

NATIONAL UNIVERSITY OF SINGAPORE

School of Computing

C S S E M I N A R

Title: **Estimation of Spatially Correlated Random Fields in Heterogeneous Wireless Sensor Networks**

Speaker: Ido Nevat, Leader of the Statistical Modelling group at I2R

Date/Time: 27 June 2016, Monday, 10:00 AM to 12:00 PM

Venue: Executive Classroom, COM2-04-02

Chaired by: Dr Low Kian Hsiang, Assistant Professor, School of Computing
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Ido Nevat received the B.Sc in Electrical Engineering from the Technion, Israel Institute of Technology in 1998, and the Ph.D. in Electrical Engineering from UNSW in 2010. From 2010 to 2013 he was a research fellow at the ICT centre at the CSIRO in Sydney, Australia. Ido is currently the leader of the Statistical Modelling group at I2R. Ido's research interests are statistical modelling, statistical signal processing, wireless communications and sensor networks.

We develop new algorithms for spatial field reconstruction, exceedance level estimation and classification in heterogeneous (mixed analog & digital sensors) wireless sensor networks (WSNs). We consider spatial physical phenomena which are observed by a heterogeneous WSN, meaning that it is partially consists of sparsely deployed high-quality sensors and partially of low-quality sensors. The high-quality sensors transmit their (continuous) noisy observations to the Fusion Centre (FC), while the low-quality sensors first perform a simple thresholding operation and then transmit their binary values over imperfect wireless channels to the FC. The resulting observations are mixed continuous and discrete (1-bit decisions) observations, and are combined in the FC to solve the inference problems. We first formulate the problem and show that the resulting posterior predictive distribution which is key in fusing such disparate observations involves intractable integrals. To overcome this problem, we develop novel algorithms that are based on a multivariate series expansion approach resulting in a Saddle-point type approximation. We then present comprehensive study of the performance gain that can be obtained by augmenting the high-quality sensors with low-quality sensors using real data of insurance storm surge database known as the Extreme Wind Storms Catalogue.