Fostering Sentiments: Assessing the Prolific Pursuits of the United Arab Emirates in Sentiment Analysis Research

Avadhesh Kumar Patel[1], Ghouse Modin Nabeesab Mamdapur[2,3]
[1]Junior Research Fellow, Department of Library and Information Science
Banaras Hindu University, Varanasi-221005. Uttar Pradesh, India
{akpbhu20@gmail.com}
https://orcid.org/0000-0002-7989-091X

[2]Research Scholar, Department of Library and Information Science,
Yenepoya Deemed to be University. Mangalore-575018. Karnataka
India {20915@yenepoya.edu.in}

[3]New Product Development and Research Department,
Synthite Industries Private Limited, Kolenchery-682311 Kerala
India {ghouse@synthite.com}
https://orcid.org/0000-0003-4155-1987

ABSTRACT: *The study conducts a scientometric evaluation of sentiment analysis research in the United Arab Emirates using the Scopus database. It identifies 243 records and observes substantial growth trends in publications, with an average annual growth rate of 78%. The analysis also reveals fluctuations in citation impact over time. Notably, 2022 is a particularly active year for publications in this study. The study finds a correlation coefficient of 0.46 between publications and citations, suggesting a moderate association. The most prolific author, K. Shaalan, hails from the British University. The UAE's top collaborator is the United Kingdom. Zayed University, British University and the University of Sharjah are among the leading contributors. The majority of publications are articles, conference papers and book chapters. The term 'Sentiment Analysis' dominates research output, followed by related terms such as 'Social Networking', 'Data Mining,' 'Social Media', 'Machine Learning', 'Natural Language Processing' and 'Deep Learning'. This study underscores the UAE's growth and impact in sentiment analysis research, reflecting advancements across various industries, businesses, manufacturing, and academic disciplines.*

Keywords: Sentiment Analysis, Scientometrics, Scholarly Impact, Natural Language Processing Research Collaboration, United Arab Emirates

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1. Introduction

Sentiment analysis, a subfield of NLP, employs computational linguistics to systematically analyse text, enabling the identification, extraction, quantification, and exploration of emotional states expressed in any language. SA, also known as opinion mining or emotion analysis, investigates individuals' feelings and characteristics as reflected in written texts. These texts can pertain to various entities, such as products, services, organisations, people, events, causes, or topics **(Liu, 2012).** SA is commonly utilised to assess customer feedback, including reviews and surveys. Additionally, sentiment analysis is frequently applied in the analysis of online media, especially on social platforms **(Majumdar, 2021)**. It uses statistics, NLP, and ML to extract subjective information from text files. This information may include a reviewer's emotions, thoughts, judgments, or assessments related to a specific subject, event, company, or business operation **(AltexSoft, 2023)**. Sentiment analysis has various practical applications, including enhanced product analytical capabilities, surveys, reputation

management, precise targeting, marketing analysis, public relations, product reviews, net promoter scores, product feedback, and customer support**(Vodovatova, 2019).**

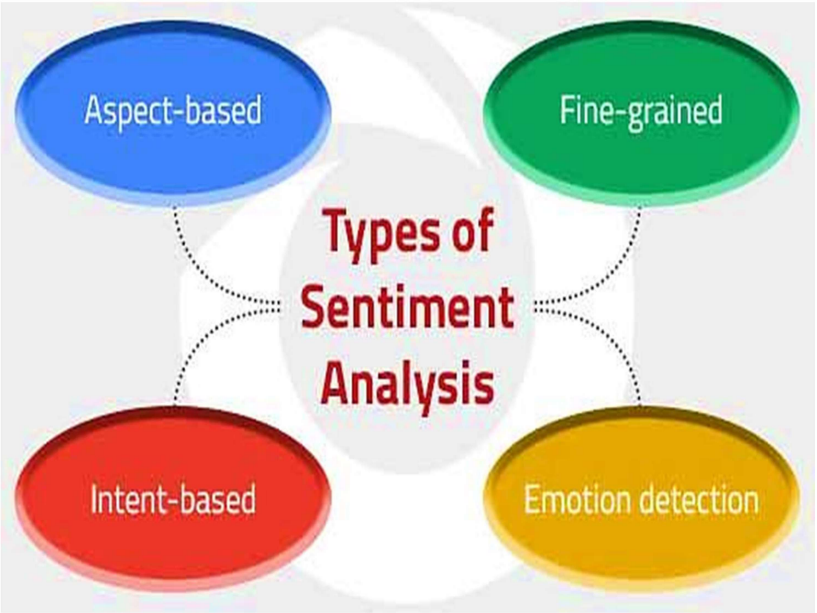

Figure 1. Types of sentiment analysis (Courtesy: *AltexSoft, 2023*)

The stages for sentiment analysis include the following factors

- Data Collection
- Text Pre-processing
- Feature Extraction
- Sentiment Analysis Model Selection
- Model Training
- Sentiment Classification
- Post-Processing and Analysis
- Visualisation and Reporting
- Evaluation (Optional)
- Deployment

In addition to the above, the most frequently explored areas in sentiment analysis include text categorisation, opinion mining, emotion detection and so on. In recent years, sentiment analysis, therefore, has undoubtedly become a prominent research accent across various industries. In this context, a scientometric study might provide deeper insight and understanding of the current state of sentiment analysis research. The study unearthed a significant surge in sentiment analysis publications in recent years, as reflected in publishing trends, citation patterns, and research themes found across multiple academic databases. In summation, the present scientometric study, applying relevant quantitative techniques, provides compelling evidence regarding the current status of sentiment analysis research confined to the UAE. However, similar studies across different geographical domains might help to assess and elucidate research trends and their potential directions.

2. Scope of the Study

This study's scope is divided into three sections; i) Sentiment analysis, ii) The publications from the UAE country, and iii) Scientometric investigation; a recent study examined the publications on sentiment analysis in the UAE country as a measure of the country's productivity, based on study of publications, citation patterns, most productive authors and institutions,

information sources, and so on. The present study covers sentiment analysis research generated within the UAE and demonstrates its productivity, association, and involvement with international researchers and scientists.

3. Review of Related Literature

Sentiment analysis has gained much importance as a study area across different industries. On the other hand, the scientometric study maps the sentiment analysis research focusing on research themes, citation patterns, and publishing trends, analysing the publications and citation databases. The study has therefore presented a review of related literature below.

• **Chen *et al.* (2022)** conducted a comprehensive bibliometric review focusing on the intersection of soft computing techniques applied to recommender systems and sentiment analysis. This study highlights the contributions of soft computing methods. It provides insight into the evolving trends and key research directions at the intersection of recommender systems and sentiment analysis within artificial intelligence.

Verma's (2022) study entitled 'Sentiment Analysis of Public Services for Smart Society: Literature Review and Future Research Directions' makes a comprehensive literature review on sentiment analysis applied to public services in the context of building smart societies. The article identifies key trends, challenges, and potential research areas to enhance the understanding of sentiment analysis in public services and its role in shaping smarter, more responsive governance.

• **Puteh *et al.* (2021)** conducted a bibliometric review on utilising deep learning techniques in sentiment analysis. It is an overview of the research landscape with the intersection of deep learning and sentiment analysis and is a rapidly evolving field in computer and mathematics education.

• **Manosso and Domareski Ruiz's (2021)** paper outlines the issues and the use of sentiment analysis in tourism research. A total of 111 papers were analysed, revealing that China (35) and the United States (24) are the top two nations researching sentiment analysis in the tourism industry.

• **Ni *et al.* (2021)** have employed bibliometric analysis to investigate the developmental trajectory of sentiment analysis technology. The study offers valuable insights into the historical evolution, emerging trends, and key research directions within the field.

• **Sarirete (2021)** delves into the scholarly landscape surrounding COVID-19 vaccines while incorporating sentiment analysis. The bibliometric study offers insights into the volume and sentiment of academic publications on COVID-19 vaccines, shedding light on prevailing sentiments within this critical research domain.

• **Casas-Valadez *et al.* (2020)**, with bibliometric analysis, explore the incorporation of sentiment analysis into decision models in the marketing world. The study found the growing relevance of sentiment analysis in marketing decision-making processes and its impact on shaping strategies and outcomes in marketing.

• **Chen and Xie (2020)** employed structural topic modelling by comprehensive bibliometric analysis of sentiment analysis research with an overview of sentiment analysis literature insights into thematic evolution and a deeper understanding of research dynamics.

A scientometric analysis to assess the global research landscape of sentiment analysis from 2003 to 2020 was made by **Gupta and Dhawan (2020).**Thiscomprehensive overview of the growth and distribution of sentiment analysis research provides valuable insights into the geographic contributions and focus areas within the field over a substantial time frame.

• **Sanchez-Nunez *et al.* (2020)** conducted a bibliometric analysis focusing on the domains of opinion mining, sentiment analysis, and emotion understanding relating to advertising it dealt with a comprehensive overview of the research trends, key contributors, and the evolution of sentiment analysis.

• **Keramatfar and Amirkhani (2019)** have identified prolific authors, nations, institutions, and bibliometric factors by conducting a bibliometric analysis of the sentiment analysis literature from 2003 to 2016.

An extensive review of sentiment analysis research was made by **Mäntylä *et al.* (2018).** They analysed research areas, publication channels and potent papers. The study also gave an overview of the historicity and significant contributions in sentiment analysis.

• **Piryani *et al.* (2017)** article gives a scientometric analysis of studies conducted on Opinion Mining and Sentiment Analysis (OMSA) between 2000 and 2015. The publication data is computationally analysed to determine the year-by-year publication

pattern, rate of publication growth, types of authors for OMSA papers, patterns of collaboration in OMSA publications, most productive nations, institutions, journals, and authors, patterns of citation and an annual citation reference network, as well as theme density plots and keyword bursts in OMSA publications over the period.

3.1. Summary of Review

The paper reviewed above showed that sentiment analysis research has been steadily gaining popularity, with the growth of literature and the number of bibliometrics/scientometric studies conducted on the subject. The review also shows its applications in industry, health care, marketing and decision-making, to mention a few of them. One of the studies found that the USA and China are at the forefront of sentiment analysis research, which is not surprising considering that these nations are also among the most prominent in this field. The study further reveals that text classification, opinion mining, and emotion recognition are among sentiment analysis's most popular research subjects. In conclusion, the scientometric study offers insightful information on the state of sentiment analysis research today and its projected future. The study can examine these factors with the literature published in UAE and its significant applications with the following objectives and potential research enquiries.

4. Objectives

As concluded above at the end of the literature review, the study aims to examine the following objectives and arrive at suitable findings.

- To study the growth of publications and citation patterns as evidence of the facts evolved above.
- To explore the correlations between research productivity and its visibility.
- To identify the most collaborative and influential contributors, involving authors, institutions of their affiliations and countries.
- To determine the significant publication patterns such as information sources, types, and sub-fields of study to map their importance.
- To assess various retrieval factors affecting research, including the accessibility of publications and the frequency of keywords to facilitate search.
- To examine supportive factors, including cited sources and references.

5. Methodology

- **Selecting the Research Theme:** This study is designed to evaluate the research productivity of the United Arab Emirates in sentiment analysis. The choice is derived from factors of UAE's economic development, substantial GDP, and abundant natural resources, focusing on UAE to scrutinise its scholarly output and advancements in this particular research domain.

- **Data Collection:** The required data was retrieved from the Scopus Citation database, and the publication's details on sentiment analysis were downloaded. The following search string was formulated and employed for data extraction: *TITLE-ABS-KEY ("Sentiment Analysis" OR "Emotion Analysis" OR "Opinion Mining") AND (LIMIT-TO (AFFILCOUNTRY, "United Arab Emirates")).* This yielded a total of 243 records pertinent to sentiment analysis publications.

- **Data Analysis:** The collected dataset was analysed using various analytical tools and software, specifically MS Excel, VOSviewer, and the R package Biblioshiny. The analysis was executed by applying scientific metrics and bibliographic parameters. VOSviewer was leveraged to construct an informative network visualisation map, illustrating collaborations and contributions among researchers and institutions.

6. Results and Discussion

6.1. Chronological Growth Trend

This study presents a comprehensive strength of publications and citation metrics from 2013 to 2023. It analyses key parameters, including Total Publications (TP), Total Citations (TC), Citation Per Paper (CPP), Total Authors (TA), and Relative Citation Impact (RCI) (Figure 2).

The total publications (TP) displayed steady growth during this period, with a notable surge in 2022 (n=56). Similarly, Total Citations (TC) exhibited an upward trend but with significant fluctuations, indicating these publications' increasing influence and impact. On average, were 22 publications published each year, with an impressive 78 per cent annual growth rate in publications over this time frame.

The annual citations per year averaged 269, with values ranging from 0 (2015) to 654 (2020). CPP fluctuated from 0 (2015) to 53 (2014) over the years, averaging 20 citations per paper. These fluctuations reflect the diverse impact of individual publications. TA consistently increased over the years, with an average of 89 authors per year, indicating collaborative

research efforts. On average, four authors contributed to each paper. Notably, *RCI* experienced fluctuations, peaking in 2018 (*n*=51.26). The analysis provides valuable insights into the evolving landscape of publications and citations in sentimental analysis research.

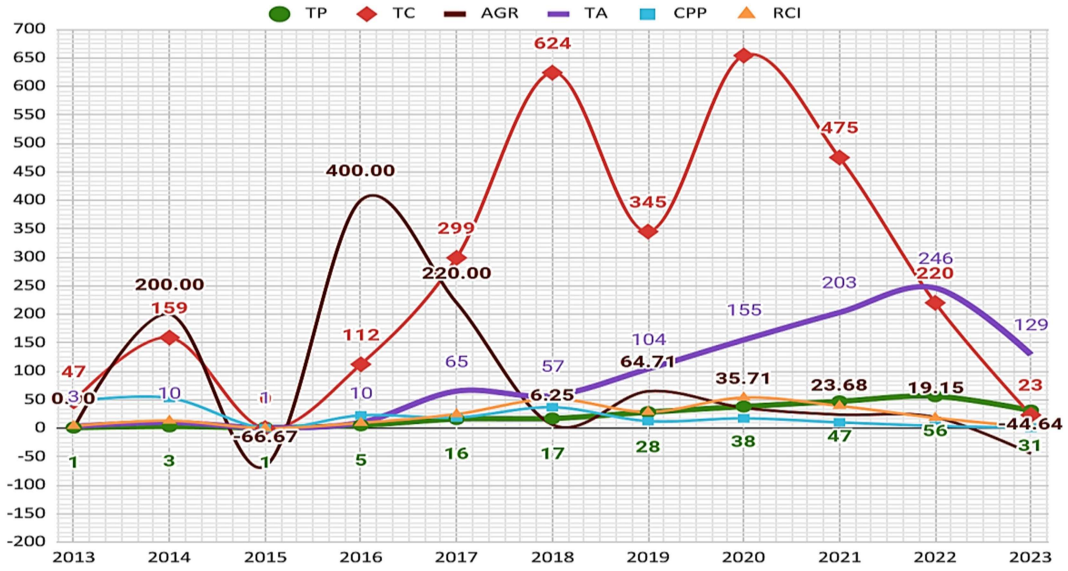

Figure 2. Yearly Trends of publications and citations of UAE

6.2. Correlative Measures of Productivity and Publicity

Correlation analysis is used to measure the relationship or association between two variables, and it is represented by the correlation coefficient (r). The correlation coefficient depends on both magnitude and direction, which can be positive or negative. It can take on values in the range of -1 to +1. A positive correlation coefficient suggests that an increase in the first variable is associated with an increase in the second, indicating a potential causal link between the two variables. Conversely, a negative correlation suggests an inverse relationship, where one variable rises while the other falls **(**Taylor, 1990; Patel *et al.,* 2023**)**. In this paper, the correlation coefficient between publications and citations is 0.46. This value suggests a relatively low relationship between publications and citations. R^2 = 0.216, which means publications are less correlated with citations, which is 20 % varied from mean points. The regression equation is y=5.6x + 145, which shows approximately 6 units increase in the dependable variable (citations) by every unit of publications (Figure 3).

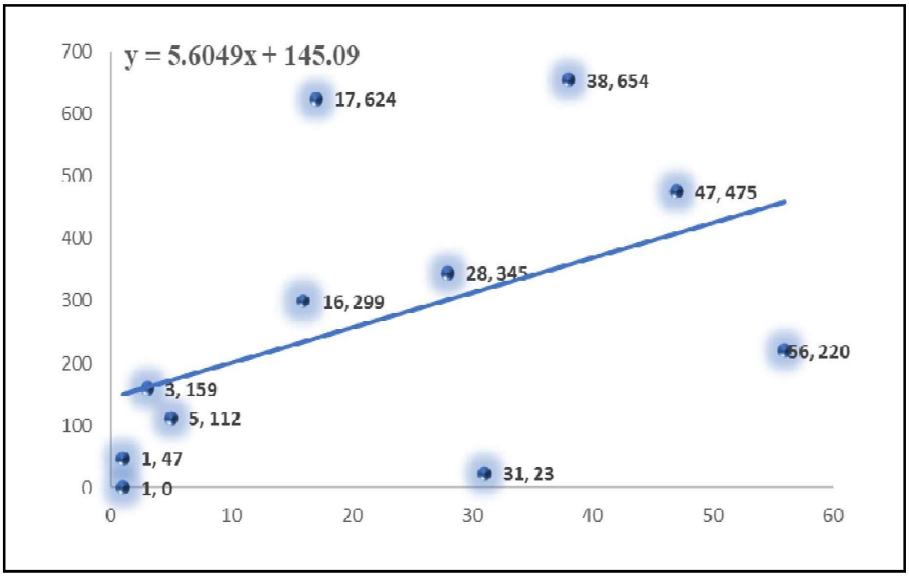

Figure 3. Relationship of Productivity and Publicity

6.3. Most Prolific Author

This study unveils the most prolific authors in the UAE who have made significant contributions to the field of sentiment analysis. Table 1 provides a detailed account of the top 25 highly productive authors, comprising 16 authors from the UAE and 9 collaborative authors from other countries. *K. Shaalan* from the *British University* stands out as the most prolific author with the highest publications (23) with 32 links, the second-highest citation count (377), the highest h-index (10), and a relative citation impact of 1.35. Following closely is *A. Elnagar* from the *University of Sharjah,* with 14 publications, 356 citations, an h-index (8), and a relative citation impact of 2.09. *M. El Barachi* from the *University of Wollongong* has 11 publications, 54 citations, an *h*-index (3), and a relative citation impact of 0.40. Notably, *N. Habash* from *New York University, Abu Dhabi* has 44 citations per publication. The top productive authors from the UAE have collaborated with researchers from five countries, including four authors from Lebanon, 2 from Pakistan, and 1 each from the *UK, Qatar*, and *Egypt*. It's worth mentioning that collaborations involving a minimum of 4 publications with foreign authors have all resulted in the highest relative citation impact, except for *E.U. Munir,* with a relative citation impact of 0.78. Additionally, *R. Baly* from the *American University of Beirut*, sports the highest relative citation impact at 5.01, followed by *W. El-Hajj* with 4.52, *H. Hajj* and *G. Badaro*, both from the *American University of Beirut* with 4.24, among others.

Authors	Affiliation	TP	TC	CPP	FA	CA	RCI	h-I	C
Shaalan, K.	British University, Dubai	23	377	16.39	0	1	1.35	10	UAE
Elnagar, A.	University of Sharjah, Sharjah	14	356	25.43	6	6	2.09	9	UAE
El Barachi, M.	University of Wollongong, Dubai	11	54	4.91	2	4	0.40	3	UAE
Habash, N.	New York University, Abu Dhabi	10	440	44.00	0	0	3.61	8	UAE
Alkhatib, M.	British University, Dubai	10	53	5.30	6	0	0.44	3	UAE
Oroumchian, F.	University of Wollongong, Dubai	7	48	6.86	0	0	0.56	3	UAE
Urolagin, S.	BITS Dubai Campus, Dubai	7	79	11.29	1	1	0.93	4	UAE
El-Hajj, W.	American University of Beirut, Lebanon	6	330	55.00	0	0	4.52	6	OC
Hajj, H.	American University of Beirut, Lebanon	6	310	51.67	0	0	4.24	5	OC
Iqbal, S.	Al Ain University, Al Ain	6	39	6.50	1	0	0.53	3	UAE
Mathew, S.S.	Zayed University, UAE	6	11	1.83	1	1	0.15	2	UAE
Al-Obeidat, F.	College of Technological Innovation, UAE	5	8	1.60	4	1	0.13	2	UAE
Badaro, G.	American University of Beirut, Lebanon	5	258	51.60	3	0	4.24	5	OC
Baly, R.	American University of Beirut, Lebanon	5	305	61.00	3	1	5.01	5	OC
Hussain, A.	University of Stirling, UK	5	244	48.80	0	1	4.01	4	OC
Mishra, R.K.	BITS Dubai Campus, Dubai	5	147	29.40	3	3	2.42	5	UAE
Salloum, S.A.	British University, Dubai	5	103	20.60	2	7	1.69	3	UAE
Afyouni, I.	University of Sharjah, Sharjah	4	12	3.00	0	0	0.25	2	UAE
Aoudi, S.	Higher Colleges of Technology, Sharjah	4	6	1.50	1	0	0.12	2	UAE
Shaban, K.B.	Qatar University, Qatar	4	172	43.00	0	0	3.53	4	OC
Asghar, M.Z.	Gomal University, Pakistan	4	63	15.75	0	1	1.29	4	OC
Khattak, A.	College of Technological Innovation, UAE	4	63	15.75	4	2	1.29	4	UAE
Monem, A.A.	Ain Shams University, Egypt	4	84	21.00	0	0	1.73	4	OC
Munir, E.U.	COMSATS University Islamabad, Pakistan	4	38	9.50	0	0	0.78	3	OC
Siddiqui, S.	British University, Dubai	4	34	8.50	3	4	0.70	4	UAE

Table 1. Top Contributive Authors

6.4. Collaborative Mapping of Authors

The process of visual representations or networks illustrates collaboration among authors in a particular research field or domain. These maps show how authors have worked together on research projects and co-authored papers. The purpose of collaborative mapping is to provide insights into the interconnection of researchers and the extent of collaboration within a specific academic or scientific community. Co-authorship analysis is a significant factor and one of the key criteria for assessing the quality of research results in an academic discipline.

Figure 4 displays a network visualisation of the top 84 collaborative authors out of 698. This network is divided into eight clusters, each represented by a different colour. Cluster 1, represented in red, comprises 19 authors, including *K. Shaalan* (23 publications, 32 links, 50 TLS), *A.A. Monem* (4 publications, 4 links, 9 TLS), *S. Siddiqui* (4 publications, 3 links, 8 TLS), and others. Cluster 2, in green, consists of 18 authors, including *S. Urolagin* (7 publications, 13 links, 15 TLS), *R. K. Mishra* (5 publications, 11 links, 15 TLS), *N. Nawaz* (2 publications, 7 links, 8 TLS), and more. Cluster 3, shown in blue, includes 14 authors, such as *M. Alkhatib* (10 publications, 11 links, 28 TLS), *F. Oroumchian* (7 publications, 12 links, 28 TLS), *M. El Barachi* (6 publications, 10 links, 19 TLS), and others. Additionally, there are ten authors in Cluster 4, seven in Cluster 5, six in Cluster 6, and five in Clusters 7 and 8.

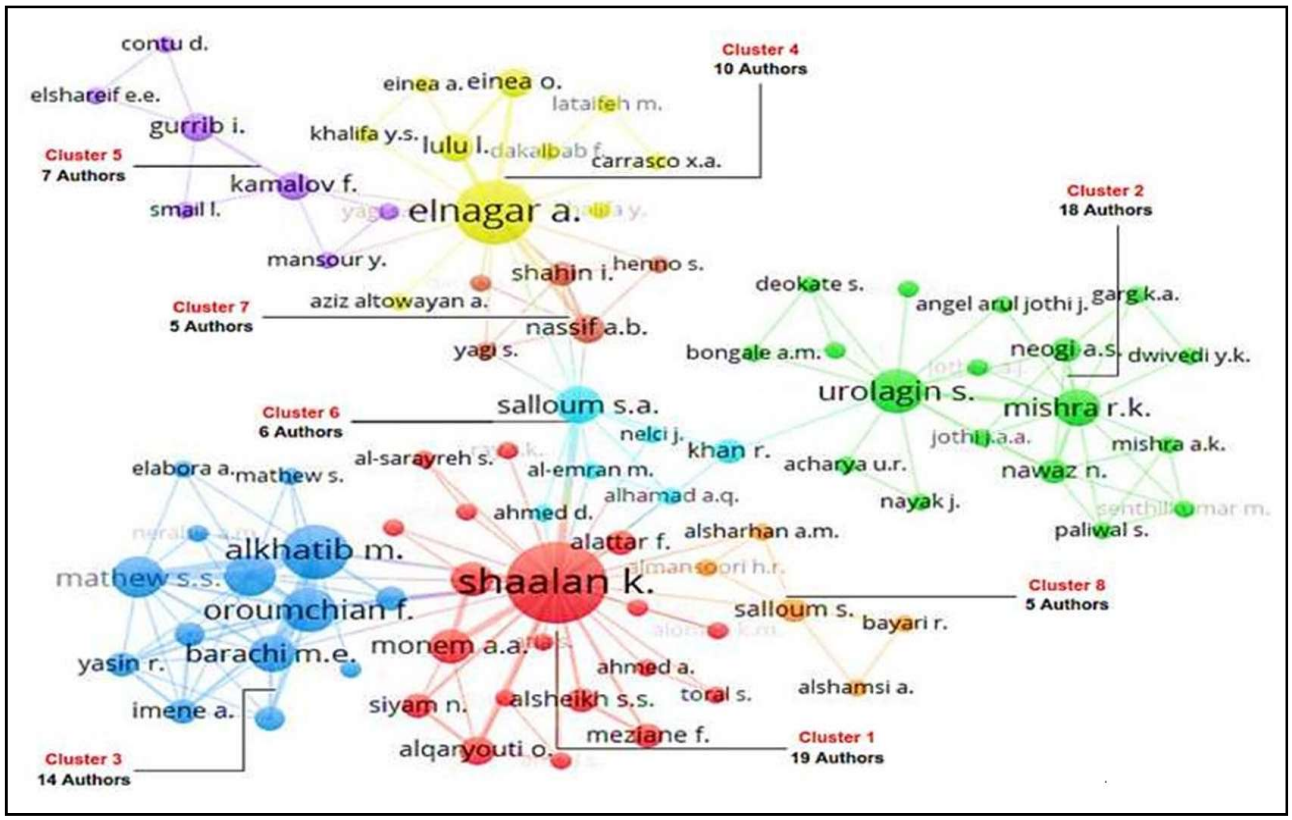

Figure 4. Collaborative Mapping of Authors

6.5. Collaborating Countries with UAE

This current study explores the collaboration of the UAE with other countries worldwide in scholarly industries, similar to industrial collaborations. The researchers set the parameters to include countries with a minimum of 5 collaborative publications and 20 citations. Out of 45 countries analysed, 16 emerged as the most collaborative partners. The network visualisation depicted in Figure 5 uses circles (nodes/entries) and straight lines (linkages) to illustrate the connections between these top collaborative countries. The size of the circles represents the quantity of publications, while the thickness of the lines indicates the strength of collaboration between countries. Notably, the UAE exhibits the highest level of collaboration with the *United Kingdom*, with 36 publications, 640 citations, and a linkage strength of 36. This is followed by collaborations with *Pakistan* (27 publications, 258 citations, 27 TLS), and *India* (26 publications, 101 citations, 26 TLS), among others. Conversely, among these top collaborative countries, the UAE has the least collaboration with Algeria, with only 5 publications and linkage strength of 5.

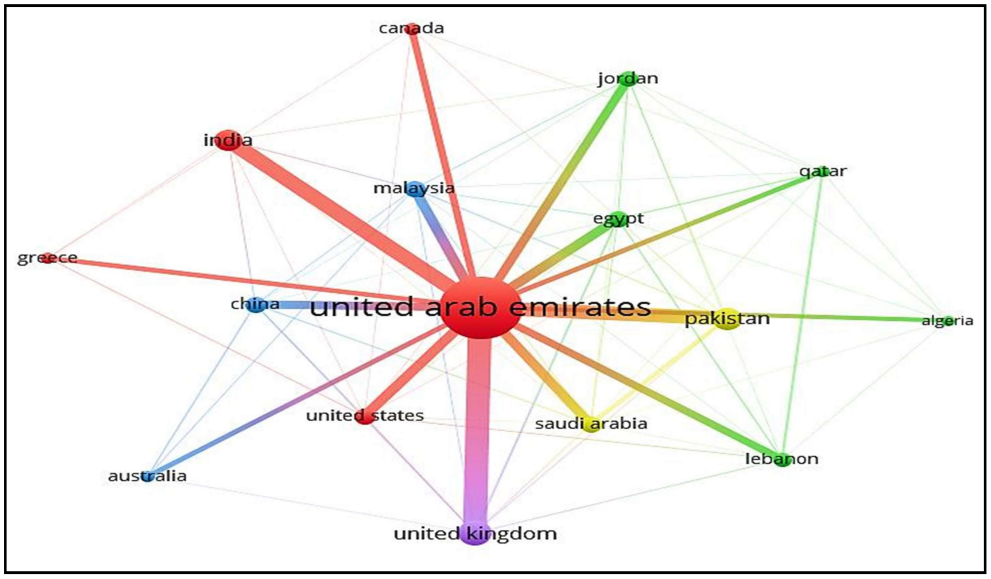

Figure 5. Network Visualisation of Collaborative Countries

6.6. Collaborating Institutions

An institute is a prominent factor for publications because authors have affiliation, and affiliation promotes them for further research and development. The productivity of the UAE is supported and dependent on their institutes. The researchers measured the collaborative effort of UAE's institutes. They revealed that *Zayed University* has the highest number of publications (n=39), followed by *British University* with 37 publications, *University of Sharjah* with 32 publications, *Birla Institute of Technology and Science* with 16 publications, *United Arab Emirates University* and *University of Wollongong* with 15 publications each, and others having less than 15 publications (Table 2).

Table 2. Highly Collaborative Institutes of UAE

Top Fifteen Affiliations	TP	TC	TLS	Link	CPP	ICP	%ICP	RCI	TA	*h*-index	HC
Zayed University	40	275	77	48	6.88	26	65.00	0.56	184	9	74
British University	37	447	57	22	12.08	20	54.05	0.99	125	12	81
University Of Sharjah	32	476	36	26	14.88	16	50.00	1.22	119	11	84
Birla Institute of Technology and Science	16	282	10	9	17.63	4	25.00	1.45	43	8	81
United Arab Emirates University	15	186	13	11	12.40	6	40.00	1.02	51	7	45
University Of Wollongong	15	79	29	12	5.27	5	33.33	0.43	63	4	25
New York University Abu Dhabi	14	454	35	24	32.43	11	78.57	2.66	85	9	133
Ajman University	12	112	31	29	9.33	8	66.67	0.77	47	4	43
Al Ain University	12	36	21	10	3.00	10	83.33	0.25	64	4	14
Khalifa University	8	78	23	22	9.75	6	75.00	0.80	41	6	25
Higher Colleges of Technology Sharjah	7	10	4	4	1.43	3	42.86	0.12	20	4	4
Abu Dhabi University	6	119	16	16	19.83	4	66.67	1.63	24	4	81
Skyline University College	6	30	19	16	5.00	5	83.33	0.41	27	3	19
Middlesex University	5	153	2	1	30.60	2	40.00	2.51	17	4	126
Canadian University	5	17	4	4	3.40	1	20.00	0.28	15	2	10

6.7. Link Visualisation

There are 314 UAE institutes which are collaborating on publications on Sentiment Analysis. The researchers used a minimum of 3 publications and 4 citation criteria for selecting institutes, found the 40 most productive collaborators and viewed their collaborative visualisation (Figure 6). The figure displays circles (nodes/entries) and lines (linkages), which define the size of circles, which means the amount of collaboration and the thickness of lines shows the connective strength of each other. It is found that *Zayed University* (48 links) has the highest collaboration with *University of Wollongong* (9 links) and *British University* (7 links), followed by *British University* with *University of Wollongong* (9 links), *University of Edinburgh* (8 links); *University of Sharjah* with *British University* (4 links), *Ain Shams University* (4 links), *Ajman University* (2 links); *New York University, Abu Dhabi* with *American University of Beirut* (7 links);. The *Birla Institute of Technology and Science* is a highly productive but a least collaborative institute among these network mapping.

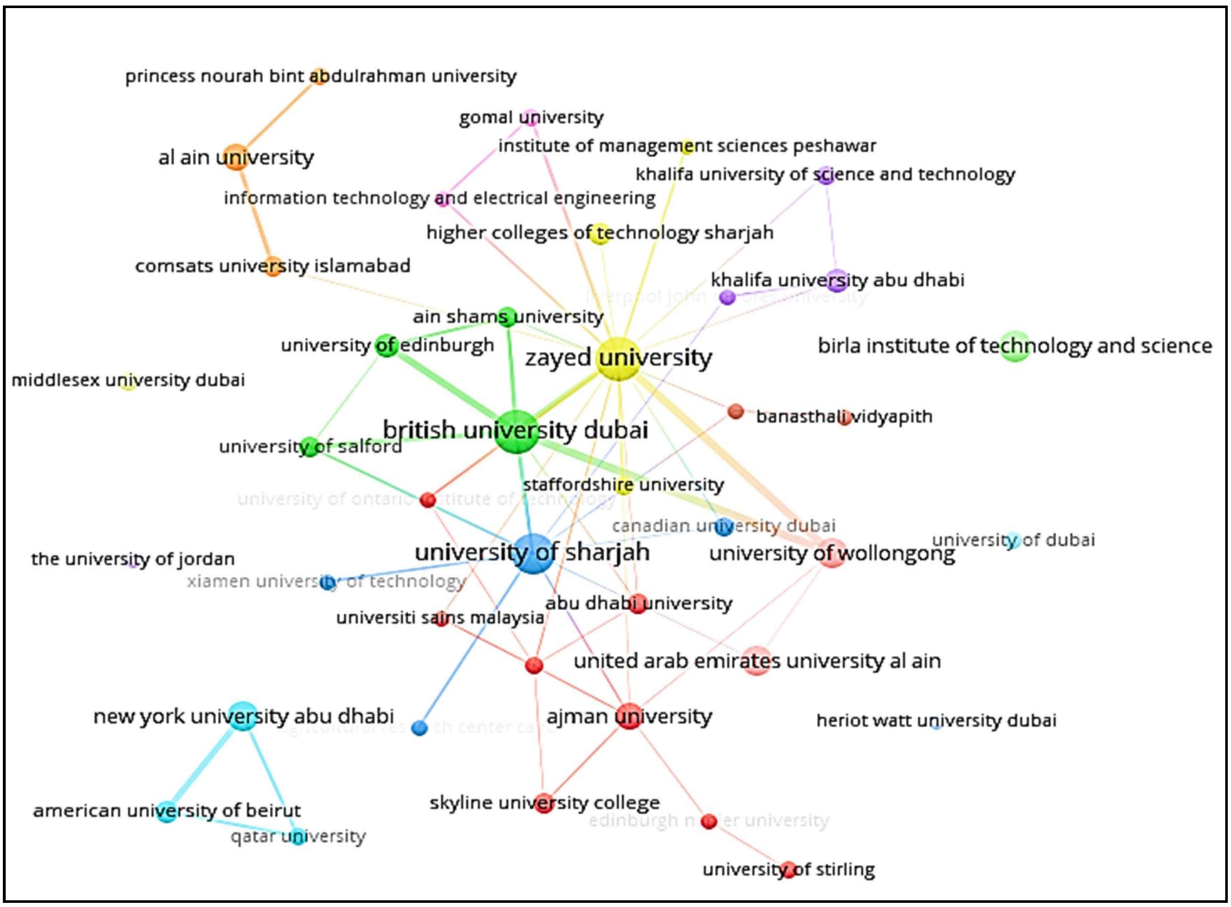

Figure 6. Links Visualisation of Collaborative Institutes of UAE

6.8. Accessibility of Publications

The accessibility of literature is one of the most important features, as it enhances the visibility and publicity of research. Ease of retrieval is crucial in supporting access to publications, benefiting researchers and future research endeavours. The study examined the impact of publication accessibility on their future growth and understanding. The dataset comprises 145 publications, with the following access types and citation counts: All open-access publications have 1817 citations. Specifically, 50 publications with Gold access have 568 citations, 11 publications with Bronze access have 49 citations, 8 publications with Green access have 115 citations, and 2 publications with Hybrid Gold access have 29 citations (Figure 7).

This analysis highlights that open-access publications achieve the highest citations, thus demonstrating that increased accessibility contributes to their effectiveness and publicity. Additionally, some publications employ a combination of access modes, such as 20 with Gold and Green access, which have received 568 citations. Similarly, 4 publications with both Bronze and Green access have garnered 12 citations, and 3 publications with Hybrid Gold and Green access have accrued 33 citations.

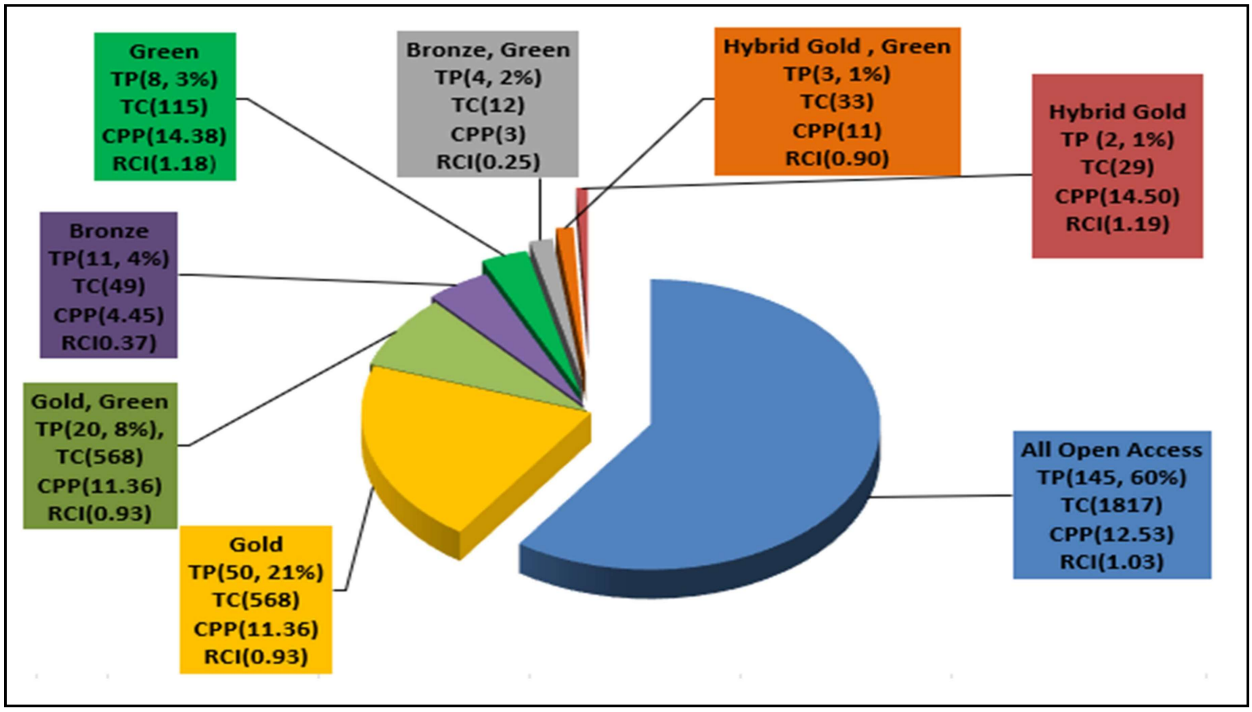

Figure 7. Accessibility of Publications

6.9. Forms distribution

The study aimed to identify the types of publications preferred by authors from the UAE, as and is a critical criterion in any research field. Scientists and researchers highly favour periodicals due to their relevance to current trends. This study reveals that most publications are papers from periodicals, followed by conference papers, book chapters, and other formats (Figure 8).

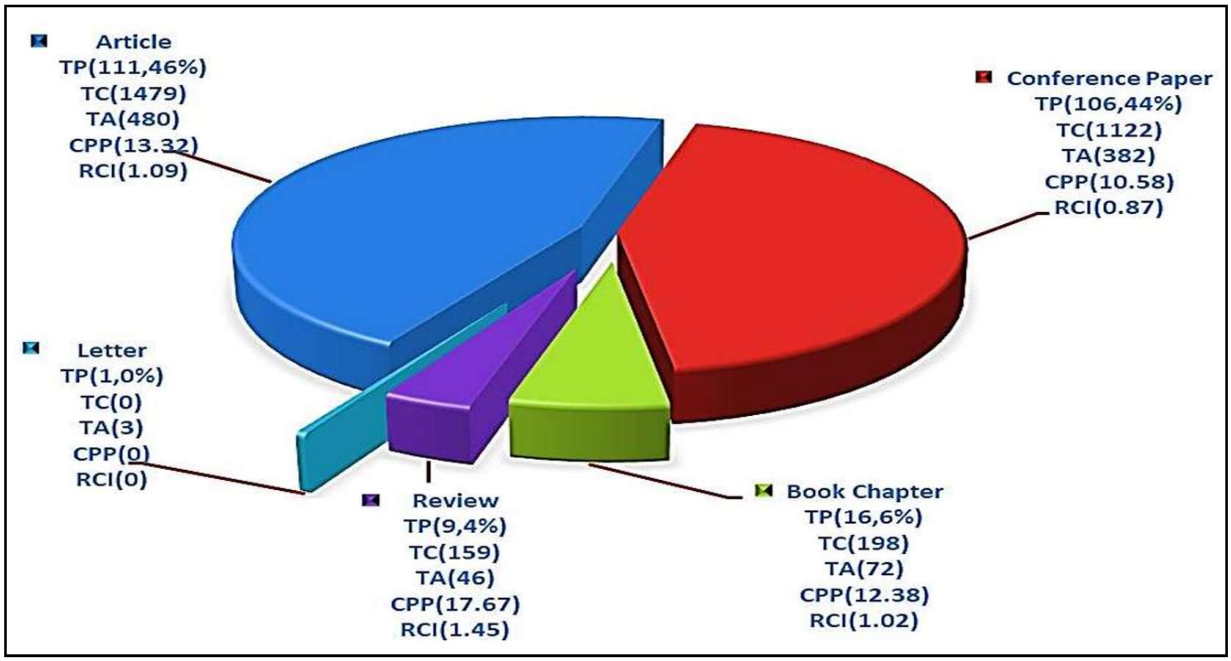

Figure 8. Proportion of Form Distributions

6.10. Co-citation Analysis of Cited Authors

The co-citation analysis evaluation revealed renowned authors frequently referenced in the research field under study literature. A total of 15,505 authors are cited in the scientific literature found from the study, and network visualisation is used to represent 89 authors who have received more than 20 citations (Figure 9).

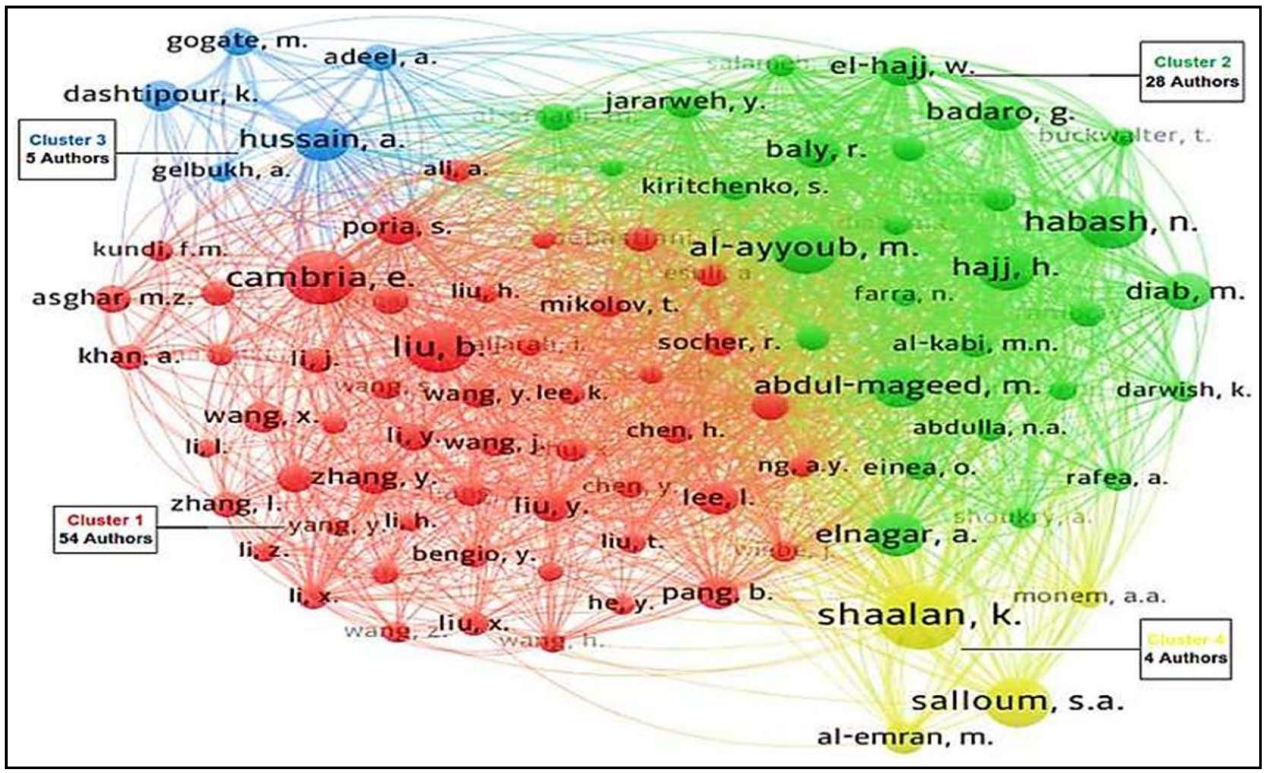

Figure 9. Co-citation Analysis of Authors

The findings reveal that *Shaalan* is the most cited author by UAE researchers, with 148 co-citations and 7,074 total link strengths. Following closely is *Cambria,* with 116 co-citations and 4,344 TLS, *N. Habash,* with 108 co-citations and 10,042 TLS, *Liu,* with 106 co-citations and 2,360 TLS; and*S.A. Salloum,* with 101 co-citations and 3,441 TLS, among others, each with fewer than 100 co-citations. The most frequently cited authors are categorised into four distinct clusters and represented by different colours. Cluster 1 (Red) comprises 54 authors, all of whom have contributed significantly to sentiment analysis research. Cluster 2 includes 28 authors renowned for their work in applied sentiment analysis. Cluster 3 consists of five authors, and Cluster 4 (Yellow) includes four authors.

6.11. Highly Cited Publications

This analysis highlights the highly cited publications on sentiment analysis by UAE scientists and researchers. Among the 243 publications considered, fifteen have garnered at least 50 citations each (Table 3). The article titled *'Sentic LSTM: a Hybrid Network for Targeted Aspect-Based Sentiment Analysis,'* authored by *Ma et al.,* and published in Cognitive Computation in 2018, holds the highest citations (*n* = 216). It is followed by the conference paper titled *'A Large-Scale Arabic Sentiment Lexicon for Arabic Opinion Mining Topics,'* authored by *Badaro et al.,* with 133 citations, presented in the Proceedings of the EMNLP 2014 Workshop on Arabic Natural Language Processing (ANLP) in 2014. Additionally, the article *'Topics, Trends, and Sentiments of Tweets about the COVID-19 Pandemic: Temporal Infoveillance Study,'* authored by *Chandrasekaran et al.,* has received 126 citations and was published in the Journal of Medical Internet Research in 2020. Another noteworthy publication is the conference paper *'CAMeL tools: An open-sourcePython toolkit for Arabic natural language processing,'* authored by *Obeid et al.,* with 90 citations, presented at the 12th International Conference on Language Resources and Evaluation in 2020.

The remaining publications have received fewer than 90 citations. These highly cited publications are primarily from 2018 (*n* = 4), followed by 2019 and 2020, each with 3 publications. Additionally, there are 2 publications from 2017 and one from 2014, 2016, and 2021.

6.12. Retrieval Indexed Keywords

Keyword occurrence analysis was conducted using VOSviewer visualisation software. With a minimum occurrence of one keyword, 1,639 keywords were indexed in the research output. Among these 1,639 keywords, 81 were highly occurring, with a minimum of 5 occurrences, as visualised in Figure 10. The term '*Sentiment Analysis*' had the highest occurrence in research output, with 211 instances and 913 link strengths. It was followed by '*Social Networking*' (66 occurrences, 394 TLS), '*Data Mining*' (58 occurrences, 324 TLS), '*Social Media*' (42 occurrences, 217 TLS), '*Machine Learning*' (41 occurrences, 234 TLS), '*Natural Language Processing*' (41 occurrences, 218 TLS), '*Deep Learning*' (34 occurrences, 200 TLS), and others with fewer than 200 occurrences. These retrieval indexes were divided into six separate clusters, each represented by different colours. Cluster 1 (Red) contains 26 items, including '*Sentiment Analysis*', '*Data Mining*', '*Natural Language Processing*' and others related to purely sentiment research publications. Cluster 2 (Green) includes 18 items, such as '*Social Networking*', '*Deep Learning*', and '*Social Aspects*' related to social tagging for sentiment research. Cluster 3 (Blue) contains 13 items, including '*Learning Systems*', '*Learning Algorithms*', and '*Support Vector Machine*' representing processing tools for sentiment research. Cluster 4 (Yellow) consists of 12 items, including '*Artificial Intelligence*', '*Forecasting*', and '*Commerce*', related to applications of sentiment analysis. Cluster 5 (Violet) includes 10 items like '*Social media*', '*Twitter*', and '*Facebook*' grouped for social networking tools. Cluster 6 (Sky) contains only 2 items, '*Sentiment Classification*' and '*Students*'.

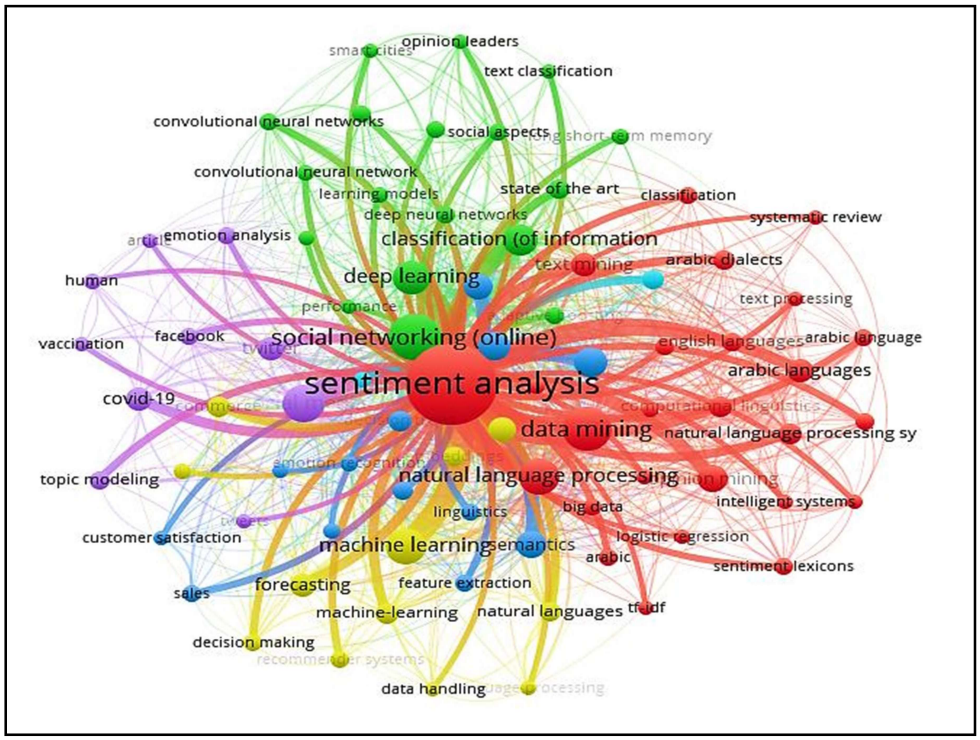

Figure 10. Network Visualisation of Retrieval Indexed Keywords

7. Major Findings

The following are the major findings of the study;

i) The study underscores the growth and impact of publications over the years, with the year 2022 standing out as the most productive year. However, it's essential to consider the context and specific factors influencing these metrics to better understand the research landscape.

ii) It is discovered that there is a 0.46 association between publications and citations. This indicates a weaker correlation between publications and citations. The most prolific author is *K. Shaalan* from the *British University.* The most productive UAE authors have worked with academic research from five other nations, including *Lebanon, Pakistan, the UK, Qatar, and Egypt*.

iii) The UAE has the highest level of collaboration with the *United Kingdom*, followed by collaborations with *Pakistan* and *India.*

iv) The highly productive institutions are *Zayed University, British University, University of Sharjah, Birla Institute of Technology and Science, United Arab Emirates University,* and *University of Wollongong*.

v) It reveals that most publications are unrestricted open access, followed by Gold-accessible, Bronze-accessible, Green-accessible, and Hybrid Gold-accessible. The results unequivocally underscore *K. Shaalan's* prominence as the most frequently co-cited author within the UAE's scientific community, followed by *E. Cambria, N. Habash, B. Liu, and S.A. Salloum*.

vi) Moreover, "*Sentiment Analysis*" emerged as the predominant keyword in research publications, signalling its prevalence. It was succeeded in frequency by '*Social Networking' 'Data Mining', 'Social Media', 'Machine Learning', 'Natural Language Processing'* and *'Deep Learning*' highlighting the key themes and areas of focus in the scholarly discourse.

8. Conclusion

This study shows the literature growth of UAE on sentiment analysis and the development of research institutes and their future scenario. Sentiment Analysis is an important and dominant evaluation area for industries, businesses, and other disciplines. Sentiment Analysis tools reveal the hidden errors and quality or drawbacks of products and services in the current scenario. In the present study, the evaluation of the productivity of the UAE shows an impact on the growth and advancement of the country in sentiment analysis research. This work was made important by the scope and limitation, which is sentiment analysis applied in every discipline and limited to the country UAE's richness of natural resources.

Abbreviations

- **AGR** - Annual Growth Rate
- **FA -** First Author
- **C -** Country
- **CA -** Corresponding Author
- **CPP** - Citation Per Paper
- ***h*-I** - *h*-Index
- **HC**-Highest Citations
- **ML -** Machine Learning
- **NLP** - Natural Language Processing
- **OC -** Other Countries
- **OMSA** - Opinion Mining Sentiment Analysis
- **RCI** - Relative Citation Impact
- **SA** - Sentiment Analysis
- **TA** - Total Authors
- **TC** - Total Citations
- **TLS** - Total Link Strength
- **TP** - Total Publications
- **WOS** - Web of Science

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