from people in the network such as question-and-answering (Q&A) tools and secondly, collaborative search which addresses sharing information with others.

Reputation, opinion mining and social search behavior can be investigated from a different perspective. Imagine that you are planning to buy an item; you are willing to know what other users said about this item, the reviews and feedback, and what other information can be found about that item. For instance, suppose you are looking for a particular mobile phone. You may find price, and seller information on e-commerce websites, review and comments on review and e-commerce resources, features and apps on social network and Q&A websites, and more information on blogs; users are often faced with an overwhelming amount of data which is spread over the entire web. Furthermore, users have to compare their findings depending on the algorithm, scale and measurement that each source uses, which is laborious and there is a high probability of error. This project addresses aggregation of such data that is called “reputation data” using federated search which is a technique for searching several data collections at the same time [5], connection between the reputation elements about

an entity in various systems with an opinion mining approach, and building trust by extracting crucial knowledge from them.

2. RELATED WORK

Finding information based on reputation and opinion can be addressed from different viewpoints, including opinion mining, which discusses computational models and extraction of opinion. Research on social networks and Q&A systems discuss collaborative and social search techniques. A variety of search methodologies has been defined in the literature to find information from different resources and validly display them such as aggregated, federated and faceted search methods.

The investigation of opinions requires retrieving data from various resources. Diaz *et al.* [5] defined *federated search* as an information retrieval technique that searches multiple resources rather than a single centralized retrieval system (e.g. retrieving documents from several digital libraries). *Aggregated search* includes the combination of non-web content such as images, news articles into one web search result. They also discussed that federated search is effective for querying several sources of data and how aggregated search can assemble the results in a standard format. Among this aggregated data can be results which are signaling the reputation of the same entity. However, even though they are addressing the same domain, there is no formal connection between them to compare and summarize them.

The current research will refine rank aggregation or the combination of many sources to produce a ranking of documents [6]. The global reputation system that is the aim of this project involves aggregating social network activities and generated reputations from opinion resources. One of the related works in aggregation is the WaterCooler tool [2] which collects internal social media activities in the HP (Hewlett Packard) Company and cross-references them with the organization’s directory. This helps the company to find people with the right expertise or interest as well as finding required information. In addition, it motivates employees to share their knowledge.

Extracting reputation information from people’s opinions and reviews also involves working with a lot of noisy text data. Dey and Haque [4] developed a system for extracting information from noisy text data and improving it by correcting spelling mistakes, grammatical errors, and incorrect capitalization of sentences. This system is based on a semi-supervised method of information extraction and it learns the knowledge of domain from a training repository. The data repository includes both clean and noisy data.

The quality of content has a direct impact on trust. Researchers discussed that the high-quality content increases the user’s trust. For instance, Gregg and Walczak [7] carried out a survey on eBay’s reputation system and the quality of sellers’ content. They concluded that a better quality website can lead to 49% growth in trust in eBay sellers and increasing the likelihood of customer interaction; good quality opinions can also improve the users’ trust.

3. RESEARCH METHODOLOGY

Figure 1 illustrates the current state of reputation systems and how they obtain reputational information. When users look for an object as a query they have to go through all possible sources of opinions and also they prefer to read the high-quality ones only. An advanced system that enables aggregation and summarization of opinions can help to resolve this problem. Dalvi *et al.* [3] have introduced a review language model (RLM) that matches restaurant reviews from the Yelp website with its corresponding

restaurant in Yahoo! Local database. They looked at the problem from two different points of view: entity matching and information retrieval and showed that their language model outperforms traditional tf-idf information retrieval methods.

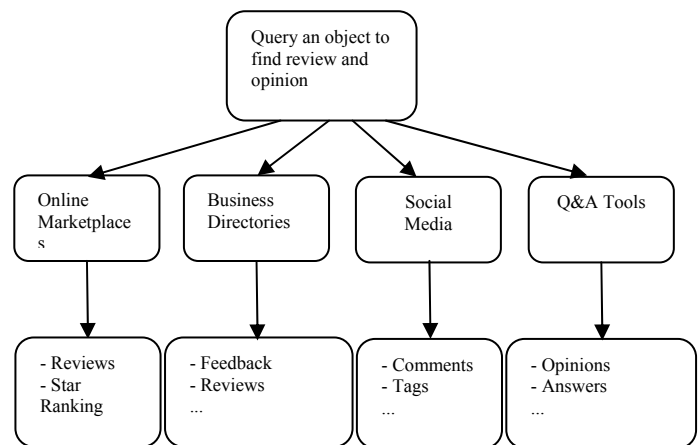


Figure 1: Reputation derive from different source of data with no connection between them

This research addresses matching reviews and other opinions such as ratings and tags from various sources with one object as query.

The steps that this research will involve:

1. Collecting opinions from several domains using federated search techniques
2. Sorting the results by applying ranking algorithms to retrieve better quality information
3. Analyzing reviews and opinions to search for relationships them using opinion mining techniques
4. Developing trust enhancing techniques using collaborative data

3.1 Experiment

Here the goal is to obtain an example to estimate how much reputation data can be found on the web about an object. As an example, “Nokia C7” mobile phone is chosen. Data is collected from following sources of data. Each source contains a collection of reviews and ratings about the object (Nokia C7) with a different structure.

- E-commerce sites: Amazon UK, eBay
- Review sites: CNET Reviews, Tchrader, Trusted Reviews, Mobile phones UK, Reevo
- Social networking sites: Facebook, YouTube
- Q&A sites: Yahoo! Answers
- Blogs: My Nokia Blog, the Handheld Blog

We state the following assumptions for this experiment:

Since all of the sources provide some spam reporting tools and also reputations and opinions are generated by genuine users, we assume all of the data sources are equal to start with (This is just an assumption for starting point).

All users’ opinions are treated equally; although a lot of research has been done on the quality of opinions.

Table 1: Example of reputation data sources for Nokia C7 mobile phone

Category	Source	Fields						
e-commerce	Amazon	5 Star Rating	Review title	Review	Helpful Review	Comment	Helpful Comment	
	eBay	5 Star Rating	Review title	Review	Helpful Review			
Review Sites	CNET Reviews	5 Star Rating	Product Ownership	Good Feature	Bad Feature	Comment		
	Mobile Phone UK	5 Star Rating	Review					
	Reevoo	Rating out of 10	Good	Bad	Helpfulness			
	Trusted Reviews	Rating out of 10	Review	User Review	Video Review	Comment		
Social Network	Facebook pages	Story	Comment	Like				
	YouTube	Video	Like Video	Dislike Video	Comment	Vote up Comment	Vote down Comment	Reply Comment
Q&A	Yahoo! Answers	Question	Answer	Vote Answer				
Blog	My Nokia Blog	Story	Comment					

Users presented anonymously and treated equally in terms of quality of content that they provide.

Table 1 shows the extracted fields for each reputation data from various resources.

The nature of information and presentation of them are different in each category.

In e-commerce sources mainly consumers provide reviews in the very early period of their experience of using the product so their reviews may not cover all aspects of the product. However, this is not easy to find as some e-commerce websites e.g. Amazon does not publish the purchase date.

Review sites on the other hand, provide a deeper experience of users; since many of them write reviews when they are dissatisfied and in average they use the product for a longer period of time compare to e-commerce reviews. Many of reviews are also written by users who do not own the product but have done a lot of research on it and the review is the outcome of their research.

On social networking websites mainly people post extra features of the product, for instance how to use it, or how to fix a problem.

On Q&A websites people generally ask questions that they cannot find them anywhere else. For instance, regarding our example - Nokia C7 – on Yahoo! Answers there are questions like (the spelling or grammatical errors are from the original source):

- Tell me about Nokia c7 experience and any disadvantage if having and camera quality?¹
- Which is the best website to download every think for Nokia c7?²

As the example (Table 1) shows the type of information is not the same. The summarization of this information can be valuable and users will save time on looking for them while they will become more informed about them.

3.2 Challenges

Aggregation of data from various sources poses the following challenges in this work:

Comparison issue: Reputation data fields from system to system are different; this work aims to find ways to match and compare similar data.

Hierarchical reviews: Some systems generate hierarchical reviews which require another level of analysis. For instance, Amazon gives the users an option to choose whether a review was useful or not, then they can leave a comment about the review and following this the next user can indicate whether the comment adds to the discussion.

¹

http://answers.yahoo.com/question/index;_ylt=At856Z.odddK3v8cFf90doEjzKIX;_ylv=3?qid=20110514021914AApTt3

²

http://answers.yahoo.com/question/index;_ylt=A1bM0em86WqXanzo8u4146UjzKIX;_ylv=3?qid=20111024031224AATPI2q

Choice of resources: Depending on the query, relevant sources of data should be considered. If the query is a product, e-commerce sites are valid; while for finding a service, business directories are appropriate resources.

Display issue: Aggregated feedback should be displayed in a way to address trust and help users for decision making

Generalization issue: How to apply the techniques to a variety of entities from finding a product to seeking an expert. Leung and Chen [8] described a similar problem which addresses significant changes in performance when a sentiment algorithm is applied to a dataset with different domain than the original one and they called it as domain adaptation issue.

Synchronization problem: Rapid growth of opinion data makes it difficult to keep them up to date. In some of research works this has been considered as “novelty” which refers to presenting the most recent published items [2].

4. CONCLUSION

There is a growing body of literature exploring user generated content and knowledge retrieval. The aim of this work is to develop a reputation system to extract opinions, construct trust and improve the search result.

Previous studies discussed federated search, sentiment analysis, and review spam and noise detection individually. We would like to integrate all these techniques and find a solution for generating trustworthy results particularly in searching for an entity such as a product, a service, or an expert.

The data will be retrieved from various resources using crawling methods to ensure the data for one entity is presented in several web locations.

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