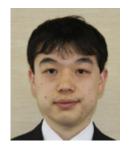# Foundation of Computer Science Laboratory

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Summary of Achievement

Refereed academic journal

[nakamura-103-002-01:2016] Shinji Kikuchi, Akihito Nakamura, and Daishi Yoshino. Evaluation on Information Model about Sensors Featured by Relationships to Measured Structural Objects. *Advances in Internet of Things (AIT)*, 6(3):31–53, August 2016.

In accordance with the requirements of expanding Machine-To-Machine communication (M2M), the network overlay is in progress in several domains such as Smart Grid. Consequently, it is predictable that opportunities and cases of integrating yielded data from devices such as sensors will increase more. Accordingly, the importance of Ontology and Information Models (IM) which normalize the semantics including sensor expressions, have increased, and the standards of these definitions have been more important as well. So far, there have been multiple initiatives for standardizing the Ontology and IM in regards to the sensors expression such as Sensor Standards Harmonization by the National Institute of Standards and Technology (NIST), W3C Semantic Sensor Network (SSN) and the recent W3C IoT-Lite Ontology. However, there is still room to improve the current level of the Ontology and IM on the viewpoint of the implementing structure. This pa- per presents a set of IMs on abstract sensors and contexts in regards to the phenomenon around these sensors from the point of view of a structure implementing these specified sensors. As several previous studies have pointed out, multiple aspects on the sensors should be modeled. Accordingly, multiple sets of Ontology and IM on these sensors should be defined. Our study has in- tended to clarify the relationship between configurations and physical measured quantities of the structures implementing a set of sensors. Up to present, they have not been generalized and have remained unformulated. Consequently, due to the result of this analysis, it is expected to implement a more generalized translator module easily, which aggregates the measured data from the sensors on the middleware level managing these Ontology and IM, instead of the layer of user application programs.

[neilyyen-103-002-01:2016] Neil Y. Yen-Song Guo Zixue Cheng Junbo Wang, Yilang Wu. Big Data Analytics for Emergency Communication Networks: A Survey. *IEEE Communications Survey 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.

[neilyyen-103-002-02:2016] Neil Y. Yen Goldina Ghosh, Soumya Banerjee. State Transition in Communication under Social Network: An Analysis using Fuzzy Logic and Density Based Clustering Towards Big Data Paradigm. *Future Generation Computer Systems*, 65:207–220, 2016.

Social networks like Facebook, Twitter, LinkedIn, are the social clouds that provide a platform for a diversified range of conversations on any theme at a stipulated time. The flow rate of a conversation can be measured from the perspective of different amalgamations formed by the theme and the level of the participation. Multiple users share the cloud resources and reallocation of the resources is also possible within the social network as and when required. The communication and conversation can be influential extensively due to the presence of big data orientation. It has been observed that depending on certain random parameters of big data driven social network few blocks of conversation may become explicit and influence on the arena of social network. The element of randomness and diversity creates ambiguity in the content of conversation. The conversation may become appealing or may lose the sympathy of the participants. This paper proposes a novel algorithm deploying Fuzzy methodology to investigate the embedded uncertainty and ambiguity involved within the conversation blocks. Fuzzy logic is capable of taking care of non-crisp states of conversation that might be the source of branding and putting a particular content to the maximum elevation across the social media and services. The experimental results and the graphs give the justification towards the effect of participants act on the topic discussion session, especially the periphery of big data framework. The pre-condition and the post-condition of the topic have

been observed after implementing the proposed algorithm and finally further scope of the research has been discussed.

[neilyyen-103-002-03:2016] Hsieh-Hui Yu Tzung-Pei Hong Neil Y. Yen Chun-Hao Chen, Vincent S. Tseng. A GA-based Approach for Finding Appropriate Granularity Levels of Patterns from Time Series. *International Journal of Web and Grid Services*, 12(3):217–239, 2016.

In our previous approach, we proposed an algorithm for finding segments and patterns simultaneously from a given time series. In that approach, because patterns were derived through clustering techniques, the number of clusters was hard to be setting. In other words, the granularity of derived patterns was not taken into consideration. Hence, an approach for deriving appropriate granularity levels of patterns is proposed in this paper. The cut points of a time series are first encoded into a chromosome. Each two adjacent cut points represents a segment. The segments in a chromosome are then divided into groups using the cluster affinity search technique with a similarity matrix and an affinity threshold. With the affinity threshold, patterns with the desired granularity level can be derived. Experiments on a real dataset are also conducted to demonstrate the effectiveness of the proposed approach.

Refereed proceedings of an academic conference

[yodai-103-002-01:2016] Yuto Miura and Yodai Watanabe. Security of (n,n)-threshold audio secret sharing schemes encrypting audio secrets. In *Proceedings of the 2016 IEEE Workshop on Statistical Signal Processing (SSP 16)*, pages 646–650, Palma de Mallorca, Spain, June 2016. IEEE.

Secret sharing is a method of encrypting a secret into multiple pieces called shares so that only qualified sets of shares can be employed to reconstruct the secret. Audio secret sharing (ASS) is an example of secret sharing whose decryption can be performed by human ears. This paper examines the security of (n, n)-threshold ASS schemes encrypting audio secrets by estimating the mutual information between secret and shares.

Unrefeered proceedings of an academic conference

[yodai-103-002-02:2016] Yuto Miura and Yodai Watanabe. Security of (n,n)-threshold ASS schemes encrypting audio secrets. In *Proceedings of*

Tohoku-section Joint Convention of IEIE, page 2A03, Miyagi, Japan, August 2016. IEIE.

Secret sharing is a method of encrypting a secret into multiple pieces called shares so that only qualified sets of shares can be employed to reconstruct the secret. Audio secret sharing (ASS) is an example of secret sharing whose decryption can be performed by human ears. This paper examines the security of (n, n)-threshold ASS schemes encrypting audio secrets by estimating the mutual information between secret and shares.

Research grants from scientific research funds and public organizations

[yodai-103-002-03:2016] Yodai Watanabe. JSPS Grant-in-Aid for Scientific Research (C), 2015–2018.

Academic society activities

[neilyyen-103-002-04:2016] Neil Y. Yen, 12 2016.

Organizer [Coordinator], The 2st IEEE International Symposium on Independent Computing (iSiC 2016) in conjunction with IEEE Symposium Series on Computational Intelligence (SSCI 2016), Athens, Greece

Advisor for undergraduate research and graduate research

[yodai-103-002-04:2016] Masaru Meguro. Graduation Thesis: Sound Classification Using the Dissimilarity Distance Based Clustering, University of Aizu, 2017.

Thesis Advisor: Y. Watanabe

[yodai-103-002-05:2016] Masae Nagashima. Graduation Thesis: Numerical experiments to evaluate upper and lower bounds on probability of type class, University of Aizu, 2017.

Thesis Advisor: Y. Watanabe

Summary of Achievement

[yodai-103-002-06:2016] Yuya Yano. Graduation Thesis: Data generation for probabilistic inference on authorship analysis of research paper publication, University of Aizu, 2016.

Thesis Advisor: Y. Watanabe

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

[yodai-103-002-07:2016] Open Laboratory at Open Campus 2016 (Summer and Autumn Sessions)

[yodai-103-002-08:2016] Off-campus Lecture at Asaka-Reimei High School (9 November 2016)

[yodai-103-002-09:2016] Off-campus Lecture at Aoi High School (11 November 2016)