

## A MASSIVELY PARALLEL ALGORITHM FOR VECTOR QUANTIZATION

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### SUMMARY

This paper is concerned with the parallel implementation of a vector quantizer system on Maspar MP-2, a single-instruction, multiple-data (SIMD) massively parallel computer. A vector quantizer (VQ) consists of two mappings: an encoder and a decoder. The encoder assigns to each input vector the index of the codevector that is closest to it. The decoder uses this index to reconstruct the signal. In our work, we used the Euclidean distortion measure to find the codevector closest to each input vector. The work described in this paper used a Maspar MP-2216 located at the Goddard Space Flight Center, Greenbelt, Maryland. This system has 16,384 processor elements (PEs) arranged in a rectangular array of 128 x 128 nodes.

The parallel VQ algorithm is based on pipelining. The codevectors are distributed equally among the PEs in the first row of the PE array. These codevectors are then duplicated on the remaining processor rows. Traversing along any row of the PE array amounts to traversing through the entire codebook.

After populating the PEs with the codevectors, the input vectors are presented to the first column of PEs. Each PE receives one vector at a time. The first set of data vectors are now compared with the group of codevectors in the first column. A data packet containing the the input vector, the minimum value of the distortion between the input vector and the code vectors it has encountered so far, and the index corresponding to the codevector that accounted for the current minimum value of the distortion is associated with each input vector. After updating the entries of the data packet, it is shifted one column to the right in the PE array. The next set of input vectors takes its place in the first column. The above process is repeated till all the input vectors are exhausted. The indices for the first set of data vectors are obtained after an appropriate number of shifts. The remaining indices are obtained in subsequent shifts.

Results of extensive performance evaluations are presented in the full-length paper. These results suggest that our algorithm makes very efficient use of the parallel capabilities of the Maspar system. The existence of efficient algorithms such as the one presented in this paper should increase the usefulness and applicability of vector quantizers in Earth and Space science applications.

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