TruthOrRumor: Truth Judgment from Web

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Abstract. Difficulty of truth judgment is the lack of knowledge. Motivated by this, we develop TruthOrRumer, which uses the information from web to judge the truth of a statement. In our system, we make sufficient use of search engines. To increase the accuracy, we also integrate web reliability computation and currency determination in our system. For the convenience for users to input the statement and review the judgment results with reasons, we design elegant interfaces. In this demonstration, we will show how the user interacts with our system and the accuracy of the system.

1 Introduction

The determination of whether a claim is a truth or a rumor has widely applications such as the judgment of the news media's speech, making sure uncertain statements, eliminating the bad impact of false information. Such techniques are called *truth judgment*. Some truth judgment methods have been proposed [1]. A difficulty in truth judgment is the lack of knowledge, especially for the truth judgment on open-field claims.

Since web is a very large knowledge base, it is a promising way to extract the knowledge from web for truth judgment. Web-based truth judgment brings following technical challenges.

(1). The information provided by multiple data sources may conflict. We may see completely different comments in different sites. For example, floods may be said on some blogs in 2012 (the end of the world), while CNN did not report it.

(2). The web may contain out-of-date information, which will misleading the judgment. For example, a news report there will be a hurricane recently, but this is a matter of a month ago. A concert had changed the time, but we still arrive at the old time.

(3). The description of a claim may have various form in different data sources. Due to the difficulty in nature language processing, it is difficult to make the computer recognize the different meanings we speak.

For these challenges, some techniques have been proposed such as a truthfulness determination approach for fact statements [2],[3]. Even though they could judge truths for many cases, they are not usable for many real applications. On one hand, they rely on the evaluation of multiple factors of data sources, which is inefficient in practice. On the other hand, they ignore the currency of information and copying relationship between data sources. For this reason, no end-to-end web-based truth judgment system for open field has been proposed.

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To support practical truth judgment, we develop TruthOrRumer, a web-based truth judgment system. Our system has following features.

(1). In contrast of crawling web pages, we use search engine to obtain sufficient related web pages for truth discovery efficiently. With the support of sufficient web pages, our system gains high accuracy in truth judgment. Additionally, with the help of search engine, our system could judge claims in open fields.

(2). For the effectiveness issues, we consider both reliability and currency of the data sources. We also use the results of truth discovery to evaluate the quality of data sources. Thus, the accuracy of our system keeps on increasing with more usages.

(3). The reasons for truth judgment are shown in our system. With this feature, users could explore the background and related information for the truth judgment. This makes the judgment results more trustable.

(4). We provide a single graphical interface. Even a preliminary user could use the system easily.

This paper is organized as follows. In Section 2, we briefly discuss the system overview to detect the principle. Then, we introduce key techniques in Section 3 before demonstrations are discussed in Section 4. The conclusions are drawn in Section 5.

2 System Overview

The organization of the system is shown in Figure 1. Then we describe these modules are follows.

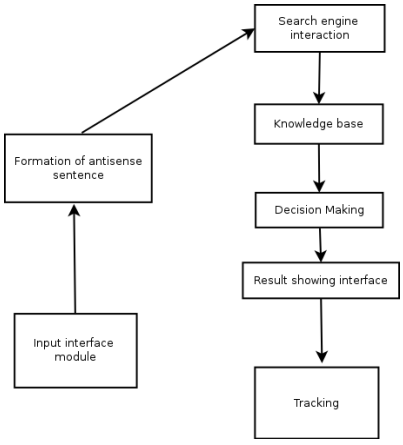

Fig. 1. System Overview

• **Input Interface Module:** This module collects users' input.

• **Formation of Antisense Sentence:** This module the system finds words such as verbs, adjectives, etc and matches thesaurus we established corresponding antonyms. As the result, the antisense statement of the input statement is generated.

• **Search Engine Interaction:** This module utilizes the search engine to obtain search results of the input statement and the antisense statement respectively. After that the system uses the results of our analysis to combine the search terms.

• **Knowledge Base:** To improve efficiency and increase accuracy, we use a knowledge base in the system. Based on the knowledge base, the relevant contents are obtained. We stored knowledge prior that we have to admit. When users use the system, it will first call the knowledge base. If the knowledge base has no relevant content, and then use the Google search engines. The advantage of this system is to improve the speed and accuracy of speech.

• **Decision Making:** This module makes decisions for the truth statement according to the search results. Search results are analysis is to parse the search results to draw the conclusion. The details of this part will be discussed in Section 3.1.

• **Result Showing Interface:** This module shows the judgment results to the users.

• **Tracking:** This module shows users the reasons for the judgment. With this module, users could review the websites that support or oppose the statement to make their own decisions.

3 Web-Based Truth Judgement

In this section, we discuss the techniques used in our system including search result analysis for truth judgment strategy, website weight computation and currency determination.

3.1 Search Results Analysis

The truth could be judged by trivially comparing the numbers of search results of the two statements. Unfortunately, this way will not work well. Consider an example. We believe that the extent of the authority of the well-known large websites comments on something is higher than the level of websites with low authority. However, for a case, with 5 true statement on CNN, but 1000 false statements on tweet, the comparison of search result numbers will draw wrong conclusions. Additionally, if some web sites copy each other, the count of the search result could not show the real popular degree. Thus the analysis takes both the reliability and the copy between data sources into consideration.

We use a weighted voting strategy for truth judgment. To reduce the affects of result numbers, we choose top-n search results for each statement. Then by analyzing the content of the web pages, irrelevant pages are filtered. The votes are from remaining pages. Each page contributes w votes for corresponding statement, where w is the weight of the page. $w=ar+(1-a)c$, where r is the reliability of the website and c is the currency factor. The computation of these parameters will be discussed in Section 3.2 and 3.3, respectively, and a is the reliability importance. a is obtained by learning from history judgment records in period.

3.2 Reliability Computation

We compute the reliability of the web page from two aspects. The first is its accuracy in history record and the second is the copying relationship.

Initially, all websites are assigned the same reliability 0.5, showing the uncertain reliability. Then we store the reliability during truth judgment, the reliability is update according to the results. Then we discuss the strategy. We denote the total numbers of positive and negative judgment in historical records supported by a web site s as T and F, respectively. We use $r=T/(T+F)$ as the reliability of the web set. The reliability of each web site is stored and maintained according to the judgment results.

With the consideration of copying relationship, we revise the techniques in [4] to modify the reliability. The major difference between our approach and that in [4] is that we use historical truth judgment results instead of the results for various tuples.

3.3 The Currency Determination

Clearly, the out-of-date statements will mislead the judgment. For accurate judgment, we propose currency determination techniques. Firstly, based on the web pages obtained from the search engine, we obtain the time stamped t in the priority order of (1) the time stated in the nearest position of the statement, i.e. in the same sentence, paragraph or text fragment with the statement; (2). the time stamp in the web page. Then the currency parameter is computed as b^{t0-t}, where b is decay factor and fixed as 0.9 in our system, and t_0 is current time stamp.

4 Demonstration

In this section, we will discuss the demonstration of our system.

The welcome interface is shown in Figure 2. As shown in Figure 3, we provide a very elegant interface for users to input the statement.

Fig. 2. Welcoming Interface

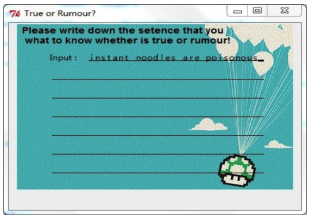

Fig. 3. Input Interface

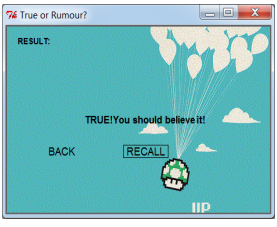

Fig. 4. Feedback Interface

Fig. 5. Tracking Interface

The judgment of the statement is shown as Figure 4. For a better interaction with users, we provide the tracking function to make users review the reasons to make the decision. Figure 5 shows that our system provides the URLs to support users to find a related site.

5 Conclusions and Ongoing Work

Internet provides plenty of information to judge the truth of a statement. To make sufficient use of the information on the web, we develop TruthOrRumer. This system permits a user to input a statement. Then the negative statement of the statement is generated. These two statements are sent to the search engine. From the obtained search results, the truth is determined. To make the judgment accurate, we also take the reliability and the currency into consideration. In this demonstration, we will show the functions and benefits of our system. Our future work includes web-based interface and involving larger knowledge base in our system.

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