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Editorial

Special Issue on Algorithms for Sequential Analysis

Georgy Sofronov

School of Mathematical and Physical Sciences, Macquarie University, Sydney, NSW 2109, Australia; georgy.sofronov@mq.edu.au

Citation: Sofronov, G. Special Issue on Algorithms for Sequential Analysis. *Algorithms* **2022**, *15*, 470. https://doi.org/10.3390/a15120470

Received: 8 December 2022
Accepted: 9 December 2022
Published: 10 December 2022

In a large variety of different fields, it is necessary to make decisions while information is still being collected. Decision-makers regularly face such problems in many areas including cybersecurity, epidemiology, financial applications, industrial quality control, network performance monitoring, resource allocations, and signal processing. This Special Issue includes a collection of articles which provide an overview of the latest developments in algorithms for sequential analysis.

In reference [1], the authors study the feasibility and efficiency of constructing and using kd-trees in Gaussian process regression. It is shown that kd-tree approximation can lead to considerable time savings without sacrificing accuracy to an extensive degree. The proposed cut-off rule is easy to interpret and it can be tailored for different computational budgets. The authors apply their method in a sequential analysis setting to the following two types of generated data: a 3D point cloud with hotspots and a simulated 2D laser Doppler vibrometry example.

Article [2] computes closed-form expressions for the value functions of optimal stopping problems. The authors derive explicit solutions to the perpetual American cancellable standard put and call options in an extension of the Black–Merton–Scholes model under the assumption that the contracts are cancelled at the last hitting times for the underlying asset price process of some constant upper or lower levels which are not-stopping times with respect to the observable filtration. It is shown that the optimal exercise times are the first times at which the asset price reaches some lower or upper constant levels with the proof being based on the reduction in the original optimal stopping problems to the associated free-boundary problems and the solution of the latter problems by means of the smooth-fit conditions.

Article [3] focuses on models of the dynamics of the spread of infection over time when the population consists of individuals who are susceptible to infection, sick, immune to vaccination or past infection, and partially susceptible. To numerically solve variational problems that appear in the epidemic dynamics model, the authors propose the use of a stochastic optimization algorithm called the Cross-Entropy (CE) method [4]. The paper presents the way in which the CE method can be used for problems of optimization of epidemiological models, and more specifically the optimization of the Susceptible–Infectious–Recovered–Cross-immune (SIRC) model based on the functions supervising the care of specific groups in the model.

In reference [5], the authors propose a novel deep neural network named graph convolutional network transformer recommender (GCNTRec). GCNTRec is capable of learning effective item representation in a user's historical behaviors sequence, which involves extracting the correlation between the target node and multi-layer neighbor nodes on the graphs constructed under the heterogeneous information networks in an end-to-end fashion through a graph convolutional network (GCN) with degree encoding, while capturing long-range dependencies of items in a sequence with the transformer encoder model. Using this multi-dimensional vector representation, items related to a user historical behavior sequence can be easily predicted. The authors empirically evaluate GCNTRec on multiple public datasets with the experimental results showing that the proposed approach can effectively predict subsequent relevant items and outperforms previous techniques.

Funding: This research received no external funding.

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

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