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Refereed academic journal

[aiguo-206-006-01:2016] Takenobu KAZUMA Yasuhiro HISADA Yu YAN, Kohei HARA and Aiguo HE. PROVIT-CI: A Classroom-Oriented Educational Program Visualization Tool. *IEICE TRANSACTIONS on Information and Systems*, E101-D(2):447–454, 2 2018.

> Studies have shown that program visualization(PV) is effective for student programming exercise or self-study support. However, very few instructors actively use PV tools for programming lectures. This article discussed the impediments the instructors meet during combining PV tools into lecture classrooms and proposed a C programming classroom instruction support tool based on program visualization - PROVIT-CI (PROgram VIsualization Tool for Classroom Instruction). PROVIT-CI has been consecutively and actively used by the instructors in author's university to enhance their lectures since 2015. The evaluation of application results in an introductory C programming course shows that PROVIT-CI is effective and helpful for instructors classroom use.

[z-cheng-206-006-01:2016] Hui-Huang Hsu Zixue Cheng Yilang Wu, Junbo Wang. A seamless repository for pervasive teamwork. *International Journal of Web and Grid Services (IJWGS)*, 12(3):273–295, 2016.

> Mobile cloud-based collaborative workflow has pervasively empowered teamwork. However, it still suffers from collaborative workflow barriers, such as workflow complexity, poor communication, and teamwork disruption. To ease collaborative workflow barriers, we propose and develop a seamless repository by integrating multiple support systems into a three-layered framework. Under the premises of availability, connectivity, and transparency, the three-layered seamless repository strengthens the collaborative workflow in pervasive teamwork. It supports various critical collaborative workflow activities such as issue tracking, revision control, content management, system visualisation, onsite participation tracking, and team communication. After a test period of one year, active teamwork involvement has been observed, which implies that the barriers are relieved. Furthermore, several hidden patterns of teamwork are discovered through the seamless repository, which are useful to improve future support for pervasive teamwork.

[z-cheng-206-006-02:2016] Neil Y. Yen Song Guo Zixue Cheng Junbo Wang, Yilang Wu. Big Data Analytics for Emergency Communication Networks: A Survey. *IEEE Communications Surveys and Tutorials*, 18(3):1758–1778, 2016.

Disaster management is a crucial and urgent research issue. Emergency communication networks (ECNs) provide fundamental functions for disaster management, because communication service is generally unavailable due to large-scale damage and restrictions in communication services. Considering the features of a disaster (e.g., limited resources and dynamic changing of environment), it is always a key problem to use limited resources effectively to provide the best communication services. Big data analytics in the disaster area provides possible solutions to understand the situations happening in disaster areas, so that limited resources can be optimally deployed based on the analysis results. In this paper, we survey existing ECNs and big data analytics from both the content and the spatial points of view. From the content point of view, we survey existing data mining and analysis techniques, and further survey and analyze applications and the possibilities to enhance ECNs. From the spatial point of view, we survey and discuss the most popular methods and further discuss the possibility to enhance ECNs. Finally, we highlight the remaining challenging problems after a systematic survey and studies of the possibilities.

[z-cheng-206-006-03:2016] Zixue Cheng Peng Li Jie Wu Junbo Wang, Song Guo. Optimization of Deployable Base Stations With Guaranteed QoE in Disaster Scenarios. *IEEE Trans. Vehicular Technology*, 66(7):6536 – 6552, 2017.

Reconstructing emergency communication networks (ECNs) quickly after a disaster occurs is critical so that people can share information and confirm their safety. In recent studies, deployable base stations (DBSs) have demonstrated their ability to reconstruct an ECN. However, considering limited resources, it is impossible to deploy DBSs in the whole disaster area. The above shortage can be covered by deploying small-cell networks (i.e., low-power transmission base stations) in areas with high communication demand, e.g., in refuges. Considering the above two-tier ECN, in this paper, we study its performance and optimization issue with the objective of minimizing the number/density of DBSs while guaranteeing acceptable coverage probabilities for both communication tiers. The majority of current research focuses on scenarios where the base stations follow a homogeneous Poisson point process of coverage probability. It is difficult to transfer the results to other applications, e.g., when communication resources are shared, such as by refugees following a disaster. In such cases, the distribution of users is closer to that of a Poisson cluster process. We then investigate the optimization method to minimize the number/density of DBSs. We used Monte Carlo methods with various parameter choices to evaluate the

results and to determine the accuracy of our evaluation.

[z-cheng-206-006-04:2016] Zixue Cheng Junbo Wang. Optimal deployment and traffic flows in mobile mesh network after a disaster. *International Journal of Ad Hoc and Ubiquitous Computing*, 25(1/2):97–108, 2017.

It is a critical research problem to quickly reconstruct a communication system after a disaster. One resolution is to deploy mobile mesh routers MMR in the disaster area to guarantee the connection of users. However, it is still a challenge to find an optimal deployment of MMRs to maximally satisfy users while ensuring a fluent and reliable communication network. In this paper, we focus on the above problems and propose a communication-demand-oriented deployment method CDODM and a global-data-traffic routing optimisation method GTFROM for a disaster. Our main contributions are 1 formalisation and optimisation of computation transmission cost in CDODM and 2 formalisation and optimisation traffic flows in GTFROM. Through the evaluation in NS3, user satisfaction calculated based on recorded throughput in NS3 can be enhanced clearly in the proposed solutions. In scalability study, the proposed methods works well, with changing range of disaster areas, number of MMRs and communication demands.

Refereed proceedings of an academic conference

[aiguo-206-006-02:2016] Masayuki Tanimoto and Aiguo He(Hirokuni Kurokawa). Omnidirectional FTV. pages 1–6, 2017.

FTV (Free-viewpoint Television) enables users to view a 3D scene by freely changing the viewpoint. It was developed based on ray-space representation. Omnidirectional FTV is 360-degree video with free viewpoint function. Omnidirectional FTV with horizontal parallax is realized by using 3-dimensional (3D) spherical ray-space. Here, 3D spherical ray-space is extended to 4D to realize vertical parallax. Ray capture and view synthesis are analyzed in 4D spherical ray-space and verified experimentally. Omnidirectional views with full parallax are successfully generated.

[z-cheng-206-006-05:2016] Junbo Wang Zixue Cheng Yilang Wu, William Putnam. A wireless peer-to-peer broadcast model for emergency vehicles using automotive networking. In *2016 IEEE Symposium Series on Computational Intelligence (IEEE SSCI 2016)*. IEEE, Dec. 2016.

Automotive networks are simple, real-time networks with very low error rates. In-vehicle infotainment (IVI) systems include GPS-based navigation and wireless hotspots for cellular communication. In the event of a power outage or a major catastrophe, such as an earthquake, existing network mainframes may either shut down completely or become overloaded with traffic. In that regard, it is important for emergency vehicles to spread the word of certain emergencies, such as road closures and traffic accidents, to vehicles within the area. In this paper, we propose a method using the peer-to-peer broadcast model to transmit emergency messages between vehicles using IVI and GPS systems. A distributed peer-to-peer algorithm is presented to deliver a high priority message and avoid acceptance of duplicated ones to enlarge the broadcasting coverage of messages with higher priority. We also discussed the usability, feasibility and future improvement of this proposed model.

[z-cheng-206-006-06:2016] Zixue Cheng Koichi Sato, Junbo Wang. Detecting real-time events using tweets. In *2016 IEEE Symposium Series on Computational Intelligence (IEEE SSCI 2016)*. IEEE, Dec. 2016.

Big Data has been one of main topics in the field of computer science. Additionally, demand for observations of the real world in real time has increased to provide services or information to people accordingly. For example, when disaster occurs, government can appropriately respond to the disaster if the situations in the disaster-stricken areas are real-timely grasped. Although there are many kinds of blog services and they are functioning as one of Big Data source, Twitter is considered as the most active Big Data source. Users can feel free to post a tweet anywhere in real time, since twitter limits a tweet to 140 characters. In this paper, a scheme is proposed which can detect what happens in real world in real time only by analyzing tweets as Big Data and let a user know the event. To this end, the following problems has to be solved. They are a) quantifying importance of words accurately and b) evaluating the quantified values dynamically. As the solutions for the problems, two new methods are proposed which are the Extended Hybrid TF-IDF and the Remarkable Word Detecting Method, and they are used in the proposed scheme. Finally an experiment is executed to evaluate the proposed methods and scheme.

[z-cheng-206-006-07:2016] Lei Jing Junbo Wang Zixue Cheng Yilang Wu, Tatsuki Kawaguchi. Campus Digital Signage: Connection of Correlated Information between Distributor and Receiver. In *31st International Conference on Advanced Information Networking and Applications Workshops (WAINA),AINA Workshops 2017*. IEEE, Mar. 2017.

Information distribution regarding immediately correlated contents is a big challenge in local communities, such as a university campus. One of the main reasons is that a campus' local network is uncovered by public search engines, and most of the local Web sites in a community operate like information silos. A secondary reason is that the daily activities in a local community are highly dynamic, people might be annoyed by the non-correlated information or they just ignore all of it, regardless of importance. In this paper, the proposed campus digital signage aims at connecting local users to correlated information as the user passes by. To this end, we build the server side with two components, one is the information collector that will automatically pull the campus information from other sites, and the other is the information poster to allow qualified users to post content. We also design a wearable client side with a BLE (Bluetooth low energy) proximity sensor to recognize approaching user's identity and dynamically push their correlated information to the digital signage display.

Unrefeered proceedings of an academic conference

[aiguo-206-006-03:2016] Masayuki Tanimoto and Aiguo He(Hirokuni Kurokawa). Ray-Space Processing for Omnidirectional FTV. In *IEICE Technical Report*, pages 31–36, Tokyo, Nov. 2017. IEICE, IEICE.

Research grants from scientific research funds and public organizations

[aiguo-206-006-04:2016] F. Rabitti. Contributed to the success of a research project subsidized by Fukushima Prefectural Academic Education Promotion Foundation. 5 public lectures have been performed., 2017.

Advisor for undergraduate research and graduate research

[aiguo-206-006-05:2016] Makoto Yamaguchi. A Study of HCI for PHW Based Prosentation Support, University of Aizu, 2017.

Thesis Advisor: Aiguo He

[aiguo-206-006-06:2016] Yuka Katsushima. SKP-based Learning Contents Creation and Recommendation for C programming beginners, University of Aizu, 2017.

Thesis Advisor: Aiguo He

[aiguo-206-006-07:2016] Yu Yan. Programming Learning Support Methods based on Adaptive Hypermedia and Program Visualization, University of Aizu, 2017.

Thesis Advisor: Aiguo He

[z-cheng-206-006-08:2016] Yusuke Hanada. Graduation thesis, School of Computer Science and Engineering, Mar. 2017.

Thesis Advisor: Z. Cheng

[z-cheng-206-006-09:2016] Yusuke Nakayama. Graduation thesis, School of Computer Science and Engineering, Mar 2017.

Thesis Advisor: Z. Cheng

[z-cheng-206-006-10:2016] Zipei Liang. Master thesis, Graduate School of Computer Science and Engineering, Aug 2016.

Thesis Advisor: Z. Cheng

[z-cheng-206-006-11:2016] Yu Wang. Master thesis, Graduate School of Computer Science and Engineering, Aug 2016.

Thesis Advisor: Z. Cheng

Other significant contribution toward university planning, management, or administration

[aiguo-206-006-08:2016] Contributed to the success of PC-Koshien, the high-school student programming contest hold in UoA every year since 2003. I have been working for PC-Koshien since its first time.

[z-cheng-206-006-12:2016] Successfully achieved MEXT project "Top Global University" as a leader

Contributions related to regional education

[z-cheng-206-006-13:2016] A Lecture at Fukushima Japan-China Friendship Association 2017 Spring gathering January 29, 2017 At the Aizuwakamatsu Washington Hotel

Did you participate in Public Lectures, and/or Open Campus? (Yes or No) If yes, please describe what you did.

[aiguo-206-006-09:2016] Computer Science Summer Camp @ UoA 2017: Opened a new Cource Basic C Programming. This year, as the first time, 10 foreign students were invited. I have designed the English version of above course for the success of that invitation.; Public lectures;