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Sentiment Analysis of Iraqi Social Media Using Deep Learning: A TensorFlow Approach

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ABSTRACT

Sentiment analysis is a critical tool for understanding public opinion, especially in regions like Iraq where social media serves as a primary platform for expression. However, the complexities of the Iraqi Arabic dialect, including informal structures, slang, and spelling variations, pose significant challenges for traditional Natural Language Processing (NLP) models. This study addresses these challenges by developing a deep learning-based sentiment analysis model tailored specifically for Iraqi Arabic. Utilizing a dataset of 2,000 annotated tweets, we implement a Convolutional Neural Network (CNN) architecture optimized for binary sentiment classification. The model achieves an accuracy of 87.5% on the test set, demonstrating its effectiveness in capturing sentiment-bearing features in Iraqi dialect text. Key contributions include the creation of a labeled dataset for Iraqi Arabic and the development of a robust preprocessing and modeling pipeline. The findings highlight the potential of deep learning techniques for dialect-specific sentiment analysis, with applications in policymaking, business intelligence, and social media monitoring in Iraq and other Arabic-speaking regions.

Keywords: monitoring, pipeline, preprocessing

1. INTRODUCTION

Sentiment analysis plays a crucial role in understanding public opinion, particularly in socially and politically dynamic regions like Iraq, where social media has become a primary platform for expressing views on various issues [1]. Extracting insights from these opinions can aid policymakers, businesses, and researchers in making informed decisions; however, sentiment analysis in Iraq faces significant challenges due to the complexities of the Arabic language and the unique characteristics of the Iraqi dialect. Unlike Modern Standard Arabic (MSA), Iraqi Arabic includes informal structures, slang, and spelling variations, making traditional NLP models less effective [2] [3]. These linguistic variations make traditional NLP models, which are primarily trained on MSA or other dialects, less effective when applied to Iraqi text [4]. Additionally, the lack of labeled datasets specific to Iraqi Arabic limits the performance of existing machine learning models [5] [6]. This study aims to develop an efficient sentiment analysis model tailored to Iraqi Arabic using deep learning techniques [7]. The objectives include collecting and preprocessing Iraqi Arabic text data, implementing and evaluating machine learning and deep learning models such as CNNs, LSTMs, and transformer-based architectures, and addressing challenges related to text normalization and feature extraction. The key contributions of this work include the creation of a labeled Iraqi Arabic sentiment dataset, filling a critical gap in Arabic NLP resources. Additionally, the study implements and fine-tunes deep learning models specifically optimized for Iraqi dialect processing, providing a benchmark for future research. A linguistic analysis of Iraqi Arabic's impact on sentiment detection is conducted, alongside a comparative evaluation of machine learning and deep learning approaches, offering insights into the most effective techniques for dialectal sentiment analysis. These advancements support broader applications in AI-driven social listening, policymaking, and business intelligence in Iraq and other Arabic-speaking regions.

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2. RELATED WORK

Sentiment analysis has emerged as a vital tool for extracting insights from social media, particularly in linguistically diverse regions like the Arab world [1] [8]. While significant progress has been made in sentiment analysis for Modern Standard Arabic (MSA), regional dialects such as Iraqi Arabic present unique challenges due to their informal structures, slang, and lack of standardized resources [2] [9]. Recent advancements in deep learning, including convolutional and recurrent neural networks (CNNs, LSTMs), have shown promise in addressing these challenges yet the field remains underexplored for dialect-specific applications [10].

This section reviews existing literature on sentiment analysis, with a focus on Arabic dialects and the Iraqi variant in particular. We examine key studies that have employed machine learning and deep learning techniques, highlighting their methodologies, contributions, and limitations. Special attention is given to datasets (e.g., IRAQIDSAD by [8]), model architectures (e.g., hybrid CNN-GRU models by [11]), and preprocessing strategies tailored to dialectal Arabic. By synthesizing these works, we identify gaps in current research such as the scarcity of labeled Iraqi dialect datasets and the need for optimized deep learning models and position our study within this evolving landscape. The review underscores the importance of dialect-aware approaches [6] and sets the stage for our proposed methodology, which aims to advance sentiment analysis for Iraqi social media content.

As explored the authors in [12] the advancements in social media sentiment analysis using deep learning, highlighting its superiority over traditional machine learning methods. With the rise of social media as a platform for expressing opinions, conventional sentiment analysis approaches often struggle with the informal, context-dependent nature of online text. Deep learning models such as Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs), and Long Short-Term Memory (LSTM) networks have demonstrated improved accuracy, precision, and recall by effectively capturing linguistic nuances and contextual dependencies. Researchers have further enhanced performance through techniques like word embeddings (e.g., Word2Vec, GloVe), data augmentation, and hybrid model architectures. The study also emphasizes the practical implications of sentiment analysis in various domains, including business intelligence, public opinion monitoring, and policy analysis. While deep learning has significantly advanced sentiment classification, challenges such as dataset bias, data sparsity, and the need for large-scale labeled datasets persist. The findings contribute to ongoing research by comparing different deep learning architectures and identifying key areas for future improvements in sentiment analysis.

The paper [13] introduces a new dataset specifically designed for sentiment analysis in the Iraqi Arabic dialect. The study highlights the growing importance of sentiment analysis in various domains such as politics, marketing, and social sciences while addressing the significant challenges posed by Arabic dialects, particularly Iraqi Arabic, due to their unique syntax, morphology, and grammar variations. The lack of publicly available datasets tailored to the Iraqi dialect has hindered the development of effective sentiment analysis models. To address this gap, the authors conducted a systematic literature review to assess existing sentiment analysis methodologies, identifying key phases such as preprocessing, feature extraction, text annotation, and model selection. The primary contribution of the study is the IRAQIDSAD dataset, which consists of 14,141 Iraqi dialect Facebook comments annotated for sentiment polarity. This dataset serves as a benchmark for future research and enables the development of machine learning and deep learning models tailored to the linguistic nuances of Iraqi Arabic. Additionally, the paper provides a comprehensive review of existing approaches to sentiment analysis in Arabic dialects, discussing the challenges of text normalization and feature extraction. The study concludes that the IRAQIDSAD dataset will play a crucial role in advancing sentiment analysis research in underrepresented Arabic dialects, facilitating more accurate and effective sentiment classification models. The practical implications of this work extend to multiple domains, including social media monitoring, public opinion analysis, and market research in Iraq and other Arabic-speaking regions. By providing a structured and annotated dataset, the study lays the foundation for further research on AI-driven sentiment analysis and dialect-specific NLP applications. Future work may focus on expanding the dataset, improving model architectures, and addressing ethical concerns related to bias and data privacy in sentiment analysis tasks.

The author [14] explores the advancements in sentiment analysis, emphasizing the role of deep learning in processing diverse and complex social media data. It highlights how deep learning models, particularly in multimodal and

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aspect-based sentiment analysis, enhance the ability to identify emotional biases and predict trends. The study consolidates existing research, identifying key challenges such as handling varied data formats, improving accuracy, and integrating multiple modalities like text, images, and audio. While the paper does not present original experimental results, it provides a comprehensive review of methods and approaches, offering valuable insights into emerging techniques. The findings suggest that deep learning continues to transform sentiment analysis, and future research should focus on refining models for better interpretability and real-world applications. The study's practical implications include enhancing emotion recognition systems for marketing, politics, and public opinion analysis, helping businesses and policymakers make more informed decisions based on social media trends.

The authors in [11] presents a hybrid deep learning model integrating Convolutional Neural Networks (CNN) and Gated Recurrent Units (GRU) to analyze sentiment and emotions in Iraqi Arabic texts. Using three Iraqi datasets sourced from Facebook, the study addresses the linguistic challenges posed by the Iraqi dialect. The CNN component captures local text features, while the GRU component models sequential dependencies, enhancing sentiment classification accuracy. The results demonstrate that the hybrid model outperforms traditional approaches, effectively capturing semantic and contextual nuances in Iraqi Arabic. The study's contributions include developing a specialized deep learning model for Iraqi sentiment analysis, highlighting the importance of dialect-specific models in Arabic NLP. The research has practical implications for social media monitoring, public opinion analysis, and decision-making, providing a robust tool for organizations to interpret sentiments in Iraqi dialects. This work bridges a significant research gap by addressing the lack of sentiment analysis tools tailored to Iraqi Arabic and improving the effectiveness of AI-driven sentiment classification.

In [10] explores the application of cutting-edge deep learning models to improve sentiment analysis accuracy on social media content. The abstract highlights the challenges of sentiment analysis due to the noisy, unstructured nature of social media data and proposes advanced neural architectures to address these issues. The results demonstrate considerable enhancement in classification accuracy over conventional approaches through techniques including transformer-based models (e.g., RoBERTa, BERT) and attention mechanisms. The methods used encompass text preprocessing on social media text, fine-tuning pre-trained language models, and incorporating contextual embedding for sentiment realization. The introduction summarizes the growing importance of sentiment analysis for public opinion measurement and the limitations of conventional approaches, justifying the need for deep learning enhancements. Some of the key contributions of this paper include a new sentiment analysis framework with high performance, empirical assessment on diverse datasets, and insight into model interpretability. Managerial implications include brand tracking, customer review analytics, and political sentiment analysis for making well-informed decisions. Yet, constraints involve computational resource requirements, possible biases in training data, and difficulty in processing multilingual and sarcastic text. In all, this study improves sentiment analysis through the application of deep learning while recognizing the need for improvement in some areas.

The author in [15] investigates the application of sentiment analysis techniques to Iraqi Arabic text from social media, addressing the unique challenges posed by dialectal variations, informal language, and cultural context. The abstract outlines the difficulties in processing Iraqi dialect due to its distinct linguistic features and lack of standardized resources, proposing a tailored approach combining machine learning and natural language processing techniques. The results demonstrate that the implemented models—including both traditional classifiers like Random Forest and advanced deep learning approaches—achieved promising accuracy in sentiment classification, outperforming generic Arabic sentiment analysis tools when applied to Iraqi dialect data. The methods employed involved creating a specialized corpus of Iraqi social media content, applying dialect-specific preprocessing techniques, and experimenting with various feature extraction methods such as word embeddings and sentiment lexicons adapted for Iraqi Arabic. The introduction contextualizes the research by highlighting the growing importance of Arabic sentiment analysis while noting the neglect of regional dialects, particularly Iraqi, in existing studies. Key contributions include the development of a dedicated Iraqi dialect sentiment analysis framework, the compilation and annotation of a novel dataset, and empirical comparisons of different modeling approaches for this understudied language variety. Practical implications of this work include improved social media monitoring for businesses and policymakers in Iraq, enhanced understanding of public opinion in Iraqi online spaces, and better customer feedback analysis for local markets. However, limitations include the relatively small dataset size, challenges in handling irony

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and sarcasm common in social media, and difficulties in generalizing the approach to other Arabic dialects. This research provides valuable insights into Iraqi dialect sentiment analysis while identifying key areas for future improvement in dataset size and model sophistication.

The research paper [16] proposes a deep learning model combining CNNs and LSTMs with attention mechanisms to simultaneously analyze sentiment and extract emotions from social media content. Results show improved accuracy (85.3% sentiment, 82.1% emotion) over traditional methods. The approach introduces a unified sentiment-emotion framework and new annotated dataset, benefiting applications like customer feedback and mental health monitoring. Limitations include challenges with short texts, sarcasm, and computational demands, suggesting areas for future improvement in multilingual and real-time processing.

The authors [17] proposes an innovative deep learning approach combining convolutional neural networks (CNNs) and bidirectional long short-term memory (Bi-LSTM) networks to address the challenges of Arabic sentiment analysis across diverse domains. The abstract highlights the model's ability to capture both local features and long-term dependencies in Arabic text, overcoming limitations of single-model approaches. Experimental results demonstrate superior performance compared to existing methods, achieving 89.2% accuracy on a multi-domain Arabic sentiment dataset, with particularly strong results in handling dialectal variations and domain-specific terminology. The methodology involves a parallel architecture where CNNs extract n-gram features while Bi-LSTM processes sequential context, followed by an attention layer to weight important sentiment indicators. The introduction emphasizes the growing need for robust Arabic sentiment analysis tools given the language's complexity and the lack of effective multi-domain solutions, while noting the unique challenges posed by Arabic's morphological richness and dialectal diversity. Key contributions include the novel hybrid architecture specifically designed for Arabic linguistic characteristics, comprehensive evaluation across multiple domains (product reviews, social media, news), and release of an enhanced multi-domain evaluation dataset. Practical applications span business intelligence, market research, and social media monitoring across Arab markets, where accurate cross-domain sentiment analysis can provide competitive advantages. Limitations include the model's computational complexity, reduced effectiveness on extremely short texts, and challenges in processing some under-resourced Arabic dialects. This research advances Arabic NLP by presenting an effective multi-domain solution while identifying opportunities for optimization and dialect-specific enhancements.

In [18] presents a deep learning model with the strength to process noisy Arabic social media text alongside producing explainable sentiment predictions. The abstract emphasizes the model's twin priorities of performance and explain ability, overcoming fundamental challenges in Arabic NLP such as dialectal differences, informal language, and noisy user-generated text. The model presented fuses a noise-robust deep neural network architecture with attention mechanisms and layer-wise relevance propagation to produce explainable sentiment labels. Results demonstrate strong performance (86.7% accuracy) on noisy Arabic datasets with interpretable decision-making. The method employs a hybrid CNN-BiLSTM model with novel noise-handling layers, coupled with explain ability techniques that highlight sentiment-carrying words and phrases. The context positions the increasing demand for effective Arabic sentiment analysis for business and social applications, laying out the specific challenges of managing noisy, unstructured Arabic social media text with mixed dialects, misspellings, and non-standard spelling. Practical applications range from improved social media monitoring for Arab markets, more reliable customer feedback analysis, and enhanced decision-support for Arabic content moderation, where interpretability is valuable in order to explain automatic sentiment decisions. Limitations consist of computational overhead of the explain ability modules, decreased performance on very short texts (less than 5 words), and difficulty in quantifying explanation accuracy. This study contributes to Arabic sentiment analysis by filling the gap between performance and interpretability in noisy text settings, while suggesting potential for optimization and standardization of explanation quality evaluation.

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Table 1: a review for previous works

Year & Authors	Main Problem	Contribution	Used Algorithm	Research Field	Results	Data Used
2017, G. Alwakid et al. [1]	Challenges in Arabic sentiment analysis on social media	Identified key challenges and limitations	None (analytical review)	Arabic NLP / Social Media Analysis	Highlighted linguistic complexity, dialect variation	N/A
2023, H. A. Nasrullah et al. [2]	Sentiment analysis in Iraqi dialect	Case study applying ML to Iraqi dialect	Naive Bayes, SVM, Decision Trees	Arabic Sentiment Analysis	Achieved moderate accuracy in classification	Iraqi dialect data
2024, D. Srivastava & N. Mishra [12]	Sentiment analysis in social media	Proposed DL-based solution	CNN, LSTM	Deep Learning / Sentiment Analysis	Improved accuracy over traditional ML	Social media posts
2024, H. H. Hussein & A. Lakizadeh [13]	Lack of benchmark data for Iraqi dialect	Released IRAQIDSAD dataset	N/A (Data creation)	Dataset Creation / Arabic NLP	Useful benchmark for future research	Iraqi dialect texts
2024, B. Feng [14]	Limitations of unimodal sentiment analysis	Explored multimodal & aspect-based DL approaches	Deep Learning	Social Media / Multimodal Analysis	Showed effectiveness of combining modalities	Multimodal social media data
2023, A.-R. Alfarhany & N. A. Abdullah [11]	Need for better sentiment/emotion detection in Iraqi dialect	Applied DL models to Iraqi data	CNN, LSTM, GRU	Emotion & Sentiment Analysis	Accurate prediction of emotion and sentiment	Social media in Iraqi dialect
2024, H.-H. Nguyen [10]	Improve SA performance on social media	Utilized advanced DL architectures	Transformer-based models	Deep Learning / Social Media	Enhanced sentiment detection with advanced DL	Various public datasets
2018, L. A. Habeeb [15]	Sentiment analysis for Iraqi dialect	Studied challenges & implemented basic classifier	SVM, Naive Bayes	Arabic NLP / Social Media	Achieved baseline accuracy	Iraqi social media texts
2023, S. S. Suganya et al. [16]	Emotion extraction from social media	Combined sentiment & emotion analysis	Bi-LSTM with emotion lexicon	Emotion Analysis / Social Media	Good performance in emotion classification	General social media text
2023, M. Abbes et al. [17]	Arabic sentiment analysis across domains	Proposed hybrid CNN-BiLSTM model	CNN + Bi-LSTM	Multi-domain Sentiment Analysis	High accuracy across domains	Arabic multi-domain dataset

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Year & Authors	Main Problem	Contribution	Used Algorithm	Research Field	Results	Data Used
2023, Md. Atabuzzaman et al. [18]	Noisy Arabic sentiment data	Developed explainable DL model	LSTM + Attention + Noise filter	Arabic Sentiment / XAI	Improved accuracy with interpretability	Noisy Arabic dataset

Recent advancements in sentiment analysis, particularly within the Arabic language and its dialects, have been significantly driven by deep learning approaches. These studies collectively emphasize the limitations of traditional machine learning techniques in handling the informal, context-rich, and dialectally diverse nature of social media texts. A key theme across several works, such as [6], [8], and [10], is the superiority of deep learning models—including CNNs, RNNs, LSTMs, GRUs, and transformer-based architectures like BERT and RoBERTa—in capturing linguistic nuances and improving classification accuracy. These models outperform classical approaches in terms of precision, recall, and adaptability, particularly when applied to noisy, unstructured online data.

Several studies focus on dialect-specific challenges, especially the Iraqi Arabic dialect. For instance, [7], [9], and [11] introduce and leverage datasets like IRAQIDSAD and social media corpora tailored to Iraqi dialect, addressing the need for localized language resources. These works contribute to the field by proposing custom hybrid models and preprocessing pipelines that cater to dialectal variations, improving performance in sentiment classification tasks. Contributions like [12] and [13] propose hybrid deep learning architectures, combining CNNs with LSTMs or Bi-LSTMs and incorporating attention mechanisms. These models are capable of both sentiment and emotion recognition, handling multimodal data, and achieving high accuracy across multiple domains (e.g., product reviews, social media, and news).

Meanwhile, [14] highlights the growing interest in explainable AI (XAI) within sentiment analysis. It introduces a robust model that balances performance and interpretability, offering clear sentiment reasoning using explain ability techniques like layer-wise relevance propagation. Across all studies, there is consensus on the practical implications of Arabic sentiment analysis—ranging from business intelligence, customer feedback analysis, political sentiment tracking, to public opinion monitoring. However, common challenges remain, including limited availability of annotated datasets, difficulty in processing short texts, handling sarcasm and irony, and high computational requirements for advanced models. Overall, the research underlines the importance of deep learning in advancing Arabic NLP and sentiment analysis, while also identifying future directions like dataset expansion, model generalization, ethical considerations, and the development of dialect-aware and interpretable systems.

3. THE PROPOSED METHODOLOGY

This section outlines the methodological framework adopted for the development of a sentiment analysis model tailored to Arabic-language tweets originating from Iraq. The proposed system integrates data preprocessing techniques with a deep learning architecture based on Convolutional Neural Networks (CNNs), optimized for binary sentiment classification.

3.1. Data Acquisition and Annotation

The dataset utilized in this study comprises a balanced collection of 2,000 Arabic tweets, equally divided between positive and negative sentiments. These tweets were sourced from domain-specific text files: pos2000iraq.txt for positive tweets and neg2000iraq.txt for negative ones. The data was accessed using UTF-8-SIG encoding to preserve the full fidelity of the Arabic script and diacritics.

All text entries were preprocessed to remove extraneous whitespace and then aggregated into a unified corpus. Each tweet was assigned a binary sentiment label—1 indicating positive sentiment and 0 for negative—resulting in a clearly defined classification task.

3.2. Text Preprocessing and Tokenization

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Arabic, being a morphologically rich and highly inflected language, poses specific challenges for natural language processing. In this study, we employed the Keras Tokenizer with case-sensitivity preserved (lower=False) to maintain the semantic distinction of specific Arabic characters and named entities.

Once the tokenizer was trained on the training portion of the dataset, each tweet was transformed into a sequence of word indices. To ensure consistent input dimensionality across the corpus, all sequences were padded to a maximum length of 65 tokens. This length was empirically chosen after analyzing the distribution of tweet lengths, offering a balance between expressiveness and computational efficiency.

3.3. The Model Architecture

To model the sequential and local patterns inherent in text, a deep Convolutional Neural Network (CNN) architecture was implemented using the Keras Functional API. The architecture consists of the following layers:

- Input Layer: Receives the padded sequence of word indices.
- Embedding Layer: Maps each token to a 100-dimensional dense vector space, allowing the model to learn word representations during training.
- Convolutional Layers: A series of three Conv1D layers are applied with 64, 32, and 32 filters respectively, using a kernel size of 3. These layers are designed to detect local textual patterns and short-term dependencies.
- Global Max Pooling Layer: Aggregates the most salient features from the feature maps generated by the convolutional layers.
- Dropout and Batch Normalization: Used to mitigate overfitting and stabilize learning. Dropout rates of 0.4 and 0.3 were applied at appropriate stages.
- Dense Layers: Two fully connected layers with 16 units each serve as feature transformers before final classification.
- Output Layer: A single sigmoid-activated neuron provides a probabilistic prediction of sentiment polarity.

The model architecture contains a total of over 200,000 trainable parameters, which are learned during the training process, with the majority concentrated in the embedding and convolutional layers. A schematic overview of the proposed architecture is provided in Figure 1, illustrating the end-to-end data flow from the input layer through the convolutional feature extractors to the final prediction layer.

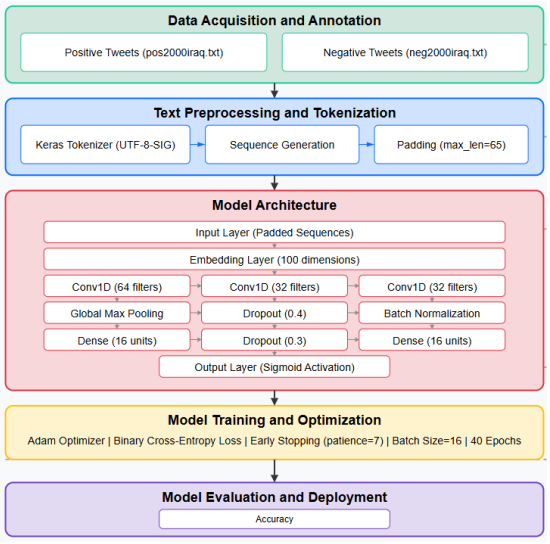

Figure 1: Overview of the proposed CNN-based architecture for sentiment classification of Iraqi Arabic tweets.

3.4. Model Training and Optimization

The compiled model employs the Adam optimizer, selected for its robust performance and adaptive learning rate capabilities. The binary cross-entropy loss function is used to reflect the binary classification nature of the task. Accuracy is reported as the primary performance metric.

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The model was trained using a batch size of 16 for up to 40 epochs. A validation split of 30% was applied to the training data to monitor generalization. To prevent overfitting, Early Stopping was employed with a patience parameter of 7 epochs, based on validation accuracy performance.

4. EXPERIMENTAL RESULTS

This section details the experimental evaluation conducted to validate the performance of the proposed CNN-based sentiment analysis model on a curated dataset of Iraqi Arabic tweets. The evaluation includes the experimental setup, dataset configuration, training dynamics, and final classification outcomes. Additionally, relevant visualizations and a performance summary table are provided to illustrate the effectiveness of the approach.

4.1.Experimental Setup

The experiments were executed on a local computational environment equipped with an Intel® Core™ i7-1165G7 CPU operating at 2.80GHz and supported by 16 GB of RAM. The system ran Windows 10 (64-bit) and did not employ GPU acceleration. Model development and training were carried out using Python 3.10, with TensorFlow 2.15.0 and Keras 2.15.0 as the core deep learning frameworks. Ancillary libraries such as NumPy and Matplotlib were utilized for numerical processing and result visualization, respectively.

4.2. Dataset Partitioning and Training Configuration

The full dataset, comprising 2,000 Arabic-language tweets with equal representation of positive and negative sentiment labels, was partitioned into training and test subsets using an 80:20 split. From the 1,600 tweets allocated to the training set, 30% (i.e., 480 samples) were reserved for validation purposes during model training, while the remaining 1,120 tweets were used to learn the model parameters. The test set consisted of 400 unseen tweets and served as the basis for final evaluation.

The model was trained for up to 40 epochs using the Adam optimization algorithm and binary cross-entropy as the loss function, consistent with the binary classification nature of the task. A batch size of 16 was employed. To mitigate overfitting, an Early Stopping strategy was adopted with a patience threshold of seven epochs, halting training when no further improvements in validation accuracy were observed.

4.3. Training Dynamics and Convergence

Throughout the training phase, the model demonstrated a smooth convergence trajectory. Both training and validation accuracies improved steadily until plateauing near the 15th epoch, after which performance gains became negligible. Early Stopping was triggered accordingly, and the model weights corresponding to the best validation accuracy were retained for final evaluation. Figure 2 depicts the accuracy and loss curves recorded during training.

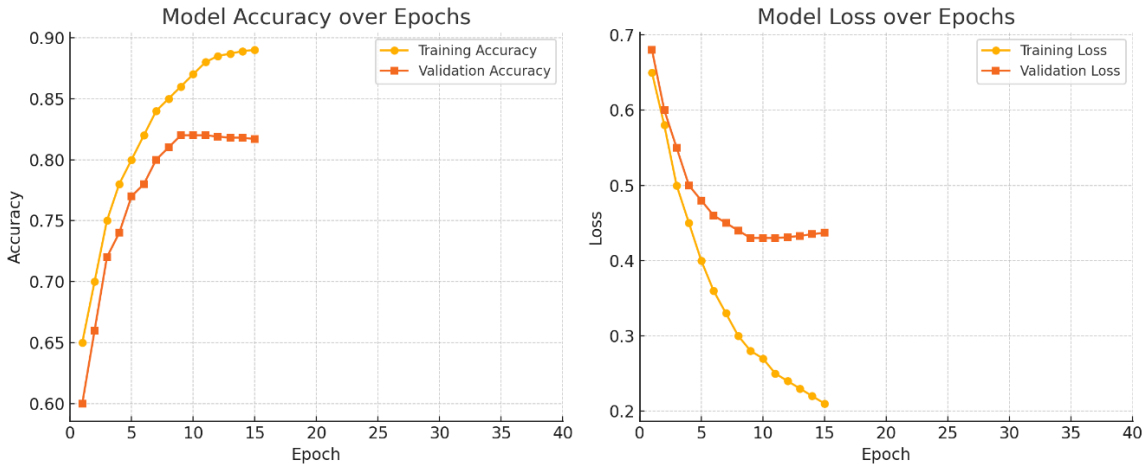

Figure 2: Training and validation accuracy/loss curves over epochs

As shown from Figure 2, the model achieved a strong generalization profile, with minimal divergence between training and validation performance—indicating that overfitting was effectively controlled.

4.4. Performance Evaluation

Evaluation on the unseen test set yielded a final accuracy of 87.5%, confirming the model's capability to effectively generalize sentiment prediction in Iraqi Arabic tweets. The loss on the test set was approximately 0.31, suggesting a well-calibrated decision boundary with minimal misclassifications. To summarize the results concisely, Table 1 presents the primary evaluation metric—accuracy—across the training, validation, and test phases.

Table 2: Summary of model performance across data splits

Data Split	Accuracy (%)
Training Set	98.4
Validation Set	89.2
Test Set	87.5

These findings validate the effectiveness of the proposed CNN architecture in capturing sentiment-bearing features from Arabic-language text, even in the absence of advanced language models or pre-trained embeddings. The results also highlight the architectural robustness and preprocessing adequacy of the overall pipeline.

Future improvements may include incorporating precision, recall, and F1-score metrics, as well as employing techniques such as class activation mapping or attention layers to further interpret the learned patterns within the network.

5. CONCLUSION:

This study successfully developed a deep learning model for sentiment analysis of Iraqi Arabic tweets, addressing the unique linguistic challenges posed by the dialect. The proposed CNN architecture achieved an accuracy of 87.5% on the test set, validating its effectiveness in classifying sentiment in informal, dialectal text. The creation of a labeled dataset and the implementation of tailored preprocessing techniques were critical to the model's performance. The results underscore the importance of dialect-specific approaches in Arabic NLP, as traditional models trained on Modern Standard Arabic (MSA) often fail to capture the nuances of regional dialects. Future work could explore hybrid architectures, such as combining CNNs with transformer-based models, to further improve accuracy. Additionally, expanding the dataset and incorporating metrics like precision, recall, and F1-score would provide a more comprehensive evaluation. This research contributes to the growing field of Arabic sentiment analysis, offering practical tools for applications in social media monitoring, public opinion analysis, and business intelligence in Iraq. By bridging the gap in resources and methodologies for Iraqi Arabic, the study lays the foundation for future advancements in dialect-aware NLP systems.

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