Bibliometric Analysis of Stress Recognition Models using VOSviewer

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Abstract

Stress is one of the most significant issues in our society because it has been a serious reason for many health-related problems and a giant loss for firms, offices, and universities. Regular high mental workloads and fast technological development, which end up in constant modification and also the want for adaptation, build the matter a lot more serious at the geographic point. This examination intends to investigate the extent of Stress Recognition Research with the help of a bibliometric review. The Scopus database was utilized to acquire data about Stress Recognition. Subject names with keywords titles, abstracts in human Stress Recognition studies were used as a kind of perspective for retrieval of the search results. Search result extraction was utilizing the VOSviewer software. Later, the outcomes of bibliometric mapping were investigated further. A sum of 500 research articles was found in the Scopus information base got to in 2021. After examining we shortlisted 231 articles. There was a significant expansion in the number of publications on Stress recognition from 2019, 2020, and 2021. Among all nations, the USA contributed the foremost publication. In the meantime, the watchwords Physiology, Machine Learning, and Human ended up being the territory's most generally examined. Through VOS Viewer we tend to analyze what numbers of articles are published regarding Stress Recognition and its relationships to a subject area. This review actually will give a reference for more analysis associated with the Stress Recognition happening

Keywords: Stress, Machine Learning, Physiology, Early Detection, Psychology

Introduction

Stress has become a part of our day-to-day life and it is not possible to keep outsell away from the Stress. The study conducted in European countries has revealed that Stress is identified as one of the most second vibrant health-related issues [a Kobayashi- 2002]. In the year 2019, business-related pressure cost around € 20 billion to the main undertakings of EU [European Economic Forecast-2020]

About 89 % of the Indian population is suffering from stress; most of them don't feel comfortable taking valuable advice from medical professionals [economictimes.indiatimes.com/- 2020]. Stress can affect the human body, behavior, feelings, and thoughts as well. Stress can be positive (eustress) and negative (distress). Positive Stress helps an individual to avoid danger or meet a deadline. But when Stress stays for a longer period it is referred to as negative Stress, the negative Stress is harmful to the human body [Cleveland Clinic- 2015]. A survey conducted in lockdown by The 7thFold, a store of HR and Wellbeing firm on Indian working experts that "50% of Indian experts have detailed that a questionable future is their highest wellspring of stress followed by Individual funds (40%) and Career Development (40%) in 2020 [People Matters- 2020].

Bibliometrics is a computational tool for quantitatively analyzing research papers on a specific subject using mathematical methods. (Jan Andersen, 2018) . It could also assess study quality, analyze

key research areas, and forecast the course of future research. The SCOPUS online data set incorporates practically all the significant exploration articles and it additionally has implicit examination devices that permit you to produce meaningful diagrams. The search results from the SCOPUS database or Web of Science database can be easily imported by the computer software for additional analysis and processes like VOSviewer or Python programming.

As per our search on Stress Recognition no bibliometric analysis of published data has been revealed until currently. As Stress recognition has not been fully studied so it becomes necessary to conduct a bibliometric analysis of the same. Hence, our examination was acted as an incredibly ideal opportunity to produce an in-depth understanding of Stress recognition and future investigation directions.

Materials and Methods

World-wide literature about Stress Recognition with machine learning or deep learning is revealed between the year 2011 to the year 2021 were scanned within the SCOPUS assortment dataset. The search terms connected to recognize the nearest matched publication comprised "Stress" or "Stressor" TITLE-ABS-KEY ("Early Detection" OR "Physiology")" AND TITLE-ABS-KEY ("Machine Learning" OR "Deep Learning") or "The global literature related to Stress Recognition with machine learning or deep learning is published between the year 2010 to the year 2021 were examined within the SCOPUS assortment database. The research terms applied to recognize the nearest match publication encased "Stress" or "Stressor" TITLE-ABS-KEY ("Early Detection" OR "Physiology") AND TITLE-ABS-KEY ("Machine Learning" OR "Deep Learning").

The information retrieved from the collected documents that address the issue contained publication year, author, language used, journal, title, affiliation, keywords, and type of the document, abstract, and total citation which were brought into a CSV file. The information recovery was done in April 2021. VOSviewer (1.6.16) was utilized for the investigation of the bibliographical coupling, Co-authorship, Co-occurrence, Citations, and Co-citation. Two standard weight properties' are connected that are laid out as "Links attributes" and "Complete connection strength property" (Zhong H- 2020).

Results and Discussion
Bibliometric Investigation of the Keywords

Authors of the research paper provided keywords that appeared up numerous times within the SCOPUS database were recorded for the conclusive investigation of the 428 keywords, out of the 344 keywords met the brink. "Physiology" (complete link strength 3,220) and "human" (complete link strength 2,684) had a solid link to "machine learning" and "mental stress". Were the keywords which appear the most.
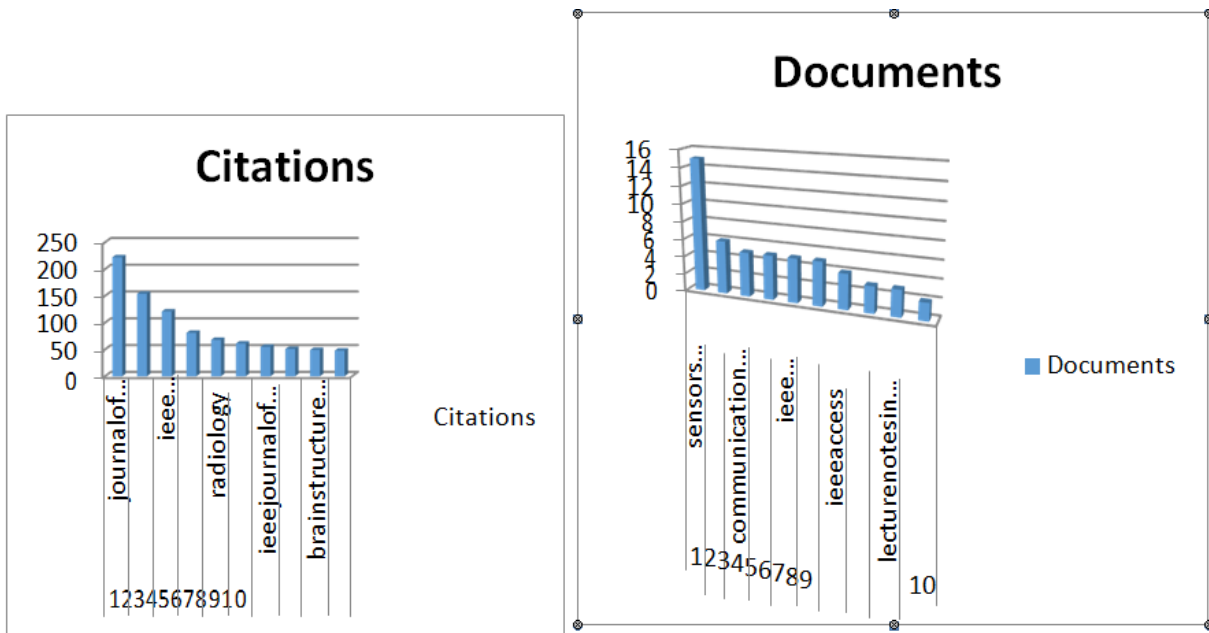
Fig 1- Shows the Bibliometric analysis of Stress Recognition keywords in the published papers. Co-occurrence of the index keywords. The dimension of nodes illustrates the recurrence of the event. Bend among nodes represents the co-occurrence within the same publication. different shapes of the circle show the importance of the keyword. The more limited the distance between of 2 nodes, the higher the quantity of co-occurrence of 2 keywords   .

Bibliometric Examination of the Publications and Citations `

The top one hundred most refereed articles in the domain of Stress Recognition were listed in Table 1. Most of them were based on facial expressions, speech including experimental setup, case studies, and surveys. The others were analysis articles that focused on facial stress recognition and voice-based Stress-recognition

id	Document	Authors	Citations	Llinks
1	Towards an automatic early stress recognition system for office environments based on multimodal measurements: A review	alberdi a. (2016)	159	12
2	Fusing texture, shape and deep model-learned information at decision level for automated classification of lung nodules on chest CT	xie y. (2018)	87	0
3	Introducing WeSAD, a multimodal dataset for wearable stress and affect detection	schmidt p. (2018)	76	1
4	Early detection of mechanical damage in mango using NIR hyperspectral images and machine learning	vélez rivera n. (2014)	75	0
5	Bridging a translational gap: Using machine learning to improve the prediction of PTSD	karstoft k.-i. (2015)	70	0
6	A hybrid BCI based on EEG and fNIRS signals improves the performance of decoding motor imagery of both force and speed of hand clenching	yin x. (2015)	68	0
7	Stress detection in daily life scenarios using smart phones and wearable sensors: A survey	can y.s. (2019b)	63	2
8	Stress detection using wearable physiological and sociometric sensors	mozos o.m. (2017)	60	3
9	Identifying objective physiological markers and modifiable behaviors for self-reported stress and mental health status using wearable sensors and mobile phones: Observational study	sano a. (2018)	59	0
10	Stress detection using wearable physiological sensors	sandulescu v. (2015)	50	1

Table 1 The top 10 most referred articles in the domain of Stress Recognition Various journals have been printed papers about Stress Recognition and twenty-five of them have printed quite three articles. The most elevated journal was sensors (Switzerland, with 15 publications.

Fig **2** The best 10 most dynamic journals. (A) Leading top 10 journals with the most-referred articles within the domain of Stress Recognition; (B) Leading top 10 published articles journals in the domain of Stress Recognition.

The best 10 most dynamic nations, authors, and organizations who have published in the field of Stress Recognition are shown in *Table 1*. Five research articles are written by can y.s. and Ersoy c. and have been cited 110 times with total link strength of 27. More than 80 articles were published by the USA with more than 1000 citations.

Table 2 The Best Top 10 most Dynamic Countries, Working in the Domain of Stress Recognition.

No.	Country	Documents	Citations	Total Link Strength
1	USA	81	1047	6
2	Spain	14	441	33
3	Germany	18	394	11
4	united kingdom	24	386	14
5	Italy	17	272	19
6	France	11	241	22
7	China	13	217	2
8	Netherlands	14	206	18

9	Australia	11	188	1
10	south korea	13	146	2
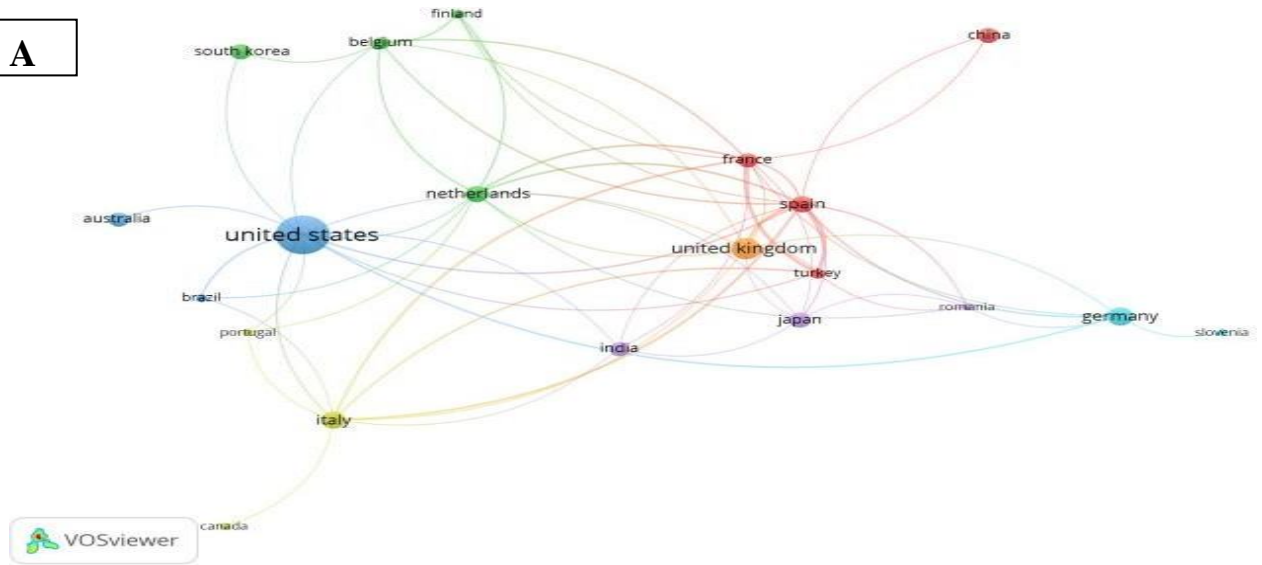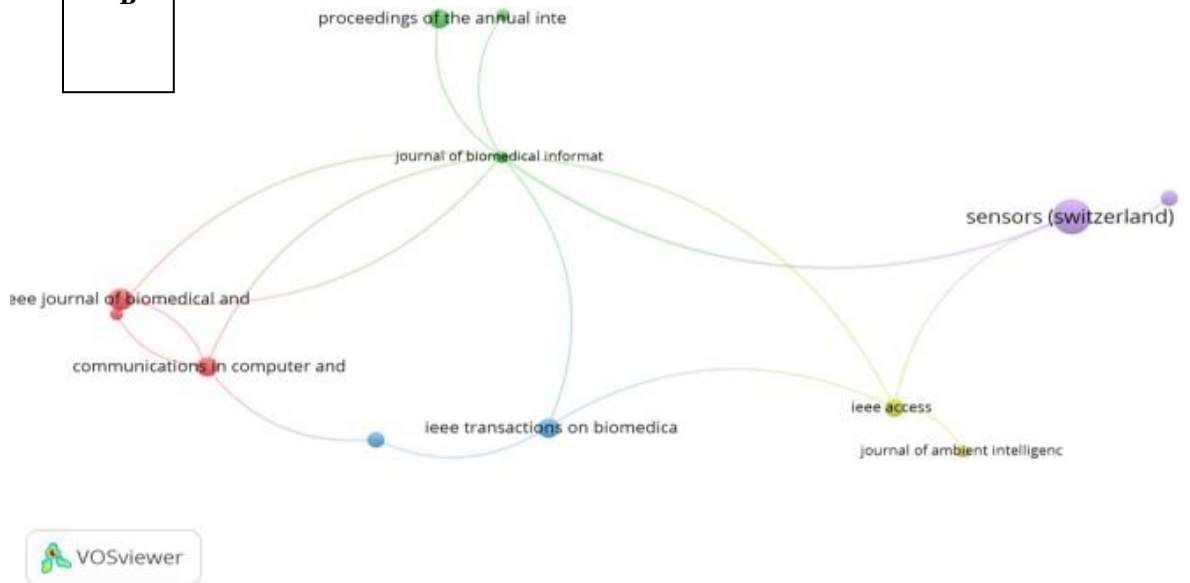
Fig 3 Shows the Bibliometric investigation of references– (A) shows references of countries. various colors demonstrate various groups and the diameter of circles represents the occurrence of references. (B) the references of sources various colors show various groups and circle diameter shows the occurrences of references.

Bibliometric Examination of co-Authorship

A sum of 1035 authors contributed their papers in the domain of Stress Recognition five papers have been published by, Can y.s. from the University of Bogazici that mostly focus on the recognition of Stress in daily life. The major colleagues with him are Ersoy c. By and the large link strength is 11.

After search and analyzing the national and global published articles, it is found that more than 100 associations have been published the connected research papers and 2 of them have more than two publicationsTotal collaborators with the USA are 14 and the overall link strength is 28. Various colors demonstrate different groups, the diameter of circles demonstrates the number of research articles. The connection strength among the two countries shown with the help of a thick line. (**Fig** *4*).

A

B
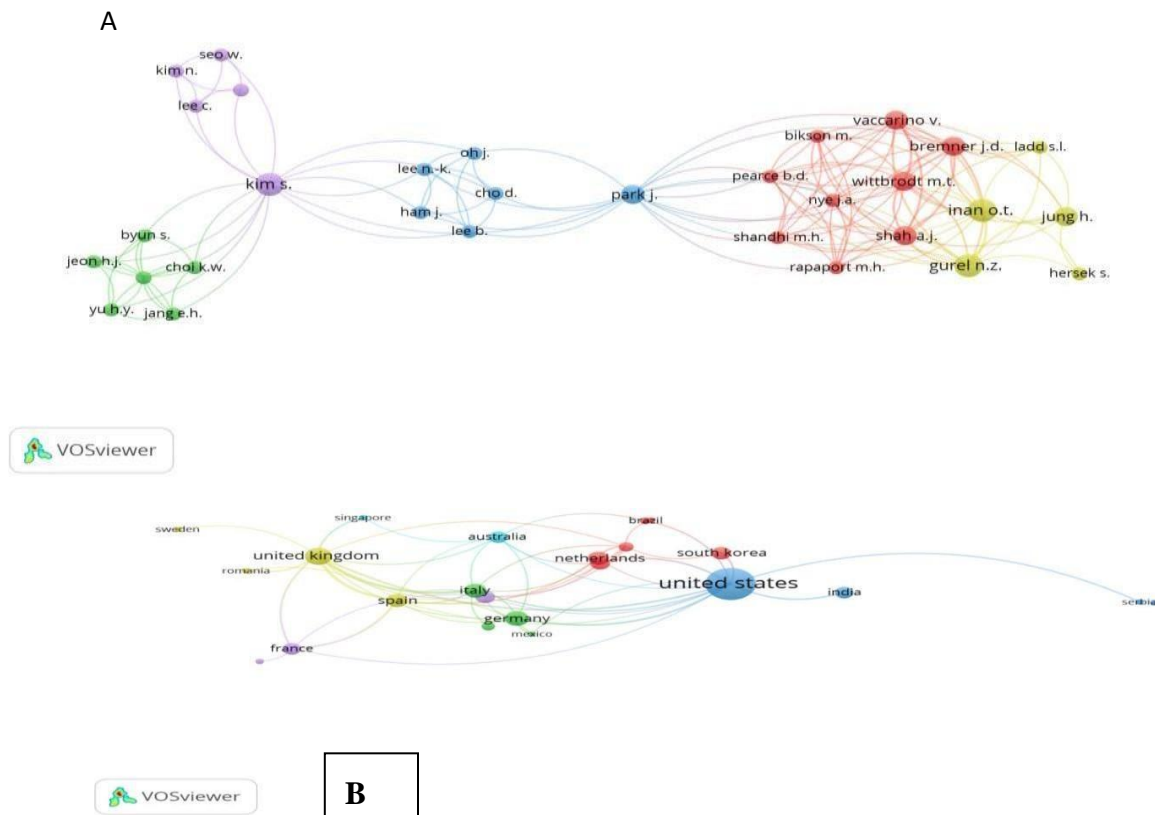
Fig 4 Bibliometric investigation of co-authorship. (shows the author that coordinates within the domain of Stress Recognition and co-authorship among authors; (B). The total number of collaborators

with the United States is 14 and the absolute connection strength is 28. Various tones show various groups and the diameter of the circles demonstrates the number of published articles. The connection strength among countries depicts by the line strength.[Co-authorship graph of countries]

**Bibliometric Examination of the co-Citation and Bibliographic Coupling**

Bibliographic coupling outline of records and sources is depicted in *Diagram 5A,* Six groups were gotten from the examination and Alberdir A has 69 links. B- Sensor (Switzerland published 15 documents with complete connection strength of 452

Fig 5 Shows the Bibliometric examination of the co-citation and bibliographic coupling.
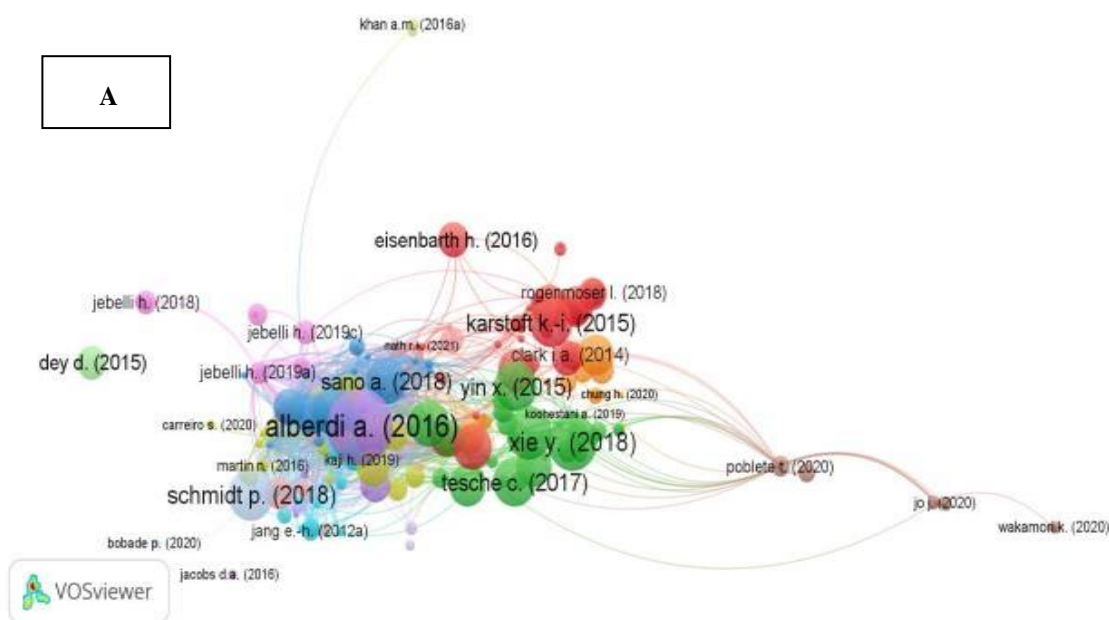
(A) Coupling of records; (B) shows the coupling of sources; (C) represents the co-citation of sources. Distinctive colors demonstrate distinctive investigated regions. The measure of the circles depicts the occurrence of co-citations. The interval between the two circles depicts their correlation.[Yuetian et al, 2020]

The 2 biggest groups of referenced sources incorporate 96 and 80 items, sequentially. The given journals are the *neuroimage* and *Sensors* (**Fig** 5 C)

B

C

Bibliometric Assessment of Trend Topics and Themes

A
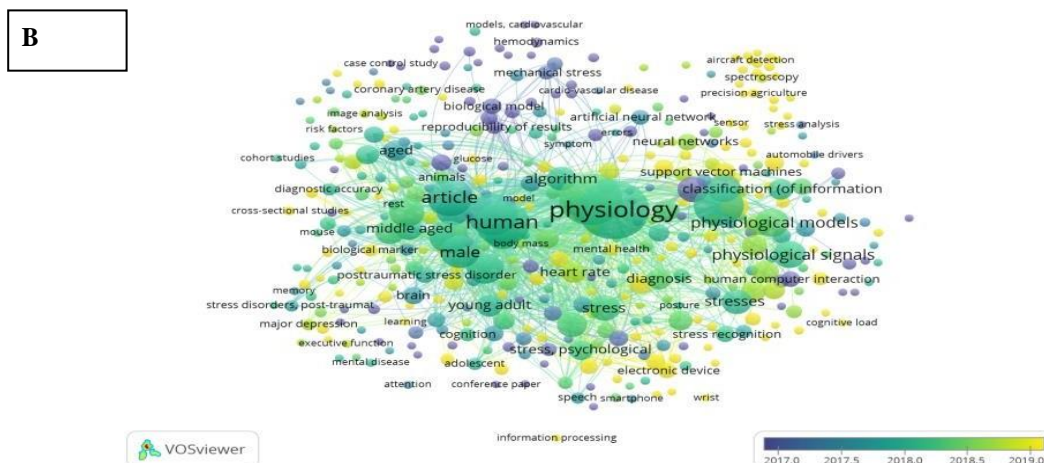
As shown in **Fig** *6A* various clusters depict different keyword and their correlations. **Fig** *6B* shows the network outline of the trend subjects as indicated by the keywords utilized from 2011 to April 2020. The pointer depicts the currently published papers from purple to yellow. Several studies focused on early stress detection, stress level, automatic stress detection, and EEG signals have been published recently.

Fig 6- Shows the Bibliometric assessment of the topic. (A) Dissemination of the topic. Six groups have appeared on the map. The red cluster depicts concepts related to physiological signals. The blue cluster involved stress-related parameters for Stress Recognition. The green cluster represents Human related parameters (B) Organized layout of in-trend topics as shown by the keywords utilized from 2011 to 2020 April. An indicator focuses upon the publications from green to a yellow color. Most study conducted on physiology, human, Machine Learning, and deep learning algorithms are used. The circle size shows how frequently a keyword occurred. The interval between the two circles demonstrates their correlation

Conclusions

Totally 500 articles on the topic of Stress Recognition were selected in the SCOPUS database between the years 2011 to 2021 out of this 231 were selected which included n SCOPUS core database. Most successive keywords had a powerful link to "Physiology" and "Machine Learning used in research study. The most-elevated journal was sensors (Switzerland) with 15 publications and 154 citations. The USA published 81 articles with 1047 citations can y.s. and Ersoy c. published 5 articles with 110 citations. The published literature has focused on three topics Stress, Stress Recognition Stress, Human, and Machine Learning. Stress is affecting the day-to-day life of individuals that's why several researchers having their eyes in this domain and published several quality research papers It is especially imperative to assess the quality of numerous good research articles and extract fruitful results. To understand the impact of stress, mental health, Machine learning, and psychology research plays an important role

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