

# A Lightweight Aspect-Based Sentiment Analysis for Food Delivery Reviews Using Dependency Parsing

Karan Marshal J<sup>1</sup>, Dr P Joseph Charles<sup>2</sup>

PG student, St.Joseph's College (Autonomous), Affiliated to Bharathidasan University, Tiruchirappalli<sup>1</sup>

Assistant Professor, Department of Computer Science, St.Joseph's College (Autonomous), Affiliated to Bharathidasan University, Tiruchirappalli<sup>2</sup>

**Abstract:** As digital platforms continue to shape consumer behaviour, the suitability of ordering food online has led to a surge in user-generated reviews. Interpreting user perspectives has become essential, and sentiment analysis offers a structured method to uncover emotions conveyed through textual data. A more granular technique, Aspect-Based Sentiment Analysis (ABSA), identifies sentiment specific to particular aspects of a service or product. This study introduces a lightweight, rule-based ABSA framework tailored to food delivery reviews. The model incorporates methods like dependency parsing and negation recognition to enhance sentiment detection. From a collection of 2,345 reviews, a subset of 40 was manually annotated to assess performance. The system achieved strong metrics in terms of precision, recall, and F1-score, representing its fitness for use in domains with limited annotated data or computational resources.

**Keywords:** Aspect-Based Sentiment Analysis, Dependency Parsing, Opinion Mining, Sentiment Polarity

## I. INTRODUCTION

In today's fast-paced world, many people rely on operational food distribution services for convenience and time savings. These platforms offer a wide variety of cuisines, simplified ordering processes, and secure digital payments, allowing users to enjoy meals without the need for cooking, offers for promotion, quick responsive service, and active engagement social media have further improved the popularity of these platforms<sup>[16]</sup>.

With the exponential growth of user-generated content, the volume of publicly available reviews has increased significantly. A core task in NLP, sentiment analysis deals with extracting opinions and emotional cues from text automatically<sup>[1]</sup>. Its applications span across areas like online commerce, political discourse, financial forecasting, and recommendation algorithms<sup>[1][4][7]</sup>. Sentiment analysis can be performed at various levels of granularity document level, sentence level, aspect level, and word level and is also commonly referred to as Opinion Mining<sup>[1, 20]</sup>.

This study focuses on Aspect-Based Sentiment Analysis (ABSA) of user reviews related to food delivery applications. We curated a dataset comprising 2,345 user reviews sourced from various mobile apps and social platforms. These reviews were pre-processed, aspects were extracted, and corresponding sentiments were identified. The model incorporates negation handling and root-level sentiment checks to enhance the identification of negative feedback<sup>[9][6][15]</sup>. This study is arranged as follows: Section 2 covers the related work, Section 3 explains the methodology, Section 4 discusses the findings, and Section 5 concludes the study.

## II. REVIEW OF LITERATURE

The growth of digital ecosystems has made user-generated feedback an essential source for evaluating customer sentiment, especially in the food delivery sector.

Fragkos et al. [16] conducted a sentiment analysis on 300 Greek-language customer reviews and found discrepancies between machine-predicted sentiments and human judgment, indicating the need for language-specific tools in under-resourced languages.

In another study, on Arabic Twitter reviews, Mustafa and Najadat<sup>[17,21]</sup> used ABSA with various ML models<sup>[21]</sup>. Twitter, leveraging both deep learning models (e.g., GigaBERT, AraBERT, Bi-LSTM-CRF) and traditional classifiers like SVM. They reported promising outcomes in detecting relevant aspects, classifying sentiment types, and determining polarity. Sulaiman et al. [18] focused on analyzing 149 social media comments related to food delivery services and they uncovered several operational issues such as delays in delivery, compliance problems, and technological difficulties from the viewpoint of service providers.

Molenaar et al. [19] conducted a scoping review exploring sentiment and emotion analysis in food-related content on social platforms. Although not directly tied to food delivery services, the findings highlight sentiment analysis as a valuable method in food and nutrition discourse.

Angelpreethi et al. [15] developed a rule-based ABSA system that extracts opinion-aspect pairs through dependency structures and determines polarity using a sentiment dictionary. The method facilitates the creation of summaries focused on user perspectives, aiding informed decisions.

Collectively, these works underline the importance of designing ABSA models that are adaptable to specific domains and languages [22]. However, many rely on intensive deep learning models or require substantial interpreted data, which may not be viable in all settings. To address this, the present research study offers a lightweight and interpretable ABSA pipeline optimized for English-language food delivery reviews.

The proposed architecture of the Aspect-Based Sentiment Analysis (ABSA) system consists of three sequential stages: data preprocessing, aspect term extraction, and sentiment tagging [15]. The architecture emphasizes simplicity and interpretability by excluding resource-heavy deep learning models and extensive datasets [23].

### III. DATA PREPROCESSING

Reviews are collected from the Twitter using API. Totally 2,242 tweets were collected from the social media platforms and mobile applications of food delivery. Basic text normalization techniques like token splitting, stop-word filtering, and stemming were applied to ready the data for next level processing. These operations checks that only linguistically significant tokens were retained, streamlining subsequent analysis stages [1, 9].

#### 3.2 Aspect Term Extraction

The model leveraged spaCy's dependency parser to extract meaningful aspect terms from the review texts. Noun phrases related to food delivery—such as “food,” “packaging,” “service,” and “support”—were extracted based on their grammatical structure. A customized keyword list specific to the domain was used to eliminate irrelevant tokens and preserve essential aspect terms [6, 15].

#### 3.3 Sentiment Tagging

For each extracted aspect, the surrounding context was examined to determine sentiment polarity. The system focused on syntactic indicators such as adjective modifiers (e.g., “delicious food”), adjectival complements, and root-level adjectives. Polarity terms were detected using a sentiment dictionary derived from SentiWordNet [13,24], customized for domain relevance, which helped differentiate between positive and negative expressions.

Negation cues were included to improve sentiment precision by accounting for words that reverse polarity. If negative indicators such as ‘not’ or ‘never’ are present near sentiment words, the sentiment value is reversed. This improves the system’s ability to recognize subtle or implicit negative opinions, especially in informal or short user reviews [8, 9].



Figure 1. Proposed architecture

### IV. RESULTS OF THE PROPOSED STUDY

Following the completion of aspect mining and opinion tagging, the proposed rule-based ABSA system was applied to the curated dataset of 2,345 food delivery reviews. The goal was to measure the system’s efficiency in classifying sentiment at the aspect level.

To evaluate performance, a random subset of 40 reviews was manually annotated by human evaluators. These manual labels served as the ground truth for comparing against the system-generated sentiment tags. Evaluation metrics such as **precision**, **recall**, and **F1-score** were calculated for three sentiment classes: **positive**, **neutral**, and **negative**.

Table 1 presents the evaluation results:

Sentiment	True Positive (TP)	False Positive (FP)	False Negative (FN)	Precision	Recall	F-Measure
<b>Positive</b>	30	4	6	0.88	0.83	0.85
<b>Neutral</b>	25	3	2	0.89	0.93	0.91
<b>Negative</b>	36	2	2	0.90	0.90	0.90

The model showed strong alignment with human annotations, especially in identifying clear positive and negative sentiments <sup>[15]</sup>. The incorporation of rule-based syntactic analysis and negation handling contributed significantly to the accurate detection of nuanced feedback, such as negative sentiments masked by indirect language.

Despite the system's lightweight nature, it delivered reliable performance, confirming its correctness for scenarios where deep learning approaches may be impractical due to limited computational resources or data availability. Furthermore, the transparent design of the rule-based model makes it easier to interpret and customize for domain-specific sentiment classification tasks.

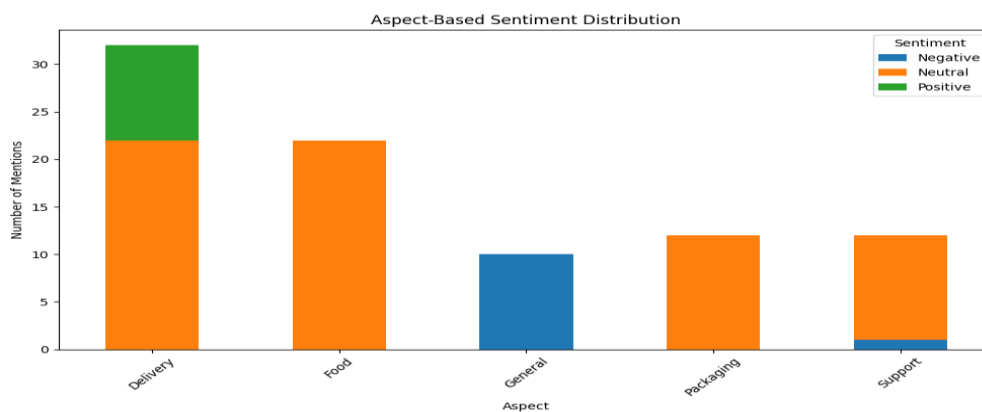


Figure 2 The distribution of Positive, Neutral, and Negative sentiments across extracted aspects

## V. CONCLUSION

This study presented a lightweight, rule-driven Aspect-Based Sentiment Analysis (ABSA) framework tailored for evaluating user feedback especially in food delivery services. By employing dependency parsing and rule-based sentiment detection, the system effectively identified aspect-specific sentiments without relying on large-scale training data or complex neural models.

The inclusion of negation handling and syntactic pattern analysis improved the system's ability to recognize subtle expressions of sentiment. Evaluation against manually annotated data revealed that the proposed study outperforms well across all sentiment classes, making it a practical solution for domain-specific sentiment classification where computational or data limitations exist.

In Future this work may expand with the model to handle more complex linguistic structures, integrating multilingual support, and exploring semi-supervised methods to further improve sentiment tagging in low-resource environments.

## REFERENCES

- [1]. Bing Liu, "Sentiment analysis and opinion mining, Synthesis Lectures on Human Language Technologies" 5 (2012), no. 1, 1-167.
- [2]. A.Angelpreethi, and Dr.S.Britto Ramesh Kumar, "Dictionary based Approach to improve the accuracy of opinion mining on big data", International Journal of Research and Analytical Reviews (IJRAR), Vol. 5, Issue 4, Oct-Dec 2018, pp- i836-844.

- [3]. Angelpreethi, "Lexicon and Machine Learning Based Comparative Analysis to Classify the Students Opinions on Covid-19 Pandemic" International Journal for Innovative Engineering and Management Research, Volume 12, Issue 2, Pages 380-387, 2023
- [4]. Varghese R and Jayasree M, "Aspect based sentiment analysis using support vector machine classifier", Advances in Computing, Communications and Informatics (ICACCI), 2013 International Conference on, IEEE, 2013, pp. 1581 - 1586. A.
- [5]. Z. Zhai, B. Liu, H. Xu, and P. Jia, "Clustering product features for opinion mining," in Proceedings of the fourth ACM international conference on Web search and data mining, 2011, pp. 347-354
- [6]. A.AngelPreethi, and Dr.S.Britto Ramesh Kumar, "Dom\_Classi: An Enhanced Weighting Mechanism for Domain Specific Words using Frequency based Probability", International Journal of Applied Engineering Research, Vol.14, Issue 1, 2019, pp 140-148.
- [7]. Minqing Hu and Bing Liu, "Mining and summarizing customer reviews", Proceedings of the tenth ACM SIGKDD international conference on Knowledge discovery and data mining, ACM, 2004, pp. 168-177.
- [8]. Angelpreethi, " Fuzzy Based Sentiment Classification Using Fuzzy Linguistic Hedges for Decision Making", Mapana Journal of Sciences, Vol. 22, Special Issue 2, pp 63-79, 2023 DoI:<https://doi.org/10.12723/mjs.sp2.4>
- [9]. A.AngelPreethi, and Dr.S.Britto Ramesh Kumar, "NIC\_LBA: Negations and Intensifier Classification of microblog data using Lexicon Based Approach "Journal of Emerging Technologies and Innovative Research (JETIR), Volume 6, Issue 6 , PP 753-759, June 2019.
- [10]. B. Santorini, "Part-of-speech tagging guidelines for the Penn Treebank Project (3rd revision)," 1990.
- [11]. S.B.R. Kumar, "Visualizing Big Data Mining: Issues, Challenges and Opportunities" International Journal of Control Theory and Applications, Volume 9, Issue 27, Pages: 455-460, 2016.
- [12]. P. S, K. R., F. Iram, and S. R. M V, N. R, "Improved Moth Flame Optimization with Deep Convolutional Neural Network for Colorectal Cancer Classification using Biomedical Images," 2024 Second International Conference on Advances in Information Technology (ICAIT), Chikkamagaluru, Karnataka, India, 2024, pp. 1-6, doi: 10.1109/ICAIT61638.2024.10690631.
- [13]. C. Fellbaum, WordNet: An electronic lexical database Springer, 2010.
- [14]. Singh, V. K., et al. Sentiment analysis of movie reviews: "A new feature-based heuristic for aspect-level sentiment
- [15]. Angelpreethi A, Kumar SBR (2017) "An enhanced architecture for feature-based opinion mining from product reviews." In: 2017 world congress on computing and communication technologies (WCCCT). IEEE, pp 89–92.
- [16]. N. Fragkos, A. Liapakis, M. Ntaliani, F. Ntalianis, and C. Costopoulou, "A Sentiment Analysis Approach for Exploring CustomerReviews of Online Food Delivery Services: A Greek Case," Apr. 2024, doi: 10.20944/preprints202404.1203.v1.
- [17]. A. M. Mustafa and H. Najadat, "Aspect-Based Sentiment Analysis for Arabic Food Delivery Reviews," *ACM Transactions on Asian and Low-Resource Language Information Processing*, Jun. 2023, doi: 10.1145/3605146.
- [18]. A. Sulaiman, A. K. Rahmat, I. Ibrahim, and F. Jamaludin, "Online Food Delivery Sentiment Analysis from the Restaurant Point of View," *Information Management and Business Review*, Sep. 2023, doi: 10.22610/imbr.v15i3(si).3472.
- [19]. A. Molenaar, E. L. Jenkins, L. Brennan, D. Lukose, and T. A. McCaffrey, "The use of sentiment and emotion analysis and data science to assess the language of nutrition, food and cooking related content on social media: A systematic scoping review.," *Nutrition Research Reviews*, pp. 1–59, Mar. 2023, doi: 10.1017/S0954422423000069.
- [20]. Yanying Mao, Qun Liu, Yu Zhang, "Sentiment analysis methods, applications, and challenges: A systematic literature review", Journal of King Saud University - Computer and Information Sciences, Volume 36, Issue 4, 2024, 102048, ISSN 1319-1578, <https://doi.org/10.1016/j.jksuci.2024.102048>.
- [21]. Ibrahim al-Jarrah, Ahmad M Mustafa, Hassan M Najadat, " Aspect-Based Sentiment Analysis for Arabic Food Delivery Reviews", ACM Transactions on Asian and Low-Resource Language Information Processing, Vol. 22, No. 7, pages 1-18, 2023, <https://doi.org/10.1145/3605146>
- [22]. Aziz K, Ji D, Chakrabarti P, Chakrabarti T, Iqbal MS, Abbasi R. Unifying aspect-based sentiment analysis BERT and multi-layered graph convolutional networks for comprehensive sentiment dissection. Sci Rep. 2024 Jun 25;14(1):14646. doi: 10.1038/s41598-024-61886-7. PMID: 38918461; PMCID: PMC11637190.
- [23]. Frasca, M., La Torre, D., Pravettoni, G. *et al.* Explainable and interpretable artificial intelligence in medicine: a systematic bibliometric review. *Discov Artif Intell* 4, 15 (2024). <https://doi.org/10.1007/s44163-024-00114-7>
- [24]. Nandwani P, Verma R. A review on sentiment analysis and emotion detection from text. Soc Netw Anal Min. 2021;11(1):81. doi: 10.1007/s13278-021-00776-6. Epub 2021 Aug 28. PMID: 34484462; PMCID: PMC8402961.
- [25]. A. Angelpreethi, "OPINE\_NEG: An approach to detecting negations and intensifiers using social media data," *International Multidisciplinary Research Journal Reviews (IMRJR)*, vol. 2, no. 8, Aug. 2025. doi: 10.17148/IMRJR.2025.020803.