

# External Awards

## ITU-AJ Encouragement Award

**Winner:** Junichi Iwatani, NTT Access Network Service Systems Laboratories

**Date:** May 17, 2018

**Organization:** The ITU Association of Japan (ITU-AJ)

For his contribution to international standardization of the next-generation wireless local area network (LAN) IEEE 802.11ax and efforts to expand outdoor use of 5-GHz-band wireless LANs.

## Best Paper Award

**Winner:** Tatsuhiko Iwakuni, Kazuki Maruta, Atsushi Ohta, Yushi Shirato, Takuto Arai, and Masataka Iizuka, NTT Access Network Service Systems Laboratories

**Date:** June 7, 2018

**Organization:** The Institute of Electronics, Information and Communication Engineers (IEICE)

For “Null-space Expansion for Multiuser Massive MIMO Inter-user Interference Suppression in Time Varying Channels.”

**Published as:** T. Iwakuni, K. Maruta, A. Ohta, Y. Shirato, T. Arai, and M. Iizuka, “Null-space Expansion for Multiuser Massive MIMO Inter-user Interference Suppression in Time Varying Channels,” IEICE Trans. Commun., Vol. E100.B, No. 5, pp. 865–873, 2017.

## TTC Information and Communication Technology Award, Minister of Internal Affairs and Communications Prize

**Winner:** Eikazu Niwano, NTT Secure Platform Laboratories

**Date:** June 14, 2018

**Organization:** The Telecommunication Technology Committee (TTC)

For his contribution to research and development, international standardization, and practical application of an IC (integrated circuit) card management system.

## Cannes Lions 2018

### Bronze Lion - Design Lions (Environment & Experience - Live Events)

**Winner:** Shingo Kinoshita and Takashi Miyatake, NTT Service Evolution Laboratories; Junji Watanabe, NTT Communication Science Laboratories; Akira Ono, Tetsuya Yamaguchi, Koji Namba, Koichi Furukado, Kiyoshi Tanaka, Katsumi Tanaka, Hikaru Takenaka, and Takuya Iwami, NTT Service Evolution Laboratories; Kazunari Moriuchi and Soichiro Usui, NTT Research and Development Planning Department

**Date:** June 19, 2018

**Organization:** International Advertising Festival Limited

For “REDEFINING DISTANCE.”

The next-generation “5G” service will be put into practical use in 2020 by NTT DOCOMO. This experimental project demonstrates the speed, capacity, and low latency of 5G technology. It was performed by “Perfume,” the group that is always on the leading edge of technopop. The members have always performed together on the stage since forming the group. For the first time in 17 years, however, the three women performed simultaneously on different stages in Tokyo, New York, and London in this event. The communications technology connected the three locations that are more than 10,000 km apart and combined the three respective performances into one without any time lag.

## Young Engineer's Award

**Winner:** Azusa Ishii, NTT Device Innovation Center

**Date:** July 6, 2018

**Organization:** Japan Association of Corrosion Control

For “Comparison of Degradation Behavior of Poly(ethylene terephthalate) between Xenon-arc Accelerated Weathering and Outdoor Exposure Tests” (in Japanese).

**Published as:** A. Ishii, T. Miwa, and H. Koizumi, “Comparison of Degradation Behavior of Poly(ethylene terephthalate) between Xenon-arc Accelerated Weathering and Outdoor Exposure Tests,” Proc. of the 38th Bosei Boshoku Gijutsu Happyo Taikai (Rust Prevention and Control Technology Conference), pp. 121–126, Tokyo, Japan, July 2018.

# Papers Published in Technical Journals and Conference Proceedings

## Resource-efficient Verification of Quantum Computing Using Serfling's Bound

Y. Takeuchi, A. Mantri, T. Morimae, A. Mizutani, and J. F. Fitzsimons

arXiv:1806.09138 [quant-ph], June 2018.

Verifying quantum states is central to certifying the correct operation of various quantum information processing tasks. In particular, in measurement-based quantum computing, checking whether correct graph states are generated or not is essential for reliable quantum computing. Several verification protocols for graph states have been proposed, but none of these are particularly resource efficient: Many copies are required in order to extract a single state that is guaranteed to be close to the ideal graph state. For example, the best protocol currently known requires  $O(n^{15})$  copies of the state, where  $n$  is the size of the graph state. In this paper, we construct a significantly more resource-efficient verification protocol for graph states that needs only  $O(n^5 \log n)$  copies. The key idea that achieves such a drastic improvement is to employ Serfling's bound, which is a probability inequality in classical statistics. Utilizing Serfling's bound also enables us to generalize our protocol for qudit and continuous-variable graph states. The flexibility of Serfling's bound also makes our protocol robust; our protocol accepts slightly noisy but still useful graph states, which are rejected by previous protocols.

## Haptic Interface Technologies Using Perceptual Illusions

T. Amemiya

Proc. of HCI International Conference 2018, pp. 168–174, Las Vegas, USA, July 2018.

With virtual reality now accessible to anyone through high-end consumer headsets and input devices, researchers are seeking cost-effective designs based on human perceptual properties for virtual reality interfaces. The author has been studying a sensory-illusion-based approach to designing human-computer interface technologies. This paper overviews how we are using this approach to develop force displays that elicit illusory continuous force sensations by presenting asymmetric vibrations and kinesthetic displays based on a cross-modal effect among visual, auditory, and tactile cues of self-motion.

## Vestibular Display for Walking Sensation in a Virtual Space

K. Shimizu, Y. Ikey, T. Amemiya, K. Hirota, and M. Kitazaki

Proc. of HCI International Conference 2018, pp. 334–339, Las Vegas, USA, July 2018.

This paper describes characteristics of walking sensation created by a vestibular display (a motion seat). An active input was introduced to a passive presentation of a walking stimulus. The participant triggered one step motion repeatedly by a game-controller button to introduce agency of motion. First, the magnitude of the seat motion was optimized to increase the walking sensation. Then, passive and partially active seat motion was evaluated. As a result, it was shown that added activity increased the walking sensation.

## Airflow for Body Motion Virtual Reality

M. Kurosawa, Y. Ikey, Y. Suzuki, T. Amemiya, K. Hirota, and M. Kitazaki

Proc. of HCI International Conference 2018, pp. 395–402, Las Vegas, USA, July 2018.

The present study investigates the characteristics of cutaneous sensation evoked by airflow to the face of the seated and standing user during the real and virtual walking motion. The effect of airflow on enhancement of a virtual reality walk was demonstrated. The stimulus condition provided in the evaluation involved the airflow, the visual, and the vestibular presentations, and the treadmill and walk-in-place real motions. The result suggested that the cutaneous sensation of air flow was suppressed while the movement was performed actively with visual information provided. The equivalent speed of air flow for the participants was 5–29% lower than the air flow speed in the real walk.

## Natural Language Inference with Definition Embedding Considering Context on the Fly

K. Nishida, K. Nishida, H. Asano, and J. Tomita

Proc. of the 3rd Workshop on Representation Learning for NLP, pp. 1–6, Melbourne, Australia, July 2018.

Natural language inference (NLI) is one of the most important tasks in NLP. In this study, we propose a novel method using word dictionaries, which are pairs of a word and its definition, as external knowledge. Our neural definition embedding mechanism encodes input sentences with the definitions of each word of the sentences on the fly. It can encode definitions of words considering the context of the input sentences by using an attention mechanism. We evaluated our method using WordNet as a dictionary and confirmed that it performed better than baseline models when using the full or a subset of 100d GloVe as word embeddings.