Context-Aware Computing and Nature-Inspired Computing

ICCASA and ICTCC 2020

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Abstract

The part of this special issue with the title of “Context-aware Computing and Nature-inspired Computing: ICCASA and ICTCC 2020” edited by Prof. Phan Cong Vinh is presented to scientists, researchers, experts and students in the fields of context-aware computing and nature-inspired computing. Hopefully, they will find this part stimulating their research related to the hot topics of contextual cognitive computing and nature-inspired computing and being useful for their future work.

Keywords Context-aware computing · Context-aware models · Context-awareness-based systems · Nature-inspired computing

1 Introduction

On behalf of the Editorial Board, we welcome you on the part of the “Mobile Networks and Applications” journal. In this part, we present six extended papers selected from contributions at 9th EAI International Conference on Context-Aware Systems and Applications (ICCASA 2020) and 6th EAI International Conference on Nature of Computation and Communication (ICTCC 2020) spanning many different aspects of context-aware computing and nature-inspired computing.

This part, with papers contributed by researchers from academia, will serve as a reference for researchers, scientists, experts and students in computer science and computer engineering, as well as developers and practitioners of designing computer systems and networks by providing them with the cutting-edge research results and future opportunities and trends. These contributions include

formal methods and practical applications for context-aware computing and nature-inspired computing. In other words, this part covers emerging research topics related to theory and applications for contextual cognitive computing and nature-inspired computing.

2 Contents

The papers in this part reflect some recent advances in context-aware computing and nature-inspired computing. Specifically, this part covers many different topics of context-aware computing and nature-inspired computing as follows:

Paper 1 by Prince Sharma, Shailendra Shukla, Satya Prakash Ghrera and Amol Vasudeva [5] presents that the rise in application of mobile phones, tablets, PDAs and internet applications for services like news, online data streaming for video, gaming, and heavy file transmissions shows significant growth in internet traffic. Conventional way for these services is to rely on the infrastructure (like cellular tower WiMAX, WiFi, and Femtocells) but current demand of data is unmanageable by these devices. The naive approach to cope with the large data is to increase the infrastructure. Drawback with infrastructure is, it requires a high financial investment, long process of development, low return value and high maintenance cost. So to overcome the burden of data offloading, researchers come up with the approach where available target set selection (NP-hard) is exploited for data offloading. This paper focuses on the

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optimization of target set selection and data offloading. Authors propose heuristics based optimal target set selection algorithm and an opportunistic data offloading approach. The proposed algorithm requires polynomial time $O(k^3)$ where k is a number of nodes in primary target set for convergence. To validate the result, authors have used *NUS* and *MIT* datasets and compared it with greedy, heuristic, and community based approaches. Analysis of the result shows that the proposed algorithm *FPDTSS* outperforms the greedy approach by 35% in terms of traffic offloading over cellular towers, 20% less as compare to heuristic approach and 23% less average latency when compared to community based algorithms. Result also shows that the optimal path determined by the proposed algorithm is the optimal route (reduction in target set nodes) to forward the data.

Paper 2 by Seyyed Mohammad Safi, Ali Movaghar and Komeil Safikhani Mahmoodzadeh [4] reports that in recent years, mobile social networks have largely been developed and gained considerable popularity. An approach to protecting privacy on mobile social networks is the use of encryption and access control. Good alternatives for use on mobile social networks are the Public Broadcast Encryption approach for appropriate concordance and consistency with the structure of social networks as well as the Attribute-Based Encryption owing to its capability and proper implementation of the access control policy. Accordingly, in this paper, a framework is presented based on the Public Broadcast Encryption and Attribute-Based Encryption. Using proxies, authors outsource some of these operations in the proposed framework to reduce the computational load of the end device, accelerate the encryption and decryption operations, and decrease the amount of storage memory for keeping the encryption and decryption parameters required by the users in the end-device. Cloud is also employed to store the shared data and user preferences in the social network. The results of investigating the privacy parameters reveal that the framework is superior to the four compared methods. Additionally, the results indicate that in terms of three important parameters in mobile social networks, namely communication, computation, and storage complexity, the method has less complexity and overhead than they have.

Paper 3 by Vo Thi Hong Tuyet, Nguyen Thanh Binh, Nguyen Kim Quoc and Ashish Khare [6] presents that in traditional text based medical image retrieval system, it is hard to find visually similar images in large medical image database. Content-based image retrieval is developed to retrieve similar images and it is based on visual attributes describing the content of an image. Developing a method for content based medical image retrieval is a challenging task. This paper proposes a new method for content-

based medical image retrieval based on salient regions and deep learning. The proposed method includes two stages: an offline task to extract local object features and an online task for content-based image retrieval in database. In first stage, authors extract local object features of medical image depending on shape, texture and intensity, and features extracted by deep learning applied in saliency of decomposition. Secondly, authors make online task for content-based image retrieval in database. The user gives query image as an input and the system will retrieve n top most similar images by similarity comparison with bag of code words feature values obtained in the first stage. Evaluation of the proposed method is based on Precision and Recall values. The dataset includes 5 groups of medical images with their quality varying from low to high. With the best medical image quality group, the accuracy can be 91.61% for Precision and 89.61% for Recall. Comparing the average values with others methods, the results of the proposed method are more than 2 to 5% better.

Paper 4 by Hiep Xuan Huynh, Nga My Lam Phan, Huong Hoang Luong, Linh My Thi Ong, Hai Thanh Nguyen and Bernard Pottier [2] reports that brown plant hopper (BPH) is one of the most dangerous insects that cause damage to rice. Aphids infected rice fields with low productivity can be lost even. Dealing with this situation, the plant protection industry has invented the light trap—a device based on the specific activity of insects phototaxis. These measures are considered effective and less costly today. However, the current light traps are usually installed next to the home of the staff assigned to manage light traps for easy tracking without attention to the impact of environmental factors around. Currently, the plant protection industry wants more scientific basis in light traps arranged so they want to review and make the factors of climate and geography in the light traps installed but not yet performed. In this paper, authors propose an approach to find appropriate positions to replace light traps based on a combination between weather factors and geographical factors with data on infected areas by BPH with various infection levels exhibited on the maps based on cellular automata method. Authors present the simulation results with 8 considered cases to determine positions for light traps in an area of more than 1400 square kilometers including 84 communes in Can Tho city, one of the largest rice granaries in Vietnam.

Paper 5 by Hong Anh Le [3] describes that the number of mobile applications downloaded recently from Google stores increase steadily. It is believed that mobile applications market revenues will grow fast and receive more attention from software developers. Even though, hardware technologies and operating systems have made a big contribution to improve the battery capacity, power consumption is one of the most important and crucial non-functional

properties of mobile applications. Many approaches have been dedicated for analyzing and optimizing the power consumption at different levels. This paper proposes a method for analyzing energy leaks of Android application at the design phase. First, it introduces a formalization of an event-based power consumption model. After that, the paper presents a method to translate this model to Event-B notations. Based on the target model, it is able to check if the application leads to energy leaks or violates the power consumption constraints based on formal proofs. Finally, the motivating examples are shown for the illustration purpose.

Paper 6 by Nguyen Van Han and Phan Cong Vinh [1] reports that dynamic system is important for cognitive science in which cognitive map, fuzzy cognitive map are special cases. Both cognitive and fuzzy cognitive maps have complex state spaces, that is: chaos, limit cycles, fixed points and so on. In this paper, authors study a class of fuzzy dynamic system, which called linguistic dynamic system. As a result, class of linguistic dynamic system is always convergent.

3 Remarkable aspects

This part has the following noteworthy aspects:

- Presenting advances of context-aware computing and nature-inspired computing.
- Formally specifying, developing and verifying context-awareness-based systems.

Therefore, the part can be used as an additional source for graduate courses to learn formal methods in computing. Additionally, it will be worthful to professionals from both academia and industry and often serve the immediate appeal to those who want to contribute to formal methods in computing.

4 Conclusions

In preparation for this part, we acknowledge the study of all the authors for their worthful contributions to the part and their excellent efforts, and also reviewers to ensure the high quality of the work presented here. All are extremely professional and cooperative. We would like to thank the Editor-in-Chief, Professor Imrich Chlamtac, for his critical support of the part's assembly process.

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Thanh University (NTTU) to take on the responsibility of a senior research scientist. He has been author or co-author of many refereed contributions published in prestigious journals, conference proceedings or edited books. He is editor of three books titled, “Autonomic Networking-on-Chip: Bio-Inspired Specification, Development and Verification” (CRC Press, 2012), “Formal and Practical Aspects of Autonomic Computing and Networking: Specification, Development and Verification” (IGI Global, 2011) and “Nature-Inspired Networking: Theory and Applications” (CRC Press, 2018). He has served on many conference program committees and has been general or technical (co)chair and (co)organizer of several international conferences such as ICCASA and ICTCC series. His research interests center on all aspects of formal methods in computing, context-awareness, nature of computation and communication, and applied categorical structures in computer science.