algorithms

MDPI

Editorial

Special Issue on Algorithms in Decision Support Systems Vol.2

Edward Rolando Núñez-Valdez

Department of Computer Science, University of Oviedo, 33007 Oviedo, Asturias, Spain; nunezedward@uniovi.es

Currently, decision support systems (DSSs) are essential tools that provide information and support for decision making on possible problems that, due to their level of complexity, cannot be easily solved by humans. These systems facilitate the extraction and manipulation of information in a flexible way, allowing users to define what information they need and how to combine it. Due to their ability to analyze and process data, they are widely used in different fields, such as population health management [1,2], education [3], medical diagnosis [4], catastrophe avoidance [5], agriculture [6], sustainable development [7], inventory organization [8], etc. The basic components needed to define the architecture of a DSS are (a) the knowledge base or database required for the storage of structured or unstructured information; (b) the user interface, essential for interactions between users and machines; (c) the model, used to infer decisions; and (d) the user, who normally uses the system and makes decisions. The models used by DSSs are usually based on different types of algorithms, such as neural networks, logistic regression, classification trees, fuzzy logic, etc.

As DSSs take on an increasingly central role in decision making in different scenarios, the need for researchers and developers to be able to refine and propose new algorithms to optimize the performance of these systems becomes more important, considering that these algorithms are usually adapted to the set of data available for a particular domain of knowledge. This Special Issue on "Algorithms in Decision Support Systems" provides a platform for researchers and practitioners in the field of decision support systems to exchange new ideas on these systems and their various applications.

This Special Issue includes seven articles meticulously scrutinized and approved for publication by our esteemed panel of experts. The major contributions of the accepted articles are outlined below.

The first article explores a crucial aspect of requirement engineering. It addresses the challenge of evaluating confidence in goal satisfaction, particularly when dealing with uncertain data used in goal model assessment. Unlike previous methods, this approach introduces a data quality tagging and propagation mechanism to compute confidence levels for goal satisfaction based on data quality.

The second article explores the growing significance of online reinforcement learning algorithms in customizing digital interventions. They extend the PCS (predictability, computability, and stability) framework, offering guidance for designing RL algorithms in digital contexts. This approach is applied to Oralytics, a mobile health study aimed at improving tooth-brushing behaviors through personalized intervention messages.

The third article introduces a method for efficiently generating alternatives in multi-attribute decision analysis. A BAG-DSM method is developed to find alternatives that require minimal changes from an initial state to achieve desirable outcomes within qualitative multi-attribute hierarchical models. It outperforms traditional methods, producing at least one suitable alternative within two seconds on average, and exhibits linear scalability with model depth.

The fourth article delves into tacit coordination games. The authors present an innovative approach for predicting cognitive conditions by analyzing coherence graph patterns

Citation: Núñez-Valdez, E.R. Special Issue on Algorithms in Decision Support Systems Vol.2. *Algorithms* **2023**, *16*, 512. https://doi.org/10.3390/a16110512

Received: 3 November 2023
Accepted: 6 November 2023
Published: 8 November 2023

extracted from multi-channel EEG data. With the application of a hierarchical classification model, their method achieved an exceptional total accuracy of 96.55%.

The fifth article offers a solution for precise healthcare cost prediction. The study, conducted within Colombia's Keralty group, employs long short-term memory (LSTM) models and K-means clustering. By analyzing sociodemographic and health-related variables, their model provides cost projections for 1 to 3 months. The model's reliability is validated with metrics such as RMSE and adjusted R2, making it a valuable tool for healthcare managers to optimize resource allocation and cost forecasting strategies.

The sixth article explores the remaining useful life (RUL) prediction for predictive maintenance, a crucial field. The authors introduce a novel approach unlike conventional neural networks, by analyzing spiking neural P (SN P) systems, a membrane computing paradigm. The article outlines how SN P systems are adapted for RUL prediction and proposes a neuro-evolutionary algorithm to optimize their structure and parameters. The results on two datasets, including NASA's CMAPSS benchmarks, show that SN P systems offer comparable performance to complex deep networks with a more reasonable number of trainable parameters, which affects memory consumption and computing time.

The seventh article introduces a platform for temporal case-based reasoning in complex domains. It extends a fuzzy vector space object-oriented model to represent timepoint knowledge objects and attributes. The article demonstrates the use of temporal fuzzy vector functions for comparing knowledge object evolution. It includes examples of implemented interfaces for various users and showcases the model's application in domains like medicine and municipal decision making. The article also discusses its current limitations and future prospects.

The research presented in this Special Issue opens new avenues of research for the scientific community. These contributions not only shed light on the current state of algorithms in decision support systems but also highlight potential breakthroughs and novel directions for future exploration. As we continue to advance in our respective fields, I look forward to the far-reaching impact and meaningful discoveries that these contributions will bring. I invite you to engage in further discussions, collaborations, and research endeavors, as together, we strive to push the boundaries of knowledge and innovation.

Acknowledgments: I extend my heartfelt gratitude to all the dedicated authors and diligent reviewers for their invaluable contributions to this Special Issue. I would like to offer a special thanks to the Editor-in-Chief of *Algorithms* for entrusting us with the privilege of curating this Special Issue.

Conflicts of Interest: The author declares no conflict of interest.

References

1. Moreira, M.W.L.; Rodrigues, J.J.P.C.; Korotaev, V.; Al-Muhtadi, J.; Kumar, N. A Comprehensive Review on Smart Decision Support Systems for Health Care. *IEEE Syst. J.* **2019**, *13*, 3536–3545. [CrossRef]
2. López-Martínez, F.; Núñez-Valdez, E.R.; García-Díaz, V.; Bursac, Z. A Case Study for a Big Data and Machine Learning Platform to Improve Medical Decision Support in Population Health Management. *Algorithms* **2020**, *13*, 102. [CrossRef]
3. Wang, W. Model Construction and Research on Decision Support System for Education Management Based on Data Mining. *Comput. Intell. Neurosci.* **2021**, *2021*, 9056947. [CrossRef] [PubMed]
4. Ahmed, A.S.; Salah, H.A. A comparative study of classification techniques in data mining algorithms used for medical diagnosis based on DSS. *Bull. Electr. Eng. Inform.* **2023**, *12*, 2964–2977. [CrossRef]
5. Buzolic, J.; Mladineo, N.; Knezic, S. Decision support system for disaster communications in Dalmatia. *Int. J. Emerg. Manag.* **2003**, *2*, 191–201. [CrossRef]
6. Zhai, Z.; Martínez, J.F.; Beltran, V.; Martínez, N.L. Decision support systems for agriculture 4.0: Survey and challenges. *Comput. Electron. Agric.* **2020**, *170*, 105256. [CrossRef]

7. Manos, B.D.; Papathanasiou, J.; Bournaris, T.; Voudouris, K. A DSS for sustainable development and environmental protection of agricultural regions. *Environ. Monit. Assess.* **2010**, *164*, 43–52. [CrossRef] [PubMed]
8. Borade, A.B.; Sweeney, E. Decision support system for vendor managed inventory supply chain: A case study. *Int. J. Prod. Res.* **2015**, *53*, 4789–4818. [CrossRef]