Guest Lecture

"Paradigm Shift in Turbo Processing: from P2P to Networks"

Prof. Tad Matsumoto [+*]

[+]Japan Advanced Institute of Science and Technology
1-1 Asahidai, Nomi-Shi, Ishikawa, Japan

[*]Center for Wireless Communications, University of Oulu, Finland

Friday, 22 February 2013
10:00 am – 11:30 am
Room BAR II / 63a
(building of the Faculty of Electrical and Computer Engineering, Georg-Schumann-Straße 11)

Abstract:

A goal of this talk is to provide audience with the knowledge about the relationship between the relay systems and the Distributed Coding techniques for correlated sources.
First of all, it is shown that performance of the conventional decode-and-forward system can significantly be improved by performing another interleaving at the relay, with which the resulting network structure is equivalent to distributed turbo code. Furthermore, since the knowledge about the bit error probability of the source-relay node can be used as the correlation between the two frames, one from the source, and the other from the relay, we can well exploit the Slepian-Wolf theorem; With the utilization of the theorem, the relay can forward the frame even though it detects errors in the information part, and the destination can recover the data losslessly.Then, this talk further expands the idea, from lossless-link-design-based to lossy-based. In this part, we assume that none of the relays at the final stage has no errors in the information parts of the frames. This category of the problems belongs to *Distributed Lossy Coding*, represented by the *Chief Executive Officer* (CEO) *problem*, in Network Information Theory. Even in this situation, still the destination can recover the data with the distortion level lower than specified.
This talk introduces conceptual bases of the lossless (Slepian Wolf) and lossy-link-design –based network design, and provides basic ideas for signal detection algorithms for the both cases based on the *turbo principle*. Results of initial simulations conducted to evaluate the performances of the detection/decoding techniques for several simple network models are also presented. The major applications of the system concept introduced in this keynote speech are Wireless Mesh Networks, Wireless Sensor Networks, Wireless Machine-to-Machine networks, Wireless Internet-of-Things, and Densely Populated Wireless Networks, as well as Rapid Construction of Monitoring Systems in Devastated Public Facilities, such as Fukushima.