A Unified Framework for Lossless Image Set Compression

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As the availability and use of digital images increase, the efficient storage of images becomes an important area of research. Traditionally, each image in a set is compressed individually, taking advantage of the redundancies existing *within* the image. In the related area of video compression, a video sequence is decomposed into individual frames. Video compression algorithms take advantage of redundancy existing among consecutive frames as well as the redundancy existing within each frame. Unlike video compression, there are applications that use large image sets whose inter-image relationships are unknown. For example, a medical database may contain a large number of X-ray images of the same body part; a database of satellite images may possess “similar” characteristics; a database of facial images contains many similar images. In some applications compressed images must be identical to the original images, therefore lossless compression must be used.

Compared with traditional image compression, the lossless compression of a set of similar images has received relatively little attention from researchers. These earlier schemes have only been effective on image sets with certain properties, and it is not clear which scheme is best *a priori*. This poster presents a framework to effectively compress sets of images in a lossless manner. We represent an image set as a graph and compute its minimum spanning tree to decide which images and differences to encode. The Centroid scheme by Karadimitriou and the previous MST scheme by Nielsen *et al.* can both be represented as a spanning tree in our graph. Thus, our scheme is *guaranteed* to be no worse than these previous schemes. In fact, our framework povides the best lossless compression for all schemes that consider inter-image redundancy between two images in a set. Our experimental results show that our new MST method always produces the best result regardless of the properties of the image sets. In some cases, the first-order entropy of the image set using our scheme results in a 29% improvement over the traditional scheme of compressing each image individually.