

Truth Discovery in Social Sensing by Review Analysis

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Abstract: *Truth discovery aims at obtaining the most credible information from multiple sources that provide noisy and conflicting values. Identifying trustworthy information in the presence of noisy data has been a crucial task. The most important challenge is to identify “misinformation spread” where a significant number of sources are contributing to false claims, making the identification of truthful claims difficult. Reviews given for the particular event can be false and mislead new users, so to avoid that we use two methods to identify the truthfulness of the review; One TPR (True Positive Rate) and second FPR (False Positive Rate). We also use RRA (Reporting Rate if Absent) to check the reporting rate of the user for that particular event. We use Crowd Analysis algorithm to calculate the above mentioned TPR, FPR and RRA. We use User Rate Summarization algorithm for checking if the user is with the crowd or without the crowd. We use Naïve Bayes algorithm for Sentiment Analysis of the reviews. The evaluation results on real-world datasets show that this method significantly outperforms the state-of-the-art truth discovery methods in terms of both effectiveness and efficiency.*

Keywords: Naïve Bayes algorithm, TPR, FPR, RRA, Truth Discovery.

using location-based social network services, and urban sensing applications using common citizens. A critical challenge that exists in social media sensing is truth discovery where the goal is to identify reliable sources and truthful claims from massive noisy, unfiltered, and even conflicting social media data. The truth discovery problem stays in the heart of the veracity challenge of big data social media sensing applications.

We summarize our contributions as follows:

- We address the important challenge i.e., misinformation spread in solving the truth discovery problem.
- We do data pre-processing to process the raw data which we have got in the reviews.
- We do sentiment analysis using Naïve Bayes algorithm for the key words obtained after data pre-processing.
- We do event wise analysis to find which event is more of positive reviews or negative reviews.
- We do review analysis to find if the user is which the crowd or without the crowd.
- Later we do the prediction process for the new reviews giving and find the truth analysis.

1. INTRODUCTION

Nowadays, people can access a vast amount of information from all kinds of sources every day. However, the information sources may provide mistaken information due to lack of expertise, malicious purposes, broadcasting failures, staleness, etc. Moreover, the individual information sources may have missing records or only provide partial information. To get the complete and precise information, it is necessary to leverage multiple information sources. The general principles are introduced here to estimate both the trustworthy information and source reliability: if the piece of information is from a reliable source, then it is more trustworthy, and the source that provides trustworthy information is more reliable. The truth discovery methods have witnessed success in resolving conflicts in various scenarios, and various domains such as information extraction, event detection, and online health community.

Examples of social media sensing include real-time situation awareness services in disaster or emergency response, intelligent transportation system applications

2. RELATED WORK

Truth discovery has received a significant amount of attention in recent years, and previous studies have developed various models to address this important challenge. Truth discovery problem has been studied to resolve the conflict among sources. The essential idea is by incorporating the source quality, information from high-quality sources is more trustworthy, and should weigh more in truth estimation. It is first formally introduced by Yin et. al. [1], which models source quality as a single score and iteratively updates source quality and truth value in an unsupervised way. The idea is shared in some early works [2]. A semi-supervised graph learning scheme was proposed to model the propagation of information truthfulness from the known ground truths [3]. Wang et al. proposed a scheme that offered a joint estimation on source reliability and claim correctness using maximum likelihood estimation approach [4]. Zhang et al. developed a constraint-aware truth discovery model to incorporate physical constraints into detecting dynamically evolving

truth [5]. However, there exists a significant knowledge gap in existing truth discovery solutions in terms of identifying truthful claims among widely spread misinformation, which is both a challenging and critical task in truth discovery.

Social media sensing is an emerging sensing paradigm where social sensors voluntarily report their observations of the physical world [6]. Combined with social media analysis techniques, social media sensing enables a great variety of applications.

3. PROPOSED MODEL

In this section, we first formulate the evolving truth discovery problem for the reviews using User Rate Analysis algorithm. We provide an effective data pre-processing method and an algorithm with pre-train steps for practical use.

3.1 Data Preprocessing

We implement data preprocessing step firstly. Here we filter the raw data and get the keywords as output. In this system we use NLP (Natural Language Processing).

1. At first we filter out the stop words like and, as, was, were etc.
2. Next we do stemming process, in which we take out words like disappearing, disappeared, etc. to only one word disappear.
3. Next is keyword extraction, where we considered only the keywords like good, great, awesome, bad, worst, etc.
4. Lastly the term frequency is checked.

3.2 Sentiment Analysis

Sentiment Analysis is identifying and categorizing opinions expressed in a piece of text, especially in order to determine whether the review is positive or negative.

In this system we are using Naive Bayes Algorithm for sentiment analysis.

3.3 Event Wise Analysis

In event wise analysis we consider whether the user is with the crowd or without the crowd review. If majority of the user have given the event review as positive then the event is positive and if a new user gives positive review then that user will be with the positive crowd or else he is without crowd count.

To analyze this we use User Review Summarization Algorithm (Algorithm 1).

Algorithm 1: User Review Summarization Algorithm

Start
Let N be number of users
For each user do the following steps

- Initialize with_crowd_count (wcc) and with_out_crowd_count (wocc) as zero (0)
- Fetch the reviews given by the user
- Let M be the total reviews given by the user
- For each review do the below process
 1. Fetch the review
 2. Extract Event_ID
 3. Fetch the Review User Type (RUT) (+ve / -ve)
 4. Fetch Review Majority Type (RMT) (+ve / -ve)
 5. If RUT = RMT then increment wcc else increment wocc
- Write user summary in table

3.4 Review Analysis

In truth discovery analysis we use Crowd Analysis Algorithm as shown (Algorithm 2).

Here we calculate True Positive Rate (TPR), False Positive Rate (FPR) and Reporting Rate while Absent (RRA) of the user. First we fetch all the reviews based on the user Id. Then we consider the reviews based on with crowd and without crowd count. Calculate and obtain the result. Based on these values we can get the truthfulness of the user.

Algorithm 2: Crowd Analysis Algorithm

Start
Read the User ID (UID)
Fetch all the reviews based on UID

- Let N be the total review given by the UID
- Let X be the number of reviews UID with crowd
- Let Y be the number of reviews UID without crowd
- Let Z be the number of reviews given by UID without attending the event

Let $TPR = X / N * 100$

Let $FPR = Y / N * 100$

Let $RRA = Z / N * 100$

Store TPR, FPR, RRA with UID in table

4. IMPLEMENTATION

In this section, we present a detailed model of how the Review analysis takes place. Large amount of user reviews will be taken to train the model. The model takes in the review and does the following: Data Preprocessing, Sentiment Analysis, Event Wise analysis and Review analysis.

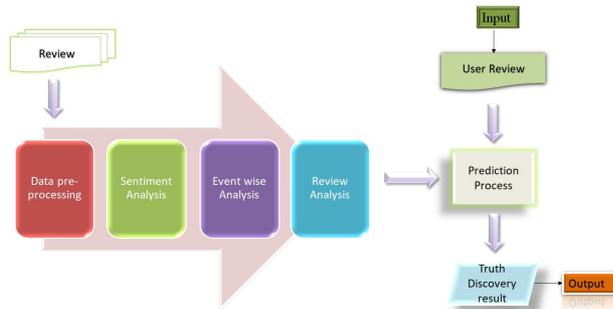


Figure 1: Review Analysis overview

After the model is trained, we test the model for new reviews. Here in the testing phase we take in new user reviews and give the output accordingly. The result is stored in the table.

5. RESULTS

In the section we come across the results. Based on how we train the model the results are obtained accordingly.

RESULT TABLE 1

Chance of true and chance of false for the give review in a particular event.

User ID	Event ID	Review	True	False	Present	Chance of True	Chance of False
1	1	Good	0.0	100.0	N	0.0	100.0
2	1	It was nice!!	100.0	0.0	Y	100.0	0.0
3	1	It was the worst show ever...!!!	0.0	100.0	Y	0.0	100.0
4	4	It was a nice show but could have been better.	100.0	0.0	Y	100.0	0.0

RESULT TABLE 2

RESULT OF With Crowd Count, Without Crowd Count, True Positive Rate, False Positive Rate and No Absence Rate.

User ID	Total Review	With crowd Decision	Without crowd Decision	No Absence	True Positive Rate	False Positive Rate
1	2	0.0	1.0	0.0	0.0	100.0
1	2	0.0	1.0	0.0	0.0	100.0
1	2	0.0	1.0	0.0	0.0	100.0
2	2	1.0	0.0	1.0	100.0	0.0
1	1	0.0	1.0	0.0	0.0	100.0
2	1	1.0	0.0	0.0	100.0	0.0
1	1	1.0	0.0	1.0	100.0	0.0

6. CONCLUSION

In this paper, we proposed User rate analysis and Crowd analysis methods to find the truthful claims of the user based on the reviews they have given. We have used Kaggle dataset to train the model based on the event. Our results will be effective on the users who give new reviews. Based on the trained dataset, the testing data will be accurate to give positive results. In our solution, we explicitly considered the source reliability, report credibility, and a source’s historical behaviors to effectively address the misinformation spread. Experiments on the

real-world datasets demonstrate the effectiveness of our model.

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