Multiple-View Object Recognition in Band-Limited Distributed Camera Networks

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Abstract

We study the classical problem of object recognition in low-power, low-bandwidth distributed camera networks. The ability to perform robust object recognition is crucial for applications such as visual surveillance to track and identify objects of interest, and compensate visual nuisances such as occlusion and pose variation between multiple camera views. We propose an effective framework to perform distributed object recognition using a network of smart cameras and a computer as the base station. Due the the limited bandwidth between the cameras and the computer, the method utilizes the available computational power on the smart sensors to locally extract and compress SIFT-type image features to represent individual camera views. In particular, we show that between a network of cameras, high-dimensional SIFT histograms share a joint sparse pattern corresponding to a set of common features in 3-D. Such joint sparse patterns can be explicitly exploited to accurately encode the distributed signal via random projection, which is unsupervised and independent to the sensor modality. On the base station, we study multiple decoding schemes to simultaneously recover the multiple-view object features based on the distributed compressive sensing theory. The system has been implemented on the CITRIC smart camera platform. The efficacy of the algorithm is validated through extensive simulation and experiments.