Abstract

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Compressive Sensing for Target Detection and Tracking within Wireless Visual Sensor Networks-based Surveillance applications

Wireless Visual Sensor Networks (WVSNs) have gained significant importance in the last few years and have emerged in several distinctive applications. The main aim of this research is to investigate the use of adaptive Compressive Sens- ing (CS) for efficient target detection and tracking in WVSN-based surveillance applications.CS is expected to overcome the WVSN resource constraints such as memory limitation, communication bandwidth and battery constraints. In ad- dition, adaptive CS dynamically chooses variable compression rates according to different data sets to represent captured images in an efficient way hence saving energy and memory space. In this work, a literature review on compressive sens- ing, target detection and tracking for WVSN is carried out to investigate existing techniques. Only single view target tracking is considered to keep minimum num- ber of visual sensor nodes in a wake-up state to optimize the use of nodes and save battery life which is limited in WVSNs. To reduce the size of captured images an adaptive block CS technique is proposed and implemented to compress the high volume data images before being transmitted through the wireless channel. The proposed technique divides the image to blocks and adaptively chooses the compression rate for relative blocks containing the target according to the sparsity nature of images. At the receiver side, the compressed image is then reconstructed and target detection and tracking are performed to investigate the effect of CS on the tracking performance. Least mean square adaptive filter is used to predicts target's next location, an iterative quantized clipped LMS technique is proposed and compared with other variants of LMS and results have shown that it achieved lower error rates than other variants of lMS.The tracking is performed in both in- door and outdoor environments for single/multi targets. Results have shown that with adaptive block compressive sensing (CS) up to 31% measurements of data are required to be transmitted for less sparse images and 15% for more sparse, while preserving the 33dB image quality and the required detection and tracking perfor- mance. Adaptive CS resulted in 82% energy saving as compared to transmitting the required image with no CS.