

ANALYSIS OF THEMES AND TRENDS IN LIFE SCIENCES AND BIOMEDICAL RESEARCH VIRTUAL REALITY

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ABSTRACT

The purpose of this study was to investigate the theme of the abstract, the theme of the Title on Virtual Reality in the Sciences and Biomedical Sciences and to investigate the trends of authors and countries who are major contributors to research on virtual reality in the sciences and biomedical sciences, the researchers used metadata from 497 journals. scientifically indexed with topic modeling algorithms. The results of the study found that for virtual reality themes listed in the abstracts of science and biomedical fields, the words that often appear were study and systems related to pediatric surgery, stroke and cancer. Then the research theme in the virtual reality title regarding science and biomedicine is to get words that often appear, namely evaluation and videos that contain about the fields of dental health, stroke and cancer, Furthermore, from a technological point of view, it relates to head-mounted devices to display 2 or 3 dimensions, and educational psychometric technology relates to learning to care for children for students. While the sports side is related to the movement of the body's physical activity in adults. Analysis of research trends for authors and countries that are major contributors to virtual reality research on science and biomedical based on wordcloud analysis with names that often appear in virtual reality is Wiederhold BK and the dominant country is United State.

Keywords:Life Sciences and Biomedical, Themes and Trends, Virtual Reality.

1. INTRODUCTION

The development of the Virtual Reality world has developed so rapidly in recent years, various technological innovations have been developed to meet customer demands and the demands of the times. Virtual Reality is the use of tools that are similar to real world life in 3 dimensions(Loureiro, Guerreiro and Ali, 2020). Currently, Virtual Reality has been implemented in almost all areas of life, for example: the industrial sector(Rumiah et al., 2019), education(Abdul and Budiman, 2019), entertainment(Boyle et al., 2014), sport(Gym, Strength and Introduction, 2019), and the health sector(Ruiz, Cook and Levinson, 2009).

One of the most important applications of Virtual Reality is in the field of Life Sciences and Biomedical Sciences. Virtual Reality has been used for years, for example, to teach anatomy(Habbal and Harris, 1995), stroke therapy(Thielbar et al., 2020), therapy of chronic diseases of the spine(Zarghooni et al., 2013), and also used for operation simulation(Kadir et al., 2019). Pubmed is a search engine that can be accessed in search of literature sources in the form of journals, Pubmed provides a lot of information for those who need to do literature studies.

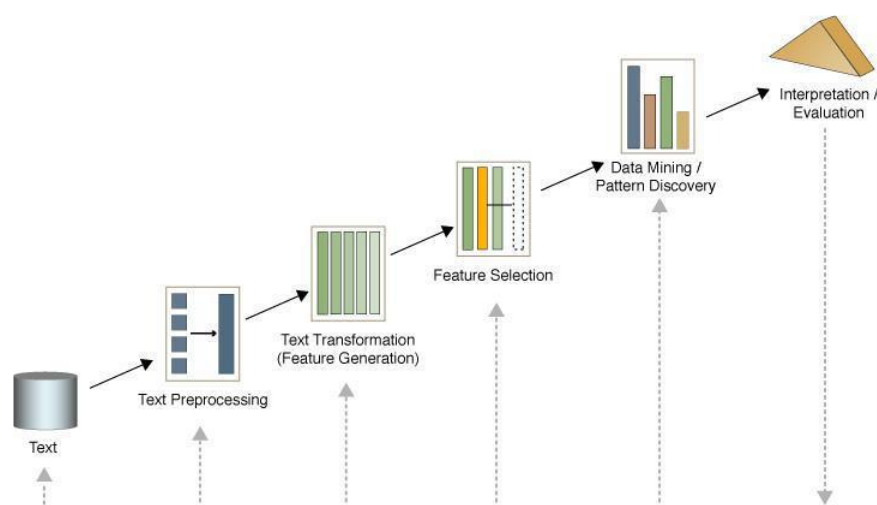
Several studies related to Virtual Reality generally discuss the application of this technology in specific fields (for example for building design simulations) and do not investigate themes and trends from research on Virtual Reality technology. Literature review studies and modeling topics are the two fields of study that are most related to research raised by the authors, where the literature studies and modeling topics aim to investigate themes and trends in specific fields or certain research, but in the context of the research that the authors have not adopted there is research that investigates research or journals regarding Virtual Reality Implemented in the field of Life Sciences and Biomedical Sciences.

Although Virtual Reality has long been implemented in the field of Life Sciences and Biomedical Sciences, there has not been a study that analyzes how research or journals actually implement these two technologies. In particular, how exactly are the themes (Title/Title and Abstract) and trends (Author and Country) of research on Virtual Reality implemented in the field of Life Sciences and Biomedical Sciences? The importance of themes and trends (state of the art) from a research in the field of life sciences and biomedical will provide many benefits including: providing a knowledge base for future researchers, journal editors, publishers.

Researchers can find direction and continue or contribute to areas that are still lacking in investigation, journal editors and publishers can make improvements to the focus and objectives of their journals, and can provide directions for issuing special issues or journal themes based on the theme. and research trends obtained from the research output that the authors provide.

2. THEORY

Topic Modeling is a statistical topic model that classifies document sections into interrelated themes without disturbing the user, the resulting topics can be general or specific depending on the parameters used (Mutanga and Abayomi, 2020). The stages of the Topic Modeling process are: preparing the text (text), the initial process of the text (preprocessing), text transformation (transformation), feature selection (feature selection), pattern discovery (pattern discovery), interpretation / conclusion (interpretation) (Latif, 2018). This stage can be seen in Figure 1.



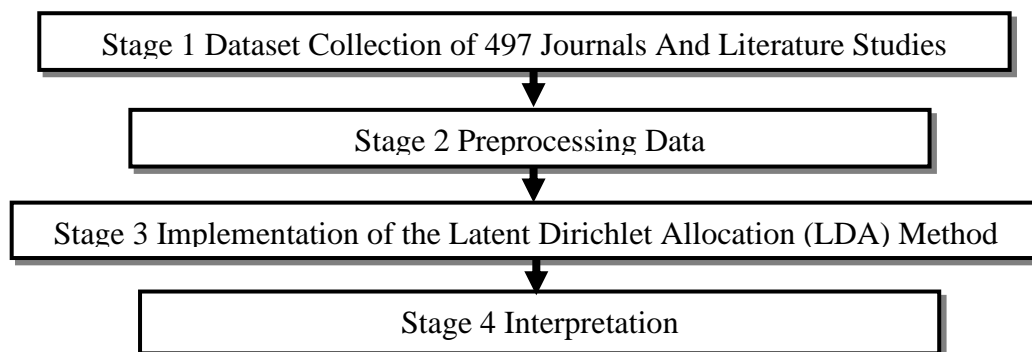
Figures. 1. Topic Modeling Process Stage (Latif, 2018)

1. Text Preparation Stage (Text)
At this stage the problems that arise are the large amount of text data in the data, high dimensions, the data structure changes every time, has a different language meaning.
2. Preprocessing Text (Preprocessing)
The next stage is the process of analyzing the text of the actual meaning and arrangement, this stage is carried out by case folding and tokenization.
3. Text Transformation (Transformation).
At this stage, the formation of text attributes is carried out by referring to the initial process of the text so that there are still word changes and word reductions in the document.
4. Feature Selection.
In the next stage, feature selection is carried out so that the words in the transformation stage can be reduced to smaller dimensions.
5. Pattern Discovery.
This stage is very decisive to find patterns from the total text.
6. Interpretation/Conclusion (Interpretation).
The last stage is to make conclusions from the results that are issued from the process and communicate to users in visual form.

The preprocessing stage above is divided into four stages, namely: (a) Case Folding, namely changing uppercase letters to lowercase letters starting from the alphabetical order a to z and eliminating letter characters. (b) Tokenization, namely cutting the input string based on each composed word/sentence. Filtering, namely pulling words/sentences from tokenization. This process can use a stopwords algorithm where words/sentences are omitted, for example: background or hyphens (symbols). (c) Stemming, namely shortening the number of indices that are not the same from other documents as well as combining other words/sentences that have the same/similar meanings but have different forms, for example: together and togetherness. (d) Stopwordenglish, namely eliminating words that have no meaning in extracting text, for example: virtual reality and animation(Albalawi, Yeap and Benyoucef, 2020),(Kurniawan, Industry and Indonesia, 2018).

3. METHODS

The research went through several stages where each stage is interrelated with the others, while the research stages are presented in figure 2:



Figures. 2. Research Stages

1. Dataset Collection of 497 Journals and Literature Studies.

This research starts from collecting metadata from 497 journals and literature studies regarding: Virtual Reality, Modeling Topics, and the Latent Dirichlet Allocation (LDA) Method that will be used.

2. Preprocessing Data.

At this stage data preprocessing will be carried out, namely the process of changing data to a data format and to clean up words that are not needed. The way to do that is: stop words, namely removing words that are not needed.

3. Implementation of the Latent Dirichlet Allocation (LDA) Method.

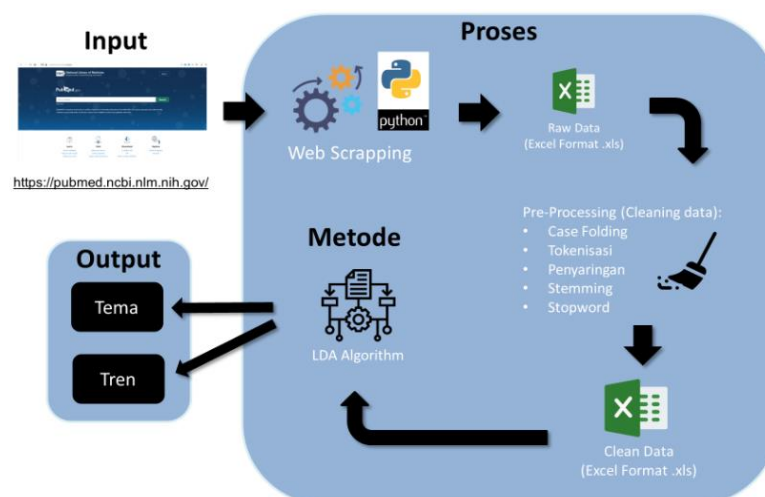
This stage is the stage of implementing the method after the data has been collected.

4. Interpretation.

After the implementation stage, the results obtained will be interpreted on the output of the LDA by researchers and validation experts.

4. RESULTS AND DISCUSSION

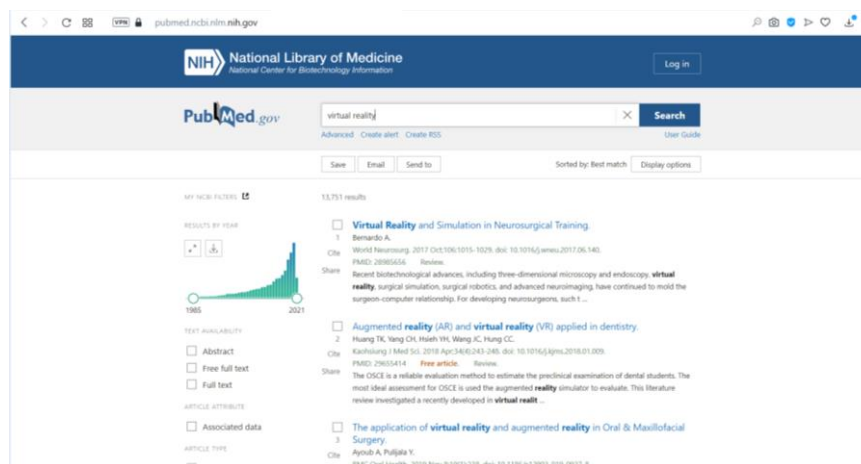
The results and analysis of data that has been scrapped and removed unnecessary words are:



Figures. 3. Stages of Data Retrieval Process

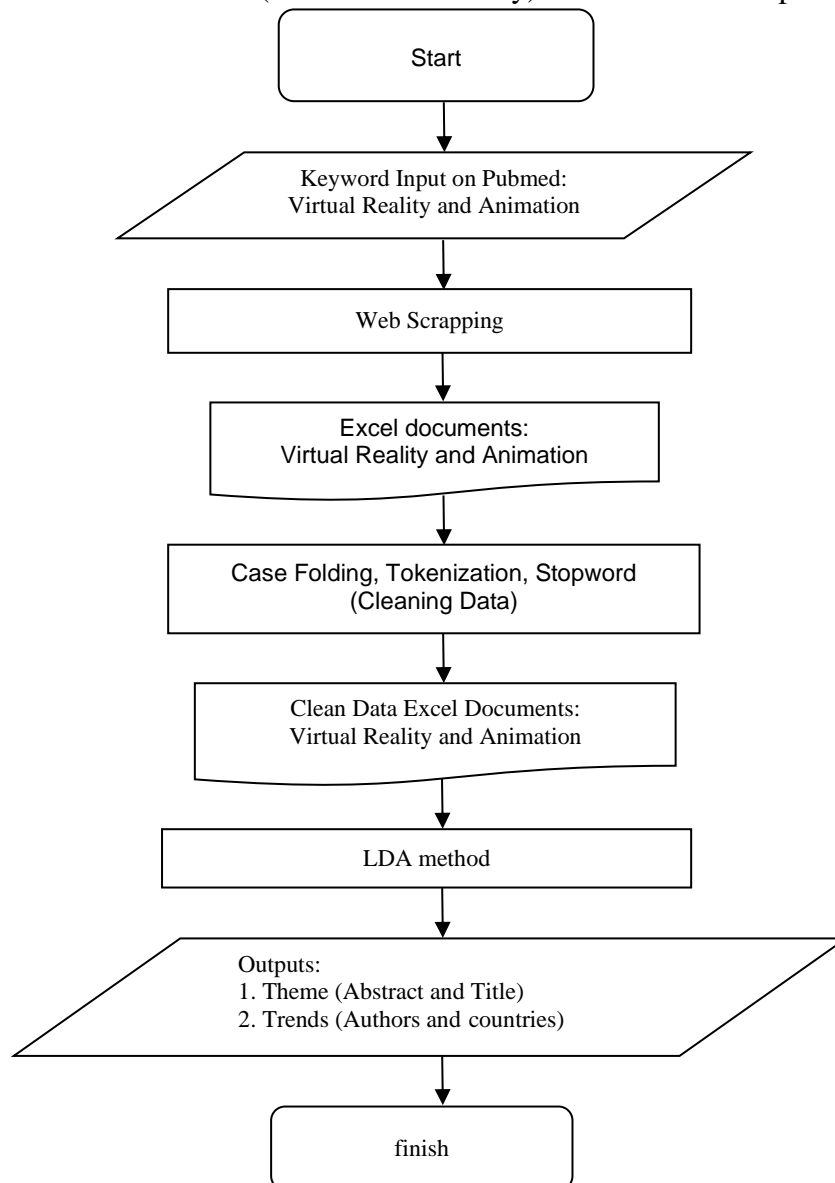
The stages of the data collection process:

1. Enter keywords on the website: <https://pubmed.ncbi.nlm.nih.gov/>



Figures. 4. Keyword Virtual Reality

2. Web Scrapping uses software, one of which is Python.
 - a. Raw Data is in the form of excel data format (results of scrapping).
 - b. Pre-processing (cleaning data) includes: Tokenization, Filtering, Stopwords.
 - c. Cleaning Data, after the data is cleaned in the form of Excel.
 - d. The Latent Dirichlet Allocation (LDA) Algorithm method, uses the rapidminer application to get output, one of which is: WordCloud.
 - e. Output, the results obtained are: Themes (Abstract and Title) in the form of WordCloud and Trends (Author and Country) in the form of Graphics.



Figures. 5. Flowcart Virtual Reality Data Retrieval Process

The number of virtual reality journals is 497 with the following details:

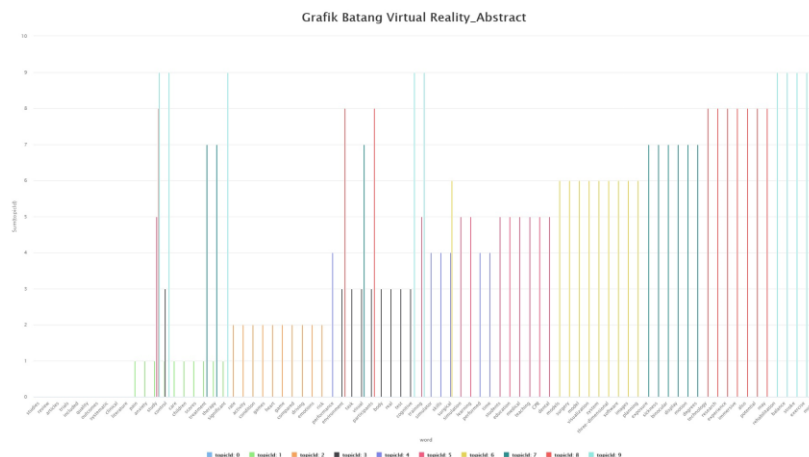
No.	Year	Number of journals	Related journals	Percentage
1.	2016	1	Technology	0.2 %
2.	2017	27	Health	5.4 %
3.	2018	73	Health	14.7 %
4.	2019	163	Health and Technology	32.8 %
5.	2020	217	Health and Education	43.7 %
6.	2021	16	Health	3.2 %
TOTAL		497		100 %

1. Abstract

Figure 6 shows that the word "study" has more words than any other word in the PubMed journal/paper followed in a row: training, control, cognitive, environment, participants, significant, surgical, visual, balance, exercise, learning , motor, rehabilitation, simulation, stroke, also, experience, immersive, may, potential, research, technology, therapy, treatment, binocular, degrees, display, exposure, motion.

decade	Year	Number of journals	Related journals	Percentage
1	2016 - 2021	497	– Health	79.8 %
			– Technology	10.2 %
			– Education	10 %
TOTAL		497		100 %

81



Figures. 7. Abstract Virtual Reality Bar Graph

In figure 7, the Abstract Virtual Reality Bar Graph shows that the word study has more topic words than other topic words in the PubMed journal/paper followed in a row: training, control, cognitive, environment, participants, significant, surgical, visual, balance, exercise, learning, motor, rehabilitation, simulation, stroke, also, experience, immersive, may, potential, research, technology, therapy, treatment, binocular, degrees, display, exposure, motion.

Table 3. Output of the 10 Biggest Words Bar Graph

No.	Say	related
1.	Study	
2.	Training	
3.	control	
4.	Cognitive	
5.	Environment	Health, Technology, Education,
6.	Participants	Sports.
7.	Significant	
8.	Surgical	
9.	Visual	
10.	balance	

2. Title

Figure 8 shows that the word Evaluation has more words than any other word in the PubMed journal/paper followed in succession: Simulation, Visual, Review, tool, Augmented, display, Education, Immersive, Medical, Neurosurgical, operating, Three -Dimensional, based, controlled, training, immersive, randomized, rehabilitation, review, trial, study, systematic, Application, Endoscopy, Framework, human, invasive, minimally, Training.

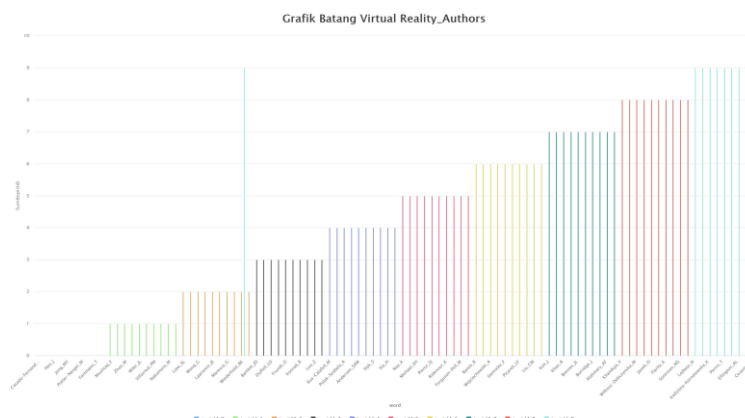
In figure 9 the Virtual Reality Title bar graph shows that the word Evaluation has more topic words than other topic words in the PubMed journal/paper followed in succession: Simulation, Visual, Review, tool, Augmented, display, Education, Immersive, Medical, Neurosurgical, operating, Three-Dimensional, based, controlled, training, immersive, randomized, rehabilitation, review, trial, study, systematic, Application, Endoscopy, Framework, human, invasive, minimally, Training.

3. Authors

Figure 10 shows that the name Wiederhold BK has more words than any other word in the PubMed journal/paper followed by the following names: Araszkiewicz A, Cesaroni S, Ellington AL, Kedziora-Kornatowska K, Kerherve VA, Ledwos N, Patrie JT, Perrin T, Reyes-Gastelum D, Caserman P, Flarity K, Huang SS, Janeh O, Khanduja V, Rosa PJ, Sorensen MS, Tahnnhauser J, Wilkosc-Debczynska M, Zajac-Lamparska L, Alahmary-AF, Bonnes JL, Burridge J, Donaldson N, Khan R, Kim J, Kim KK, Paddison S, Simon A, van Geuns RJ.



Figures. 10. WordCloud Virtual Reality Authors



Figures. 11. Authors Virtual Reality Bar Graph

Figure 14 shows that the author's name: Wiederhold BK has more trends than other authors in the PubMed journal/paper followed by the author's names: Araszkiewicz A, Cesaroni S, Ellington AL, Kedziora-Kornatowska K, Kerherve VA, Ledwos N, Patrie JT, Perrin T, Reyes-Gastelum D, Caserman P, Flarity K, Huang SS, Janeh O, Khanduja V, Rosa PJ, Sorensen MS, Tahnnhauser J, Wilkosc-Debczynska M, Zajac-Lamparska L, Alahmary-AF, Bonnes JL, Burridge J, Donaldson N, Khan R, Kim J, Kim KK, Paddison S, Simon A, van Geuns RJ.

Table 5. Output from the 10 Biggest Words Graph

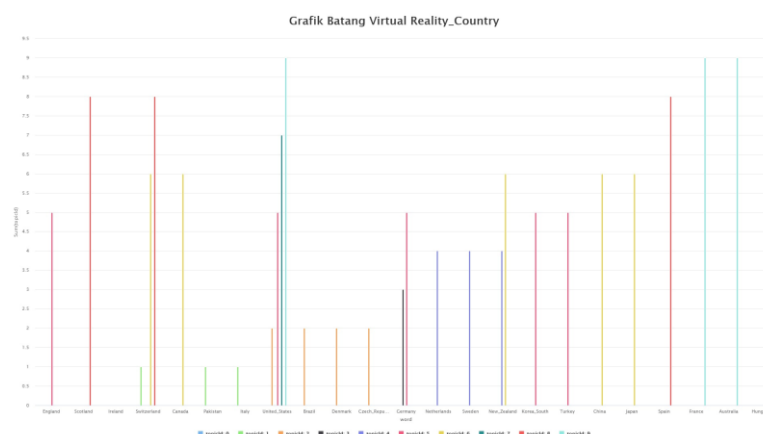
No.	Name
1.	Wiederhold bk
2.	Araszkiewicz a
3.	Cesaroni S
4.	Ellington al
5.	Kedziora-kornatowska k
6.	Kerherve va
7.	Ledwos n
8.	Patrie jt
9.	Perrin t
10	Reyes-gastelum d

4. Country

Figure 12 above shows that the United States has more words than any other word in the PubMed journal/paper followed by countries: Switzerland, New Zealand, Australia, France, Hungary, Germany, Spain, Scotland, Canada, China , Japan, Turkey, England, South Korea, Netherlands, Sweden.



Figures. 12. WordCloud Virtual Reality Country



Figures. 13. Virtual Reality Country Bar Graph

Figure 13 shows that the United States has more trends than other countries in the PubMed journal/paper followed by countries: Switzerland, New Zealand, Australia, France, Hungary, Germany, Spain, Scotland, Canada, China, Japan, Turkey, England, South Korea, Netherlands, Sweden.

Table 5. Output of the 10 Largest Words Bar Graph

No.	Country
1.	<i>united states</i>
2.	<i>Switzerland</i>
3.	<i>New zealand</i>
4.	<i>Australia</i>
5.	<i>france</i>
6.	<i>Hungary</i>
7.	<i>Germany</i>
8.	<i>spain</i>
9.	<i>Scotland</i>
10	<i>Canada</i>

All Virtual Reality wordclouds (Abstract and Title) are validated by experts by medical personnel to make interpretations. The results of the Expert Validation by several medical personnel who the researchers joined together, namely:

1. That word: "study" in WordCloud Virtual Reality (Abstract) in medical science is to learn about the anatomy of the body in detail before making a decision about what disease the patient is suffering from.
2. That the word: "Evaluation" in WordCloud Virtual Reality (Title) in medical science is needed to evaluate patients who are treated every day to take further action regarding the disease they are suffering from.

5. CONCLUSIONS AND SUGGESTIONS

Based on the results of the study in choosing the Topic Modeling method, the following conclusions can be drawn:

1. The topic modeling method for analyzing research themes in Virtual Reality abstracts regarding science and biomedicine was obtained based on Wordcloud analysis with words that often appear, namely studies and systems that contain technology related to pediatric surgery, stroke and cancer; education related to: medical education on anatomy and dementia care education; and sports related to body and facial movements.
2. The topic modeling method for analyzing research themes in Virtual Reality titles regarding science and biomedicine was obtained based on Wordcloud analysis with words that often appear, namely evaluations and videos that contain health fields related to teeth, stroke and cancer; technology relating to head-mounted devices for displaying 2 or 3 dimensions, psychometric technology; education related to student learning to care for children and children's education in preparation for MRI without sedation; and sports related to the movement of the body's physical activity in adults.
3. Topic modeling method for analyzing research trends for authors and countries who are the main contributors to Virtual Reality research on science and biomedical based on Wordcloud Analysis with the name that often appears in Virtual Reality is Wiederhold BK and the dominant country is United State.

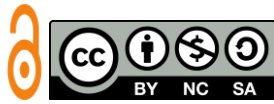
Suggestion

1. By using the Topic Modeling method, further research needs to be done using other methods to make it more accurate.

2. Further research needs to be done in the field of forensics for virtual reality in Life Sciences and Biomedicals.
3. Often, some words that are not standard appear because the existing list of words has not been properly handled, so another method is needed.
4. Future research is expected to continue regarding issues using methods and frameworks for implementation.
5. Researchers have not been able to do a deeper cross-check regarding the reasons for the most dominant country trends due to limited research time.

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