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DEEP LEARNING APPROACH FOR ASPECT CATEGORY DETECTION: A BIBLIOMETRIC ANALYSIS

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ABSTRACT

This article presents a quantitative and qualitative assessment of current research trends by conducting a bibliometric analysis of the sentiment analysis literature from 2020 to March 2024 using the Scopus database. Our focus is on the review of scientific documents, the arrangement of subject categories, the research trend in aspect category detection, the top 10 scholars that write the most number articles in aspect category detection and keyword trends. Our research shows that specialists in computer science, engineering, mathematics, medicine, decision science, material science, social sciences, business and management accounting, energy, and health are the most common topic groups in this industry. A study of keywords shows that terms like "BERT" and "deep learning" are frequently used together. This highlights the use of sophisticated models like BERT in this field and suggests a tendency to use innovative architecture to achieve better results. Conversely, although terms such as "sentiment analysis" and "aspect-based sentiment analysis" have modest frequency, their link strengths indicate a significant correlation with the main theme, emphasising the relationship between aspect category detection and sentiment analysis in research projects. we also provide the deep-learning technique used by the author for aspect category detection.

2020 Mathematics Subject Classification:
2020 ACM Computing Classification Codes:

Introduction

In natural language processing (NLP) and sentiment analysis, aspect category detection is a crucial activity that seeks to recognise and classify particular aspects or features of textual input. It is essential to many fields, including social media analysis, product feedback, and customer reviews. It helps academics and organisations make sense of and derive insights from vast amounts of unstructured text data.

Traditional methods for aspect category detection often rely on handcrafted features and rule-based approaches, which may lack the robustness and scalability required to handle the complexity

and variability of natural language. In recent years, deep learning techniques have emerged as a promising alternative, leveraging neural networks to automatically comprehend complex patterns and semantic links by learning hierarchical representations of text data.

This article presents a comprehensive bibliometric analysis of the application of deep learning approaches to aspect category detection, aiming to provide insights into the most recent cutting-edge techniques, important research patterns, and identification of possible future paths in this rapidly evolving field. By systematically analysing a diverse collection of scholarly publications, we seek to identify prominent authors, institutions, and countries contributing to this area of research, as well as the most influential journals and conferences.

Furthermore, this research paper conducted a detailed examination of the methodologies and architectures employed in deep learning-based aspect category detection, including convolutional neural networks (CNNs), recurrent neural networks (RNNs), and transformer-based models such as BERT (Bidirectional Encoder Representations from Transformers). Researchers investigate the incorporation of pre-trained word embeddings, attention mechanisms, and transfer learning techniques to enhance the performance and generalisation ability of these models across different datasets and domains.

Moreover, we explore the various challenges and limitations associated with existing approaches, such as data sparsity, domain adaptation, and model interpretability, and discuss potential strategies to address these issues in future research endeavours. Additionally, the research paper highlights emerging trends such as multi-task learning, semi-supervised learning, and the integration of domain-specific knowledge graphs to further advance the state-of-the-art in aspect category detection using deep learning techniques.

Overall, this bibliometric analysis aims to provide researchers, practitioners, and stakeholders with a thorough comprehension of the current landscape and prospects of deep learning-based aspect category detection, facilitating informed decision-making and fostering innovation in this critical area of NLP research.

The remainder of this paper is organised as follows: related work to the Arabic ACD task is discussed in section 2. Section 3 provides the research question. The methodologies used in this paper are presented in Section 4, while Section 5 discusses the results and Section 6 provides the conclusion.

Literature Review

Aspect Category Detection (ACD) within the domain of Aspect-Based Sentiment Analysis (ABSA) has garnered considerable interest in recent years because of its importance in understanding user opinions and sentiments toward products or services. Various deep learning approaches have been proposed and evaluated for this task, each aiming to improve the accuracy and efficiency of aspect category detection in different languages, including Arabic.

Almasre [1] explored the application of AraBERT vr2, a deep learning model, for aspect category detection in Arabic language text. The study compared two pipelines: one using AraBERT's classification layer directly and the other incorporating a data augmentation step before classification. The augmented model utilized the HARD dataset with a Word2Vec model for extending the training

data. Despite similar F1-scores between the baseline and augmented models, the study highlights the importance of robust dataset creation and augmentation methods in enhancing aspect category detection accuracy.

In a related study, Abbas et al. [2] presented a novel approach to ACD in restaurant patron reviews, leveraging Mobile Edge Computing (MEC) and federated learning. With the help of federated deep neural networks, the suggested method was able to get an astounding accuracy of 88.38%. The study emphasised the significance of pre-processing procedures, including data cleaning, balancing, and TF-IDF feature extraction, which are used to create a dependable dataset for classification. These approaches demonstrate the potential of federated learning in improving ACD accuracy.

Bensoltane and Zaki [3] addressed the limitations of existing Arabic ABSA research by proposing a method that combines BERT with temporal convolutional networks and bidirectional gated recurrent units. This approach aimed to enhance semantic and contextual feature extraction for aspect category detection. Additionally, the study explored methods to handle class imbalance, with data augmentation through back-translation proving effective in improving F1-scores by more than 3%.

Almasri et al. [4] tackled the challenge of aspect category detection in Arabic using a semi-supervised self-training approach with AraBERT v02. The framework involved developing a teacher model trained on labelled data, generating pseudo labels for unlabelled data, training a noisy student model on combined datasets, and assembling both models for improved performance. Results indicated the superior performance of the ensembled teacher-student model over baselines and other deep learning approaches, showcasing the effectiveness of semi-supervised learning in enhancing ACD accuracy.

Overall, these studies underscore the importance of deep learning approaches, robust dataset creation, preprocessing techniques, and innovative strategies such as data augmentation and semi-supervised learning in advancing aspect category detection in various languages, including Arabic. Additional investigation in this field shows potential for enhancing sentiment analysis and enhancing user experience in diverse domains.

Aspect Category Detection (ACD) is a crucial subtask within Aspect-Based Sentiment Analysis (ABSA), aimed at categorising reviews based on product features or entity aspects. With the exponential growth of customer reviews on e-commerce and social media platforms, ACD has garnered much focus in recent years because of its relevance in understanding consumer sentiments and preferences. In this literature review, we delve into the methodologies proposed in various studies focusing on deep learning approaches for ACD, analysing their efficacy, advancements, and areas of improvement.

One notable study by Babu et al. [5] explored the effectiveness of linguistic, lexical, vector-based, and semantic features in ACD using a multi-label multi-class support vector machine (SVM). The research investigated the superiority of vector-based features over text-based features, leveraging deep learning techniques to generate vector-oriented features. The experimental findings showed that the suggested method surpassed state-of-the-art techniques in ABSA, achieving promising precision, recall, and F1-scores. This highlights the significance of incorporating deep learning methodologies in ACD tasks to enhance performance and accuracy.

Furthermore, Kumar and Abirami [6] addressed the class imbalance problem prevalent in real-world ACD applications using bidirectional Long Short-Term Memory (LSTM) and Gated Recurrent Unit (GRU) networks. Their approach applied data-level techniques, such as stratified sampling, to mitigate imbalanced classes. By employing corpus-specific and pre-trained word embeddings, the proposed method effectively tackled the imbalance issue and demonstrated superior performance compared to conventional machine learning algorithms. This underscores the importance of leveraging advanced neural network architectures to handle complex challenges in ACD tasks.

In a similar vein, Khan et al. [7] suggested a novel convolutional attention-based bidirectional modified LSTM model for ACD, incorporating techniques such as next-word prediction, next-sequence prediction, and pattern prediction. By extracting significant features from public reviews, the proposed approach achieved remarkable F1-scores on benchmark datasets, outperforming existing methods. The integration of attention mechanisms and deep learning architectures proved instrumental in enhancing the accuracy and robustness of ACD systems, showcasing the potential for further advancements in this field.

Moreover, Chebolu et al. [8] conducted a comprehensive survey on ACD methods, categorizing them into supervised and unsupervised learning approaches. By analysing representative methods and datasets, the survey provided valuable insights into the strengths, weaknesses, and future research directions in ACD. The review highlighted the growing prominence of deep neural networks, attention mechanisms, and word embeddings in ACD tasks, signalling a shift towards more sophisticated and data-driven methodologies.

In conclusion, the reviewed studies underscore the pivotal role of deep learning approaches in advancing ACD techniques, addressing challenges such as class imbalance, feature extraction, and model robustness. By leveraging neural network architectures, attention mechanisms, and word embeddings, researchers have made significant strides in improving the accuracy, efficiency, and scalability of ACD systems. However, there remains ample room for further research and innovation to address emerging challenges and enhance the applicability of ACD in real-world scenarios [8].

Research Questions

RQ 1: What are the trends? What are the research trends in aspect category detection?

RQ 2: Who writes the most number articles?

RQ 3: What is the type of document by subject of research?

RQ 4 : What are the popular keywords related to the study?

RQ 5 : What are Popular Deep Learning Technique for Aspect Category Detection?

Methodology

The process of collecting, categorising, and scrutinizing bibliographic data from scientific publications is known as bibliometrics [9]. It involves advanced techniques such as document co-citation analysis along with the process of collecting, categorising, and scrutinising bibliographic data from scientific publications. To ensure a comprehensive bibliography and credible findings, a successful literature review requires an iterative process that encompasses identifying relevant keywords, conducting a literature search, and conducting in-depth analysis. With this in mind, the

research focused on top-tier papers provides useful insights into the theoretical viewpoints that influence the topic of study. Using the SCOPUS database for data collection was crucial to ensuring data reliability. Moreover, only papers published in thoroughly peer-reviewed scientific journals were included, whereas books and lecture notes were intentionally removed to guarantee the inclusion of publications of high quality. In particular, Elsevier's Scopus, known for its comprehensive coverage, allowed for the retrieval of articles from 1962 to February 2024 for further scrutiny.

The study used the SCOPUS database to ensure data reliability, excluding books and lecture notes and focusing solely on peer-reviewed academic papers to ensure high-quality materials. Specifically, papers from 1962 to February 2024 were gathered for further analysis using Elsevier's Scopus. Bibliometrics involves organising, coordinating, and analysing bibliographic data from scientific publications, including detailed information such as publishing journals, publication year, and significant author classification, as well as more advanced techniques like document co-citation analysis. To carry out a thorough literature review and provide dependable results, it is crucial to adhere to an iterative methodology that encompasses the identification of pertinent keywords, the execution of a literature search, and the undertaking of a comprehensive analysis. Therefore, the study aimed to focus on prominent works, which offer insightful analyses of theoretical perspectives.

Data Search Strategy

The study employed a screening phase to ascertain the search phrases for retrieving articles. The investigation began by doing an online search of the Scopus database and gathering a total of 36 publications. Subsequently, the query string as seen at Table 1 was modified to include the updated search keywords ""aspect category detection*" OR "aspect base sentiment analysis" OR " supervise learning" and "deep learning"" should be focussed on aspect category detection. All articles from Scopus database relating to Aspect Category Detection were incorporated in the study.

Table 1: The search string

Scopus	TITLE-ABS-KEY (("aspect category detection*" OR "aspect base sentiment analysis" OR " supervise learning" AND "deep learning")) AND PUBYEAR > 2020 AND PUBYEAR < 2024 AND (LIMIT-TO (SUBJAREA , "COMP") OR LIMIT-TO (SUBJAREA , "ENGI") OR LIMIT-TO (SUBJAREA , "MATH") OR LIMIT-TO (SUBJAREA , "DECI")) AND (LIMIT-TO (DOCTYPE , "ar") OR LIMIT-TO (DOCTYPE , "cp")) AND (LIMIT-TO (LANGUAGE , "English"))

Data Analysis

Nees Jan van Eck and Ludo Waltman developed the VOSViewer program, which is a user-friendly bibliometric tool, at Leiden University in the Netherlands. The application is used extensively for visualizing and comprehending scientific literature. It excels in generating density maps, grouping related objects, and creating intuitive network representations. Due to its versatility, researchers can examine co-authorship, co-citation, and keyword co-occurrence networks, enabling them to gain a comprehensive understanding of the research environment. The interactive interface and continuing updates guarantee the dynamic and efficient analysis of large datasets. VOSviewer is an indispensable tool for academics seeking to gain insights into complex study subjects due to its ability to calculate metrics, create visualisations, and handle various bibliometric data sources.

VOSviewer's ability to convert complex bibliometric statistics into readable maps and charts is one of its most notable capabilities. The software is excellent at clustering related items, evaluating keyword co-occurrence patterns, and creating density maps, with a focus on network visualisation. Its intuitive interface helps researchers by making it possible for both new and seasoned users to efficiently explore study landscapes. With its customised visualisations and ongoing development, VOSviewer stays at the forefront of bibliometric analysis, providing insightful metrics calculation. VOSviewer's versatility in handling various bibliometric data sources, including co-authorship and citation networks, makes it an essential tool for researchers looking to gain a deeper understanding of their fields of study.

Large datasets containing PlainText formatted data on the publication year, title, author name, journal, citation, and keywords were obtained from the Scopus database between 2020 and December 2023. We then used VOSviewer software version 1.6.19 to analyse these datasets. This software made it easier to analyse and create maps by applying VOS clustering and mapping algorithms. As a substitute for the Multidimensional Scaling (MDS) method, VOSViewer concentrates on putting objects in regions with a small number of dimensions, so that the distance between any two objects correctly represents their similarity and relatedness. VOSViewer and the MDS methodology are comparable in this regard. Oppositely to MDS, which emphasises similarity metrics calculation such as cosine and Jaccard indices, VOS uses a more appropriate technique to normalize co-occurrence frequencies, called the association strength (ASij), which is computed as:

Definition 4.1. [10] Association Strength

$$S_{ij} = \frac{c_{ij}}{w_i w_j} \qquad (1)$$

where and represent either the total number of occurrences or the total number of co-occurrences of items and , respectively, and indicates the number of co-occurrences of items and . It is evident that the similarity between items and was determined by applying formula[10].

Results and Findings

The Research Trends in Aspect Category Detection Studies According to the Year of Publication

"The research trends in aspect category detection studies have evolved significantly over the years, reflecting the advancements and shifting focuses within this field according to the year of publication."

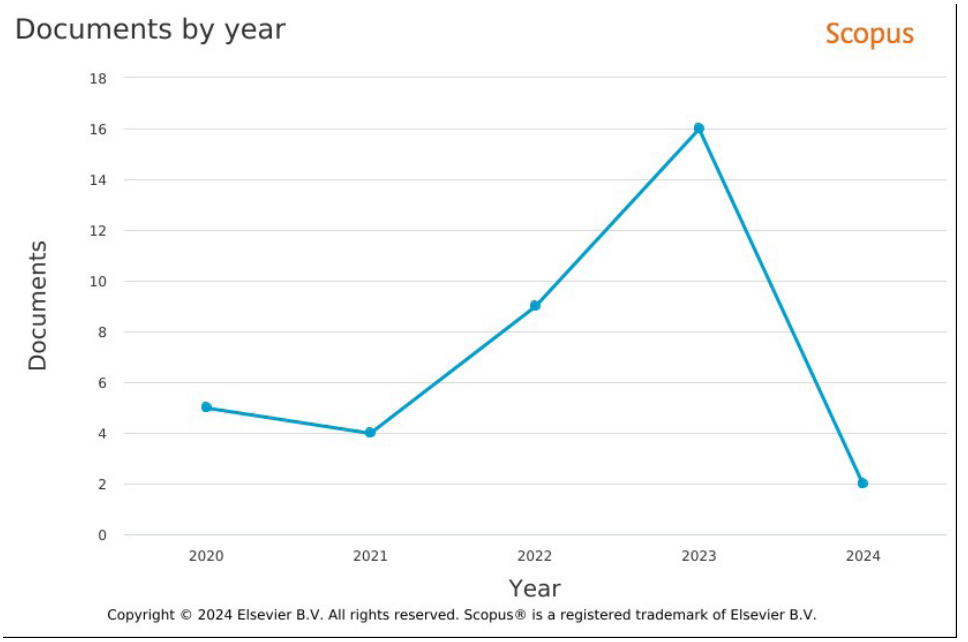

Figure 1: Depicting the publication of documents by year

Figure 1 shows a document published with research interest aspect category detection and deep learning from 2020 to March 2024. The data shown in Figure 1 taken from the Scopus database shows that aspect category detection has seen a notable increase in research interest in recent years. From a low of five publications in 2020 to a noteworthy peak of sixteen in 2023, the number of publications has climbed. This increasing tendency is indicative of the increased understanding of the value of aspect category detection across a range of applications, most notably sentiment analysis and natural language processing. The consistent rise in publications from 2020 to 2022, with the maximum number of research papers seen in 2023, suggests that interest in and progress in this field are growing. The increase from nine articles in 2022 to sixteen in 2023 points to a possible shift in emphasis and potential methodological advances, especially with the incorporation of deep learning techniques that have completely changed the way aspect category identification is approached.

With just two publications in 2024, there is a minor decline, though, which could point to a shift in the direction of study. A number of factors, including changes in research focus toward more sophisticated or diverse applications of deep learning in natural language processing, the topic's maturation leading to fewer exploratory studies, or perhaps the inevitable fluctuations in academic publishing cycles, could be blamed for this decline. Even with this downturn, the overall trend over the previous five years shows that aspect category identification has garnered significant and ongoing interest, highlighting its vital role in furthering automated text analysis and improving our comprehension of subtle sentiment in a variety of textual data sources. According to the data, even if the area may be developing, the years of foundational effort have created a solid platform for future study and advancement.

Top 10 Scholar Writes the Most Number of Articles

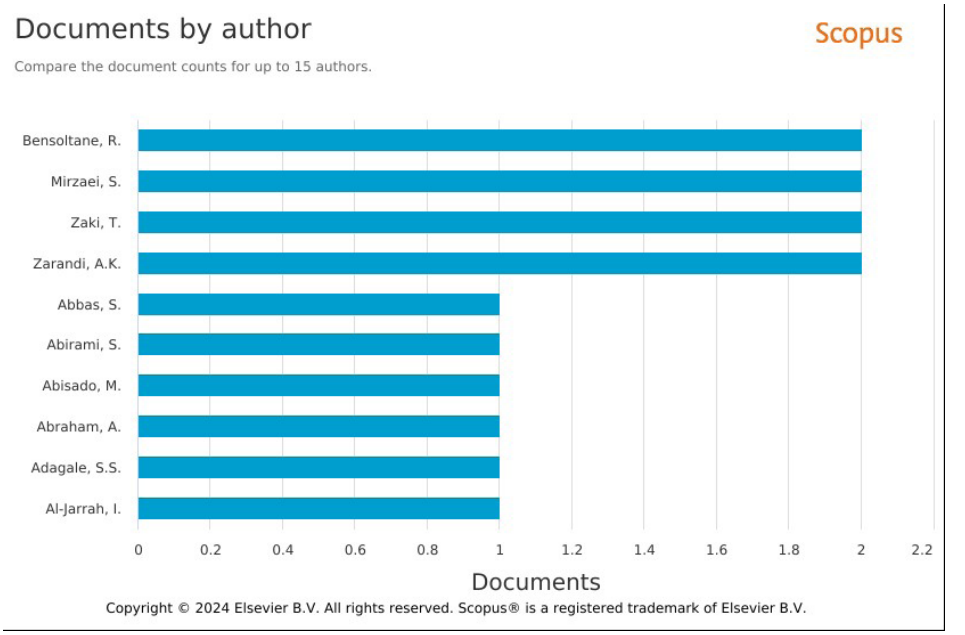

Figure 2: Top 10 Scholar writes the greatest number of articles

Table 2: Top 10 Scholar writes the greatest number of articles

AUTHOR NAME	Number of publications	Percentages
Bensoltane, R.	2	0.055
Zaki, T.	2	0.055
Mirzaei, S.	2	0.055
Zarandi, A.K.	2	0.055
Abbas, S.	1	0.027
Abirami, S.	1	0.027
Abisado, M.	1	0.027
Abraham, A.	1	0.027
Adagale, S.S.	1	0.027
Al-Jarrah, I.	1	0.027

Figure 2 and Table 2 show the top 10 scholars that write the greatest number of articles in Aspect Category Detection. The ranking is sorted based on the number of documents published by the author. In the bibliometric analysis of the top researchers in the field of deep learning for aspect category detection, it's intriguing to observe a distribution where multiple researchers exhibit similar levels of productivity. Among the top 10 researchers, Bensoltane, R., Zaki, T., Mirzaei, S., and Zarandi, A.K. each have two publications, constituting a 0.055% share individually. This convergence suggests a certain level of equilibrium in contribution and perhaps indicates shared interest or collaboration within the domain. However, it's worth noting the long tail of the distribution, with several other

researchers each contributing a single publication, albeit with a slightly lower percentage. This diversity in the number of publications underscores the breadth of research efforts in the field, potentially reflecting various methodologies, datasets, or application domains explored by different scholars.

Moreover, while the number of publications serves as a basic metric for productivity, it doesn't necessarily reflect the impact or quality of the research output. Thus, deeper analysis beyond mere publication counts is crucial to understanding the significance of each researcher's contribution. Factors such as citation count, journal prestige, and the novelty of the proposed methodologies could provide additional insights into the influence and relevance of their work. By considering these dimensions alongside publication counts, a more thorough comprehension of the research environment in deep learning for aspect category detection can be achieved, facilitating informed discussions on emerging trends, key contributors, and potential future directions in the field.

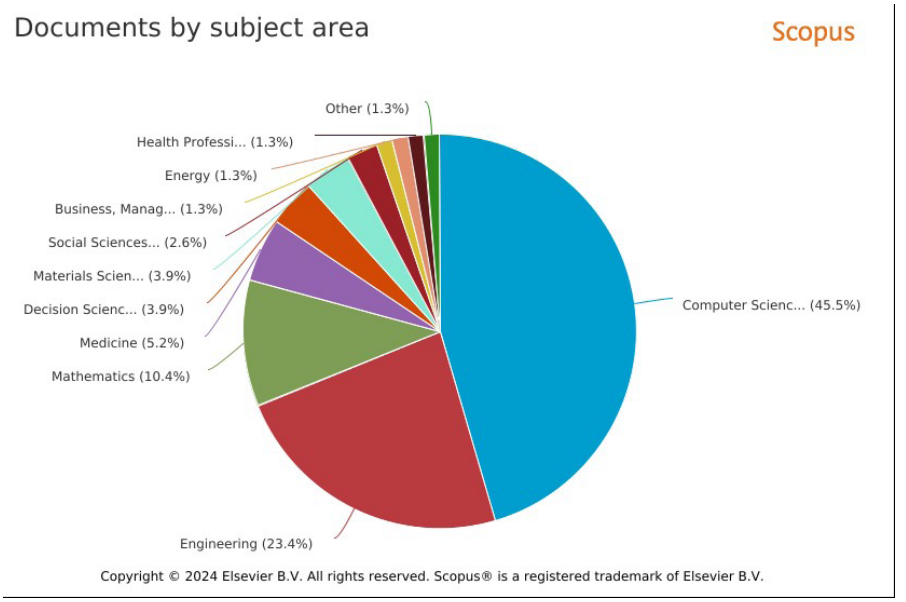

Figure 3: Frequent Document by subject of research

Table 3: Number of Publication by subject of research

Subject Area	Number of Publication	Percentages %
Computer Science	35	45.5
Engineering	18	23.4
Mathematics	8	10.4
Medicine	4	5.2
Decision Sciences	3	3.9
Materials Science	3	3.9
Social Sciences	2	2.6
Business, Management and Accounting	1	2,33
Energy	1	2,33
Other	1	1.3

In the realm of bibliometric analysis, the distribution of publications across subject areas provides valuable insight into the interdisciplinary nature of research. The data that demonstrated in Figure 3 and Table 3 shows number of documents publish based on subject of research. As evidenced by the findings from the Scopus analyser, the dominance of Computer Science as the leading subject area, comprising 45.5% of the publications, underscores the pivotal role of computational techniques, particularly deep learning, in aspect category detection. This dominance reflects the inherent synergy between deep learning methodologies and the burgeoning demand for automated text analysis in diverse fields. Engineering follows suit, with a notable 23.4%, indicative of the integration of computational tools within engineering domains for enhancing efficiency and innovation. The substantial presence of Mathematics, Medicine, and Decision Sciences further underscores the interdisciplinary nature of aspect category detection, drawing upon mathematical foundations, medical applications, and decision-making paradigms.

Moreover, the distribution reveals intriguing nuances within the landscape of scholarly inquiry. While Computer Science and Engineering occupy prominent positions, the modest representation of Business, Management, and Accounting, alongside Energy, suggests untapped potential for cross-disciplinary collaborations. Exploring the intersection of deep learning with these domains holds promise for addressing real-world challenges, such as business sentiment analysis and energy sector optimization. Additionally, the presence of publications in Materials Science, Social Sciences, and the 'Other' category underscores the diverse applications of aspect category detection, spanning from material characterization to sociological inquiries. By delving into these subject areas, researchers can glean valuable insights into the evolving research landscape and identify avenues for further exploration and collaboration, thereby enriching the interdisciplinary fabric of deep learning-based bibliometric analyses.

The Popular Keywords Related to the Study

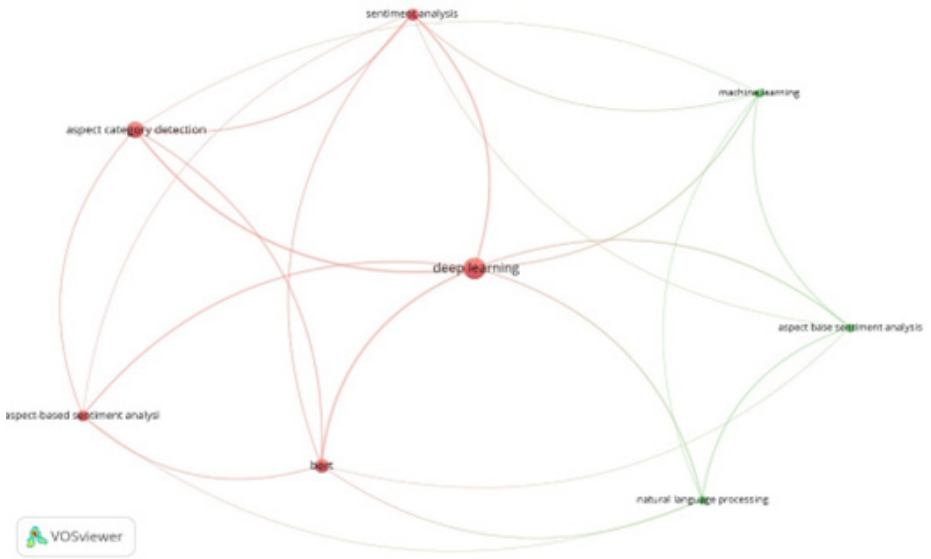

Figure 4: Network visualization map of keywords' co-occurrence

The network visualization map of keyword co-occurrence is shown in Figure 4. Figure 4 shows the most keyword used for publication related with Aspect Category Detection base on Scopus Count (search date 17 march, 2024). The bibliometric analysis offers valuable insights into the landscape of research related to deep learning approaches for aspect category detection. One notable observation is the prominence of deep learning techniques, evident from its highest occurrence and total link strength among the keywords examined. This underscores the increasing significance of deep learning methodologies in this field, reflecting its efficacy in handling complex tasks like aspect category detection. Additionally, the prevalence of keywords such as "BERT" alongside "deep learning" emphasises the adoption of advanced models like BERT within this domain, indicating a trend towards leveraging state-of-the-art architectures for improved performance. On the other hand, while keywords like "aspect-based sentiment analysis" and "sentiment analysis" exhibit moderate occurrences, their link strengths suggest a noteworthy association with the overarching theme, highlighting the interconnectedness between sentiment analysis and aspect category detection within research endeavours.

Furthermore, the analysis unveils a relatively lower occurrence of keywords like "machine learning" and "natural language processing" in comparison to "deep learning," indicating a focused interest within the research community towards deep learning methodologies specifically for aspect category detection. This suggests a shift or perhaps a specialisation within the broader domains of machine learning and natural language processing towards more nuanced techniques like deep learning for addressing the challenges inherent in aspect category detection tasks. Despite their lower occurrences, the comparable link strengths of these keywords with others suggest their

importance and relevance within the literature, signifying their foundational role in supporting and enriching research endeavours in this area. Overall, the bibliometric analysis underscores the growing influence of deep learning approaches and advanced models like BERT in shaping research directions and methodologies for aspect category detection, while also highlighting the continued significance of related areas such as sentiment analysis and natural language processing in advancing the field.

Popular Deep Learning Technique for Aspect Category Detection

Few articles report research on aspect category recognition using deep learning algorithms, according to documents gathered by researchers from the 2020–2024 Scopus database. Five papers that look at aspect category recognition using deep learning approaches are found based on the content of the article, and 16 documents total from a search of a Scopus database with area limits for aspect category detection.

Bensoltane and Zaki [11] created the BERT-BiGRU model by utilizing the advancements made to the BERT technique. According to experimental results, BERT-BiGRU greatly outperforms the baseline and related work on the e SemEval task 5 workshop in 2016 dataset, achieving the best F1-score (65.5%) among the assessed models.

The Contextualised Neural Language Models (CNLMs) method was employed by Karaoglan [12] and Findik. The efficacy of the suggested methodologies is assessed using benchmark datasets comprising 4500 evaluations from the restaurant and laptop industries. The outcomes demonstrate that the suggested strategies, which make use of hybridised CNLMs, beat cutting-edge techniques, with f-scores exceeding 0.90 for the restaurant dataset and 0.85 for the laptop.

Abbas et al. [2] in their study on the use of deep neural networks for aspect category detection of mobile edge customer reviews. The testing findings show that the suggested method accomplished an astounding 88.38% accuracy, endorsing the suggested method for aspect category identification.

Almasri et al. [4] utilizing the Hotel Arabic-Reviews Dataset (HARD) 2016 and the SemEval 2016 hotel review dataset. The researcher employs AraBERT, a BERT model that has been developed. AraBERT collaborated with student and teacher models. Findings show that, when it comes to predicting the Aspect Categories in the combined datasets, the ensembled teacher-student model outperforms the original noisy student implementation by 0.3% in its micro F1. It has, nevertheless, increased by 1% above the instructor model's micro F1.

For the Arabic Aspect Category Detection (ACD) Task, Bensoltane and Zaki [3] in 2023 coupled BERT with a temporal convolutional network and a bidirectional gated recurrent unit network. The method's F1-score of 84.58% for the Arabic ACD test indicates that it performed better than the baseline and other models, according to the evaluation data. Back-translation-based data augmentation has demonstrated its efficacy with an F1-score improvement of over 3% overall.

Based on the previous review, it can be inferred that BERT is the most popular model among researchers for using a deep learning strategy to complete the aspect category detection task in fact, BERT was employed in the three papers mentioned above.

According to Scopus database-based articles published between 2020 and 2024, there isn't much research conducted in the area of deep learning-based aspect category detection. The majority

of earlier researchers employed models of BERT, CNLM, and deep neural networks. The study's findings demonstrate that a deep learning strategy yields very accurate outcomes. Combined with machine learning techniques, efficiency can be raised, see [13,14,15].

The presentation above shows Aspect category detection research peaked in 2023 with 16 publications released overall, with Bensoltane and Zaki publishing the most of any researcher. Computer science has conducted the most study on ACD based on published articles, with research in engineering, mathematics, medical, decision science, materials science, business, accounting, and energy management following closely behind. The author frequently uses the keywords aspect category identification, machine learning, aspect-based sentiment analysis, deep learning, natural language processing, and sentiment analysis, according to the mapping visualization. Researchers using deep learning methodologies most commonly employ the BERT model in the ACD task.

Discussions and Conclusions

Discussions

In the examination of top researchers in deep learning for aspect category detection, the analysis reveals a distributed landscape characterized by multiple researchers with similar levels of productivity. This convergence hints at collaborative efforts or shared interests within the domain, fostering a sense of equilibrium in contribution. However, the long tail of the distribution signifies the diverse array of research efforts, reflecting various methodologies, datasets, and application domains explored by different scholars. While publication counts offer a basic metric for productivity, deeper analysis incorporating factors such as citation count and journal prestige is essential to gauge the impact and quality of research output accurately. By considering these dimensions, a more nuanced understanding of the research landscape can be attained, facilitating informed discussions on emerging trends, key contributors, and future directions in deep learning for aspect category detection.

The analysis of subject areas reflects the interdisciplinary nature of research in aspect category detection, with Computer Science and Engineering dominating the landscape. This dominance underscores the pivotal role of computational techniques, particularly deep learning, in addressing the challenges of aspect category detection. However, the modest representation of certain disciplines such as Business, Management, and Accounting alongside Energy suggests untapped potential for cross-disciplinary collaborations. Exploring these intersections can lead to innovative solutions for real-world challenges, enriching the interdisciplinary fabric of research in aspect category detection. Furthermore, the presence of publications in diverse fields like Materials Science and Social Sciences highlights the multifaceted applications of aspect category detection, spanning from material characterization to sociological inquiries. By embracing interdisciplinary collaborations, researchers can leverage diverse perspectives and methodologies to advance the field and address complex problems more effectively.

Our examination of the Scopus database revealed a dearth of research on aspect category recognition using a deep learning methodology. It is hoped that by publishing this article, more academics would investigate aspect category recognition with deep learning alone or in conjunction with machine learning.

Conclusions

In conclusion, the bibliometric analysis enables insightful observations on the landscape of research. in aspect category detection and deep learning approaches for aspect category detection. The results emphasize the worldwide scope of research endeavours, as contributions from various geographic areas enhance the dialogue and stimulate advancements in their respective disciplines. Despite regional disparities, collaborative endeavours and inclusive approaches have the potential to accelerate progress and foster meaningful impact in education and computational linguistics.

Moreover, the analysis highlights the growing influence of deep learning methodologies, particularly in aspect category detection, reflecting their efficacy in handling complex tasks and driving research directions. By embracing advanced models like BERT and fostering interdisciplinary collaborations, researchers can push the boundaries of knowledge and address real-world challenges more effectively. Overall, the bibliometric analysis serves as a roadmap for future research endeavours, guiding stakeholders towards informed decision-making and collaborative opportunities for collective advancement in aspect category detection and computational linguistics.

Conflict of Interest Statement

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analysis, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

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