Aspect-Based Sentiment Analysis: A Survey of Deep Learning Methods

Ugranada Channabasava, Golu Kumar Ram, Bhanu Bhakta Jaishi, Chitrasen Raj, and Keshav Kumar Shandliya

Abstract The process of analyzing, processing, concluding, and inferring the sentiment of subjective texts is known as sentiment analysis (Shandilya et al. in Aspect-based sentiment analysis survey of deep-learning. IEEE [1]). Sentiment analysis is used by businesses to better understand their customers public opinion polling, market research, and brand evaluation reputation, comprehension of customer experiences, and social media research the media's influence. Depending on the various aspect requirements granularity is classified as positive, negative and neutral of the sentiment analysis. This article provides an overview of recently proposed methods for dealing with a sentiment analysis problem based on aspects (Liu et al. in Aspect-based sentiment analysis-a survey of deep learning methods. IEEE [2]). There are currently three popular approaches: deep learning, lexicon-based, and traditional machine learning methods.

Keywords Sentiment analysis based on aspects · Sentiment analysis based on natural language processing · Web scraping · Opinion mining

1 Introduction

Many people read online customer reviews and ratings. According to studies, consumers trust online reviews or comments from strangers before purchasing a product or service. In this field, numerous statistical surveys and studies have been conducted. According to a study conducted in, 39% of customers read about eight reviews, while only 12% read 16 or more reviews before purchasing a product; 98% of customers admit that customer reviews of previous buyers influence their purchasing decision. According to statistics, potential buyers are willing to spend 31% more on a product or service that has received positive feedback.

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Many reviews are lengthy, making it difficult for a potential customer to read them and decide whether or not to purchase the product. The large number of reviews also makes it difficult for product manufacturers to track customer sentiments and opinions about their products and services.

As a result, creating a review summary is required. Reviews are described using sentiment analysis [3]. Sentiment analysis employs the natural concept of natural language processing to extract subjective information required for source materials. The main task is to determine whether the stated opinion is positive or negative [4].

Because customers rarely express their opinions in simple terms, judging an opinion stated can be a difficult task. Some perspectives are comparative, while others are direct. By simply condensing these ratings into two more general categories positive or negative sentimental analysis helps shoppers visualize customer satisfaction while making purchases [5]. Feedback is largely used to help customers make online purchases and learn about current product market trends, which helps retailers create market strategies.

2 Problem Statement

- A word of opinion that is regarded as positive in one circumstance may be regarded as negative in another.
- We can significantly increase the precision and capability of sentiment analysis with the use of machine learning.

2.1 Existing System

At different granularities, enough work has been done in the field of sentiment analysis. Some works at the document level classify the entire review based on the reviewer's subjective judgment. In certain sentence-level studies, the focus is on determining the polarity of a sentence (e.g., positive, neutral, or negative) using semantic data gleaned from the sentences' textual content. Additionally, several recent researches also include sentiment analysis at the phrase level, with the major emphasis being on phrases, which are collections of words that frequently have a unique idiomatic meaning. The topic of sentiment analysis at the aspect level, however, is still developing and needs additional study. Sentiment analysis has been used in a variety of industries, including the travel and entertainment sectors. While another article employs Perceptron neural networks, the work employed a combination of machine learning characteristics and lexical features. Additionally, research has been done on the data derived from social media, such as Twitter's mapping of social media attitudes using observations and quantifiable data. The study made the case that tracking customer opinion online may serve as dynamic feedback for any firm. The study classified the moods of Twitter tweets into three classifications:

positive, negative, and neutral using a tree kernel-based model. This can also be used to track how the general public feels about a specific incident, piece of news, etc.

Method	Year of proposal	Classification	Text level	Prediction accuracy	Pros	Cons
OPINE	2005	Unsupervised rule-based approach	Word	87%	Domain independent	Difficulty in availing OPINE system, thus rare to get applied in real life
Sentiment analysis: Adjectives and adverbs are better than adjectives alone	2006	Linguistic approach	Document	Pearson correlation of 0.47	Adjectives are given more priority (adjectives expresses human sentiments better than adverbs alone)	None
Opinion digger	2010	Unsupervised machine learning method	Sentence	51%	Rates product at aspect level	Requires rating guidelines to rate. Works only on known data
Sentiment classification using lexical contextual sentence structure	2011	Rule-based approach	Sentence	86%	Said to be domain independent	Depends solely on wordNet
Interdependent latent Dirichlet allocation	2011	Probabilistic graphical model	Document	73%	Faster in comparing and correlating sentiment and rating	Correlation between identified clusters and feature or ratings are not explicit always [6]
A joint model of feature mining and sentiment analysis for product review rating	2011	Machine learning	Document	71% (in 3 categories) 46.9% (in 5 categories)	Automatic calculation of feature vector	Use of WordNet

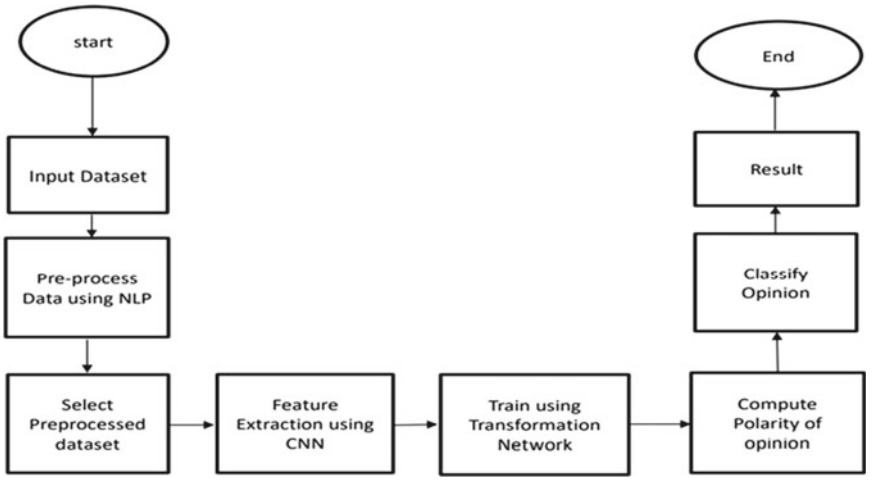

Fig. 1 Flowchart

2.2 Proposed System

Figure 1 says that, the architecture of the proposed system, the main goal is to be the process the data using an NLP and then used VADER analysis to get the priority of user opinion.

3 Literature Survey

Sl. No.	Title	Author	Methodology	Limitations
Paper-1	Survey of Deep Learning Techniques for Aspect-Based Sentiment Analysis	Ishani Chatterjee, Haoyue Liu	ABSA is treated as a multiclassification problem by traditional machine learning and deep learning techniques	Data preprocessing is underrated process. People focus more on methodology and give less attention to preprocessing of data
Paper-2	A Sentiment Analysis Survey	Preeti Routray, Smita Prava Mishra	Here, various aspects of text document sentiment analysis are reviewed	Need to improve the quality of system such as accuracy
Paper-3	Deep Learning Sentiment Analysis	Shilpa P C, Rissa Shereen, Vinod P	Twitter message sentiment analysis system. The tweets that we take into account for the analysis are a mix of various and emotions	Further analysis is required to obtain personality of the user from their tweets

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Sl. No.	Title	Author	Methodology	Limitations
Paper-4	Survey on Sentiment Analysis and Opinion Mining	G. Vinodhini, RM. Chandrasekaran	In this study, issues in the subject of sentiment analysis are discussed along with methodologies and methods	Major obstacles include the use of several languages, opinions based on features, and phrase complexity
Paper-5	Sentiment Analysis Algorithm and Application	Walaa Medhat, Ahmed Hassan, Hoda Korashy	This study primarily focuses on providing a concise overview of SA techniques and the connected topics	More work is needed for sentiment analysis to analyze a context-based SA
Paper-6	Deep Learning and Machine Learning for Sentiment Analysis	Yogesh Chnadra, Antoreep Jana	Different techniques for sentiment analysis have been considered Sentiment analysis is done using machine learning classifiers	One of the difficulties with sentiment analysis is accuracy

4 Methodology

The implementation of the project consist of four steps that can be defined below [7–12]:

1. Data Preprocessing
2. Filtering
3. Compute Polarity of Opinion
4. Classify Opinion.

Data Preprocessing

The review contains word that are not required in the classification model. It can consist of hyperlinks, emoji special characters, double quotation, punctuation, extra white space. Data preprocessing in defined for the removal of such words. Stop-words such as ‘is’, ‘are’, ‘the’, which do not contain any meaning are filtered out by using inbuilt python module. Streaming and lemmatization are also done using NLP to normalize the text for further preprocessing using the model [13–16].

Data Scraping

It is done to extract data from the preprocessed data. In this project we have used this process to extract the features that are required for the analysis of the sentence. Once the data scraping is done then the extracted feature is used for the classification of the polarity of the user opinion.

Compute Polarity of Opinions

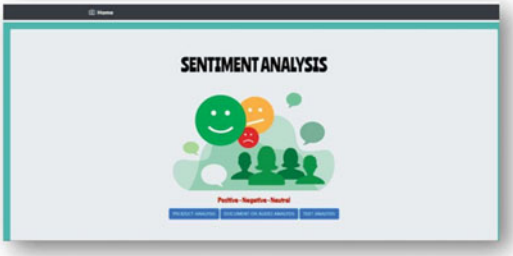
Once the data is done then the extracted data is used by the VADER analysis tool to compute the polarity of the sentence. A list of features/words is used; these words have been labeled as either positive or negative.

Classify Opinions

The statement is categorized as positive or negative depending on the compound score after the polarity calculation [17, 18]. The compound score totalizes ratings with values ranging from − 1 (negative) to + 1 (positive).

The sentiment is favorable (complex score ≥ 0.05). Sentiment of Neutrality: (− 0.05, compound score 0.05). Unfavorable Attitude: (compound score = − 0.05)

5 Results

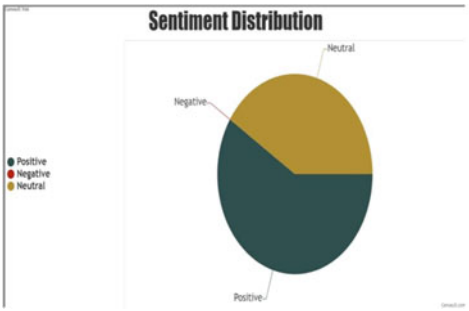


Snapshot 1: Home Page
- It contains 3 options –
  1. Product Analysis
  2. Document Analysis
  3. Text Analysis

Snapshot 2: PRODUCT ANALYSIS
- Enter Product URL

Snapshot 3: Enter Text for Text analysis

Snapshot 4: Upload .PDF or .TXT for document analysis.



Snapshot 5: Sentiment Distribution using pie chart.

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