ASPECT BASED SENTIMENT CLASSIFICATION

Erdem Ertürk
Computer Engineering Department
Middle East Technical University
Ankara, Turkiye
erdem.erturk@metu.edu.tr

***Abstract*—*Aspect-Based Sentiment Analysis (ABSA) focuses on identifying the sentiment polarity of specific aspects within a text, providing detailed sentiment insights beyond general classification. This project addresses sentence-level ABSA in academic peer reviews using the ASAP-Review dataset, which includes aspect and sentiment annotations. We propose a transformer-based architecture that incorporates aspect-aware embeddings to better associate sentiments with their relevant targets. To further enhance contextual understanding, the model integrates mechanisms for capturing deep implicit features, allowing it to preserve fine-grained semantics and resolve overlapping sentiment cues. Our goal is to build a lightweight yet accurate system that improves aspect-level sentiment classification while maintaining robustness across diverse review categories.*

Keywords*—*Deep Learning, NLP, transformer, aspect classification, sentiment classification

I. INTROUCTION

Aspect-Based Sentiment Analysis (ABSA) is a fine-grained sentiment analysis task that aims to determine the sentiment polarity toward specific aspects or targets mentioned in text. Unlike traditional sentiment analysis, which assigns a general sentiment to an entire sentence or document, ABSA focuses on identifying sentiments at the aspect level—making it especially useful for analyzing reviews, feedback, or peer evaluations. In this project, we focus on sentence-level ABSA, which is particularly relevant for short, aspect-rich texts such as reviewer comments in academic peer reviews.

With the rise of pretrained language models such as BERT, performance in sentiment classification tasks has improved significantly. However, sentence-level ABSA still presents challenges such as understanding implicit sentiment, disambiguating overlapping aspects, and modeling local context effectively. To address these challenges, we aim to develop a transformer-based approach leveraging recent advances in contextualized embeddings and attention mechanisms, and evaluate its effectiveness on the ASAP-Review dataset, a corpus of academic peer reviews annotated with aspect classes and sentiments.

II. LITERATURE REVIEW

A. Aspect-Based Sentiment Analysis (ABSA) Overview

First, confirm that you have the correct template for your paper size. This template has been tailored for output on the A4 paper size. If you are using US letter-sized paper, please close this file and download the Microsoft Word, Letter file.

B. Pretrained Language Models and ABSA

The template is used to format your paper and style the text. All margins, column widths, line spaces, and text fonts are prescribed; please do not alter them. You may note peculiarities. For example, the head margin in this template measures proportionately more than is customary. This measurement and others are deliberate, using specifications that anticipate your paper as one part of the entire proceedings, and not as an independent document. Please do not revise any of the current designations.

C. Target-Dependent Sentiment Classification Using BERT

One significant advancement is the work by Gao et al. titled "Target-Dependent Sentiment Classification with BERT" [3]. Instead of treating the input text uniformly, this approach modifies the input to explicitly inform the model about the aspect target. By inserting special tokens or modifying embeddings based on the target location, the model learns to pay localized attention to aspect-relevant parts of the sentence. This method demonstrated that even without architectural changes to BERT itself, intelligent input formatting could considerably enhance ABSA performance. The idea of target-awareness inspires this project's approach, where reviewer aspect labels are used to condition the model's focus during training.

D. Deep Implicit Feature Extraction with CABiLSTM-BERT

While BERT captures powerful contextual embeddings, studies have pointed out that deeper transformer layers might lose local, nuanced information critical for sentiment tasks. CABiLSTM-BERT, proposed by He et al. [4], addresses this by combining BERT with a Contextual Attention BiLSTM (CABiLSTM) module. This hybrid model captures implicit, fine-grained semantic features through recurrent modeling while maintaining BERT's global contextual understanding. The introduction of attention mechanisms at the BiLSTM layer helps the model dynamically emphasize sentiment-bearing parts of the sentence in relation to the aspect. In this project, similar hybrid techniques will be explored to improve the model's ability to detect subtle sentiments embedded within dense peer review comments.

E. Research Motivation

Although transformer-based models such as BERT have substantially advanced the state of ABSA, challenges still remain:

- Target information underutilization: Many models do not sufficiently guide the attention mechanism toward aspect-relevant text spans.
- Loss of fine-grained semantic cues: Deep transformers may sometimes overshadow subtle contextual clues critical for sentiment reasoning.
- Domain-specific language: Academic peer reviews differ from product reviews or tweets; they feature formal expressions and indirect sentiment, posing unique challenges.

Motivated by these gaps, this project proposes a

XXX-X-XXXX-XXXX-X/XX/$XX.00 ©20XX IEEE

target-aware, context-enhanced transformer model specifically designed for sentence-level ABSA in academic peer reviews.

III. PROPOSAL

In this project, we aim to build a strong baseline for sentence-level Aspect-Based Sentiment Analysis (ABSA) on the ASAP-Review dataset by fine-tuning a pretrained BERT model. On top of this baseline, we will integrate two different enhancement techniques inspired by recent literature: (i) target-aware encoding strategies proposed for Target-Dependent Sentiment Classification with BERT, and (ii) deep implicit feature extraction methods from CABiLSTM-BERT. By adding these two mechanisms separately to the baseline, we will evaluate how each contributes to improving aspect-sentiment prediction performance. This experimental setup will allow us to systematically measure the effectiveness of both techniques and understand which factors contribute most to success in academic peer review sentiment analysis. In order to systematically progress the project, following research questions have been developed:

1) How can target-aware modifications to pretrained transformer models improve sentence-level aspect-based sentiment classification performance in academic peer reviews?
2) Can the integration of deep implicit feature extraction mechanisms further enhance the model's ability to associate sentiments with nuanced, contextually complex aspects compared to vanilla transformer baselines?

These questions evaluate both the effect of explicitly modeling aspect information and the impact of additional deep contextual modeling on ABSA outcomes.

We propose to fine-tune a pretrained BERT-base-uncased model as the baseline. We will then implement two enhanced models:

Target-aware BERT: Incorporating aspect position and masking into the input embeddings to guide attention toward aspect-relevant words.

CABiLSTM-BERT: Extending BERT outputs with a lightweight Contextual Attention BiLSTM layer to capture deep, implicit contextual cues around aspects.

We will also combine the architectures to have both features from both papers. The results will be compared with both the baseline and the separate ideas. All models will be developed using PyTorch and the Hugging Face Transformers library. Training experiments, model checkpoints, and result metrics will be manually logged and saved in local files and Git repository artifacts to ensure reproducibility without relying on external experiment tracking platforms.

The models will be evaluated using:

- Macro-averaged F1 Score: To fairly evaluate performance across all aspect classes, regardless of frequency.
- Accuracy: To measure the overall correctness of aspect-sentiment predictions.

Optional analyses may also include Precision, Recall, and Confusion Matrix visualizations for deeper insights.

We anticipate that; Target-aware encoding will help the model focus attention on sentiment-bearing phrases linked to the correct aspect. Deep feature extraction will improve the model's robustness in handling long sentences, indirect sentiment, and complex sentence structures common in academic peer reviews. Both enhancements should provide measurable gains over the plain BERT fine-tuning baseline. When combined, they are expected to perform superior to either enhancement alone by simultaneously capturing both global contextual information and localized semantic cues around the aspects, leading to an overall improvement in aspect-sentiment prediction accuracy. Moreover, this work aims to demonstrate that different enhancement strategies can be successfully integrated into the same underlying architecture to achieve superior performance, emphasizing the flexibility and extensibility of transformer-based models for specialized tasks like sentence-level ABSA.

REFERENCES

The template will number citations consecutively within brackets [1]. The sentence punctuation follows the bracket [2]. Refer simply to the reference number, as in [3]—do not use "Ref. [3]" or "reference [3]" except at the beginning of a sentence: "Reference [3] was the first ..."

Number footnotes separately in superscripts. Place the actual footnote at the bottom of the column in which it was cited. Do not put footnotes in the abstract or reference list. Use letters for table footnotes.

Unless there are six authors or more give all authors' names; do not use "et al.". Papers that have not been published, even if they have been submitted for publication, should be cited as "unpublished" [4]. Papers that have been accepted for publication should be cited as "in press" [5]. Capitalize only the first word in a paper title, except for proper nouns and element symbols.

For papers published in translation journals, please give the English citation first, followed by the original foreign-language citation [6].

[1] G. Eason, B. Noble, and I. N. Sneddon, "On certain integrals of Lipschitz-Hankel type involving products of Bessel functions," Phil. Trans. Roy. Soc. London, vol. A247, pp. 529–551, April 1955. *(references)*

[2] J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68–73.

[3] I. S. Jacobs and C. P. Bean, "Fine particles, thin films and exchange anisotropy," in Magnetism, vol. III, G. T. Rado and H. Suhl, Eds. New York: Academic, 1963, pp. 271–350.

[4] K. Elissa, "Title of paper if known," unpublished.

[5] R. Nicole, "Title of paper with only first word capitalized," J. Name Stand. Abbrev., in press.

[6] Y. Yorozu, M. Hirano, K. Oka, and Y. Tagawa, "Electron spectroscopy studies on magneto-optical media and plastic substrate interface," IEEE Transl. J. Magn. Japan, vol. 2, pp. 740–741, August 1987 [Digests 9th Annual Conf. Magnetics Japan, p. 301, 1982].

[7] M. Young, The Technical Writer's Handbook. Mill Valley, CA: University Science, 1989.