



**Sentiment analysis of reviews written in the Saudi
dialect to classify customer satisfaction levels in
e-commerce.**

Prepared By

Areej Haddaj Alqarni

252001729

**Submitted in fulfillment of the requirements for the degree Master
of Science in Artificial Intelligence**

At

College of Informatics

Midocean University

UAE

Supervisor: Dr. Yasser Abdul Hammed

College of Informatics, Midocean University, Comoros

[2026- Third Trimester]

1. Background

In the last few years, e-commerce has seen unprecedented growth, and it has become an inseparable part of consumers' buying behavior. Along with this growth, organizations have become increasingly aware of the need to understand customers in a digital environment through opinion analysis and reviews coming from every online platform and social networking site. The modern markets cannot solely depend on conventional feedback mechanisms but need intelligent tools that can interpret customer digital impressions for service quality improvements, data-driven decision-making, and increasing customer satisfaction.

Therefore, it is important to have digital tools that help companies understand their customers' opinions about products, especially given the vast number of reviews that cannot be analyzed manually. Sentiment analysis provides insights into customer opinions by examining their reviews and determining whether they are positive, negative, or neutral through the processing of textual content.

Sentiment analysis in the Arabic language has become a crucial area of research, especially for understanding customer opinions on social media and online reviews. Researchers face significant challenges, including dialectal variation, morphological complexity, and ambiguity in informal or abbreviated texts. To address these issues, previous studies have emphasized the importance of building corpora and lexicons specific to different dialects, such as Jordanian, Egyptian, and Saudi Arabic, to develop more accurate and effective models for sentiment analysis in Arabic.

There are clear gaps in previous studies, as the datasets used to train the models were small and were often collected manually from multiple platforms. This lack of sufficient data has directly affected the models' performance, and the limited dataset may have contributed to the inaccuracy of the models' evaluation results.

This research aims to enhance Arabic customer sentiment analysis in the e-commerce context by collecting a large and diverse dataset of user reviews from popular platforms such as Amazon and SHEIN using web scraping techniques. Once collected, the data will be cleaned and preprocessed to ensure its quality and suitability for analysis, including noise removal, text normalization, and tokenization.

Furthermore, the study seeks to leverage Transfer Learning by employing pretrained language models such as SaudiBERT and AraBERT to classify the sentiment of the collected reviews with higher accuracy compared to traditional approaches. Combining a large, domain-specific dataset with transfer learning techniques is expected to improve the models' generalization capabilities, enhance the accuracy of sentiment analysis in the

Saudi e-commerce context, and provide actionable insights to better understand customer experiences.

Key Word

Nlp, Sentiment analysis Arabic, Customer reviews, Saudi dialect, e-commerce.

2. Related work

Paper 1: Enhancing Customer Experience Through Arabic Aspect-Based Sentiment Analysis of Saudi Reviews

Summary

This study addressed Aspect-Based Sentiment Analysis (ABSA) of product reviews written in the Saudi dialect, with the aim of enhancing customer experience using Natural Language Processing (NLP) techniques and machine learning. The researchers manually collected and constructed two datasets containing a total of 4000 reviews (2000 for electronics and 2000 for clothing) , sourced from prominent Arabic platforms such as Amazon, Jarir, Shein, Noon, and Twitter.

Methodology

- Conducted aspect-based sentiment analysis on Saudi dialect product reviews using machine learning and NLP techniques.
- Machine learning algorithms: SVM, RF, NB, KNN. - Manual annotation of two datasets of 2000 reviews each.
- Feature extraction techniques: POS tagging, TF-IDF, n-grams.
- Data preprocessing: cleaning, normalization.
- Feature extraction: converting text into numerical vectors using POS tagging, TF-IDF, n-grams.
- Performed 10-fold cross-validation for reliability.

Paper 2: Enhancing Arabic Sentiment Analysis in E-Commerce Reviews on Social Media Through a Stacked Ensemble Deep Learning Approach

Summary

This study proposes a stacked ensemble approach for Arabic sentiment analysis, leveraging deep learning models like CNN, Bi-GRU, and Bi-LSTM, and achieves high accuracy on extensive datasets including HARD, BRAD, ARD, and a real dataset of 71,583 reviews.

Methodology

- Stacked ensemble approach combining CNN, Bi-GRU, Bi-LSTM, CNN-Bi-GRU, and CNN-Bi-LSTM models.
- Feature extraction using AraBERT model.
- Training on HARD, BRAD, ARD, and a real dataset of 71,583 Arabic reviews.
- Evaluation metrics: accuracy, precision, recall, F1-score, specificity.

Paper3: Sentiment lexicon for sentiment analysis of Saudi dialect tweets

Summary

This study proposes a stacked ensemble approach for Arabic sentiment analysis, leveraging deep learning models like CNN, Bi-GRU, and Bi-LSTM, and achieves high accuracy on extensive datasets including HARD, BRAD, ARD, and a real dataset of 71,583 reviews.

Methodology

- Stacked ensemble approach combining CNN, Bi-GRU, Bi-LSTM, CNN-Bi-GRU, and CNN-Bi-LSTM models.
- Feature extraction using AraBERT model.
- Outputs combined using multilayer perceptron algorithm.
- Training on HARD, BRAD, ARD, and a real dataset of 71,583 Arabic reviews.
- Evaluation metrics: accuracy, precision, recall, F1-score, specificity.

Paper 4: Arabic Tweets Sentimental Analysis Using Machine Learning

Summary

In this study the researchers built an Arabic tweets corpus, specifically in the Jordanian dialect, suitable for sentiment analysis. They also explored several preprocessing strategies and machine learning algorithms to evaluate performance in order to find the best ML approach . They found that SVM outperforms Naïve Bayes, achieving higher accuracy and F-score.

Methodology

-Data Collection: Tweets were retrieved using multiple keywords related to general Jordanian topics through the Twitter API.

-Data Filtering using RapidMiner: RapidMiner was used to retrieve and initially filter the tweets before manual processing.

-Manual Selection for Dialect Verification: Tweets were manually selected to ensure they were written in the Jordanian dialect or Modern Standard Arabic (MSA), based on content and expression of sentiment.

-Data Cleaning using ASAP Utilities: The cleaning process included removing links, duplicate tweets, hashtags (#), foreign characters, and correcting repeated characters within the text.

-Manual Annotation: Tweets were annotated as positive or negative by two human experts, with a third expert consulted when necessary to ensure annotation accuracy.

Paper 5: Social media Sentiment Monitoring in Smart Cities An application to Moroccan dialects

Summary

This study examines citizens' sentiments extracted from social media posts written in the Moroccan dialect to assess their satisfaction with traffic conditions. The study applied machine learning algorithms to extract and analyze textual data and accurately classify sentiments. It focused on three Moroccan cities, and the results revealed a predominance of negative sentiments, particularly in the city of Rabat.

Methodology

- Automatically extracted and processed social media data to generate reports on city concerns.
- Used a Python script to collect a training dataset of 4,000 lines and a test dataset of 2,750 rows related to three Moroccan cities.
- Employed machine learning techniques: Naive Bayes, SVM, KNN, and Decision Tree for classification.
- Preprocessing steps included binary weighting, transformation of acronyms and emoticons, translation to MSA Arabic, and stemming using ISRI Arabic Stemmer.

Paper	Author /year	Algorithm	Key Findings
Enhancing Customer Experience Through Arabic Aspect-Based Sentiment Analysis of Saudi Reviews	Razan Alrefae, Revan Alqahmi, Munirah Alduraibi, Shatha Almatrafi, Asmaa Alayed/2024	SVM, Random Forest (RF), Naive Bayes (NB), KNN	RF with TF-IDF + tri-grams achieved 86.26% accuracy (electronics), SVM with TF-IDF + bi-grams achieved 86.51% (clothing).
Enhancing Arabic Sentiment Analysis in E-Commerce Reviews on Social Media Through a Stacked Ensemble Deep Learning Approach	Nouri Hicham, Sabri Karim, Nassera Habbat/2023	CNN, Bi-GRU, Bi-LSTM, CNN-BiGRU, CNN-BiLSTM, Stacked Ensemble (MLP)	Best accuracy of 0.9256 achieved using stacked ensemble combining outputs of all models.
Sentiment lexicon for sentiment analysis of Saudi dialect tweets	Abdulmohsen Al-Thubaity, Qubayl Alqahtani, Abdulaziz Aljandal/2018	Lexicon-based approach	SauDiSenti performed better for neutral tweets and showed promising results despite being smaller than AraSenTi.

Arabic Tweets Sentimental Analysis Using Machine Learning	Khaled Alomari, Khaled Shaalan, Hatem M. Elsherif/2017	SVM ,Naïve Bayes	A corpus of 1,800 Arabic tweets was built in the Jordanian dialect and Modern Standard Arabic (MSA) (900 positive, 900 negative). The results showed that SVM outperformed Naïve Bayes in terms of accuracy and F-score.
Social media Sentiment Monitoring in Smart Cities An application to Moroccan dialects	Monir Dahbi, Saadane Rachid, Samir Mbarki, Rachid Saadane/2019	Naive Bayes, SVM,KNN, Decision Tree,Unigrams,Binary weighting	-Particularly in the city of Rabat, the results showed a predominance of citizens' sentiments. -Converting the text to Modern Standard Arabic (MSA) led to better results in machine learning algorithms compared to using the Moroccan dialect. -SVM and Naïve Bayes achieved the highest performance after converting the text to MSA.

References

- [1] Alrefae, R., Alqahmi, R., Alduraibi, M., Almatrafi, S., & Alayed, A. (2024). Enhancing Customer Experience Through Arabic Aspect-Based Sentiment Analysis of Saudi Reviews. *International Journal of Advanced Computer Science & Applications*, 15(7).
- [2] Hicham, N., Karim, S., & Habbat, N. (2023). Enhancing Arabic Sentiment Analysis in E-Commerce Reviews on Social Media Through a Stacked Ensemble Deep Learning Approach. *Mathematical Modelling of Engineering Problems*, 10(3).
- [3] Al-Thubaity, A., Alqahtani, Q., & Aljandal, A. (2018). Sentiment lexicon for sentiment analysis of Saudi dialect tweets. *Procedia computer science*, 142, 301-307.
- [4] Alotaibi, S., Mehmood, R., & Katib, I. (2019, June). Sentiment analysis of Arabic tweets in smart cities: A review of Saudi dialect. In *2019 Fourth International Conference on Fog and Mobile Edge Computing (FMEC)* (pp. 330-335). IEEE.
- [5] Abo, M. E. M., Qazi, A., Saad, A. A. A., Elsaheb, H. A., & Abdelaziz, A. (2024, August). Sentiment Analysis in Saudi Arabic Dialect for HAJJ Season Services Using Twitter Data. In *2024 1st International Conference on Logistics (ICL)* (pp. 1-5). IEEE.
- [6] Alahmary, R. M., Al-Dossari, H. Z., & Emam, A. Z. (2019, January). Sentiment analysis of Saudi dialect using deep learning techniques. In *2019 International conference on electronics, information, and communication (ICEIC)* (pp. 1-6). IEEE.
- [7] Kaseb, A., & Farouk, M. (2022, December). SAIDS: A novel approach for sentiment analysis informed of dialect and sarcasm. In *Proceedings of the Seventh Arabic Natural Language Processing Workshop (WANLP)* (pp. 22-30).
- [8] AlFutamani, A. A., & Al-Baity, H. H. (2021). Emotional Analysis of Arabic Saudi Dialect Tweets Using a Supervised Learning Approach. *Intelligent Automation & Soft Computing*, 29(1).
- [9] Dahbi, M., Saadane, R., & Mbarki, S. (2019, October). Social media sentiment monitoring in smart cities: an application to Moroccan dialects. In *Proceedings of the 4th International Conference on Smart City Applications* (pp. 1-6).
- [10] AlFutamani, A. A., & Al-Baity, H. H. (2021). Emotional Analysis of Arabic Saudi Dialect Tweets Using a Supervised Learning Approach. *Intelligent Automation & Soft Computing*, 29(1).
- [11] Alomari, K. M., ElSherif, H. M., & Shaalan, K. (2017, June). Arabic tweets sentimental analysis using machine learning. In *International conference on industrial, engineering and*

other applications of applied intelligent systems (pp. 602-610). Cham: Springer International Publishing.