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APPLYING FUZZY LOGIC AND MACHINE LEARNING IN ELECTRONICS

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ABSTRACT

The paper provides an overview and analysis of the current state of research on the use of machine learning and fuzzy logic to solve challenges in electronics. The subject of the investigation.The goal of this domain is to summarise successes, trending topics, and future research objectives. A bibliographic approach was combined with a careful assessment of 66 selected publications as part of the applied research process. The findings demonstrate a gradual increase in interest in machine learning and fuzzy logic techniques for modelling, implementing, and upgrading various hardware-based intelligent systems over the last ten years. Machine learning and fuzzy logic techniques for modelling have sparked a lot of attention in the previous ten years

Keywords*: Fuzzy logic; neural networks; intelligent devises; sensors; Internet of Things; robotics.*

1. INTRODUCTION

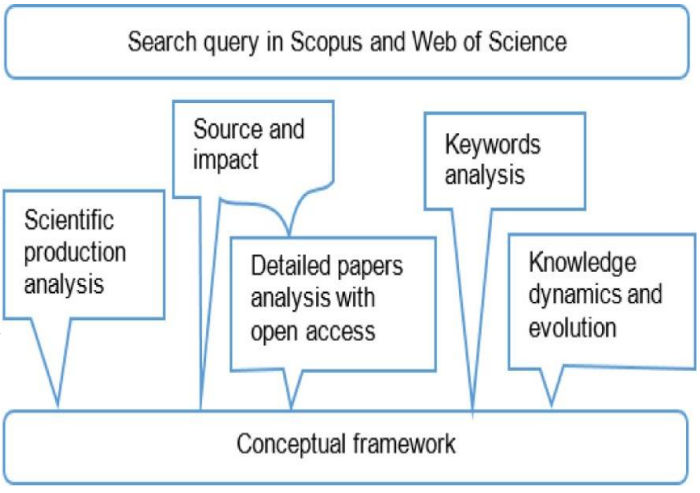
There has been a remarkable increase of digitalization and electronization in the previous three decades. Even "digital natives" are now familiar with the use of electronic devices, smart phones, and other sophisticated systems, which are already commonplace in our daily lives. Everyone is submerged in the ocean of information and communication technologies, and artificial intelligence solutions in the form of software or hardware techniques are used by everyone. Artificial intelligence is the simulation of human intelligence by machines. These are the systems, applications, and user interfaces that build a predetermined world based on known or expected optimal scenarios. The application of machine learning techniques to deformable objects [9] is a minor fraction of the research challenges that demand it. The goal of this project is to identify the most typical applications of machine learning in the field of electronics, whether they are basic or sophisticated.Another scientific subject that is utilised for modelling, description, and evaluation of things and systems with various levels of complexity is fuzzy logic.with the fuzziness, ambiguity, and uncertainty of their characteristics and qualities [10]. The use of logical rules in conjunction with the knowledge base developed results in a fuzzy or crisp inference that could point to one or more solutions. Fuzzy logic is commonly used in electronics.utilised to model and develop electrical devices, systems, and processes while taking into account the dynamic.

2. METHODOLOGY

This investigation's methodology combines bibliometric and visual analysis.

Figure 1 shows presentations and a full review of 66 selected scholarly papers.

Researchers utilize bibliometric analysis to map scientific knowledge about researched issues in a particular domain [12,13]. This enables for the conception of the explored regions, as well as information on previous and current scientific study. production, as well as identifying certain trends and research areas for the future. The resultant



Bibliographic data from the scientific literature is used to create bibliometric maps and figures.Creating search queries in the databases Scopus and Web of Science: "machine learning"and electronics," "fuzzy logic and electronics," and "fuzzy logic and electronics." After time filtering, the received results (the indexed works from 2011 to 2020 are considered, and they are organized by relevancy.proceed with the Biblioshiny package [14], which is included in the R software for statistical computing. The creation of a conceptual framew. • the most often used author's keywords and generated keywords, as well as the maps dIn addition, 66 open-access scientific publications from the most relevant and high-h-index sources are studied for a better

knowledge of the explored scientific subject .enveloped with trending subjects and knowledge progression.

3. APPLICATION OF MACHINE LEARNING

The application of machine learning in electronics is presented in this section by looking at the "big picture," using a bibliometric method [15], and conducting a systematic review of selected papers. Scientific publications A conceptual summary of recent research issues, including the annual scientific production, major sources of scientific papers, and current trends

3.1 Scientific Production:

In the Scopus database, 1535 documents are found, in which 3672 keywords are employed by 4893 authors. The authors of single-authored documents are 79; the authors of multi-authored documents are 4814; the coefficient, showing co-authors per documents, is 4.08; and the collaboration index is 3.46. In the scientific database Web of Science, a smaller number of documents (434) is identified, written by 1810 authors as the authors of single-authored documents are 27 and the authors of multi-authored documents are 1783. The coefficient, presenting co-authors per documents, is 4.72, and the collaboration index is 3.38. It seems that a big part of the indexed documents in Scopus and Web of Science are prepared in collaboration among several authors as the countries of the corresponding authors with the biggest contribution according to Scopus are: USA, China, India, Japan, and Germany (Figure 2). The parameter Multiple Countries Publication (MCP) measures the international collaboration as at least one co-author should be from another country. The parameter Single Country Publication (SCP) indicates that the corresponding author and his co-authors are from one country

4. APPLICATION OF FUZZY LOGIC

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4.1 Scientific Development:

The Scopus database returned 1021 documents as a result of the search. The number of documents returned in Web of Science is 199. Scopus has indexed papers that have There are 2617 authors who use 2577 keywords. The coefficient for single-authored texts is 36, whereas the coefficient for multi-authored publications is 2581.The cooperation index is 2.74, while the number of co-authors per document is 3.15. On the internet. There are nine single-authored publications and 618 multiauthored documents in the Journal of Science; the average number of co-authors per document is 3.35, and collaboration is high. The majority of the papers published are obviously collaborative. work. The corresponding author and his co-authors are usually from the same country.

4.2 Source Characteristics:

Figure 16 shows the twenty most relevant sources with published scientific articles in the investigated area according to Scopus. They can be divided into two categories: IECON Proceedings (Industrial Electronics Conference), IICPE (Indian International Conference on Power Electronics), IEEE International Symposium on Industrial Electronics, ICPEICES (IEEE International Conference on Power Electronics Intelligent Control and Energy Systems), and scientific journals and books

- Lecture Notes in Electrical Engineering, • Applied Mechanics and Materials, • IEICE Transactions on Communications
- Procedia Engineering, • Advanced Materials Research

5. CONCLUSIONS

This paper examines and reviews papers on machine learning and fuzzy logic that have been published and indexed in Scopus and Web of Science.Electronics logic techniques The conceptual vision to be articulated is the defined goal and the mapping of the knowledge gained in the examined domain As a result,Topics that are currently trending and research directions are identified. To make this analysis more thorough and more comprehensive, a bibliometric method combined with a full paper review is implemented The findings provide an overview of the scientific field over the last ten years.Machine learning usage for solving a wide range of problems is on the rise. Issues in electronics and the use of fuzzy logic with a wavering curve.

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