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Article

Introduction to the SI "Advances in operations research and machine learning focused on pandemic dynamics"

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Editorial

Introduction to the SI “Advances in operations research and machine learning focused on pandemic dynamics”



The World after the pandemic crisis deeply changed. Our life not only in the daily aspects have had reflects in terms of new challenges. Decision making and the related its own processes dynamics changed with respect the past. Deeply, it means. The emerging Artificial intelligence (AI) and related subfields of research are increasing the sphere of influence in many aspects of Science, redefining the balanced joining among the decision maker (Woman/Man) and the machine. Starting from this reflection, We wanted to arrange a collection of new scientific contributions in trying to point out the strategical centrality played by this new platform of scientific mixture among different disciplines and fields of knowledge to get new findings in this frame scenario [1–3]. This approach it will be important in the next future not only in terms of forecasting issue but also to the contrary for that concerns the back-casting to inspire the build a sustainable and robust growth and structural development [5,6].

Due to many aspects of the epidemic situations in terms of epidemiological, clinical and impact Data, Operations Research and Machine Learning (ML) have great strengths corresponding to the optimization category. By this collection of papers, We focused on providing the conceptual framework for algorithms that are tailored for causal inference, updated with the behavior of coronavirus. These algorithms were improved to provide valid confidence intervals for estimated effects on the models in the engineering, economics and natural sciences. The main objective of this proposal has been to allow the researchers to explore the applications of AI and ML in making decisions [4,5].

The work by Ali et al. [7], presents a novel evolutionary computation-based Padé approximation (EPA) scheme for constructing a closed-form approximate solution of a nonlinear dynamical model of Covid-19 disease with a crowding effect that is a growing trend in epidemiological modeling. In the proposed framework of the EPA scheme, the crowding effect-driven system is transformed to an equivalent nonlinear global optimization problem by assimilating Padé rational functions. Keeping in view the complexity of formulated optimization problem, a hybrid of differential evolution (DE) and a convergent variant of the Nelder-Mead Simplex algorithm is also proposed to obtain a reliable, optimal solution. The comparison of the EPA scheme results reveals that optimization results of all formulated optimization problems for the Covid-19 model with crowding effect are better than those of several modern metaheuristics. EPA-based solutions of the Covid-19 model with crowding effect are in good agreement with those of a well-practiced nonstandard finite difference (NSFD) scheme.

Narayanamoorthy et al. [8] by their own article present an interesting analysis related to Vaccine efficacy during the pandemic time. The study was conducted by the using with CSF-ELECTRE-I approach.

The Authors in their analysis start from the evidence that COVID-19 vaccinations have been shown to be safe, efficacious, and life-saving. Anyway, like other vaccines, they do not entirely protect everyone who receives them, and no one knows how effectively they can prevent people from spreading the virus to others or whether the booster dosage is dangerous to some vulnerable people. By a mathematical approach, the pragmatic, appropriate, and phenomenal mechanism of the complex spherical fuzzy set enhances the decision-making efficacy and the ordering quality of the ELECTRE I method to include a profitable and optimal approach for MAGDM. In the CSF environment, critically ill patients are investigated systematically using a pairwise comparison based ELECTRE-I technique. In this paper, the Authors have improved the precision of the CSF-based ELECTRE-I approach to an unique score function presenting really interesting evidences for that concerns decision making related two alternatives as well.

Yue Qi et al. [9], present a work by which introducing a counter-COVID measure for stocks, extending portfolio selection classical approach, and at the same time considering a multiple-objective portfolio selection. Because of the uncertainty in measuring counter-COVID, the Authors perform a robust optimization model. Specifically, were analytically compute the optimal solutions as a trail of an optimal portfolio due to the change of counter-COVID. This trail was named as mean-parameterized nondominated path. Moreover, the path is a continuous function of the change, so the portfolio relatively mildly varies for the change. In contrast, researchers typically still focus on 2-objective robust illustrations and infrequently explicitly compute the optimal solutions for multiple-objective portfolio optimization. This one in pills the main contribution of the paper.

Colajanni et al. [10], developed a supply chain optimization model for the preparation, provision, transportation, and execution of swab tests during COVID-19 pandemic. The proposed approach is based on a multi-tiered network consisting of manufacturing companies of reagents, processing laboratories, landing stations for UAVs and test centers. As innovations in the supply chain, the sharing of reagents between processing laboratories and the use of UAVs, using 5 G technology, are contemplated in the management of the COVID-19 Pandemic. To obtain the optimal solutions of the underlying optimization problem, the Authors have provided a variational formulation problem for which results of existence and uniqueness have been obtained.

Kang et al. [11], introduce by their article a study for analyzing the medication service robot selection during Coronavirus pandemic. Robotics are used among other strategies, to lower COVID's fatality and spread rates globally. The robot resembles the human body in shape and is a programmable mechanical device. As COVID is a highly contagious

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disease, the treatment for the critical stage COVID patients is decided to regulate through medication service robots (MSR). The use of service robots diminishes the spread of infection and human error and prevents frontline healthcare workers from exposing themselves to direct contact with the COVID illness. The selection of the most appropriate robot among different alternatives may be complex. So, there is a need for some mathematical tools for proper selection. Therefore, this study design the MAUT-BW Delphi method to analyze the selection of MSR for treating COVID patients using integrated fuzzy MCDM methods, and these alternatives are ranked by influencing criteria. The trapezoidal intuitionistic fuzzy numbers are beneficial and efficient for expressing vague information and are defuzzified using a novel algorithm called converting trapezoidal intuitionistic fuzzy numbers into crisp scores (CTrIFCS). The most suitable criteria are selected through the fuzzy Delphi method (FDM), and the selected criteria are weighted using the simplified best-worst method (SBWM). The performance between the alternatives and criteria is scrutinized under the multi-attribute utility theory (MAUT) method. Moreover, to assess the effectiveness of the proposed method, sensitivity and comparative analyses are conducted with the existing defuzzification techniques and distance measures. This study also adopt the idea of a correlation test to compare the performance of different defuzzification methods. Touqeer et al. [12], present a paper by which discussing a new approach for managing multiple criteria group decision-making situations with completely unknown priority weights modeled as IT2TrPFPRs (i.e. "interval type-2 trapezoidal pythagorean fuzzy preference relations"). To aggregate the opinion of multiple decision-makers, a hybrid averaging operation based on weighted averaging and ordered weighted averaging (OWA) operations is employed for a collective decision environment. To calculate the fuzzy priority weight vectors in case of completely unknown environment, the Authors construct a non-linear optimization model. An integrated optimization model based on a new signed distance-based closeness coefficients approach is employed to determine the priority ranking of alternatives. Feasibility of the proposed technique is discussed with an implementation of patient centered medicine system for choosing the appropriate treatment method. Moreover, a comparative investigation with previous approaches is conducted to demonstrate the effectiveness of the given approach.

Ahmad et al. [13], have arranged a study to attain the following objectives: (i) identifying the potential psychological problems/factors that might have been caused due to COVID-19 led social distancing and lockdowns, and (ii) Determining the ranks of the identified psychological factors to reflect their degree of criticality. The first objective was achieved by gathering information about the potential psychological factors from the experts. Data, in terms of linguistic variables, were collected from the experts and analyzed using two fuzzy-based multi-criteria decision-making (MCDM) methods i.e. Fuzzy Best Worst Method (F-BWM) and Fuzzy TOPSIS (F-TOPSIS) which led to the accomplishment of the second objective. The results of this study revealed that anxiety, stress, panic attacks, frustration, and insomnia were the top five critical psychological factors that might have affected people due to this pandemic. Consistency of the results was ensured by comparing the obtained ranks with the ranks found using the Fuzzy WSM and Fuzzy MABAC methods. In addition, the robustness of the results was ascertained by conducting the sensitivity analysis. Based on the findings of the study, the identified factors were categorized into most, average, and least critical psychological factors.

The Special Issue collects of 7 papers, presented by distinguished and experienced authors from 12 different Countries (China, Iran, Iraq, Italy, India, Lebanon, Malaysia, Pakistan, Republic of Korea, Saudi Arabia, Taiwan, Turkey).

In summary, this collection provides a list of technical papers that could be of interest to operational researchers, scientists and practitioners in the fields object of this one in exploring strategies, methods, models and tools to improve a new approach meeting the arising challenges within a "dynamically changeable" Society.

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Ali Ahmadian (Co-Guest Editors) is an *Adjunct Professor* at the Kean University- Wenzhou Campus, an *Associate Researcher* at the Mediterranean University of Reggio Calabria, Italy and an *Associate Fellow Researcher* at the Institute of IR 4.0, The National University of Malaysia. As a young researcher, he is dedicated to research in applied mathematics. He received his Ph.D. in early 2014 as the best postgraduate student from Universiti Putra Malaysia (UPM). After his Ph.D. He took a postdoctoral fellowship at the same university as part of the numerical analysis research group and at the same time joined the University of

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