Bibliometric Visualisation of AI Research in Arab Countries (2013–2025): Emerging Trends, Gaps, and Future Directions

Modhi Lafta Mutar[1], Asaad Shakir Hameed[2*], Zakir Hussain Ahmed[3],
Zainab Sameer Gatea[4], Ruwaidah F. Albadri[5] and Arwa Abdullah Alsalman[6]

[1]Presidency of the University, Shatrah University, Thi-Qar, Iraq
[2*]Presidency of the University, Shatrah University, Thi-Qar, Iraq; Mazaya University College, Thi-Qar, Iraq
[3]Department of Mathematics and Statistics, College of Science, Imam Mohammad Ibn Saud Islamic
University (IMSIU), Riyadh, Saudi Arabia
[4]State Company for Gas Filling and Services Branch of Thi-Qar, Ministry of Oil, Iraq
[5]ICT Department, Technical Institute of Samawah, Al-Furat Al-Awsat Technical University, Al-Muthanna, Iraq
[6]Department of Educational Sciences, Majmaah University (MU), Al-Majmaah, Saudi Arabia
E-mail: [1]dr.modhi.aljashami@shu.edu.iq, [2]dr-asaad@shu.edu.iq, [3]zaahmed@imamu.edu.sa,
[4]engzainabgatea@gmail.com, [5]ins.rod@atu.edu.iq, [6]ar.alsalman@mu.edu.sa
ORCID: [1]https://orcid.org/0000-0002-3038-8507, [2]https://orcid.org/0000-0001-5979-6232,
[3]https://orcid.org/0000-0003-1938-6137, [4]https://orcid.org/0009-0002-2541-4405,
[5]https://orcid.org/0000-0002-0089-1953, [6]https://orcid.org/0000-0001-7014-6775

Abstract - **Artificial Intelligence (AI) has become a key driving force of global digital transformation, with Arab international locations increasingly prioritising its adoption through country-wide techniques, which include Saudi Vision 2030 and Oman Vision 2040. Despite this momentum, AI studies output within the location stays thematically slender and fragmented, restricting its worldwide effect. This examines ambitions to map and compare the AI studies panorama in Arab countries, pick out rising tendencies, and find underdeveloped domain names requiring further scholarly attention. Data had been retrieved from the Scopus database, yielding 3,583 studies from 2013 to 2025, which have been passed through several filtering phases to arrive at 1405 documents. Using VOSviewer, the evaluation included co-authorship networks, keyword co-prevalence, and quotation styles. Results suggest that studies' pastime is focused among a restricted variety of prolific authors and institutions, with susceptible cross-country collaboration. The most often used terms are Deep Learning (DL), Saudi Arabia, ChatGPT, Machine Learning (ML), and Artificial Intelligence (AI). Research on COVID-19 accounted for 3.9% of the overall output, suggesting a brief shift toward healthcare packages and public health. Many concerns remain about Arabic natural language processing (NLP), regional datasets, AI ethics, and interdisciplinary programs. In order to strengthen the Arab region's position in global AI research, the low common citation impact emphasizes the necessity of excellent institutional coordination, theme diversification, and alignment with strategic national visions.**

Keywords: **Artificial Intelligence, Chatgpt, Artificial Intelligence Applications, Arab Countries**

I. INTRODUCTION

1.1 Background and Context

The rapid growth of AI has affected governance, healthcare, finance, and transportation (Sharma et al., 2020; Zuiderwijk et al., 2021). From 2013 to 2023, the number of AI papers worldwide increased by more than 300 times, primarily due to deep learning and large language models (LLMs). The introduction of ChatGPT in 2022 has caused a notable change in how AI is used by the general public, claim. AI is at the forefront of digital and economic progress, according to national initiatives implemented by nations like the United Arab Emirates and Saudi Arabia. (Farhi et al., 2023) highlighted that educational integrity has beneficial and worrying implications for using ChatGPT in education (Elsadig, 2024).

Nevertheless, a significant part of the Arab world remains behind in terms of the number of research findings and concrete AI applications (Li et al., 2023; Lim et al., 2024). Moreover, AI adds to the GDP by 2030, and Saudi Arabia makes its economy diversified by being a global centre of technology. According to its Vision 2030 program, it has introduced the most ambitious and superior change plan in the Kingdom of Saudi Arabia (Al-Jehani et al., 2021; Alattas, 2024). In the context of the current realisation of the 2030 Vision of Comprehensive Development of Higher Education in Saudi Arabia, (Alotaibi & Alshehri, 2023) analysed that the concept of artificial intelligence (AI) integration has been considered to become an overarching goal in the context of activities related to many higher education institutions in the country (Mehra & Iyer, 2021). The COVID-19 pandemic

revealed additional gaps in digital infrastructure and raised the importance of AI in areas related to bridging the gap in public health, supply chains and remote services (Shetty & Kapoor, 2024; Haleem et al., 2022; Haleem et al., 2022; Jabali et al., 2022). In conclusion, recent study (Sureshkumar & Mahabub Basha, 2025) indicated that while AI can enhance academic performance, learner engagement, and personalized instruction, it may also undermine social communication skills and foster an excessive reliance on automated decision-making at the expense of critical thinking and independent problem-solving.

1.2 Problem Statement

The Arab world has a minimal presence in the global research in AI, with little publication impact (Filippi et al., 2023), and it is slow at adopting advanced model research such as Machine Learning (ML) and Deep Learning (DL). This deficit restricts the region from implementing AI in the most essential areas, including medical practice, education, and government. There are poor research ecosystems and low cross-institutional cooperation that limit advancement.

1.3 Regional Background

There has been a global impetus on the implementation of artificial intelligence (AI); however, there is an existing imbalance in terms of research publication, utilisation of contemporary AI technologies, as noted by (Pal, 2023), in addition to application within areas of work. Although some countries, including Egypt, Saudi Arabia, and the UAE, have introduced national AI strategies, backwardness among Arab countries remains regarding the use of context-aware advanced models of AI, as described by (Qasrawi et al., 2023; Rahman et al., 2022; Razavi et al., 2022), including DL and ML, etc., in both academic and practical investigations (Purnama et al., 2024).

1.4 Scope of the Study

The publication performs a bibliometric analysis of the publications concerning AI in the context of Arab countries from 2013 to 2025. It does, however, focus on trends in research output, the growth of post-COVID-19 themes, the adoption of modern AI technologies (such as DL, ML, ChatGPT, and so forth), and industry representation. The goal is to identify gaps and offer suggestions to bring regional research more closely in line with worldwide trends in artificial intelligence.

1.5 Research Questions

1. How extensively has advanced AI equipment been adopted in Arab research agendas, considering the period from 2013 to 2015?
2. In what methods did the pandemic reshape AI research priorities within the vicinity?
3. What is the comparative effect of Arab scholars on AI improvement and realistic use?
4. Which underexplored regions in AI require more educational awareness?

1.6 Research Objectives

i. To examine the extent of modern AI, particularly in deep learning (DL), machine learning (ML) and ChatGPT that have been integrated into Arab research agendas post-2019,

ii. To analyse how the COVID-19 pandemic influenced the thematic orientation of AI research in the Arab region,

iii. To compare the contributions of Arab authors to AI studies and their impact on its implementations, and

iv. To identify research gaps and underdeveloped domain names within AI implementations, providing insights into regions requiring additional scholarly attention and innovation.

II. LITERATURE REVIEW

2.1 Global Bibliometric Trends in Artificial Intelligence

The bibliometric analysis has emerged as the best way of monitoring the development of artificial intelligence (AI), as mentioned by (Dwivedi et al., 2023), as a scientific discipline. Besides, bibliometric analysis has shown publication growth on AI to be exponentially growing in the last 13 years, but particularly accelerating since 2013 because of gains in computational capability and access through open-source libraries, in addition to model training on cloud platforms. According to the 2023 AI Landscape Report by Elsevier, the number of publications on the topic of AI climbed to more than 270,000 in 2022, up about 80,000 from 2013, with deep learning, computer vision, and natural language processing (NLP) among the most popular sub-subgroups.

The current research worldwide has been aimed at research clusters and institutional networks. For instance and (Wider et al., 2023; Yao et al., 2024) conducted a co-citation analysis and a co-occurrence of keywords to map the global AI research clusters and found that the interdisciplinary intersections between AI and other domains, including medicine, economics, and environmental science, have increased. Although the studies have traced the history of AI research, not many of them have incorporated the disruptive effect of the COVID-19 pandemic on the direction of AI research. The exceptions are (Wichmann et al., 2022), who demonstrated that there were substantive increases in the number of AI-related publications on pandemic-related concerns that included medical diagnostics, epidemic modelling, digital contact tracing, and many others.

2.2 Regional Focus-Bibliometric Studies in Arab Countries

Locally, there has been some piecemeal charting of the Arab world AI research landscape, sometimes as part of larger surveys on digital change or science innovation. (Rehman et al., 2022) analysed the state of AI research in the GCC countries through the information provided by Scopus and found that the number of publications was growing in the last several years, between 2015 and 2020. However, merely analysed the quantity of publications and metrics of citations

without any disaggregation by theme and emphasis on what happened after the pandemic. More importantly, Arab academic literature has not been explicitly examined in the context of adopting or including modern forms of AI, including the transformers, diffusion models, or the LLMs, included in existing regional studies (Bordbar & Shirazi, 2019).

2.3 The Missing Link- Post-COVID Shifts and Frontier AI Models

The pandemic of COVID-19 has radically redefined the priorities of research worldwide, speeding up the process of incorporating AI in medical practice, logistics and solutions to any number of problems in the delivery of services to the population. Among the research activities thriving during the period 2020-2022, (Goyal et al., 2025) analysed that one can distinguish AI-based diagnostic tools, NLP-based chatbots to support mental health, and predictive analytics to enable effective resource allocation. However, in 2025, a thorough bibliometric work mapping these trends in publications within the Arab countries was not found.

Most of the Arab academic works have failed to reflect the global trend on the frontier of AI, such as LLMs, multimodal AI, and self-supervised learning. For instance, the preliminary analysis of our current data indicates that less than 5.0% of the AI-related articles produced by Arab institutions in 2013-2025 mention the LLMs or reference them. In contrast, only 3.1% of the articles involving transformer-based models apply a variant of this model.

2.4 Thematic Applications- Healthcare, Governance, and Education

A substantial literature already exists on the thematic uses of AI worldwide, especially in healthcare, governance, and education components that experienced a dramatic improvement throughout and post-COVID-19.

Healthcare: Worldwide, the potential implications of AI in the healthcare field have matured, and deep learning and computer vision models are applied in radiology, oncology, genomics, and diagnostics. Describe that epidemiological models, vaccine logistics and symptom triage were all developed at a rapid speed through AI models during COVID-19. Moreover, an Arab Web of Science scan from 2020 to 2024 reveals that healthcare AI publications are scarce, with only 8.7% of total AI publications. In contrast, worldwide, 19 to 22% of total AI publications are healthcare related.

Governance: Another potential area is the application of AI to e-governance, policy analytics, and digital services to citizens. Further, LLMs are starting to be used around the world in the same capacity, helping to draft law, automatically translate, and in civic engagement applications. Nevertheless, there is a lack of development in this aspect among Arab-region AI researchers (Almaqtari et al., 2024). Since developments have occurred primarily in the past few years, especially in the areas of digital governments and artificial intelligence-based visa processing systems (see the UAE, the NEOM regions in Saudi Arabia, etc.), few scholars have aspired to reflect on them to date.

Education: AI-driven learning with the application of NLP, adaptive learning, and multimodal analytics has thrived in the post-COVID world. Instead, most of the research done by the Arabs in this area has been restricted to fundamental machine learning utility to identify plagiarism or grades. (Faraji et al., 2022; Farhi et al., 2023) say that the potential of LLMs in automatic adaptivity, intelligent tutoring systems, and language translation has not been investigated systematically or localised within the Arabic academic environment.

2.5 Theoretical Framework- Scientometrics and Innovation Diffusion

The study is a scientometric study that looks at science, science communication and scientific performance using quantitative methods. (Zhang et al., 2024) highlight that co-authorship analysis, keyword co-occurrence and citation mapping are scientometric instruments that allow robust methodology in terms of tendencies, gaps and networks of research in the academic field. When used in the analysis of AI, these tools help elucidate the pattern of research interests, inter-institutional, and the infiltration of emerging technologies in scholarly productions. The innovation diffusion theory assumes that the process of technological implementation is determined on the foundation of a bell-curve model, the aspects of communication channels and social systems, in addition to the nature of the innovation. In the case of the Arab, this framework supports the idea of the relatively uneven academic absorption of modern AI tools, even in the face of potent driving forces in the state and trends.

III. RESEARCH DESIGN

The study follows a quantitative bibliometric approach that was used to examine the academic environment of the artificial intelligence (AI) research in Arab states during 2013-2025. As (Gan et al., 2022) stated, the bibliometric analysis is a quantitative method that offers a way of analysing the ways of publications, theme development, and collaboration patterns of scientific disciplines using data. When analysing the paradigm of AI that appeared at the frontier, namely deep learning, transformer-based models, and large language models (LLMs), (Liu et al., 2024) mentioned that morphological is a good design to use. Additionally, (Razavi et al., 2022) and (Zaidan et al., 2024) point out that a comparative approach of time is used in the research in the study that is seeking to determine the effects of the COVID-19 pandemic.

3.1 Search Strategy and Data Collection

Providing an efficient and accurate bibliometric examination, an organised search method was applied on the Scopus library, which has gained much prestige due to its level of coverage of peer-reviewed literature in the areas of science,

technology, and the social sciences. The use of Scopus was selected because of its good inclusion policy and powerful measurement devices that play an important role in the comparative study of scientific production in languages such as AI in the Arab countries.

To carry out an enhanced bibliometric analysis with visualisation techniques in VOSviewer, the dataset must belong to a well-recognised scientific database such as Scopus or Web of Science. The platforms ensure the uniformity of their metadata, citational quality and compatibility with bibliometric tools. This is necessary to generate correct visual maps, authorship graphs and thematic maps that illustrate the real picture and development of AI research in the Arab world.

3.1.1 Formulating Search Queries

The initial move towards information gathering entailed the construction of a well-designed query that recovered the relevant documents in the Scopus database. The specific form of this query was aimed at retrieving scholarly articles related to Artificial Intelligence and ChatGPT regarding the Arab countries. Among the primary search keys, there were such words as: artificial intelligence, machine learning, deep learning, large language model, transformer model, and ChatGPT (Liu et al., 2023). The search was performed based on the TITLE-ABS-KEY field to retrieve the document with relevant information in titles, abstracts, or keywords. They were exported as a CSV with the metadata that may include the title, the authors, the source of the publication, keywords, the abstract, the affiliation to the institution, and the number of citations. The constructed Boolean query employed a set of keywords which included ("artificial intelligence" OR "ChatGPT") AND "Iraq", "Saudi Arabia", "UAE", "Egypt", among others, covering 19 Arab countries along with a more general phrase ("Arab Countries") to increase the retrieval rate of documents.

Identified Search Items are defined as follows:
"Artificial intelligence" OR "ChatGPT" AND ("Iraq" OR "Saudi Arabia" OR "UAE" OR "Egypt" OR "Jordan" OR "Qatar" OR "Kuwait" OR "Oman" OR "Bahrain" OR "Syria" OR "Morocco" OR "Algeria" OR "Tunisia" OR "Sudan" OR "Libya" "Palestine" OR "Lebanon" OR "Mauritania" OR "Yemen"), ("artificial intelligence" OR "ChatGPT" AND "Arab Countries").

According to Lim, Kumar and Donthu (2024), (Haghani, 2023), the refinement step was needed to keep the quality and relevancy of the dataset with high-level bibliometric mapping. Consequently, (Son et al., 2023) highlight that the ultimate data was a credible and concise body of work of AI research in the Arab world within the given time slot. This

thorough investigative search yielded a total of 3,583 documents, covering a diverse array of publication types. Using Scopus was a tactical decision due to its longstanding reputation for providing deep indexing as well as broad multidisciplinary coverage, guaranteeing the acquisition of credible, high-impact scholarly literature pertinent to AI in the Arab world.

3.1.2 Refining the Data Through the Exclusion Procedure

Following the preliminary retrieval, a scientific exclusion method was implemented to beautify the best and relevant part of the dataset. The filtering criteria had been primarily based on each document type and contextual association. As proven in the below Fig, Search Strategy and Data Collection, documents have been excluded if they met any of the following situations:

1. Publications not within the defined date range (2015–2026) – 258 documents removed,
2. In-press articles – 113 removed,
3. Non-peer-reviewed content such as errata, editorials, notes, statistics papers, letters, and retracted documents – a total of 79 files excluded,
4. Less rigorous formats, which include short surveys and e-book chapters – 255 documents removed,
5. Specific focus became additionally located on except conference-associated literature (839 convention papers and 109 convention opinions) and books (10 entries), and
6. Crucially, documents with non-Arab institutional affiliations have been removed (515 files), ensuring the dataset strictly displays AI studies rooted in the Arab instructional and institutional landscape.

After making use of these exclusion standards, the refined corpus consisted of 1,405 excessive-relevance documents, forming the inspiration for the subsequent bibliometric evaluation, the use of VOSviewer. The following Table shows the section Search Strategy and Data Collection in detail (Table I).

A dataset was divided into two points in time: 2013-2019 (pre-pandemic) and 2020-2025 (post-pandemic) to capture the influence of the COVID-19 pandemic on terms related to research in the field of AI. The depiction of emerging artificial intelligence systems, namely transformer architectures and LLMs, particularly in the works by the Arab authors, was given particular attention (Abdelwahab et al., 2023; Khan et al., 2023; Ali et al., 2023; Königstorfer & Thalmann, 2022). Although there was an increase in the interest levels of these technologies globally, it was revealed that there is an underrepresentation of models in the sampled literature.

TABLE I SEARCH STRATEGY AND DATA COLLECTION

Search Strategy and Data Collection	
Formulating Search Queries	
("artificial intelligence" OR "ChatGPT" AND "Iraq" OR "Saudi Arabia" OR "UAE" OR "Egypt" OR "Jordan" OR "Qatar" OR "Kuwait" OR "Oman" OR "Bahrain" OR "Syria" OR "Morocco" OR "Algeria" OR "Tunisia" OR "Sudan" OR "Libya" OR "Palestine" OR "Lebanon" OR "Mauritania" OR "Yemen") and ("artificial intelligence" OR "ChatGPT" AND "Arab Countries")	
Obtaining Documents Via the Scopus Database Search Engine	
3,583 documents found	
Refining the Data Through the Exclusion Procedure	
Filtering Procedure	
Object	*Documents Excluded*
Publications not within the defined date range, 2013 to 2025	*258 documents*
In press	*113 documents*
Erratum	*33documents*
Editorial	*15 documents*
Note	*13 documents*
Data paper	*8 documents*
Letter	*7 documents*
Retracted	*3 documents*
Short survey	*2 documents*
Conference paper	*839 documents*
Conference review	*109 documents*
Book chapter	*253 documents*
Book	*10 documents*
Non-Arab affiliations	*515 documents*
Data Collection After Filtering Procedure	
1405 documents	

IV. RESULTS AND DISCUSSIONS

The findings of this bibliometric analysis represent a focused subset of the general scholarly output on synthetic intelligence in Arab nations, encompassing contributions by individual authors, nations, and educational institutions. These consequences are derived from data retrieved from the Scopus database by using the predefined search phrases mentioned in this examine. By inspecting all articles that met the inclusion criteria, the evaluation provides in-depth information on the local studies landscape, which is finally mentioned in an element within the following sections.

4.1 Leading Authors in AI Research Across Arab Countries

This segment highlights the most influential authors contributing to synthetic intelligence studies in Arab countries, based on their general link energy and citation impact. These leading scholars constitute the core intellectual drivers of the sphere, shaping its thematic route and fostering collaborative networks across the location (Table II).

TABLE II TOP AUTHORS BY TOTAL LINK STRENGTH AND CITATION IMPACT IN AI RESEARCH (2015–2025)

Author	Documents	Citations	Total Link Strength
Salah M.	6	34	1191
Abdelfattah F.	5	31	1188
Dahleez K.	5	31	1188
Mallick J.	5	59	384
Alqadhi S.	5	32	383
Singh A.	5	29	36
Allahham M.	5	60	51
Sallam M.	5	278	28
Syed W.	5	95	15
Rahman A.	5	206	17
Ali N.	5	81	13
Khasawneh M.A.S.	6	23	8
Al-Jumeily D.	5	58	4
Ahmad M.	5	20	0

This assessment in the above Table is conducted on bibliographic coupling using VOSviewer, where the selection criteria requested a minimum of five publications and at least five citations per author. Of the 1405 documents in the dataset, only 14 authors fulfilled these requirements. The key indicator applied in the evaluation is the Total Link Strength (TLS), which quantifies the author's relations with other authors and the weight of their shared references. It

shows the integration, collaboration and impact of an author within the scholarly network. The findings show that Salah M. has the highest TLS of 1191, which demonstrates a significant bibliographic collaboration and engagement with other researchers in the field of AI within Arab countries. He is followed closely by Abdelfattah F. and Dahleez K. with a TLS of 1188, indicating a comparable level of scholarly interconnectedness. These authors are at the core of the AI research ecosystem in the region, and as such, they are highly influential in knowledge creation and dissemination. Ahmad M. (TLS: 0) and Al-Jumeily D. (TLS: 4) seem to sit toward the bottom of the connectivity spectrum. Although they meet the publication and citation criteria, the lower TLS shows a lack of interconnection with the peer research network, likely due to the nature of their independent, specialised fields. This assessment sheds light on the authoritative hierarchy as well as the periphery of author collaboration in AI research among Arab countries within the bibliometric network, as shown in the following Fig. 1.
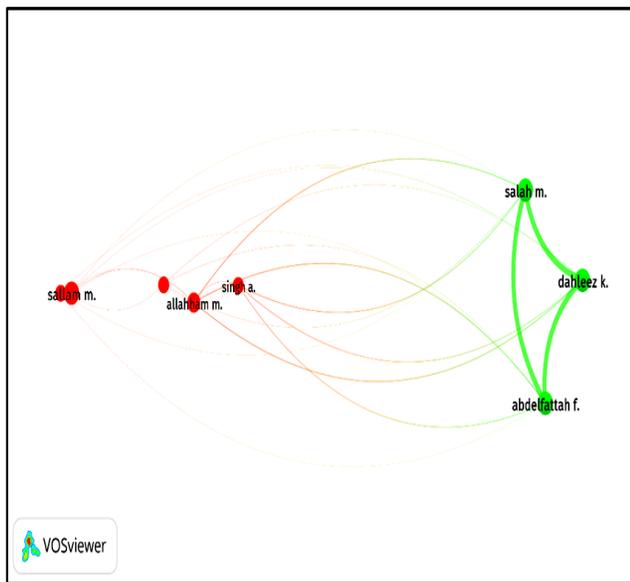

Fig. 1 Graphical Representation of Bibliographic Coupling Among Prominent AI Researchers in Arab Nations

The illustration in the above Fig 1 shows the bibliographic coupling network of the most productive AI researchers from the Arab countries. It captures the heterogeneity of the most productive AI researchers based on their bibliographic coupling. Each author is represented with a node (circle), and the node size is proportional to the document count of that author. The connections (lines) between the nodes indicate the authorship references, citing the same literature with bibliographic references, and the thickness represents the Total Link Strength (TLS) of the nodes.

In the network, two colour-coded clusters are visible.
Green Cluster: Salah M. and Dahleez K. show the strongest bibliographic coupling in the network with Abdelfattah F. Within this cluster, Abdelfattah is the weakest with only two connections, almost forming a sub-network. The links between them are the thickest, meaning that the cited sources overlap considerably, and vector-based positioning places

them next to each other in a densely coupled academic sub-network reflecting the sub-network. Their nodes are relatively large, which means a significant number of publications.

Red Cluster: This cluster is more dispersed and includes authors like Allaham M., Singh A., and Sallam M. Some of these authors have high publication or citation counts (e.g., Sallam M), but the total link strength is lower, which means that the connections are thinner and fewer. This indicates lower interconnectedness, less shared referencing (thematic overlap) and diversity of the work.

The colour difference (green vs. red) indicates different bibliographic communities, i.e., authors in one cluster are more likely to cite a similar set of references that do not overlap significantly with those of the other cluster. This, in turn, reflects two principal streams of thought or intellectual camps within the regional community's research activities on AI.

In summary, this visualisation portrays a picture of collaborative and intellectual cohesion among our primary authors, which seems to be primarily internal (within clusters) rather than across clusters; and that an interdisciplinary pathway might be necessary in creating this long-range link amongst scholars.

4.2 Co-occurrence keywords analysis

Co-occurrence keyword analysis is a bibliometric technique used to become aware of the conceptual shape of a study's area by inspecting how frequently specific keywords appear together in scholarly guides. This approach reveals dominant studies' subject matters, rising subjects, and the interconnections among principles, supplying treasured insights into the highbrow panorama of the field. The following Table shows the results of this analysis:

TABLE III TOP CO-OCCURRING KEYWORDS IN AI RESEARCH FROM ARAB COUNTRIES (2013–2025)

Keyword	Occurrences	Total Link Strength
Artificial Intelligence	604	286
Machine Learning	151	128
Saudi Arabia	100	91
Chatgpt	83	60
Deep Learning	58	58
Covid-19	47	34
Artificial Intelligence (AI)	47	18
Jordan	45	45
AI	39	28
Higher Education	35	37
Education	27	35
Artificial Neural Network	25	12

The evaluation of the results in the above Table is based entirely on the coincidence of creator key phrases extracted from the dataset of 405 files associated with AI studies in Arab worldwide locations. A threshold was set to consist of

the most effective keywords that appeared a minimum of 25 times, resulting in the preference of 12 key phrases out of a total of 4,336. These 12 keywords have been then ranked by using general link energy, which displays the degree of co-prevalence with other key phrases—indicating their centrality and connectivity within the community. (Table III)

The maximum dominant keyword grew to be "artificial intelligence" with 604 occurrences and the satisfactory overall link power of 286, positioning it as the middle thematic axis of the research panorama. This changed into found by using "system reading" (151 occurrences, 128 hyperlink power), indicating a robust subdomain cognisance. Other outstanding terms included "Saudi Arabia" (100 occurrences), "ChatGPT" (eighty-three), and "deep getting to

know" (fifty-eight), reflecting both technological and geographical hobbies in trendy AI research dispositions.

Notably, "COVID-19" seemed 47 times with a moderate hyperlink strength of 34, showcasing its effect on AI research at some stage in the pandemic, specifically in fitness and catastrophe management packages. Similarly, key phrases which incorporate "better schooling", "training", and "artificial neural network" spotlight implemented contexts in academia and clever structures.

Overall, the visualisation derived from this co-occurrence evaluation gives crucial perception into the thematic instructions and interdisciplinary nature of AI research throughout the Arab location, with sturdy clusters around central AI generation, geographic mentions, and societal programs.
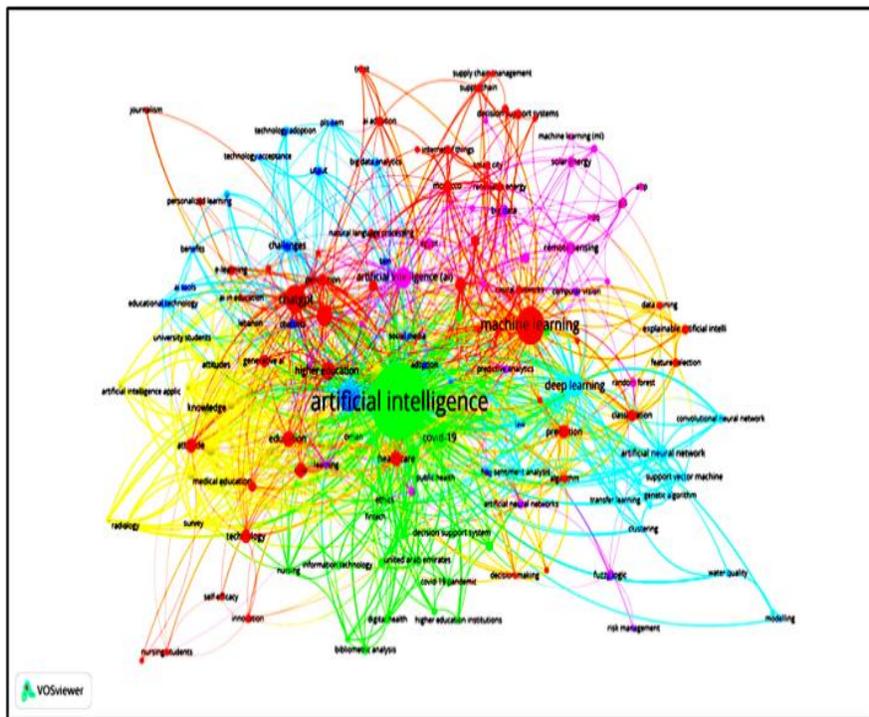

Fig. 2 Visualisation of Keyword Co-occurrence Networks in AI Research Across Arab Countries

The visualisation in the above Fig 2 illustrates the co-incidence community of key phrases utilised in AI-related research across Arab countries, in which every node represents a keyword and its size displays the frequency of occurrence. The largest and most dominant cluster is the inexperienced cluster, targeted around "artificial intelligence", which has the best occurrence and the strongest connections to different terms, including "healthcare", "COVID-19", and "training". This shows that AI programs in healthcare and education are the most prominent research awareness.

The orange cluster represents "gadget mastering" and associated computational techniques, strongly connected to "deep getting to know" (light blue cluster) and "synthetic neural networks". These connections spotlight a widespread emphasis on advanced AI modelling and predictive analytics.

The light blue cluster specialises in technical methodologies like "deep learning", "artificial neural network", and "assist vector device", showing robust methodological research ties. The thickness of the connecting strains between cluster, especially between "artificial intelligence" and "machine learning", as well as "deep learning" displays the highest hyperlink strengths, underscoring the important position of those standards in shaping the regional AI studies landscape. This shape is famous not only for the simplest, most common phrases but also the strongest thematic interconnections, indicating that research in Arab countries is closely focused on AI's technical foundations and its applications in essential sectors, which include health and education.

4.3 Co-citation analysis of cited authors

Between 2013 and 2025, the co-intensity of authors was quoted to highlight the intellectual basis for AI research in

Arab countries analyzed. By implementing the minimum leveling limit of 50, a total of 106 influential authors were identified by 98,907. The ten best co-citation author Wang, Y.; Dwivedi, yk; Sarasted, m.; Hair, cf; Ringle, c. M.; Zhang, Y.; Lee, Y.; Liu, y.; Zhang, J. and Chain, Y. Among them play hair, Ringle, Sarastedt and Dwivedi an important functional role, often quoted for their contribution to quantitative research design and technology that uses models. Their prominence emphasizes that AI studies in the Arab region often produce on the structure established in organizational acceptance of empirical modeling, user behavior and technology. Meanwhile, writers such as Wang, Zhang, Li, Liu and Chen represent current and computational dimensions of research, emphasizing machine learning, data analysis and technical implementation. Thus, the Cum-Prasantiper network reflects two complementary intellectual flow methodological and applied-as at the same time suggests how AI-scholarships develop in Arab countries are based in global research traditions while developing regional approaches and interdisciplinary integration. Table IV shows this analysis as follows.

TABLE IV TOP 10 MOST CO-CITED AUTHORS

Rank	Author	Citations	Total Link Strength
1	Wang, Y.	245	3419
2	Dwivedi, Y.K.	236	4102
3	Sarstedt, M.	235	4765
4	Hair, J.F.	207	3963
5	Ringle, C.M.	200	4132
6	Zhang, Y.	190	2833
7	Li, Y.	176	2705
8	Liu, Y.	171	2579
9	Zhang, J.	159	2575
10	Chen, Y.	157	2244

The co-citation visualization map generated in Fig. 3 the usage of VOSviewer famous 4 principal clusters that illustrate the highbrow structure of AI studies in Arab countries between 2013 and 2025. as follows.
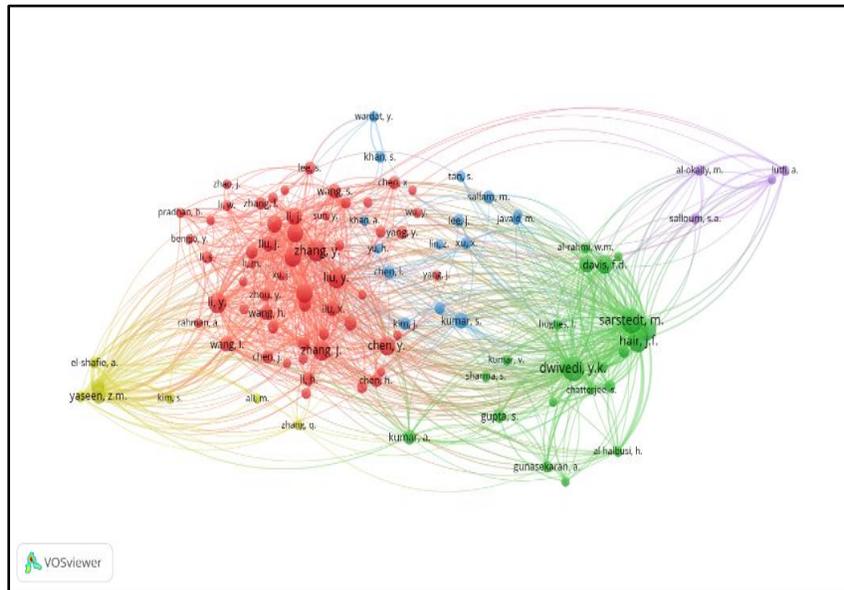

Fig. 3 Visual Representation of the Co-Citation Network of Authors in AI Research Conducted Across Arab Countries

The computational and technical underpinnings of artificial intelligence (AI) are represented by the red cluster, which is dominated by authors like Zhang, Y., Li, Y., and Chen, Y., with an emphasis on machine learning, deep learning, and applied algorithms. With a focus on quantitative modeling and technology adoption frameworks that are frequently used in social and organizational AI studies, the green cluster which comprises Sarstedt, M., Hair, J.F., Ringle, C.M., and Dwivedi, Y.K. reflects the methodological and behavioural aspects of AI research.

The blue cluster serves as a link between computational and applied viewpoints by bringing together interdisciplinary academics that study both technical and contextual elements of artificial intelligence. The purple cluster, which includes Al-Okaily, M., Salloum, S.A., and Lutf, A., is made up of up-and-coming Arab academics who are interested in context-specific and localized AI applications that are pertinent to Arab nations. Lastly, the yellow cluster, which is headed by Yaseen, Z.M. and El-Shafie, A., represents regional applied AI research initiatives with a focus on engineering, environmental modeling, and hybrid intelligent systems. It is a crucial but ancillary link to the global AI research network.

The graphic, taken as a whole, emphasizes the growth and diversity of AI scholarship in the Arab world by integrating regional applied research trends with worldwide methodological influences.

4.4 Analysis on Time Zone View of Keywords

This section presents an analysis of research keywords based on their respective time zones. Although the Arab world spans a variety of regions, it is largely within UTC+1 to UTC+3, and shows minimal temporary variation. Thus, the focus is on thematic differences between countries rather than differences over time. Table V recorded the results of this analysis as follows.

TABLE V DISTRIBUTION OF KEYWORDS AND TIME ZONES

Country	Time Zone	Keywords Count
Saudi Arabia	Asia/Riyadh	124
Egypt	Africa/Cairo	98
Algeria	Africa/Algiers	85
United Arab Emirates	Asia/Dubai	64
Morocco	Africa/Casablanca	53
Tunisia	Africa/Tunis	49
Jordan	Asia/Amman	38
Qatar	Asia/Qatar	22
Lebanon	Asia/Beirut	20
Oman	Asia/Muscat	17

The analysis of the Arab countries' Time Zone View of Keywords famous that regardless of spanning distinctive areas, the Arab global operates within a narrow range of time zones (UTC 1 to UTC 3), ensuing in minimal temporal variant in studies pastime. Instead, the principal differences seem within the thematic recognition of every us of a's key phrases. North African countries consisting of Algeria, Morocco, and Tunisia basically inside the Africa/Algiers region (UTC 1) tend to emphasise subjects like artificial intelligence, fuzzy logic, renewable electricity, and optimization, reflecting sturdy interest in implemented computational and strength research. Meanwhile, Egypt and neighbouring nations within the Africa/Cairo sector (UTC 2) cognizance heavily on water management, nanotechnology, sun power, and public fitness, mirroring nearby demanding situations related to sustainability and resource efficiency. In the Gulf area, along with Saudi Arabia, the UAE, and Qatar, placed specially within the Asia/Riyadh region (UTC 3), studies key phrases deal with machine gaining knowledge of, IoT, smart cities, and blockchain, showcasing a pressure towards virtual transformation and innovation-pushed economies. Overall, while Arab nations share similar working and publication cycles due to time alignment, the diversity of studies topics demonstrates awesome national priorities across the place.

4.5 Keyword Burst Analysis

Table VI presents the Keyword Burst analysis for studies outputs from Arab nations, this analysis highlighting intervals of speedy increase or 'bursts' inside the usage of specific key phrases over the years. A key-word burst shows an unexpected boom in attention or research hobby in a subject. The analysis makes use of guide 12 months statistics from Scopus data, making use of a five-year rolling z-rating to discover massive surges ($z \geq 2.0$) in keyword frequencies.

TABLE VI KEYWORD BURST SUMMARY

Keyword	Burst Start	urst End	Peak Year	Peak Z	Duration (Years)
ANN	2018	2018	2018	2.0	1
Challenges	2020	2020	2020	2.0	1
GIS	2018	2018	2018	2.0	1
IOT	2020	2020	2020	2.0	1
OMAN	2021	2021	2021	2.0	1
Solar Energy	2021	2021	2021	2.0	1
United Arab Emirates	2019	2019	2019	2.0	1

The burst detection results screen brief, focused durations of surprising research attention throughout particular keywords in Arab countries. Each key-word experienced an unmarried-12 months burst, indicating a fast but time-bounded upward push in relevance. For example, "ANN" and "GIS" each peaked in 2018, reflecting early interest in computational modeling and geospatial technologies. In evaluation, "IoT" and "challenges" surged in 2020, marking a shift closer to applied digital structures and hassle-orientated studies subject matters.

By 2021, the emergence of "Oman" and "solar energy" shows developing studies engagement with countrywide improvement contexts and renewable power tasks, respectively. The keyword "United Arab Emirates" showed a wonderful burst in 2019, probable tied to united states-precise innovation applications and coverage-driven studies enlargement.

What makes this table especially treasured is its precision in pinpointing when every study subject matter emerged sharply, rather than displaying the general volume of publications over time (as within the discern). It captures the moment of acceleration — when attention to a subject spiked unexpectedly permitting clearer identity of evolving priorities inside the Arab scientific landscape.

V. LIMITATIONS

Although this way is a strong model to conduct a bibliometric investigation, some limitations of it should be acknowledged. First, (Angulo et al., 2021) describe that focusing on the English-language publications and indexing them in Scopus might have excluded relevant research that is not published in English or geographical journals. Second, the limitation of affiliation-based filtering may leave out the contributions of the Arab scholar who works at non-Arab institutions.

VI. EMERGING TRENDS IN AI RESEARCH

The bibliometric evaluation of 1,415 AI-associated guides from Arab international locations highlights several dominant and emerging issues. The maximum frequent key phrases—Artificial Intelligence (47.9%), Machine Learning (12%), and Saudi Arabia (7.9%)—underscore the centrality of middle AI technologies and their sturdy geographical representation within the local research panorama. Other full-size terms, inclusive of ChatGPT, Deep Learning, and COVID-19, contribute to the rising effect of generative AI, advanced computational models, and pandemic-driven improvements. The routine presence of themes associated with Health, Education, and Data Analysis indicators a sustained and growing interest in leveraging AI for essential societal sectors, aligning with broader virtual transformation agendas along with Saudi Vision 2030 and Oman Vision 2040. Collectively, those patterns indicate a maturing AI studies environment inside the Arab world, characterised by each technological advancement and strategic utility in high-impact domains. Fig 4 presents the proportion distribution of the top co-occurring keywords recognised on this evaluation,

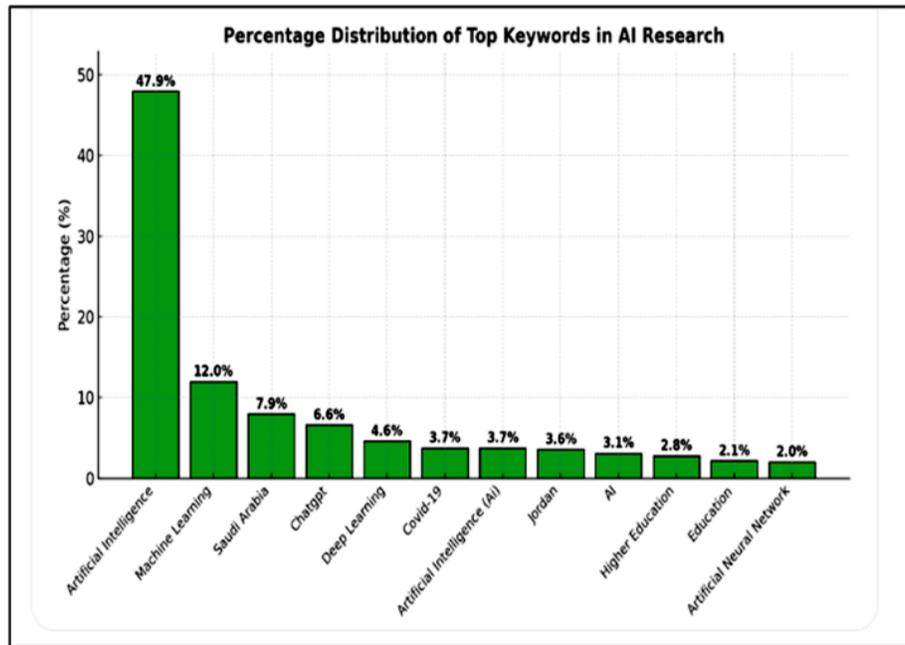visually illustrating the thematic dominance of AI-associated ideas and their interconnections (Fig 4).

Fig. 4 Top Emerging Trends in AI Research based on keyword frequency in publications from Arab countries

VII. RESEARCH GAPS AND UNDERDEVELOPED DOMAINS IN AI APPLICATIONS

The study points to a scattered and different level of interest in modern AI in Arab research agendas since 2019. The use of the large language models (LLMs) and deep learning, as mentioned by (Dwivedi et al., 2023; ElObeidy, 2013; Zhang et al., 2024), has become widespread in the global academic community, yet Arab countries contribute to it modestly and in a concentrated manner (Malik et al., 2023; Mizumoto & Eguchi, 2023). This is corroborated by the fig, where country diversity is absent (mean = 1.2) and there is no difference in institutional affiliation- all the observations are of one institution. Despite the slight diversion with the focus on communicative and healthcare-related research during the COVID-19 pandemic, discussed by (Younes & Altakhaineh, 2022) and (Al-Jumaili et al., 2023), the application of high-tech AI solutions has not advanced considerably, in contrast to the other areas (Goyal et al., 2025). Even though some of the articles written by Arabs have been published in high-impact journals, analysed by (Amin et al., 2023; Danish & Senjyu, 2023), the citation analysis has demonstrated a low level of academic impact, with the average of 6.8 and Skewness of 1.73, which depicts that most of the publications are not referred to and cited (Zhang et al., 2024).

The absence of representation in the fundamental areas, including healthcare, governance, and Arabic natural language processing (NLP), further highlights the gap between the development of AI around the world and its engagement in the Arab scholarly interest (Lv et al., 2024; Almaqtari et al., 2024; Mahmoud & El-Hamayed, 2016). This trend shows a delayed adoption curve in line with the theory of innovation diffusion, as pointed out by

scientometric tools. The mapping done with the help of VOSviewer confirms that studies of Arab researchers are thematically sporadically distributed and lightly grouped. Attention towards frontier technologies such as transformers or LLMs is insignificant.

Collectively, the results suggest that institutional cooperation must be enhanced, subject to diversification and policy-based incentives used to bring the Arab research in AI closer to international patterns. Furthermore, a lack of consistent collaboration across North African and Gulf countries may be hindering the development of region-specific solutions. Moreover, AI used in the humanities and social sciences is underdeveloped, and this is an opportunity for increased academic integration.

VIII. CONCLUSION AND RECOMMENDATIONS

The trend toward AI research in the Arab world has been on an upward scale, and machine learning, healthcare, education, and intelligent systems are getting significant attention. Nevertheless, there is a need to strategically align to fill the existing gaps in language technologies, cross-sector integration, and regional cooperation. Policymakers and academic institutions are supported to invest in infrastructure, develop interdisciplinary work and develop localised datasets and solutions. The enhancement of the collaboration between Arab nations can increase knowledge exchange and rapid innovation according to the local requirements. Ethical, inclusive applications of AI and culturally relevant uses of AI must be prioritised in future studies.

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