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Prediction in Aspect-Based Sentiment Analysis with Cross-Platform Reputation Generation System

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ABSTRACT: The active growth of Internet-based applications such as social networks and e-commerce websites leads people to generate a tremendous amount of opinions and reviews about products and services. Thus, it becomes very crucial to automatically process them. Over the last ten years, many systems have been proposed to generate and visualize reputation by mining textual and numerical reviews. However, they have neglected the fact that online reviews could be posted by malicious users that intend to affect the reputation of the target product. Besides, these systems provide an overall reputation value toward the entity and disregard generating reputation scores toward each aspect of the product. Therefore, we developed a system that incorporates spam filtering, review popularity, review posting time, and aspect-based sentiment analysis to generate accurate and reliable reputation values. The proposed model computes numerical reputation values for an entity and its aspects based on opinions collected from various platforms. Our proposed system also offers an advanced visualization tool that displays detailed information about its output. Experiment results conducted on multiple datasets collected from various platforms (Twitter, Facebook, Amazon . . .) show the efficacy of the proposed system compared with state-of-the-art reputation generation systems.

I. INTRODUCTION

Having easy access to the web has radically changed the way people interact with brands and products. From physical products to online services, people tend to instantly share their opinions and reviews on various platforms on the Internet. A recent research experiment¹ shows that consumers are more willing to share a review when the experience they have had evokes emotions, whether positive or negative. This large volume of consumers' reviews holds insightful information about the quality of the product/service, therefore analyzing them will help consumers make a better judgment toward the targeted item. In the past few years, a new sub- field of natural language processing (NLP) called reputation generation has been well-established as an area of interest. The main focus of reputation generation systems is to produce a numerical value in which an entity is held based on mining customer reviews and their numerical ratings.

1.1 Background

In the digital era, online reputation has become a critical asset for businesses, individuals, and organizations. With the proliferation of social media, review platforms, and forums, people now have the power to shape perceptions through their opinions. This dynamic has led to an increased focus on reputation management systems that can analyze vast amounts of data across multiple platforms to gauge public sentiment. Traditional reputation management tools often rely on basic sentiment analysis techniques that classify text as positive, negative, or neutral. However, these methods overlook the granular details within user reviews and feedback, such as the specific features or aspects of a product or service that customers discuss. This is where Aspect-Based Sentiment Analysis (ABSA) comes into play.

1.2 Problem Statement

The core problem is the absence of a **robust, scalable, and cross-platform reputation generation system** that can:

- **Aggregate and process data** from multiple online platforms seamlessly.
- **Perform aspect-based sentiment analysis** to identify and evaluate sentiments tied to specific product or service features.
- **Generate dynamic, real-time reputation scores** that reflect accurate public sentiment across diverse sources.

- **Provide actionable insights** for businesses to manage and enhance their reputation effectively.

1.3 Objectives

➤ Data Aggregation from Multiple Platforms

- Objective: Collect user feedback, reviews, and comments from diverse platforms like social media (Twitter, Facebook), review sites (Yelp, TripAdvisor), e-commerce platforms (Amazon, eBay), and forums (Reddit).
- Purpose: To get a holistic view of public sentiment across different audiences.

➤ Aspect-Based Sentiment Analysis (ABSA)

- Objective: Identify and analyze specific aspects (e.g., price, quality, customer service) mentioned in user reviews and comments.
- Purpose: To move beyond simple positive/negative sentiment and understand which features of a product or service are being praised or criticized.

1.4 Scope of the project

To design and develop a system that can gather, analyze, and interpret sentiment from user-generated content across multiple platforms, providing real-time reputation scores for brands, products, or services.

II. LITRATURE REVIEW

D. Wang, S. Zhu, and T. Li, SumView: Product rating systems are very popular on the web, and users are increasingly depending on the overall product ratings provided by websites to make purchase decisions or to compare various products. Currently most of these systems directly depend on users' ratings and aggregate the ratings using simple aggregating methods such as mean or median

U. Farooq, A. Nongailard, Y. Ouzrout, and M. A. Qadir, Knowing the strengths and weaknesses of a product is very important for manufacturers and customers to make decisions. Several sentiment analysis systems are proposed to determine the opinions of customers about products and product features. However, the aggregation methods used are not able to estimate a true reputation value and to reflect the recent opinions quickly.

Z. Yan, X. Jing, and W. Pedrycz, The Internet provides a convenient platform for people to freely share their opinions on any entities. The opinions expressed in natural languages carry the subjective attitudes and preferences of humans. They represent the public perspectives on any entity, thus impact user decisions and behaviors in some way.

A. Benlahbib and E. H. Nfaoui, This paper aims to improve a recent work that handles the task of generating reputation based on fuzing and mining opinions expressed in natural languages and user feedback ratings.

E. I. Elmurngi and A. Gherbi, Online reputation systems are a novel and active part of e-commerce environments such as eBay, Amazon, etc. These corporations use reputation reporting systems for trust evaluation by measuring the overall feedback ratings given by buyers, which enables them to compute the reputation score of their products. Such evaluation and computation processes are closely related to sentiment analysis and opinion mining.

III. PROBLEM STATEMENT

3.1 EXISTING MODEL

Poria et al. presented the first deep learning approach for the AE task in opinion mining. The authors employed a 7-layer deep convolutional neural network to tag each word in the textual opinions as either aspect or non-aspect word. The authors also proposed a set of heuristic linguistic patterns and integrated them with the deep learning classifier which significantly improves the accuracy compared with the previous SOTA methods. In [19], the authors proposed an attention-based long short-term memory (LSTM) [20] for aspect-level sentiment classification. The idea is to learn aspect embeddings and let aspects participate in computing attention weights.

3.1.1 Drawbacks

An existing system not implemented Aspect term extractor which performs the basic token-level classification for each token, which means that each token will be given a label, and a classification is performed to predict the aspects in the sentence.

An existing system is not implemented Local Context Focus in which Local context is a new technique that can be adapted to most ne-grained NLP tasks.

3.2 PROPOSED SYSTEM

This system aims at generating a reputation value toward online entities (movies, hotels, restaurants, services, etc.) and computing a satisfaction score toward each aspect of the target entity by processing textual and numerical data collected from multiple platforms. Proposed system presents its architecture. First, we start by collecting users' reviews from different platforms such as Twitter, Amazon, YouTube, etc. Next, an automatic spammers filtering system is employed to detect and eliminate unwanted spam reviews.

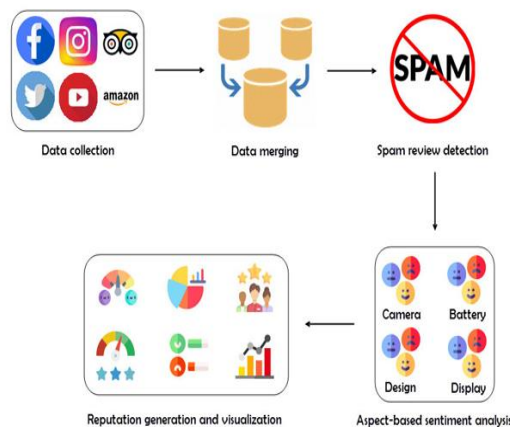


Fig 1 : Proposed System Overview

3.2.1 Advantages Of Proposed System

- Fine-tuned Bidirectional Encoder Representations for Aspect-Based Sentiment Analysis.
- Aspect-Based Sentiment Analysis on the ABSA Warehouse of Apps RE views dataset.
- Explainable Artificial Intelligence for Bidirectional Encoder Representations.

IV. PROPOSED METHODOLOGY

SYSTEM OVERVIEW

This system aims at generating a reputation value toward online entities (movies, hotels, restaurants, services, etc.) and computing a satisfaction score toward each aspect of the target entity by processing textual and numerical data collected from multiple platforms.

DATA COLLECTION AND PREPROCESSING

One of the important features of the proposed system is the ability to collect and process data from various plat forms. Previous reputation generation systems gather neces sary data from either e-commerce websites such as Amazon, TripAdvisor, or social media platforms such as Twitter and Facebook. In this work, we decided to normalize the features of all platforms in order to create a single merged dataset by classifying the platforms on the Internet into two types: the first type provides the accessibility of extracting the textual review with the number of likes received for that review such as Amazon, YouTube, etc. The second type provides the accessibility of extracting the textual review with the number of likes received for that review along with the number of times the review was shared among the network such as Twitter, Facebook, etc.

OPINION SPAM DETECTION

One of the main drawbacks of opinion-sharing platforms is that anyone from anywhere in the world can post reviews about products or services without any boundaries. Opinion spammers aim to manipulate customers opinions by either promoting or demoting the reputation of the target entity, thereby misleading the consumers. Filtering and eliminating spam reviews is very critical for our reputation system in order to produce a trusted and reliable reputation value that leads to a safe decision-making process for the customers.

AUTHOR CONTENT SIMILARITY (CS)

Spammers regularly post reviews that are identical or near-identical to their previous reviews, since it is a time-consuming activity for them to write a new spam review each time.

USER NUMBER OF REVIEWS FREQUENCY (UNRF)

Posting too many reviews about the same entity is not considered normal behavior for genuine reviewers. A recent study shows that only 5-8% of spammers have a lesser ratio of posting reviews in a single day [56].

ASPECT-BASED SENTIMENT ORIENTATION SCORE

The goal of this sub-section is to extract the aspects from the reviews and predict their sentiment polarities. For example, given a product review: The camera on this phone is good but the design is bad, the ABSA model needs to extract the aspects camera and design, and correctly determine their polarity. In this review, the consumers opinions on camera and design are positive and negative respectively.

REPUTATION GENERATION

Since we are dealing with opinions shared on the Internet, the reputation of an entity is formed and influenced by various factors that shift public opinion over time. These factors include the popularity and reliability of the user sharing the online review, the time the review was posted online, and finally, the sentiment orientation of aspects of an entity within the online review. This section aims to introduce those three factors, and to calculate for each factor a numerical score that will be exploited to generate the final reputation value for a specific entity.

V. RESULT ANALYSIS

Since we are dealing with opinions shared on the Internet, the reputation of an entity is formed and influenced by various factors that shift public opinion over time. These factors include the popularity and reliability of the user sharing the online review, the time the review was posted online, and finally, the sentiment orientation of aspects of an entity within the online review. This section aims to introduce those three factors, and to calculate for each factor a numerical score that will be exploited to generate the final reputation value for a specific entity.

VI. SAMPLE OUTPUTS

Fig 2.Home page



Fig 3. Accuracy Algorithm wise



Fig 4. Percentage Show Graph

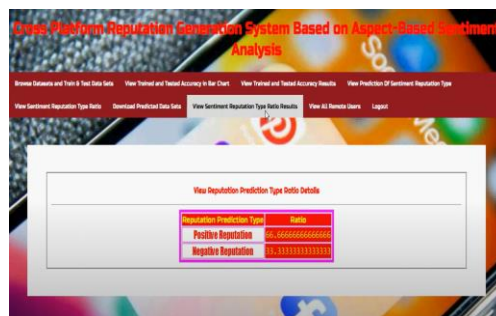


Fig 5. Reputation Generation Prediction type details with Ratio

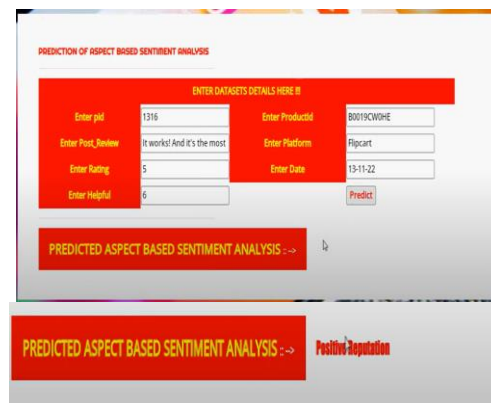


Fig 6: Predicted Aspect based sentiment Analysis in Pie Chart

VII. CONCLUSION

In this project, we proposed a reputation system capable of generating numerical reputation values for a specific item (product, movie, service, hotel, etc.) and its aspects based on opinions and reviews expressed online. The contribution of this work revolves around four components that were not exploited in previous systems. The first one is cross-platform compatibility, where the proposed system can collect and process opinions from different platforms (Facebook, Amazon, Twitter, TripAdvisor, etc.) as well as managing and standardizing those platforms features. The second one is opinion spam filtering, where the spam opinions are detected and eliminated based on spammers behavior features, keeping only authentic opinions. The third one is employing a SOTA aspect-based sentiment-analysis model named LCF-ATEPC in order to extract and analyze the aspects within the textual opinions.

VIII. FUTURE WORK

In the future, we propose to investigate the effectiveness of our proposed system by attempting to generate more than the numerical reputation values, such as extending the system to automatically generate a textual summary of the benefits and drawbacks of the targeted entity. Also, we intend to extend this system to be used in multilingual content.

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