Bibliometric study on the Heuristics simulated annealing

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Introduction

This article conducts a bibliometric study on simulated annealing and its connections to other optimization heuristics. It aims to uncover trends and interactions between these heuristics for future research insights. The study uses Web of Science and Scopus databases for analysis.

Methodology and Materials

In this study, we carried out a comprehensive investigation into the trends and patterns of scientific publications in the areas of interest. The research was based on two renowned databases: Web of Science and Scopus. The selection criteria for the publications was meticulous, ensuring that only relevant work was considered. The methodology adopted, as well as the results obtained, can be summarized as follows:

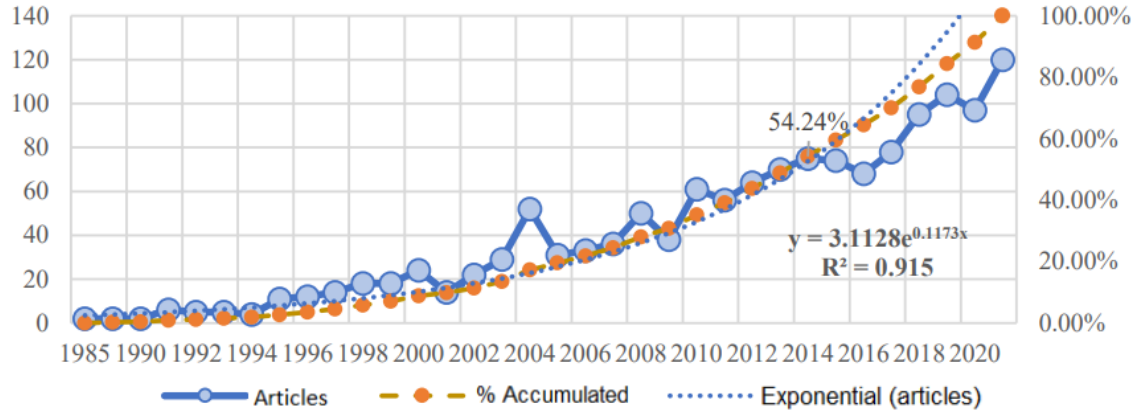
Methodology and Materials

1. This study used the Web of Science and Scopus databases due to their widespread use and support by the Bibliometrix R software package.
2. The database search employed the terms: ("Simulated Annealing") AND ("heuristic") AND ("real"), yielding 1,984 publications from 1985 to 2021.
3. After merging the databases and removing duplicates using the R-tool software and the Bibliometrix Library, 1,390 publications remained.
4. The bibliometric study classified the publications by year, country, research area, journal, author, and number of citations.
5. The three primary laws of Bibliometry were observed: Bradford's Law, Lotka's Law, and Zipf's Law.

Results

When examining the data on Simulated Annealing, Figure 1 depicts its scientific production growth over time. Despite declines in publications in specific years like 2005, 2009, 2011, and 2016, there was a significant increase overall. Articles on the topic went from 12 in 1996 to 104 in 2019, with over half of them published in the last six years, emphasizing the recency of this research area.

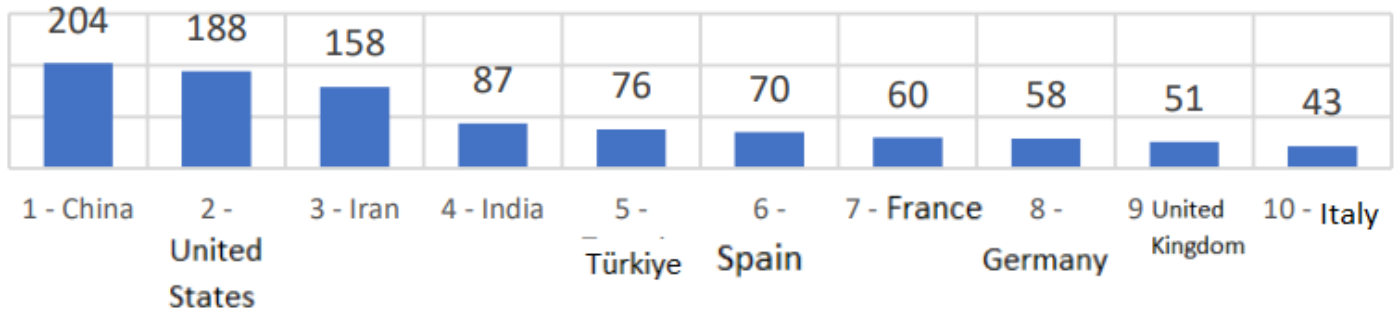
Figure 1: Temporal evolution of the number of articles published on Simulated Annealing



Results

Research on Simulated Annealing with the terms "heuristic" and "real" originated from 65 different countries. As shown in Figure 2, China was the leading contributor, publishing 204 out of the 1,390 articles. This output surpasses the combined total of articles from Germany, the United Kingdom, and Italy, which rank eighth, ninth, and tenth respectively.

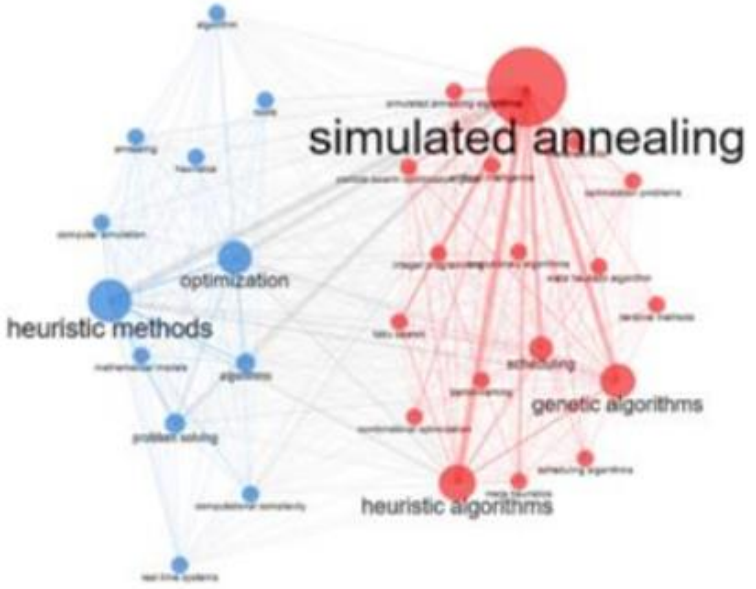
Figure 2: The top ten countries see research on Simulated Annealing containing the terms heuristic and real.



Results

A "keyword Plus" list was compiled from the article database to finalize the bibliometric study. For clarity in visualizing relationships, the number of nodes representing the keywords was limited to 30. These nodes were utilized to construct the network depicted in Figure 4.

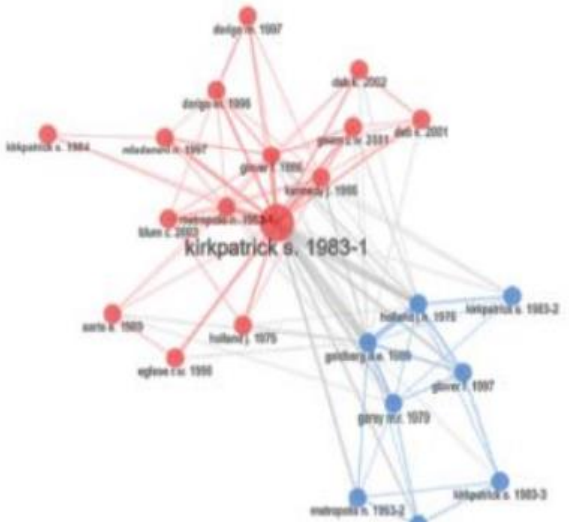
Figure 4: Network of sample keywords plus keywords.



Results

A co-citation analysis of articles on Simulated Annealing with "heuristic" and "real" terms was conducted to understand their interrelations. Using the paper field for visualization, nodules were capped at 30, including any isolated ones. Co-citation measures semantic similarity; the more two documents are cited together, the stronger their connection. Figure 4 highlights that (Kirkpatrick et al. 1983) interacts strongly with many works, likely due to its publication date.

Figure 5: Network of bibliographic couplings of sample articles



Conclusion

This paper conducted a bibliometric study analyzing 1,390 articles on Simulated Annealing with the terms "heuristic" and "real" from 1985-2021 in Web of Science and Scopus databases. Key findings include:

Conclusion

1. Exponential growth in research on Simulated Annealing, with half of the articles published in the last six years.
2. China contributed to roughly one-sixth of these articles.
3. Few journals published the majority of these articles, with "Lecture Notes in Computer Science" leading with 50 articles.
4. Professor Reza Tavakkoli-Moghaddam was the top contributor.

Conclusion

5. Recent keywords included metaheuristic, optimization, scheduling, genetic algorithm, and particle swarm optimization.
6. Results are specific to the sampled articles and cannot be generalized.
7. The study achieved its goal of understanding the evolution and trends in Simulated Annealing research.
8. The findings can guide future research in Operational Research related to Simulated Annealing.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