# Challenges in Practical Distributed Video Compression

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Distributed compression in sensor networks has been considered for a number of years. Theoretical results indicate that significant gains can be achieved (in terms of reduced power consumption) by exploiting spatial correlation in the process of routing data through a network. However only relatively limited practical work has been done to achieve these gains, in particular for complex data types such as video.

We will discuss recent work that illustrates the challenges in achieving practical distributed video compression.

First, in the context of wireless sensor networks we have studied distributed wavelet transforms, where nodes cooperate to compute the transform and compress the resulting coefficients as data is routed through the network. While this work has been applied to highly correlated spatially distributed data (e.g., temperature measurements produced by motes), it shows that better performance can be achieved by using routing-aware compression techniques. Software based on this work will soon be available as an add-on to the Collection Tree Protocol (CTP) distributed with TinyOS.

Second, many authors have proposed distributed source coding (DSC) techniques based on information theoretical results (e.g., work by Slepian and Wolf). A key difficulty in applying these ideas in a practical setting is that performance predicted by theoretical results is only achieved when exact correlation models are known (i.e., the correlation between data being encoded at two separate sensors). Our work on DSC techniques for hyperspectral imaging illustrates how it is possible to approach the problem in a practical setting. We show that starting with unknown correlation parameters it is possible to estimate sufficiently good models under constraints on the amount of data exchanged between the distributed encoders.

Based on this past experience we suggest that future distributed video encoding systems will require routing-aware coordination of encoders as well as rate constrained correlation estimation across the network.