West Science Interdisciplinary Studies
Vol. 02, No. 01, January and 2024: pp. 188-196

Revealing The Academic Terrain: A Bibliometric Analysis of AI Virtual Reality Research Patterns

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ABSTRACT

"Revealing the Academic Terrain: A Bibliometric Analysis of AI Virtual Reality Research Patterns," the author explores the complex field of academic works that investigate the relationship between artificial intelligence (AI) and virtual reality (VR). Using bibliometric techniques, we carefully investigate the development, patterns, and influential figures in this ever-changing subject. Our investigation reveals the intricate network of academic publications, clarifying trends in publishing trends, cooperation networks, and topical areas of interest. Our study offers useful insights for scholars, practitioners, and policymakers who want a thorough grasp of the present and potential future orientations of AI virtual reality research by negotiating this scholarly landscape.

Keywords: *Research on AI Virtual Reality, Evaluation of Bibliographic Information, Scholarly Writings, Trends in Publications, Collaboration Networks*

1. INTRODUCTION

The field of big data-driven product design is flourishing as a result of the advancements in 5G and the Internet of Things. Furthermore, as a result of recent advancements in processing power and software structures, artificial intelligence (AI) is also developing. The digital twin is a cutting-edge technology that links the real and virtual worlds. It does this by using artificial intelligence (AI) algorithms to analyze a variety of sensor data. Various sensors are particularly useful in this context as they help gather environmental data. The high power consumption and frequent need for battery replacement of current sensor technologies—such as cameras, microphones, inertial measurement units, etc.—remain an issue despite their widespread usage as sensing components for a variety of applications. Self-sustaining and low-power sensors can be realized through the use of triboelectric nanogenerators, or TENGs, as a viable platform [1].

It is a difficult task to train a contemporary ophthalmic surgeon. Innovative techniques to practice surgery in low-risk simulators, evaluate and improve abilities in the operating room using video content analytics, and learn from seasoned surgeons remotely can all be beneficial to microsurgical education. We may be able to explore new avenues for instruction and improve upon existing methods of education thanks to advancements in upcoming technology. Surgery tracking and assessment may be made easier with the use of artificial intelligence, which has already been applied extensively in ophthalmology. Growing possibilities for simulating and observing operating rooms have been made possible by immersive technology thanks to the development of virtual reality head-mounted displays. The uses of these technologies are examined here, and their future in ophthalmic surgical education is discussed [2].

This article examines possible areas of overlap between the developing field of virtual reality research and philosophy. With an eye towards an interdisciplinary readership, it puts forth a number of novel research objectives through the presentation of a variety of tangible instances that exhibit strong theoretical significance and heuristic fertility. These include the conscious experience

itself, social and "Bayesian" virtual reality, amnestic re-embodiment, the fusion of human-controlled avatars and virtual agents, virtual ego-dissolution, the manipulation of the reality/virtuality continuum, the interaction between VR and AI, fMRI and VR, VR-based social hallucinations and the rise of a virtual Lebenswelt, religious faith, and practical phenomenology. With any luck, these instances might indicate some possible new study topics and function as first suggestions for more intensive future involvement [3].

Accidents in the operating room (OR) are rare but terrible occurrences. Handling OR fluids improperly might cause harm, even death. With the goal of effectively training clinicians to respond correctly to OR crises, we have created an artificial intelligence (AI)-based virtual trainer for OR emergencies that is based on the SAGES FUSE curriculum and the "fre triangle" theory. In order to help with training, the simulator can anticipate the user's actions in the virtual OR and give them prompt feedback. We looked at the reliability of the AI-assisted OR fre training at the SAGES Learning Center for 2019 [4].

The motions and pressures of simulated instruments are tracked by virtual reality simulators, creating massive datasets that may be further examined using machine learning methods. The comprehension, evaluation, and training of psychomotor performance may all benefit from these developments. As a result, there is a rise in the quantity and complexity of articles that cross the boundaries of computer science, medicine, and education due to the use of machine learning techniques to assess performance on virtual reality simulators. Despite the fact that research in this area has benefits for all disciplines, there are significant reporting differences that restrict cross-disciplinary communication and information transfer. Our goal was to create a checklist that would serve as a broad foundation for doing research on the use of machine learning algorithms with virtual reality simulations. Both writers and reviewers may quickly evaluate the general quality and particular shortcomings of a paper by referring to the clear subsections of the checklist and the overall score [5].

The quality of life is significantly impacted by perceived cognitive decline, which is a common complaint among elderly individuals with mild cognitive impairment (MCI). Caregivers see a subtle decline in their relative based on behavioral changes, even if the condition cannot be diagnosed as dementia. Most importantly, it can quickly progress to dementia if doctors do not identify this illness in time. Therefore, it is important to recognize MCI early. Virtual reality (VR) and artificial intelligence (AI)-based dimensional assessment methods may be combined with traditional neuropsychological measurements, which form the basis of a categorical diagnostic paradigm. VR may be used to build extremely controlled ecological simulations that mimic real-world environments similar to those where patients often do their instrumental activities of daily living (IADLs) [6].

As contemporary training has evolved, more sophisticated standards, such those for creativity, economy, realism, and safety, have been put forth. The training needs of new technology and equipment against the backdrop of contemporary industry are difficult for traditional training methods to meet. There were serious problems with traditional training approaches. We present the idea that artificial intelligence and virtual reality will help future intelligent training in order to address the challenging technical training issue against the backdrop of the current industry. The core of future training facilities will be virtual reality technology, as we initially stated in this study.

Next, we proposed the use of artificial intelligence as a means of producing clever training examples [7].

Table 1. Researchers on the topic REVEALING THE ACADEMIC TERRAIN: A BIBLIOMETRIC ANALYSIS OF AI VIRTUAL REALITY RESEARCH PATTERNS have conducted some bibliometric analysis

Autrhor & Year	Citation	Source	Research Findings
[6]	63	GOOGLE SCHOLAR	Intelligent systems are developing quickly as a result of recent advances in computer power, software design, and artificial intelligence technologies. Better links between real and virtual items may now be made, and digital twins will be more useful for a wider range of manufacturing and industrial processes. A growing number of sensors are used in digital twin applications. An improved option for implementing low-power/self-sustaining systems will be more effectively utilized with the digital twin thanks to the TENG-based intelligent system. Furthermore, the intelligent system's feature direction depends on sensor fusion with multimodality data. On many different circumstances, intelligent systems are necessary. Process automation and optimization will reach new heights with the use of AI because of its capacity for multimodal physiological signal analysis, accurate feature categorization and prediction of sensor data, and efficient processing of large, multidimensional datasets. Predicting the behavior of extremely complex production systems is another benefit of intelligent systems. However, intelligent systems based on digital twins will both advance and captivate the smart future. One of the essential components of the metaverse are digital twins because of their inherent qualities.[264, 263] As a result, virtual worlds and experiences beyond our wildest dreams could be available to us through the metaverse.
[6]	14	GOOGLE SCHOLAR	Our efforts to combat global blindness should be aided by these cutting-edge innovations, which range from AI surgical support tools to VR-based immersion and training platforms. They should also become our clinical companions as we learn the art of surgery during our residency and throughout our careers. These new technologies, when combined with the lower latency and increased bandwidth provided by 5G wireless, may allow us to "see one, do one, and teach one" through innovative modalities. They may also make high-quality ophthalmic surgical instruction more accessible and reasonably priced globally, offering remote teaching and viewing sessions, virtual operating room simulations, and automated perioperative guidance and feedback. These tools have a lot of potential to help us improve, but they will need to be developed iteratively, standardized, and rigorously validated before being used.
[3]	36	GOOGLE SCHOLAR	This post was primarily meant to serve as an inspiration for an interdisciplinary readership, as the introduction made clear. Through a number of specific instances and potential research initiatives, contact points and future avenues for interdisciplinary interaction between several subdisciplines of philosophy and VR research have been examined. Theories of consciousness and virtual reality (VR) were examined, as well as embodiment and bodily self-consciousness in VR, amnestic re-embodiment (where the user is unaware that they have entered VR), the issue of personal identity in VR, rt-fMRI-NCCF

			(or "walking around in the neural correlate of consciousness" as described by a newly proposed variant of real-time fMRI-based neurofeedback using VR technology), and PSM-actions (i.e., novel forms of actions exclusively initiated in the conscious self-model which causally bypass the nonneural body).
[7]	15	GOOGLE SCHOLAR	AI-assisted simulators provide the opportunity to evaluate knowledge and enhance learning in a secure, repeatable, and immersive setting. Our AI-guided OR fre simulator's efficacy and utility for OR fre training were key factors in proving its validity. The simulator will be used to evaluate OR staff and instruct them on how to react appropriately in the event of an iatrogenic fracture.
[9]	13	GOOGLE SCHOLAR	When creating and evaluating virtual reality manuscripts that employ machine learning to evaluate surgical proficiency in virtual reality simulation, researchers in the fields of computer science, medicine, and education can use the MLASE checklist to assist verify quality. Our checklist, we hope, will contribute to the growing field of machine learning aided surgical education by bridging the knowledge gap between computer science, medicine, and education.
[5]	2	GOOGLE SCHOLAR	In conclusion, the bulk of the literature has examined the use of various combinations of VR, gait kinematic analysis, and machine learning; however, this paper is the first to combine all three approaches and techniques to improve MCI early detection and potentially forecast its course over time. According to Coravos et al. (2019), virtual reality (VR) enables the gathering of "Digital Biomarkers," or physiological and behavioral data, using digital technology. These biomarkers may be employed as indicators of biologic processes or reactions to therapeutic treatments that are directly related to brain functioning. Conversely, AI enables the development of a prediction model that uses a dimensional approach to MCI and applies machine learning techniques to an individual's digital biomarkers to discover certain behavioral and cognitive patterns in a safe and ecological environment.
[7]	10	GOOGLE SCHOLAR	We initially introduced virtual reality technology in this article as the basis for upcoming training centers. The degree to which virtual reality is applied determined the size and scope of upcoming instruction.The future training impact was decided by the quality of the virtual reality application. To bolster this belief, we also examined the virtual reality application development landscape and the degree to which it has been applied to actual practice. Next, we made the argument that the creation of intelligent training scenarios was made possible by artificial intelligence. Virtual reality might meet the need for intelligence facilities in the future as long as it is integrated with artificial intelligence and meets real-world practice requirements.

Uncovering the nuances in the academic landscape studying the link between artificial intelligence (AI) and virtual reality (VR) is the main goal of this research paper, which focuses on the bibliometric analysis of AI virtual reality research trends. The objective of this academic work is to provide light on the complex web of scholarly publications by clarifying the changing patterns, networks of collaboration, and key players in this rapidly developing subject. The investigation uses bibliometric methods to carefully examine trends and advancements in AI virtual reality research, providing useful information for academics, professionals, and decision-makers. By traversing this

academic terrain, the publication aims to offer a thorough grasp of the current and possible future directions in AI virtual reality research, adding to the body of knowledge in this developing academic field.

2. METHODS

The aim of this publication is to examine the body of scholarly literature that delves into the complex interplay between artificial intelligence (AI) and virtual reality (VR). The focus is on the bibliometric study of AI virtual reality research trends. The emphasis is on closely analyzing the trends, progress, and key players in this ever-evolving industry. By offering insights into publication patterns, collaborative networks, and thematic areas of interest within the changing environment of AI virtual reality research, the magazine aims to highlight the intricate web of academic publications. Additionally, it seeks to provide insightful viewpoints for academics, professionals, and decision-makers who are traversing the academic landscape with clarity and depth and who want a thorough grasp of the current and possible future trends in AI virtual reality research.

2.1 Journal Reputation

A highly regarded journal has been chosen at this point and is currently being processed. The journal check findings are displayed in Table 2.

Table 2. Profile of a journal with a specific theme on Exposing the Scholarly Landscape: A Bibliometric Examination of AI Virtual Reality Research Trends.

Point of View	AIS	BJoP	Frontiers	SN	SN	IEEE	CE
Publisher	Advanced Intelligent System	British Journal of Opthalmology	Frontiers	Springer Nature	Springer Nature	IEEE	Elsevier
First published	2021	2020	2017	2019	20020	2017	2020
Last published	2022	2020	2018	2020	20020	2018	2020
Scopus Indexed	No	YES	Yes	YES	Yes	No	Yes
Web of Science Indexed	No	No	No	No	No	No	No
Impact factor by SJR	0.110	3.18	1.19	2.42	2.42	5.95	2.8

Table 2 demonstrates that all journals indexed using Frontiers, BJoP, and SN on a scale are classified as Q1 and CE. Analysis is equally crucial because this case incorporates journalism on artificial intelligence on virtual reality.

2.2 Journal Metrics Information

The characteristics and metrics of the three chosen journals—Frontiers, SN, and CE—are clearly described in this section. Table 3 summarizes key findings from the three chosen journals. The Publish or Perish program is used to extract this metric data from metadata (PoP).

Table 3. Metrics Information of Selected Journals

Metrics data	Frontiers	SN	CE
Publication years	2019-2020	2014-2016	2020
Citation years	4	9	3
Papers	4	20	50
Citations	353	3008	1551
Cites/year	88.25	334.22	517.00
Cites/paper	88.25	150.40	31.02

Authors/paper	2.75	3.55	3.52
h-index	4	19	21
g-index	4	20	38
hI,norm	4	14	13
hI,annual	1.00	1.56	4.33
hA-index	4	10	13

2.3 Reference Management

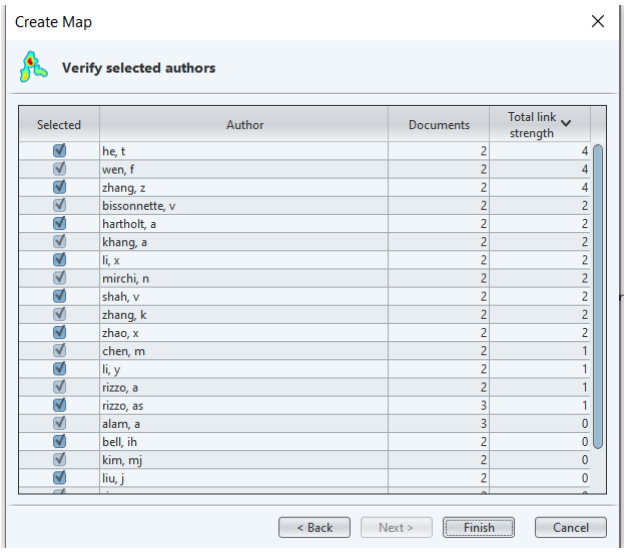
Using the Mendeley tool to add references is the final step after obtaining articles from three separate journal websites (SN, Frontiers, CE, AIS, BJoP, IEEE). References are necessary for each article's metadata, which consists of author information, keywords, abstracts, and other material organized in a more thorough and comprehensible manner.

2.4 Bibliometric Analysis

The next step is bibliometric analysis, which comes after the accuracy of all the article metadata has been confirmed. The bibliometric analysis in this paper was done using VosViewer, a program that runs on database files.csv file found by doing a Google Scholar search for "AI Virtual Reality".

3. RESULTS AND DISCUSSION

Researchers track the development of multimedia research on face recognition using bibliographic data and VOSViewer software to identify the type of data. Then, we read data from reference management files whose file formats in the data source are compatible with RIS. Next, use the counting technique with comprehensive counting, allowing a minimum of 5 authors and a maximum of 25 writers per document. Consequently, 22 out of 519 writers meet the criterion.



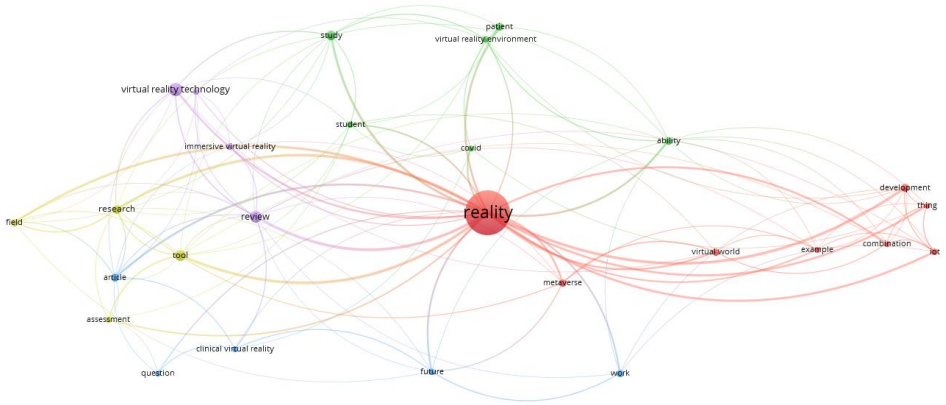


Figure 1. Network Visualization Map of Keywords

In Figure 1, the hues blue, yellow, red, green, and purple represent several groups. Throughout the whole article, a selection of the terms that appear most frequently in the cluster are displayed. There are presently five published article categories, as this cluster shows. More details are provided in Table 4.

Table 4. Clusters and keywords therein

Cluster	Total items	Most frequent keywords (occurrences)	Keywords
1	8	Reality (291), development (10), virtual world (9)	Combination, development, example, iot, metaverse, reality, thing, virtual world
2	6	Study (15), patient (10), ability (8)	Ability, covid, patient, student, study, virtual reality environment
3	5	Article (10), work (8), future (7)	Article, clinical virtual reality, future, question, work
4	4	Tool (18), research (13), field (5)	Assesment, field, research, tool
5	4	Virtual reality technology (25), review (20), immersive virtual reality (7)	Characteristic, immersive virtual reality, review, virtual reality technology

We may look at the responses that were taken straight out of the cluster to find out what the latest trends are in multimedia research concerning facial recognition. Figure 2 displays an article density visualization. In Cluster 1, the term "facial expression recognition" is most frequently employed.

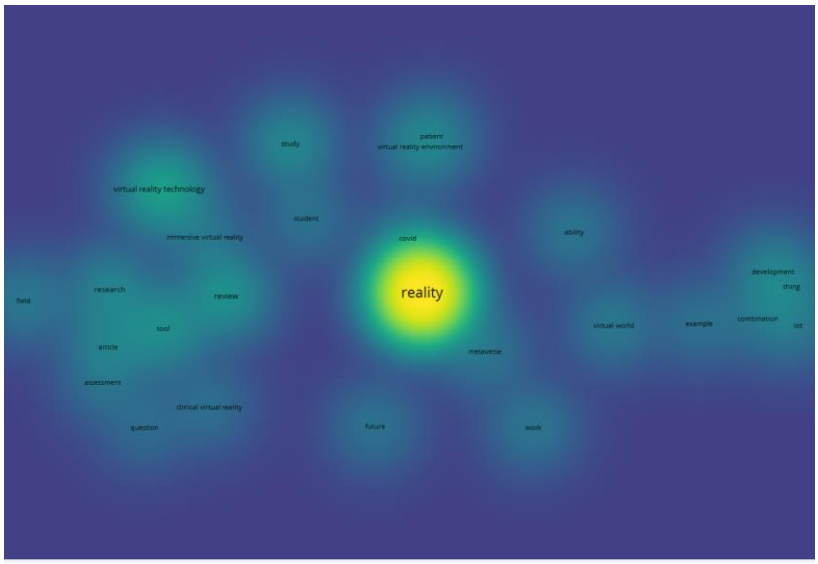


Figure 2. Density Visualization Map of Keywords

At least in keywords, one of these mapping clusters—cluster 1—is present. This cluster covers the artificial intelligence subject "Virtual Reality". Furthermore, certain terms—such as "combination," "charasteristic," and so forth—rarely appear in keyword lists inside any cluster. Stated differently, there remains a research vacuum that will likely contribute to future trends—trends that are, of course, tailored to the circumstances of the world today and tomorrow.

CONCLUSION

In the current study, many works with AI-related "Virtual Reality" topics are reviewed. This article's content was compiled from IEEE, Frontiers, and Springer Nature (SN). Our investigation led us to the conclusion that several of the above listed papers may be interesting subjects for AI articles because of their increased impact on the virtual reality space nowadays.

The current study has at least two problems. First off, despite the study's use of formal techniques (PoP software, VOSviewer, and Mendeley), the author's subjective assessment is still there and has the potential to identify errors. Although many additional journals qualify as Thomson Reuters, the analysis is mostly focussed on journals that are indexes scopus. Future research projects should use complex sample sizes that comprise several sources that are not listed in Scopus' index.

ACKNOWLEDGEMENTS

We are appreciative of the University of Majalengka's assistance to us as writers during the course of our professional lives. We express our gratitude to Mr. Dadan Zalaludin s.t m.t., our instructor, for his significant help and experience in identifying bibliometric analysis and assessing symmetrical literature.

REFERENCES

[1] Z. Zhang, F. Wen, Z. Sun, X. Guo, T. He, and C. Lee, "Artificial Intelligence-Enabled Sensing Technologies in the 5G/Internet of Things Era: From Virtual Reality/Augmented Reality to the Digital Twin," *Advanced Intelligent Systems*, vol. 4, no. 7, Jul. 2022, doi: 10.1002/aisy.202100228.

[2] S. K. Bakshi, S. R. Lin, D. S. W. Ting, M. F. Chiang, and J. Chodosh, "The era of artificial intelligence and virtual reality: Transforming surgical education in ophthalmology," *British Journal of Ophthalmology*, vol. 105, no. 10. BMJ Publishing Group, pp. 1325–1328, Oct. 01, 2021. doi: 10.1136/bjophthalmol-2020-316845.

[3] T. K. Metzinger, "Why is virtual reality interesting for philosophers?," *Frontiers Robotics AI*, vol. 5, no. SEP, 2018, doi: 10.3389/frobt.2018.00101.

[4] D. Qi *et al.*, "Virtual reality operating room with AI guidance: design and validation of a fire scenario," *Surg Endosc*, vol. 35, no. 2, pp. 779–786, Feb. 2021, doi: 10.1007/s00464-020-07447-1.
[5] A. Winkler-Schwartz *et al.*, "Artificial Intelligence in Medical Education: Best Practices Using Machine Learning to Assess Surgical Expertise in Virtual Reality Simulation," *J Surg Educ*, vol. 76, no. 6, pp. 1681–1690, Nov. 2019, doi: 10.1016/j.jsurg.2019.05.015.
[6] S. Cavedoni, A. Chirico, E. Pedroli, P. Cipresso, and G. Riva, "Digital Biomarkers for the Early Detection of Mild Cognitive Impairment: Artificial Intelligence Meets Virtual Reality," *Front Hum Neurosci*, vol. 14, Jul. 2020, doi: 10.3389/fnhum.2020.00245.
[7] M. IEEE Systems, Chinese Association of Automation, and Institute of Electrical and Electronics Engineers, *Proceedings, 2017 Chinese Automation Congress (CAC) : Oct. 20-22, 2017, Jinan, China.*

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