Internship Proposal

Multimedia Sensor Placement for an Optimal Coverage of a Target Area

Keywords: Networks (wireless, sensors, multimedia) and combinatorial optimization.

Context and object:

Wireless Sensor Networks (WSNs) are a new kind of networks composed by tiny devices equipped with sensor boards and wireless communication capabilities. Wireless sensors can then communicate among each other and with one or several data-sink points. This new kind of networks is emerging thanks to the diverse application they allow. In outdoor environments, the environments we are interested on here, WSNs can be used for area surveillance, intrusion detection, fire detection, energy and lighting control or climate monitoring, to name a few.

The recent evolution of the technology allowed to go from a model where all the wireless sensors was mainly dedicated to measure simple environmental parameters such as temperature or humidity to sensors having multimodal and multimedia capabilities. Indeed, the availability of affordable hardware devices such as low-resolution and low-power consumption CMOS cameras and microphones allows today to embed them to communicating motes. *Cyclops* and *Stargate* are two concrete examples of such communicating multimedia sensors. A new research area has then appeared. This one concern multimedia data transmission over wireless sensor networks and is commonly called *Multimedia Wireless Sensor Networks* or *MWSN* [1].

Most of the applications that are foreseen for MWSNs require a prior optimal placement of multimedia sensors in the targeted area. Indeed, these applications of MWSNs in particular as well as WSNs in general necessitate the placement of the sensors in such a way that an optimal coverage of the 'monitored' area is performed. Several techniques for optimal sensor placement had been proposed in the literature [2]. However, these had been proposed for sensors that are scalar (i.e. sensors with unidirectional sensing capabilities) and homogeneous (i.e. the coverage area of the sensor). MWSNs are by essence heterogeneous (i.e. the sensitivity of the microphone and the zoom of the camera) and directional (i.e. opening angle of the camera and the microphone). These make them completely different from scalar sensors. These two characteristics (heterogeneity and directional sensing) render the placement problem far more complex from the one related to scalar sensors. Hence, the optimal placement techniques previously proposed in the literature cannot be used to MWSNs without modification. A specific technique for the optimal placement of wireless multimedia sensors taking into account the above mentioned characteristics is necessary. The objective of this internship is to research, develop and validate such a technique. This one should allow placing communicating multimedia sensors with the aim to cover optimally a targeted area.

This involves determining the optimal number of sensors to be used to cover X% of an area (X being a parameter of the problem) and then to determine the location of these sensors.

Required Competences: Combinatorial optimization, Networks, C/C++.

Funding: Yes.

Duration: 4 to 6 months.

Location: ENSIIE – 1 Sq. de la résistance, 91025 Evry CEDEX – http://www.ensiie.fr

Bibliography:

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[2] M. Younis and K. Akkaya, "Strategies and Techniques for Node Placement in Wireless Sensor Networks: A Survey," Elsevier Ad-Hoc Networks Journal, Volume 6, Issue 4 (June 2008).

[3] N. Tezcan and W. Wang, "Self-orienting wireless multimedia sensor networks for occlusion-free viewpoints," Computer Networks, 52(13), 2558-2567, 2008.

[4] C.S. Revelle and H.A. Eiselt, "Location analysis: A synthesis and survey," European Journal of Operational Research, 165, 1-19, 2005.

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