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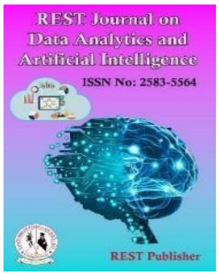

Optimization Techniques: Strategies for Enhanced Performance Using WSM Method

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Abstract: *Optimization techniques are important for improving the efficiency and effectiveness of systems in various fields, including engineering, data science, and business management. These methods aim to identify the optimal solution by refining objective functions while adhering to predefined constraints. Traditional methods such as linear programming (LP), nonlinear programming (NLP), and dynamic programming (DP) are commonly used to address complex optimization challenges. In addition, advanced meta-heuristic algorithms, including genetic algorithms (GA), particle swarm optimization (PSO), and ant colony optimization (ACO), have become popular for handling large-scale, multi-objective, and convergent problems. With the rapid progress in machine learning and artificial intelligence, hybrid approaches that combine deep learning models with optimization algorithms are increasingly attracting attention. This paper provides an in-depth analysis of various optimization techniques and their real-world applications their effectiveness in solving real-world problems. In addition, it emphasizes the importance of selecting an appropriate technique based on problem complexity and computational efficiency. Optimization plays a key role in developing accurate models, fostering innovation, and generating sustainable solutions. It helps researchers tackle complex problems with greater accuracy, ultimately leading to advancements in technology, industry, and society. The optimization process follows a systematic approach to finding the best possible solution within defined constraints. It begins by defining an objective function that represents the goal to be optimized, followed by identifying constraints that limit the solution space. Alternative Decision Making Techniques: For example, in selecting the best car, methods such as Analytical Hierarchic Properference Similarity to Ideal Solution (TOPSIS) are useful. AHP prioritizes criteria through pairwise comparisons and assigns weights, while TOPSIS identifies the best alternative by measuring its proximity to an ideal solution. Factors such as cost, efficiency, safety, and effectiveness are essential for making informed decisions. Car D: Choosing the right car involves evaluating many factors such as cost, fuel efficiency, safety, comfort, and performance, Car E: Normalize the decision matrix to standardize different criteria. Assign weightage based on user preferences. Reliability: In this scenario, reliability is assigned a weight of 0.4, which is the most important criterion compared to the other factors. This means that the optimization process will prioritize car A, B, C, D, or E based on their reliability scores. Style: Since style is assigned a weight of 0.1, it has a smaller impact compared to more important factors like reliability (0.4) or fuel efficiency (0.2). However, when all factors are considered together, cars with better styling will still score higher. Cost: Price is 0.3, which is one of the most important factors, but not the only one. Cars with lower prices and lower long-term costs will score better in the MCDM rankings. Fuel Economy: Fuel economy is a key factor in choosing a car, affecting operating costs, environmental impact, and long-term affordability. Optimization techniques are crucial for addressing complex real-world challenges in various domains. Choosing the right approach, whether traditional or meta-heuristic, helps researchers effectively identify optimal solutions. The integration of machine learning with optimization improves accuracy and efficiency, ensuring continued advances in both research and practical applications. The application of optimization techniques consistently yields improved solutions, improving efficiency and effectiveness in various domains. The results demonstrate that advanced methods such as met heuristics can effectively solve complex, non-convex problems that traditional methods struggle with. These techniques provide optimal or near-optimal solutions, significantly improving decision-making and resource allocation.*

Keywords: *Optimization methods, meta-heuristics, genetic algorithms, particle swarm optimization, linear and nonlinear programming, dynamic programming, constrained optimization strategies, solution approaches, resource management, evolutionary algorithms, decision-making strategies, and many other objectives.*

1. INTRODUCTION

To obtain the optimal solution when faced with many similar options, a strategic decision must be made. Since these alternatives are different but part of the same real-world system, choosing the best one among them is complex and requires careful evaluation. Improving the selection process involves distinguishing between options and ranking them effectively. This requires identifying relevant qualitative and quantitative factors that help differentiate and evaluate the available choices. [1] This review article aims to provide a thorough analysis of the various methods, their developments, applications, and possible future directions. It explores hybrid approaches that combine data-driven models with multiple techniques, leveraging machine learning and big data analytics. A detailed assessment of the strengths and limitations of each method will provide valuable insights into their suitability for different decision-making situations. These techniques have proven their effectiveness in addressing complex decision-making challenges. In various fields such as business, management, engineering, environmental planning, health, and public policy. Rapid technological and economic developments over the past five decades have had a significant impact on human life, leading to increasingly complex decision-making challenges. These methods are designed to assist individuals who are faced with multiple decision-making criteria and alternatives. The development of these techniques is driven by real-world problems that require consideration of multiple factors, while practitioners are able to apply advanced decision-making methods through recent advances in mathematical optimization and scientific computing. [3] To face the difficulties of global competitiveness, manufacturing companies are faced with the concern of selecting the most preferred practices, product design, machinery, equipment and process. The large number of options, combined with conflicting criteria, makes the decision-making process challenging. To aid in this complex process, optimization serves as a valuable tool for analysing real-world problems and selecting the most appropriate or cost-effective alternatives, especially in manufacturing processes. Since there is no single, definitive solution, different problems are classified based on the nature of their solutions. Optimization, as an engineering discipline, focuses on identifying the optimal values of the design criteria. However, This often requires balancing Many competitive goals, where Improving one metric may come at the cost of another. Multi-objective optimization (MOO) overcomes these conflicts by providing a mathematical framework for achieving an optimal design that satisfies multiple criteria for a specific application. The process of optimizing multiple objective functions simultaneously this process is referred to as multi-objective optimization. Due to the similarities between single and multi-objective optimization, the same algorithms can often be used for both. The primary difference lies in the transformation of the multi-objective problem into a single-criteria optimization problem. Like many countries around the world, Turkey is focused on reducing energy use, especially in the construction sector. The extensive and growing reliance on fossil fuels to meet rising energy needs is a major contributor to global warming and climate change. With the growing demand for environmentally friendly building solutions, there is a continuous drive to use sustainable building materials more efficiently while reducing their environmental impact. In recent years, environmental problems arising from energy production using non-renewable resources, coupled with the growing demand for energy, have greatly accelerated the transition to renewable energy sources. Of these, solar energy is the most promising option, with an annual production capacity that exceeds the world's total energy consumption. Infectious diseases have posed a global threat to human health for centuries. They can be transmitted from animals to humans, from humans to humans, or from humans to animals. The human immunodeficiency virus (HIV), which causes human immunodeficiency syndrome (AIDS), was first identified by French researchers forty years ago, two years after American scientists reported the first cases of AIDS. Since the beginning of the HIV/AIDS epidemic, the virus has spread worldwide, leading to more than 84 million infections and more than 40 million deaths. HIV weakens the immune system, which includes white blood cells, antibodies, and other key cells that protect against infections. In vitro studies reveal that HIV spreads by two mechanisms: virus-to-cell (VTC) and cell-to-cell (CTC) transmission. CD4 white blood cells, which play a key role in immune defines, are specifically targeted and affected by HIV. The life cycle of the virus begins when it attaches to a CD4 cell and injects its proteins and genetic material into the host cell. In parallel, rapid technological advances have led to the decline of traditional machining methods, giving rise to a variety of non-traditional machining (NTM) techniques across industries. Although NTM requires significant initial investment, it offers significant advantages such as high precision, smooth surface finishes and the ability to machine a variety of materials including composites, ceramics, high-strength alloy steels, and complex geometries. In addition, NTM reduces thermal deformation and heat-affected zones (HAZ), making it a preferred choice in modern manufacturing. On another front, osteoarthritis (OA) is a chronic and progressive joint condition characterized by pain, swelling, and restricted motion, which significantly affects a person’s mobility and quality of life. Furthermore, Alloy 718, a nickel-based super alloy, is widely recognized for its exceptional mechanical strength, corrosion resistance, heat and fatigue resistance, and low thermal conductivity. These desirable characteristics make it a popular choice for manufacturing critical components in aircraft, rockets, and submarine engines. However, these same properties make Alloy 718 difficult to machine. As a result, extensive research is being conducted to investigate its machinability under various cutting and lubrication conditions and to investigate the performance of various cutting tools. Similarly, wheelchairs are one of the most widely used assistive devices, meeting the daily needs of millions of people with disabilities. With the global population of disabled people increasing, the demand for assistive devices is steadily increasing every year.

2. MATERIAL

Alternatives: Car A: It sounds like you are referring to multiple criteria decision making (MCDM) techniques for car evaluation. These methods aid in decision making by evaluating multiple criteria to determine the best choice among available alternatives.

Car B: Analytical Hierarchy Process (AHP) evaluates criteria by conducting pairwise comparisons and assigning weights accordingly.

Car C: To choose the best car, one needs to evaluate many factors such as cost, efficiency, safety, and effectiveness. Techniques help improve the decision by considering multiple factors and systematically ranking the alternatives.

Car D: Choosing the right car involves evaluating many factors such as cost, fuel efficiency, safety, comfort, and performance. Techniques help improve the decision-making process by systematically analyzing and ranking the available options based on multiple criteria.

Car E: Normalize the decision matrix to standardize different criteria. Assign weightage based on user preferences. Determine best and worst values. Calculate Euclidean distances from best and worst solutions. Sort cars based on similarity to best solution.

Evolution Parameter: Reliability: In this scenario, reliability is assigned a weight of 0.4, which is the most important criterion compared to the other factors. This means that the optimization process will prioritize car A, B, C, D, or E based on their reliability scores.

Style: Since style is assigned a weight of 0.1, it has a smaller impact compared to more important factors like reliability (0.4) or fuel efficiency (0.2). However, when all factors are considered together, cars with better styling will still score higher.

Cost: Price is 0.3, which is one of the most important factors, but not the only one. Cars with lower prices and lower long-term costs will score better in the MCDM rankings.

Fuel Economy: Fuel economy is a key factor in choosing a car, affecting operating costs, environmental impact, and long-term affordability. Multi-criteria decision-making (MCDM) techniques help optimize vehicle selection by balancing fuel efficiency with other key factors such as cost, reliability, and safety. In this case, fuel economy is assigned a weight of 0.2, meaning it has a moderate influence on the decision-making process.

3. WSM METHOD

Topological quantum states of matter have recently emerged as an important and rapidly growing area of research in condensed matter and materials physics. A Well semimetal (WSM) refers to a novel quantum state that emerges due to time-reversal or reversal symmetry violation. WSMs are characterized by zero-energy points in their bulk spectra and localized Fermi arc excitations at their surfaces. Many materials have been theoretically predicted to have WSM properties. Based on these predictions, angle-resolved photoelectron spectroscopy experiments have verified the existence of WSMs, leading to the subsequent observations of both Well spots and Fermi arcs. In addition, spots were initially predicted and later found to be important in photonic crystals. In the context of radar-based measurements, the object tracking problem focuses on identifying the number of aircraft in the observation area, classifying them as commercial, military, or recreational, and determining their speeds, identities, and positions. However, object tracking presents significant challenges due to various sources of uncertainty, making it a complex task. Education is a way to face the future of a country and state. Good quality education will affect the level of human resources in a country. Higher education is an institution after secondary education that produces production, that is, students. Higher education is taken after secondary education. Higher education is taken after secondary education. The primary purpose of higher education is to develop students individuals with strong faith and devotion to God, uphold ethical values, maintain physical well-being, acquire knowledge, demonstrate creativity, independence, talent, competence, and cultural awareness, all for the benefit of their country. Students, as the output of a university, must have the skills to support themselves to achieve a bright future. Competition in work or employment is currently very tight university graduates need to be more creative intelligent. Being creative and innovative is a need and obligation for today's students. The increasing number of university graduates means that universities need to be smart about improving the skills of their students. A major limitation of WSM and other techniques is the inability to integrate data from various sources. These methods are not well suited for decision-making scenarios that involve multiple criteria that are unknown or unfamiliar to decision makers or experts. In some cases, some—if not all—of the criteria are only partially understood due to gaps in awareness, knowledge, or expertise. As a result, the decision-making process involves two distinct sets of criteria: those derived from a common information source, typically a group of experts, and those specific to an alternative information source. Therefore, the primary objective of this paper is to improve or refine WSM to effectively process and address decision-making scenarios that involve information from a variety of sources.

4. ANALYSIS AND DISCUSSION

TABLE 1. Optimization Techniques

	Reliability	Design	Cost	Fuel efficiency
Vehicle A	9.00	6.00	6.00	8.00
Vehicle B	7.00	7.00	8.00	9.00
Vehicle C	9.00	8.00	7.00	8.00
Vehicle D	7.00	7.00	8.00	9.00
Vehicle E	9.00	8.00	7.00	8.00

When choosing a car, several factors play a major role. Reliability (0.4) is the most significant factor, followed by cost (0.3), fuel economy (0.2), and style (0.1). Using best option can be determined by assigning weighted scores to each criterion. In this dataset, reliability and style are beneficial (B), meaning higher values are better, while cost and fuel economy are useless (NB), meaning lower values are preferred.

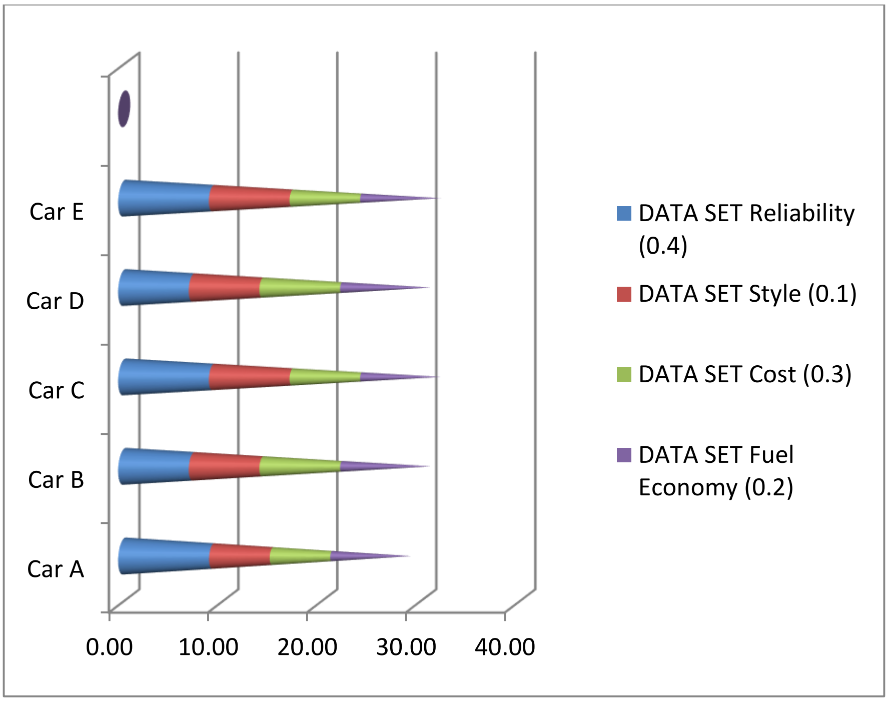

FIGURE 1. Optimization Techniques

Figure 1 A 3D stacked bar chart represents the ratings of five cars based on four key Evaluation factors: reliability (0.4), design (0.1), and cost (0.3) and fuel efficiency (0.2). Each criterion is assigned a specific weight, with greater emphasis on reliability. The chart visually compares how each car scores in these categories. From the visualization, cars C and E have higher overall scores, indicating stronger performance across multiple factors.

TABLE 2. Performance Value

	Reliability (0.4)	Design (0.1)	Cost (0.3)	Fuel efficiency (0.2)
Vehicle A	1.00000	0.75000	1.00000	1.00000
Vehicle B	0.77778	0.87500	0.75000	0.88889
Vehicle C	1.00000	1.00000	0.85714	1.00000
Vehicle D	0.77778	0.87500	0.75000	0.88889
Vehicle E	1.00000	1.00000	0.85714	1.00000

The dataset provides performance values for five cars based on four key criteria: reliability (0.4), design (0.1), and cost (0.3) and fuel efficiency (0.2). These values are normalized to a value of 1.00000, which represents the best performance for each criterion. The higher the value, the better the car performs in that category, except for cost, which is a non-useful (NB) criterion, meaning that lower values are preferable. According to the data, cars C and E have the highest performance values, scoring 1.00000 in reliability, style, and fuel economy, making them strong contenders. Car A also performs well but lags behind in style (0.75000). Cars B and D score low, especially in price and reliability, which could affect their rankings.

TABLE 3. Weight

	Reliability	Design	Cost	Fuel efficiency
Vehicle A	0.25	0.25	0.25	0.25
Vehicle B	0.25	0.25	0.25	0.25
Vehicle C	0.25	0.25	0.25	0.25
Vehicle D	0.25	0.25	0.25	0.25
Vehicle E	0.25	0.25	0.25	0.25

It looks like you are comparing five cars (A, B, C, D, E) based on four different factors: reliability, style, cost, and fuel economy, each with a different weight. The weights for each factor are as follows: reliability (0.4), design (0.1), and cost (0.3) and fuel efficiency (0.2). From the data provided, each car has an equal rating of 0.25 on all factors. In this particular comparison, the cars are assumed to be equally efficient on all criteria, and no car stands out based on these specific attributes.

TABLE 4: Weighted normalized decision matrix

	Reliability	Design	Cost	Fuel efficiency
Vehicle A	1.00000	0.93060	1.00000	1.00000
Vehicle B	0.93910	0.96717	0.93060	0.97098
Vehicle C	1.00000	1.00000	0.96220	1.00000
Vehicle D	0.93910	0.96717	0.93060	0.97098
Vehicle E	1.00000	1.00000	0.96220	1.00000

In a weighted normalized decision matrix, each car is rated on four factors: reliability, style, cost, and fuel economy. The matrix uses normalized values for each factor, and each factor is assigned a weight: reliability (0.4), design (0.1), and cost (0.3) and fuel efficiency (0.2). According to the data, Car A scores well on reliability, cost, and fuel economy, but scores slightly lower on style. Although it is slightly lower than Car A in reliability and cost, Car B performs reasonably well on all factors. Car C scores well on style and matches Car A's performance in reliability and fuel economy. Car D shares similar ratings to Car B, with minor differences in style and fuel economy.

TABLE 5. Priority Rating

Vehicle A	0.93060
Vehicle B	0.82072
Vehicle C	0.96220
Vehicle D	0.82072
Vehicle E	0.96220

The preference score represents the overall performance of each car based on a weighted normal decision matrix. These scores provide a clear indication of which car is best aligned with the weighted criteria of reliability, wear and tear, cost, and fuel economy. From the given data, both Car C and Car E lead with a preference score of 0.96220, reflecting their strong performance on the factors evaluated.

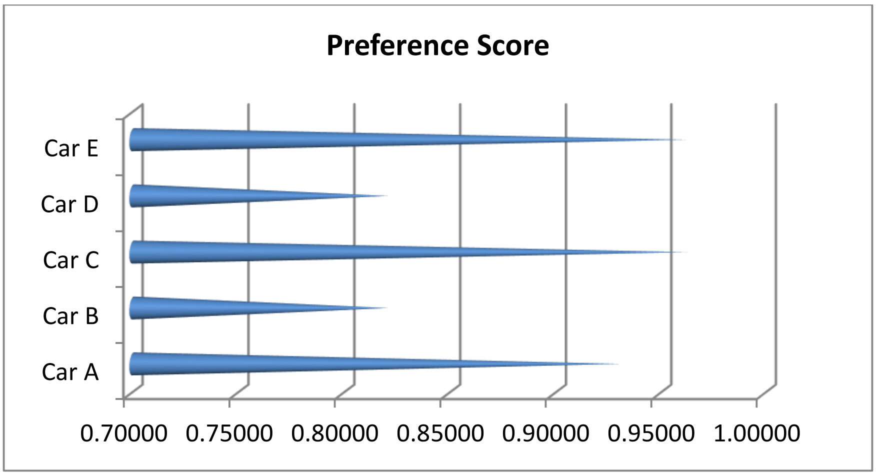

FIGURE 2. Optimization Techniques

Figure 2 Comparison of preference scores for different car models the bar chart illustrates the preference scores for five car models (Car A to Car E). The horizontal bars represent scores ranging from 0.7 to 1.0. Car E exhibits the highest preference score, while Car B and Car D have relatively low scores.

TABLE 6. RANK

	Rank
Vehicle A	3
Vehicle B	4
Vehicle C	1
Vehicle D	4
Vehicle E	1

The horizontal bar chart in Figure 1 shows the priority scores for five car models: Car A, Car B, Car C, Car D and Car E have scores ranging from 0.7 to 1.0, with a higher score indicating higher priority. Car E has the highest priority score, followed by Car C, Car B and Car D, which have relatively lower scores.

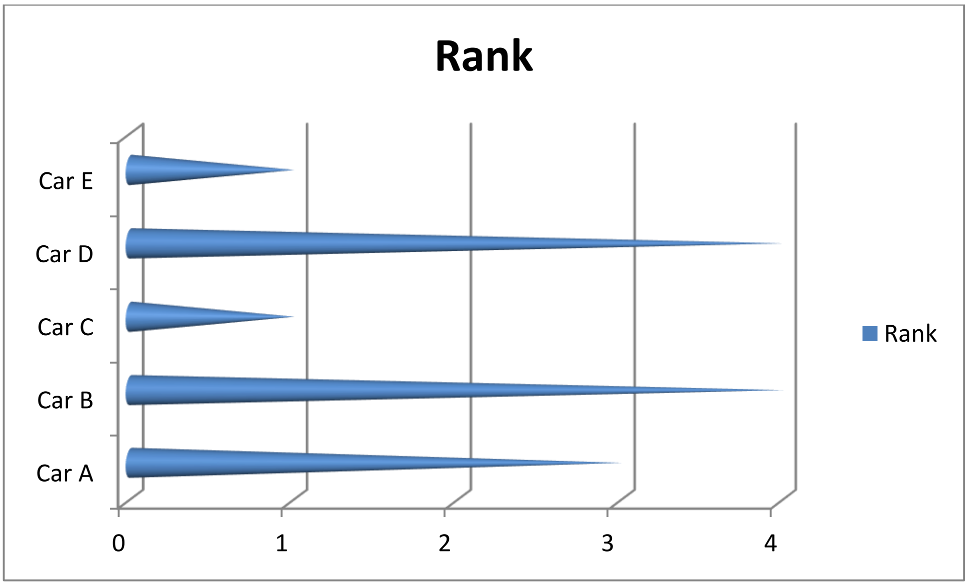

FIGURE 2. Optimization Techniques

Figure 3 Car C and Car E share the first rank (rank 1), while Car A ranks 3rd. Car B and Car D share the lowest rank (rank 4), indicating relatively poor performance. This visualization allows for a clear comparison of how each car model performed based on the ranking criteria.

5. CONCLUSION

MCDM is a valuable approach to address decision-making challenges, from everyday choices to complex scientific problems. It serves as a powerful tool that not only streamlines the selection process but also improves its accuracy. This in-depth review explores the advances, Applications and future possibilities of MCDM techniques. We explore fuzzy-based techniques, data-driven models, hybrid approaches, and other methods, emphasizing their advantages, disadvantages, and applications in various fields. This review underscores the important role of MCDM in facilitating complex decision-making processes involving multiple criteria and objectives. These methods provide valuable insights to decision makers, helping them evaluate and select alternatives based on their preferences and priorities. Furthermore, the study identifies potential areas for future research through an analysis of 628 articles from 20 scholarly journals organized using a structured classification framework. In general, optimizing multiple criteria requires more computational effort than optimizing a single criterion. Preference expression methods typically require Users can define their preferences through objective functions. On other hand, methods that use a posteriori priority allow users to explore possible solutions in a criterion space. Choosing a specific measurement method for top priority helps decision makers create a utility that reflects their preferred preferences. University department websites serve as valuable platforms for sharing details about academic staff, training facilities, and laboratories, making them an essential resource for current and prospective students. These websites should focus on attracting a wide audience to increase the visibility of the department and provide comprehensive information to students. Apart from the visitors who access the site directly, there are also those who come through search engines. To increase traffic from search engines, departmental websites should secure high rankings in the search engine results page (SERP).

REFERENCES

[1]. Singh, Aarushi, and Sanjay Kumar Malik. "Major MCDM Techniques and their application-A Review." *IOSR Journal of Engineering* 4, no. 5 (2014): 15-25.

[2]. Sahoo, Sushil Kumar, and Shankha Shubhra Goswami. "A comprehensive review of multiple criteria decision-making (MCDM) Methods: advancements, applications, and future directions." *Decision Making Advances* 1, no. 1 (2023): 25-48.

[3]. Toloie-Eshlaghy, Abbas, and Mahdi Homayonfar. "MCDM methodologies and applications: a literature review from 1999 to 2009." *Research Journal of International Studies* 21, no. 21 (2011): 86-137.

[4]. Majumder, Himadri, and Abhijit Saha. "Application of MCDM based hybrid optimization tool during turning of ASTM A588." *Decision Science Letters* 7, no. 2 (2018): 143-156.

[5]. Odu, G. O., and O. E. Charles-Owaba. "Review of multi-criteria optimization methods–theory and applications." *IOSR Journal of Engineering* 3, no. 10 (2013): 1-14.

[6]. Ulutaş, Alptekin, Firgen Balo, and Ayse Topal. "A new hybrid MCDM method for optimizing natural stone selection for building envelopes." *Revista de la construcción* 22, no. 3 (2023): 646-660.

[7]. Algarni, Mohammed, Mashhour A. Alazwari, and Mohammad Reza Safaei. "Optimization of nano-additive characteristics to improve the efficiency of a shell and tube thermal energy storage system using a hybrid procedure: DOE, ANN, MCDM, MOO, and CFD modeling." *Mathematics* 9, no. 24 (2021): 3235.

[8]. Farooq, Fozia Bashir, Sobia Sultana, Nouf Abdulrahman Alqahtani, and Muhammad Imran. "Optimization of HIV drugs through MCDM technique Analytic Hierarchy Process (AHP)." *PloS one* 20, no. 1 (2025): e0316617.

[9]. Petković, Dušan, Miloš Madić, Miroslav Radovanović, and Valentina Gečevska. "Application of the performance selection index method for solving machining MCDM problems." *Facta Universitatis, Series: Mechanical Engineering* 15, no. 1 (2017): 97-106.

[10]. Ahmed, Aariz, and R. Srikanth. "Application of geospatial techniques and the MCDM method to optimize interlinking of rivers in India." *Journal of the Indian Society of Remote Sensing* 51, no. 4 (2023): 849-863.

[11]. Nazari, Amirhossein, Abbas Roozbahani, and Seied Mehdy Hashemy Shahdany. "Integrated SUSTAIN-SWMM-MCDM approach for optimal selection of LID practices in urban stormwater systems." *Water Resources Management* 37, no. 9 (2023): 3769-3793.

[12]. Goswami, Shankha Shubhra, Dhiren Kumar Behera, Soupayan Mitra, C. Ahamed Saleel, Bahaa Saleh, Abdul Razak, Abdulrajak Buradi, and Abiot Ketema. "Development of entropy embedded COPRAS-ARAS hybrid MCDM model for optimizing EDM parameters while machining high carbon chromium steel plate." *Advances in Mechanical Engineering* 14, no. 10 (2022): 16878132221129702.
[13]. Begic-Hajdarevic, D., S. Klančnik, K. Muhamedagić, A. Čekić, M. Cohodar Husic, M. Ficko, and L. Gusel. "FDM process parameter selection by hybrid MCDM approach for flexural and compression strength maximization." *Advances in Production Engineering & Management* 19, no. 1 (2024).
[14]. Mian, Syed Hammad, Emad Abouel Nasr, Khaja Moiduddin, Mustafa Saleh, Mustufa Haider Abidi, and Hisham Alkhalefah. "Assessment of consolidative multi-criteria decision making (C-MCDM) algorithms for optimal mapping of polymer materials in additive manufacturing: A case study of orthotic application." *Heliyon* 10, no. 10 (2024).
[15]. Özkan, Barış, Eren Özceylan, Mehmet Kabak, and Metin Dağdeviren. "Evaluating the websites of academic departments through SEO criteria: a hesitant fuzzy linguistic MCDM approach." *Artificial intelligence review* 53 (2020): 875-905.
[16]. Ferdous, Jannatul, Farid Bensebaa, Abbas S. Milani, Kasun Hewage, Pankaj Bhowmik, and Nathan Pelletier. "Development of a generic decision tree for the integration of multi-criteria decision-making (MCDM) and multi-objective optimization (MOO) methods under uncertainty to facilitate sustainability assessment: a methodical review." *Sustainability* 16, no. 7 (2024): 2684.
[17]. Gribiss, Hamza, Mohammad Mohsen Aghelinejad, and Farouk Yalaoui. "Configuration selection for renewable energy community using MCDM methods." *Energies* 16, no. 6 (2023): 2632.
[18]. Ehrgott, Matthias, Kathrin Klamroth, and Christian Schwehm. "An MCDM approach to portfolio optimization." *European Journal of Operational Research* 155, no. 3 (2004): 752-770.
[19]. Solanki, Mihir, and Aakarsh Jain. "Optimization of material removal rate and surface roughness using Taguchi based multi-criteria decision making (MCDM) technique for turning of Al-6082." *Proceedings on Engineering* 3, no. 3 (2021): 303-318.
[20]. Shojaei, Fereydoon, Heidar Dashti Naserabadi, and Mohammad Javad Taheri Amiri. "Developing a fuzzy bi-objective programming and MCDM model for bridge maintenance strategy optimization." *Scientific Reports* 14, no. 1 (2024): 13336.
[21]. Ahmed, R., M. Afifi, and A. Nassar. "Using multi-criteria decision making (MCDM) methods in Egyptian construction projects." In *Canadian Society for Civil Engineering Annual Conference*. 2019.
[22]. Chen, Chui-Zhen, Juntao Song, Hua Jiang, Qing-feng Sun, Ziqiang Wang, and X. C. Xie. "Disorder and metal-insulator transitions in Weyl semimetals." *Physical Review Letters* 115, no. 24 (2015): 246603.
[23]. Bouraya, Sara, and Abdessamad Belangour. "A Wsm-Based Comparative Study Of Vision Tracking Methodologies." *Int. J. Adv. Comput. Sci. Appl* 12, no. 8 (2021): 87-98.
[24]. Ramadhan, Rizal Furqan. "ACHIEVEMENT STUDENT SELECTION SYSTEM USING THE SAW METHOD AND WSM METHOD." *JITK (Jurnal Ilmu Pengetahuan dan Teknologi Komputer)* 10, no. 1 (2024): 108-115.
[25]. Sorooshian, Shahryar, and Yasaman Parsia. "Modified weighted sum method for decisions with altered sources of information." *Mathematics and Statistics* 7, no. 3 (2019): 57-60.
[26]. Lopes, Diego Max Silva, Alexandro Rocha Scislewski, Lineu Azuaga Ayres da Silva, and Anna Luiza M. Ayres da Silva. "World Stress Map (WSM) as an Initial Research Tool for In Situ Stresses and the Contribution of Data Referring to Brazil." In *COBRAMSEG2020: anais*. 2022.
[27]. Whalley, W. Brian. "Earth Science, Art and Coastal Engineering at the Seaside: Envisioning an Open Exploratorium or Geo-Promenade at Weston-Super-Mare, Somerset, United Kingdom." *Geoheritage* 14, no. 4 (2022): 113.
[28]. Boggi, Silvina, Ramiro Alonso, and Walter Gustavo Fano. "Shielding effectiveness of a metamaterial measured at microwave range of frecuency, known as Wire Screen Metamaterial (WSM)." *Progress In Electromagnetics Research M* 63 (2018): 33-46.
[29]. Martin, T. J., T. L. Harvey, C. G. Bender, D. L. Seifers, and J. H. Hatchet. "Control of wheat streak mosaic virus with vector resistance in wheat." *Phytopathology* 74, no. 8 (1984): 963-964.
[30]. Shah, Pratik V., and Kandarp K. Thaker. "Evaluation of WSM, LRFD and FE Methods for Pile Capacity Calculation with Pile Load Test for IGM." In *Proceedings of the Indian Geotechnical Conference 2019: IGC-2019 Volume I*, pp. 335-347. Springer Singapore, 2021.