

## Computer Networks Laboratory



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## Refereed Journal Papers

- [z-cheng-01:2014] Zixue Cheng, Junbo Wang, Neil Y. Yen, Joseph C. Tsai, and Tongjun Huang. A Context-Aware IoT Middleware for Management of Conflicts Using a Priority Scheme Based on Diagram of Situation State Transition. *JIT Journal of Internet Technology*, 16(1):151–162, 2015.

Context-aware service is an extremely important research issue for users to collaborate with multiple smart objects embedded with various sensors in a local ubiquitous computing environment. And it is showing more important position in Internet of Things (shortly IoT) environment, when considering more complex situations happening in different locations. There is a need for IoT middleware to well organize the situations, e.g., creation and deletion of a situation, state transmission of the situation, in order to effectively provide services adaptive to various situations in IoT environment. Meanwhile conflict requests for situation-aware services are really hard to be solved, since many situations happen in the same time period need common resources for the services. In order to tackle the problem, we first propose an IoT middleware based on diagram of situation state transition (DSST), to specify and manage states of a situation. And then a priority scheme based on DSST for resolving conflicts is also presented by considering different states of situations. Experiment results demonstrate the feasibility of proposed method and the performance of situation-aware services based on the conflict resolution scheme.

- [z-cheng-02:2014] Peng Li, Song Guo, and Zixue Cheng. Max-Min Lifetime Optimization for Cooperative Communications in Multi-Channel Wireless Networks. *IEEE Transactions on Parallel and Distributed Systems*, 25(6):1533–1542, 2014.

Cooperative communication (CC) has been proposed for achieving spatial diversity without requiring multiple antennas on the same node. Many efforts in exploiting the benefits of CC focus on improving the performance in terms of outage probability or channel capacity. However, the energy efficiency of CC, which is critical for the applications with energy constraints, has been little studied. In this paper, we study the lifetime maximization problem for multiple source-destination pairs using CC in multi-channel wireless networks by an optimal dynamic allocation of resources in terms of power, channel, cooperative relay, and transmission time fraction. We prove it NP-hard and formulate it as a mixed-integer nonlinear programming (MINLP) problem, which is then transformed into a mixed-integer linear programming (MILP) prob-

lem using linearization and reformulation techniques. By exploiting several problem-specific characteristics, a time-efficient branch-and-bound algorithm is proposed to solve the MILP problem. Extensive simulations are conducted to show that the proposed algorithm can significantly improve the performance of energy efficiency over existing solutions.

- [z-cheng-03:2014] Yinghui Zhou, Zixue Cheng, Lei Jing, Junbo Wang, and Tongjun Huang. Pre-classification based hidden Markov model for quick and accurate gesture recognition using a finger-worn device. *Applied Intelligence*, 40(4):613–622, 2014.

Hidden Markov Model (HMM)-based recognition methods are very commonly used for some applications and can be highly accurate. However, they have a high computational complexity that creates problems when they are used for gesture recognition on resource-constrained wearable devices. In this paper, we propose a pre-classification method to reduce recognition complexity by dividing gesture vocabularies into groups, and maintain, even improve, the recognition accuracy by adaptively adjusting the HMMs for different groups. The technique consists of three tasks: gesture grouping, group modeling, and gesture modeling. Gesture grouping is performed using a K-means++ algorithm; the groups are modeled using a table-based method; and the gestures are modeled using an HMM-based approach. We evaluated the pre-classification method using real data collected by a tiny finger-worn device called a Magic Ring. The complexity of our method is much less than the standard Hidden Markov Model, without any loss of accuracy.

## Refereed Proceeding Papers

- [aiguo-01:2014] Hara Kohei Suga Shota Yu Yan, Nakano Hiroto and Aiguo He. A C Programming Learning Support System and Its Subjective Assessment. In *Proceedings of IEEE International Conference on Computer and Information Technology (CIT) 2014*, pages 561–566, 2014.

Currently, learning support environment for C programming beginners is still very unsatisfactory. This paper introduces a program visualization based support system for C programming learning and instruction, PROVIT. It provides useful functions for students and instructors to use at lectures, excises or their homes. The feature of PROVIT is that it can show the execution of any program written by the students or instructors, by interesting GUI, so the internal

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behaviors of the running program which usually will be hidden from beginners' eyes can be observed easily. PROVIT has been used in a special lecture for teaching high-school students and a subjective evaluation from the students was performed at an experiment. This paper also reports the result of the experiment.

[aiguo-02:2014] Kataoka Masayoshi Kazuma Takenobu and Aiguo He. A Global Feature for Non-Rigid 3D Shape Retrieval with Shape Similarity. In *Proceedings of IEEE International Conference on Computer and Information Technology (CIT) 2014*, pages 732 – 736, 2014.

In the area of 3D shape retrieval, research about how to compare faster and more accurate is an important topic. 3D shape retrieval can be used in computer-aided design, video games, advertising and many other fields. This article proposes an enhanced 3D shape retrieval feature named “parted Angle-Distance histogram (pAD)”, which is (1) robust over isometric deformations, (2) tolerant of topological and geometrical errors and degeneracies, and (3) able to be computed for non-manifold or “polygon-soup” models, for searching surface-based 3D shape models. Pad is produced by three steps, (1) model conversion, (2) model clustering, and (3) 2D histogram generation. Two experiments for pAD are conducted: computing performance test and retrieval accuracy test, and they showed significant performance improved from preceding features.

[z-cheng-04:2014] Yinghui Zhou, Yoshio Asano, Lei Jing, and Zixue Cheng. Life Support System by Motion Sensor-Based Behavior Monitoring and SNS-Based Information Sharing. In *Proc. of Internet of Vehicles Technologies and Services 2014 (The First International Conference on Technologies and Services)*, pages 407–415. , Springer International Publishing, Sep. 2014.

Behavior monitoring is an important method for life support of elderly persons. However, current behavior monitoring system is hard to be applied into our lives whether from user side or from supporter side. In this paper, we propose a sensor-based input system that can detect daily activities automatically and provide necessary information to remote supporters. The system adopts a wearable device to obtain activity data and for activity recognize and analysis. Moreover, we develop a rule-based algorithm and employ AHP method for information mining and filtering of daily activities. The filtered information is shared to supporters through cloud to reflect users' behavior and health

situations. The system is evaluated by 10 subjects and the result indicates its feasibility and effectiveness.

### Academic Activities

[aiguo-03:2014] Aiguo He, 2014.  
Session Chair, IEEE CIT 2014.

### Patents

[z-cheng-05:2014] Junbo Wang Lei Jing, Zixue Cheng (Shigaku Tei). ジェスチャ認識装置及びジェスチャ認識方法, 2014.

### Ph.D and Others Theses

[aiguo-04:2014] Yu Yan. Master Thesis: Personalized C Programming Learning Support Based on Programming Visualization Technology, University of Aizu, 2014.

Thesis Advisor: Aiguo He

[aiguo-05:2014] Shota Suga. Graduation Thesis:A Method for Auto Grammatical Explanation of C Program, University of Aizu, 2014.

Thesis Advisor: Aiguo He

[aiguo-06:2014] Kohei Hara. Graduation Thesis:A Fill-in-the-Blank Problem Generator for C Program Beginner, University of Aizu, 2014.

Thesis Advisor: Aiguo He

[aiguo-07:2014] Mariko Saitoh. Graduation Thesis:Sensor Device Horizontal Rotation Control for Human Computer Interaction Support, University of Aizu, 2014.

Thesis Advisor: Aiguo He

[z-cheng-06:2014] Tomoko Tanikawa. Master thesis, Graduate School of Computer Science and Engineering, Mar 2015.

Thesis Advisor: Z. Cheng

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[z-cheng-07:2014] Zairan Wang. Master thesis, Graduate School of Computer Science and Engineering, Mar 2015.

Thesis Advisor: Z. Cheng

[z-cheng-08:2014] Nariyoshi Chida. Graduation thesis, School of Computer Science and Engineering, Mar. 2015.

Thesis Advisor: Z. Cheng

[z-cheng-09:2014] Ikumi Obu. Graduation thesis, School of Computer Science and Engineering, Mar 2015.

Thesis Advisor: Z. Cheng

[z-cheng-10:2014] Kyo Ota. Graduation thesis, School of Computer Science and Engineering, Mar 2015.

Thesis Advisor: Z. Cheng

[z-cheng-11:2014] Dido VONGSA. Master thesis, Graduate School of Computer Science and Engineering, Mar 2015.

Thesis Advisor: Z. Cheng

[z-cheng-12:2014] Zixian Lu. Master thesis, Graduate School of Computer Science and Engineering, Mar 2015.

Thesis Advisor: Z. Cheng