International Journal of Network Dynamics and Intelligence

Scilight

Editorial

Inaugural Issue for International Journal of Network Dynamics and Intelligence

Zidong Wang*

Department of Computer Science, Brunel University London, Uxbridge, Middlesex, UB8 3PH, United Kingdom
* Correspondence: Email: zidong.wang@brunel.ac.uk. Tel.: +44-1895-266021. Fax: +44-1895-251686

Received: 26 December 2022
Accepted: 26 December 2022
Published: 27 December 2022

It has been my great pleasure to introduce you the inaugural issue for *International Journal of Network Dynamics and Intelligence* (IJNDI), which serves as a uniquely positioned world-leading journal dedicated to publishing high quality, rigorously reviewed, original papers that contribute to the methodology and practice in the field of network dynamics and network intelligence, where theory, practice and applications are the essential topics being covered.

Recent advances in dynamics analysis and intelligent computation have contributed much to the successful handling of complex networked systems which include, but are not limited to, network sciences, neural networks, emerging networks, network intelligence, network learning, and network optimization. The overall aim of this inaugural issue is to bring together the latest/innovative knowledge and progresses in handling networked dynamics and intelligence, which are largely dependent on methods from artificial intelligence, applied mathematics, statistics, operational research, and engineering. There are ten high-quality papers published in this inaugural issue that have covered various aspects of network science and engineering, including complex networks, biological networks, sensor networks, neural networks, network intelligence, network learning, as well as dynamical networks.

The internet of things refers to a set of technologies cooperating to network the physical world which aims to interconnect everything and enable proper processing on the collected data to support high-level decision making. The concept of internet of things greatly extends the coverage area that human being can perceive, access, and even control. In the first paper entitled "*A survey on evolved LoRa-based communication technologies for emerging internet of things applications*" by Yao *et al*., the concept of LoRa techniques is introduced, a fundamental understanding of LoRa communication is provided, and LoRa techniques working together with other technologies to deliver better services to end users is demonstrated in emerging IoT application areas. The objective of this survey is to (1) provide a fundamental understanding of the LoRa technology; (2) explore research activities studying LoRa based communication systems for new IoT applications; and (3) demonstrate how the LoRa technology works together with other technologies to deliver better IoT services to end users.

The output regulation problem is one of the central control problems in the control community. The output regulation aims to design a feedback control law for a given plant such that the output of the plant asymptotically tracks a class of reference inputs in the presence of a class of disturbances while ensuring the internal stability of the closed-loop system, where the cooperative output regulation problem is an extension of the leader-following consensus problem of multi-agent systems. In the second paper entitled "*The cooperative output regulation by the distributed observer approach*" by Su et al., the cooperative output regulation problem is discussed by using the distributed observer approach with the emphasis on linear multi-agent systems, the distributed observer approach and the distributed internal model approach are developed, and the evolution process of three types of distributed observer approaches and the corresponding solutions to the cooperative output regulation problem are given. Finally, some variants and extensions of the distributed observer approach are surveyed for completeness.

Transmission lines are one of the most salient parts of a power delivery system, which are exposed to unexpected and severe atmospheric conditions, making them prone to faults. Therefore, detection, identification, and location estimation methods are essential for an efficient and timely repair of transmission lines faulty regions and reduction of the excessive costs of triggering circuit breakers when faults are detected mistakenly. In the third paper entitled "*Real-time sensing and fault diagnosis for transmission lines*" by Shakiba et al., a robust detection and identification system is designed by using the convolutional neural networks. Moreover, the robustness of this technique is analysed for the variations of the phase difference between two connected buses, fault resistance, source inductance

fluctuations, fault inception angle, local bus voltage fluctuations, and measurement noises. Finally, the time delay analysis is conducted to indicate that the presented technique can detect, identify, and estimate the location of faults before tripping relays and circuit breakers disconnect a faulty region.

Recent advances in artificial intelligence have shown promising results in various image-based systems, improving accuracy and throughput, while reducing latency. Nevertheless, there are also multiple challenges integrating AI in existing systems, such as poor explainability, data imbalance and bias. These challenges affect the reliability of the neural networks used in artificial intelligence applications. In the fourth paper entitled "*Can AI see bias in X-ray images?* " by Alicja et al., a detailed analysis of chest X-ray datasets of 14 common lung disease categories is performed, which includes data cleaning, visualization, common features selection, and distribution inspection, the presence of class imbalance and bias is examined by comparing the probability of favorable outcome for privileged and unprivileged instances, and various CNN topologies are compared to select the best performing one and evaluate the possibility for bias mitigation using different weighting approaches.

Cognitive computing is recognized as the next era of computing. To make hardware and software systems more human-like, emotion artificial intelligence and cognitive artificial intelligence which simulate human intelligence are the core of real artificial intelligence. The current boom of sentiment analysis and affective computing in computer science gives rise to the rapid development of emotion artificial intelligence. Nevertheless, the research of cognitive artificial intelligence has just started in the past few years. In the fifth paper entitled "*From emotion AI to cognitive AI*" by Zhao et al., the authors discuss the future cognitive artificial intelligence, which makes computers capable of analyzing, reasoning, and making decisions like human users. The relationship between the emotion and cognition is discussed, the emotion artificial intelligence and cognitive artificial intelligence are introduced, and the important aspects of cognitive artificial intelligence are specifically discussed including engagement, regulation, decision making, and discovery. Finally, the opinions of research focus are displayed for future cognitive artificial intelligence.

Common spatial pattern technique is very popular in terms of electroencephalogram (EEG) features extraction in motor imagery-based brain-computer interface. Through the simultaneous diagonalization of the covariance matrices, common spatial pattern intends to transform data into another mapping with data of different categories having maximal differences in their measures of dispersion. In the sixth paper entitled "*Deep common spatial pattern based motor imagery classification with improved objective function*" by Yu et al., the authors argue that the objective function realized by original common spatial pattern method could be inaccurate by regularizing the estimated spatial covariance matrix from EEG data by trace, leading to some flaws in the features to be extracted. To this end, an improved objective function is proposed by investigating and analyzing the theoretic limitation of the original common spatial pattern algorithm, and a novel DCSP method is proposed to extract sensitive and discriminative features from raw EEG signals, aiming to solve the problem of inaccurate objective functions in the original common spatial pattern algorithm.

The adaptive dynamic programming (ADP) technology is widely used benefiting from its recursive structure in forward and the prospective conception of reinforcement learning. Furthermore, ADP-based control issues with communication constraints arouse ever-increasing research consideration in theoretical analysis and engineering applications due mainly to the wide participation of digital communications in industrial systems. In the seventh paper entitled "*Adaptive dynamic programming for networked control systems under communication constraints: A survey of trends and techniques*" by Wang et al., the development of ADP-based dominant methods is investigate consisting of the structure and the algorithms, ADP-based control latest development under communication constraints is profoundly introduced, including ADP-based control with network-induced phenomena and one with communication protocols, and the applications of the ADP-based control method in practical systems are systematically reviewed. Finally, conclusions and future works are given.

Most biological processes are not conducted by single biological individual but depend on the joint efforts of multiple interacting molecules. The diversity of nodes in a complex network causes each node to have varying significance, and the important nodes often have a significant impact on the structure and function of the network. Although the interpretation of the results of biological networks must always depend on the topological study of nodes, there is presently no consensus on how to use these metrics, and most network analyses always result in a basic interpretation of a limited number of metrics. In the eighth paper entitled "*A mini review of node centrality metrics in biological networks*" by Wang et al., the authors assess the current applications, advantages, disadvantages as well as potential applications for 10 typical nodal metrics in biological networks. A review of previous studies is provided, and the suggestions are made correspondingly for the purpose of improving biological topology algorithms. Finally, some recommendations are given.

Non-Gaussian randomness widely exists in complex dynamical systems, in which the traditional mean-variance index cannot fully reflect the systematic characteristics. To improve the performance of control design subjected to non-Gaussian noises, stochastic distribution control theory is proposed, where the output probability density func-

tion is investigated as an additional system variable. Following this framework, stochastic distribution control is extended to other research subjects in control systems such as filter design, fault diagnosis, and so on. In the ninth paper entitled "*Recent advances in non-Gaussian stochastic systems control theory and its applications*" by Zhang et al., the authors summarise the main research work regarding non-Gaussian stochastic systems in the last 5 years. The stochastic distribution control problem is reviewed, the results of minimum entropy systems are summarized, non-Gaussian filtering is considered, the algorithm complexity is indicated, and the potential directions are given for future work.

Bovine brucellosis is one of the most important infectious and contagious zoonotic disease that hinders livestock productivity and consequently causes major economic losses to producers. It is a cause of great concern in places with important agricultural activities, such as in Central and South American countries. Due to this scenario, several countries adopt official control programs, with the purpose of reducing impacts caused both on human and animal health. In the last paper entitled "*Individual-based modelling of animal brucellosis spread with the use of complex networks*" by Pinto et al., the authors study the spread of brucellosis in the state of São Paulo with the help of the complex network theory and to propose control measures for its eradication. the used compartmental model is described, complex networks are presented, and optimal control is presented. Finally, results show that using the same level of vaccination, same cost, a heterogeneous policy is able to eradicate the disease, different from what is observed in a homogeneous approach.

This inaugural issue is a timely reflection of the research progress in the area of network dynamics and intelligence. Finally, I like to acknowledge the tremendous efforts from all the high-profile authors in preparing high-quality papers. I am also very grateful to the reviewers for their thorough and on-time reviews of the papers. Last, but not least, my deepest gratitude goes to the admin staff at Scilight Press for their consideration, help, and advice to publish this inaugural issue.

Zidong Wang
Editor-in-Chief of IJNDI
London, UK
December 2022

Citation: Wang, Z. Inaugural Issue for International Journal of Network Dynamics and Intelligence. *International Journal of Network Dynamics and Intelligence*. https://doi.org/10.53941/ijndi0101001