東北大学 電気通信研究所

研究室外部評価資料

(2013 年度-2018 年度)

Activity Report of Research Laboratory for External Review

April 2013 - March 2019
(FY.2013-2018)

Research Institute of Electrical Communication

Tohoku University

コミュニケーションネットワーク研究室

Communication Network

A. 研究室名 / Research Laboratory

コミュニケーションネットワーク研究室
Communication Network

B. 構成員 / Faculty and Research Staff (as of May 1, 2019)

※ 欄を適宜追加削除等調整して下さい．期間内に異動等があった場合には，在籍期間を記載して下さい．

教授 / Professor	
氏名 Name	木下　哲男 Tetsuo Kinoshita (April 2010 - March 2019)
分野名 Research Field	インテリジェントコミュニケーション研究分野 Intelligent Communication
准教授 / Associate Professor	
氏名 Name	北形　元 Gen Kitagata (April 2012 -)
分野名 Research Field	インテリジェントネットワーク研究分野 Intelligent Network
助教 / Assistant Professor	
氏名 / Name	高橋 秀幸/ Hideyuki Takahashi　(April 2011 – March 2019) 笹井 一人/ Kazuto Sasai　(April 2012 – September 2018)
他 / Others	
	日本学術振興会特別研究員 DC2: 1 名 (April 2015 - March 2017)

C. 研究目的 / Research Purpose

様々なネットワークシステム、そして、これらを基盤として構築される多様な情報システムは、人々の日常生活や仕事を支援し、新しいライフスタイルと社会を生み出す上で重要な役割を担うシステムとして期待される。本研究室では、その設計と構築に向けた基礎から応用に至る研究に取り組む。

People expect that various networks exist everywhere in the society and information systems over such networked environment support everyday life and social activities of people and create new life styles as well as information society. This laboratory aims at research and development of advanced network-based intelligent systems.

D. 主な研究テーマ / Research Topics

１．サイバー社会の情報基盤／次世代ユビキタスサービス基盤
２．マルチエージェントフレームワーク／知識型設計方法論
３．知識型ネットワークミドルウェア／利用者指向サービス
４．高耐性ネットワーキング／利用者指向ネットワーキング
５．エージェント応用／知識応用システム／ネットワーク応用システム

1. Software Infrastructure of Cyber society (Cyberware) / Next generation ubiquitous service infrastructure
2. Multiagent framework/Design methodology
3. Knowledge based network middle-ware / User-oriented Service
4. High tolerability networking / User-oriented networking
5. Agent-based/Knowledge-based/Network-based systems

E. 学術論文等の編数 / The Number of Research Papers

	2013	2014	2015	2016	2017	2018	Total
(1) 査読付学術論文 Refereed journal papers	11	3	2	3	8	3	30
(2) 原著論文と同等に扱う 査読付国際会議発表論文 Full papers in refereed conference proceedings equivalent to journal papers	0	0	0	0	0	0	0
(3) 査読付国際会議 Papers in refereed conference proceedings	18	15	6	7	8	12	66
(4) 査読なし国際会議・シンポジウム等 Papers in conference proceedings	0	0	0	0	0	0	0
(5) 総説・解説 Review articles	0	0	0	0	0	0	0
(6) 査読付国内会議 Refereed proceedings in domestic conferences	0	0	0	0	0	0	0
(7) 査読なし国内研究会・講演会 Proceedings in domestic conferences	18	17	25	30	18	15	123
(8) 著書 Books	0	1	0	0	0	0	0
(9) 特許 Patents	0	0	0	0	0	0	0
(10) 招待講演 Invited Talks	0	1	0	0	0	0	1

F. 特筆すべき研究成果 / Significant Research Achievements (FY.2013-2018)

See Ref. 1. "#" mark indicates research carried out at a former organization.

2013-2018 年度の研究成果（論文・特許など）のうち，前半（2013-2015 年度）と後半（2016-2018 年度）それぞれで代表的な数件（2-3 件程度ずつ）について，参考資料を引用して，その特徴と学術的意義などを簡単に紹介する．英文のみ，もしくは和文と英文で記載．要約は 300 字程度．論文誌の要約/Abstract のコピー可．学術面での国際的インパクトならびに社会的影響を 100 字程度で記載．
必ずしも当該期間内に発表・出版したものに限るのではなく，例えば過去に発表したものでもこの期間内に成果が得られたり，評価されるようになったりしたものも含むものとする．
インパクトファクターや被引用件数など，できる限り第三者が定量的に評価できる指標を用いてアピールすること．それらの指標にはそぐわない場合には，その事情とそれに変わる適当な評価指標・尺度を示すこと．

[2013-2015]

1. Tetsuo Kinoshita "Basic Characteristics of a Macroscopic Measure for Detecting Abnormal Changes in a Multiagent System," Sensors, Vol. 15, No. 4, pp.9112-9135, Apr. 2015, [IF: 2.033], [Times Cited:]

Abstract: Multiagent application systems must deal with various changes in both the system and the system environment at runtime. Generally, such changes have undesirable negative effects on the system. To manage and control the system, it is important to observe and detect negative effects using an appropriate observation function of the system's behavior. This paper focuses on the design of this function and proposes a new macroscopic measure with which to observe behavioral characteristics of a runtime multiagent system. The proposed measure is designed as the variance of fluctuation of a macroscopic activity factor of the whole system, based on theoretical analysis of the macroscopic behavioral model of a multiagent system. Experiments are conducted to investigate basic characteristics of the proposed measure, using a test bed system. The results of experiments show that the proposed measure reacts quickly and increases drastically in response to abnormal changes in the system.

International impact on both academic and social aspects: This work provides a new macroscopic measure for a multiagent system, which can detect undesirable changes in a multiagent system. This work attracts great attention because it contributes to achieving a stable operation of a multiagent system by macroscopic observation.

2. Khamisi Kalegele, Kazuto Sasai, Hideyuki Takahashi, Gen Kitagata, Tetsuo Kinoshita "Four Decades of Data Mining in Network and Systems Management," IEEE Transactions on Knowledge and Data Engineering, Vol.27, No.10, pp.2700-2716, Oct. 2015, [IF: 2.476], [Times Cited: 8]

Abstract: This work provides an account of how data mining has been applied in managing networks and systems for the past four decades, presumably since its birth. We look into the field's applications in the key Network and Systems Management (NSM) activities-discovery, monitoring, analysis, reporting, and domain knowledge acquisition. In the end, we discuss our perspective on the issues that are considered critical for the effective application of data mining in the modern systems which are characterized by heterogeneity and high dynamism.

International impact on both academic and social aspects: This work attracts rising attention because it gives comprehensive discussions about data mining technologies and network and systems management, which is the key technology to achieve future autonomic network and systems management.

[2016-2018]

3. Lana Sinapayen, Keisuke Nakamura, Kazuhiro Nakadai, Hideyuki Takahashi, Tetsuo Kinoshita, "Swarm of Micro-Quadrocopters for Consensus-based Sound Source Localization," Advanced Robotics, Vol.31, No.12, pp.624-633, Apr. 2017 [IF: 0.961]

Abstract: In this paper, we propose an algorithm for simultaneous indoor self-localization and Sound Source Localization (SSL) using a swarm of microphone-embedded-micro-quadrocopters (size 10cm). Micro-quadrocopters are extremely noisy, have low CPU power and cannot lift heavy equipment: the small payload of each micro-quadrocopter only allows us to equip it with one microphone in addition to the inbuilt motion sensors. To perform robust SSL despite these issues, we propose three functions: (1) Self-localization of the quadrocopters using sound landmarks placed in the environment, and simultaneous localization of unknown sound sources; (2) Sound source detection; (3) Distributed data fusion based on noisy information from all members of the swarm. To achieve these, we propose three algorithms that are robust to noise, can perform with a varying number of quadrocopters, and do not rely on GPS nor motion capture to allow indoor operations: (1) A sound-based Unscented Kalman Filter (UKF) for self-localization of each quadrocopter; (2) A peak-based algorithm for sound source detection; (3) A distributed SSL algorithm for swarms with consensus-based integration using a new filter termed Unscented Kalman Consensus Filter (UKCF). We evaluated the proposed methods in real world and in simulated environments. The preliminary results show that the sound-based UKF represents an improvement of 37% on position estimation precision compared to basic dead reckoning approaches, even when the theoretical assumptions are violated; the distributed UKCF gives an improvement of 85% on SSL compared to a single-sensor approach in simulation.

International impact on both academic and social aspects: This work contributes to indoor flying of drones where positioning systems such as GPS cannot be used. It may give an impact on the development of indoor applications utilizing autonomous drones such as emergency evacuation systems.

4. Yusuke Tanimura, Kazuto Sasai, Gen Kitagata, Tetsuo Kinoshita, "Knowledge-Based Network Management System for Movable and Deployable ICT Resource Unit," Journal of Computer and Communications, Vol.5, No.7, pp.135-151, May 2017, [RG Journal Impact: 0.49], [903 Downloads, 1,268 Views]

Abstract: When a disaster occurs, the demand for information and communication technology (ICT) services drastically increases. To meet such demands, a national project was undertaken in Japan to develop the Movable and Deployable ICT Resource Unit (MDRU). One challenge regarding the MDRU is securing operators to work the units in emergency situations. As ICT service users have diverse and frequently changing demands, strong technical skills and practical knowledge are required for the administration of MDRUs. In this paper, we propose a knowledge-based network management system to alleviate the burden on administrators. To deal with the structural changes to network systems that frequently occur with changes in ICT service demand, we introduce modularization techniques into our previous research. The proposed system can be easily reconfigured by join/disjoin modules corresponding to changes in the system configuration of the MDRU. The results of our experiments using the implemented experimental system confirm that the proposed system can be applied to MDRU operation and effectively supports administrators.

International impact on both academic and social aspects: The result of this work attracts great attention because it is an essential and practical technique to realize automatic management of network systems in the shortage of manpower such as disaster situation.

G. 特筆すべき活動 / Significant Activities (FY.2013-2018)

See Ref. 2-6. "#" mark indicates research carried out at a former organization.

研究室外部評価参考資料の 2 以降を参照しながら，2013-2018 年度のなどの活動の中から特筆すべきものを取り出し，前半（2013-2015 年度）と後半（2016-2018 年度）に分けて簡単に紹介する．英文のみ，もしくは和文と英文で記載.

[2013-2015]

We have planned and organized the International Conference on Smart Technologies for Energy, Information and Communication (IC-STEIC 2014) in Aug. 2014, which is a part of Bilateral Joint Research Projects between Japan and Korea. Aim of STEIC2014 is to explore and discuss the present and future of the smart technologies and their applications from a viewpoint of energy, information, and communication. Many researchers from Japan and Korea attended the conference and had deep discussions about smart technologies.

[2016-2018]

We have organized the First International Workshop on Practical Issues, Systems & Applications for Disaster Risk Reduction in Smart Computing (DRRSC 2019) in Feb. 2019, which is also a part of Bilateral Joint Research Projects between Japan and Korea. This workshop aims at practical research and study, new consumer electronics, advanced information technology including Internet of Things (IoT) and Artificial Intelligence (AI), and novel system and application for disaster risk reduction based on big data and smart computing.