It is well-known that tree-structured vector quantization may sacrifice performance for reduced computation. The performance loss can be attributed to two separate sources, the design approximation and the search inaccuracy. The former has been well understood and much improved in the past. The latter is less known. To measure the search performance, we define search accuracy as the percentage of input vectors that are quantized with minimum distortion. Our studies show that low search accuracy is the main cause of performance loss for some of the best current tree-structured vector quantizers.

Although the design approximation and search performance can be analyzed separately, we observe that the result of design may actually affect the search accuracy. Most of the current design techniques seek to minimize the distortion in the design without any consideration of their effect on the search. The tree search accuracy as a result of these designs could be as low as 50 percent. In order to improve the overall performance, the tree design should not be optimized without consideration of tree search accuracy. The difficulty is that it is not possible to measure the search accuracy at the design stage.

We develop a design algorithm that incorporates the search accuracy and produce a tree-structured that improves the search accuracy significantly. Experimental results in image compression show that the strategy works surprisingly well in improving the tree search accuracy from low of 50% to over 80 and 90%. The overall quantization performance is thus improved significantly to surpass existing tree-structured VQs and even full-search VQ in terms of the overall distortion versus the entropy rate as shown in the following figure.