

# Morphological Coding of Images

by

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## Abstract

The potential for the use of morphological coding in transmitting head-and-shoulder images typically encountered in video teleconferencing applications is developed and evaluated in this thesis. Morphological coding is defined here as the reduction of an image to a linear superposition of basic morphemes each characterized by a coded position, intensity, and type; the morphemes may overlap spatially, may be non-orthogonal, and may be one or multi-dimensional.

The development of morphological coding here involves 1) design and implementation of optimum filters for morpheme detection and estimation, 2) morphological coding and reconstruction of one-dimensional images such as scan lines of a horizontal raster, and 3) grouping of one-dimensional morphemes in adjacent scan lines of two-dimensional images into coded "stroke" features similar to the brush strokes in an artist's painting. Procedures for achieving the above are presented and the results are evaluated using psychovisual considerations together with rms-error criteria. Causes limiting quality and bit-rate reduction in morphologically coded images are studied in detail.

Morphological coding is then compared to other methods of image coding, with emphasis on the exclusive features of morphological coding. Finally, a view in a different perspective is offered for morphological coding. It is proposed that the notion of the "morpheme" be associated with a local measure of the signal characteristic rather than with a set of basis functions.

The capability of the algorithm implemented in this thesis to reduce an image to strokes is epitomized in a 128×128 pel image which was reconstructed at a bit rate of 0.5 bit/pel and signal-to-noise ratio of 23 dB. The limitation of this method of morphological coding to produce higher quality images at lower bandwidths is traced to three fundamental issues: The choice of morphemes, the practical considerations in algorithm implementation, and the limitation of the use of simple functions to reconstruct arbitrarily complex structures. Suggestions are made to further investigate the role of each in attempting to improve the performance of morphological coding.

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