LINEAR DISCRIMINANT ANALYSIS IN IMAGE RESTORATION AND THE PREDICTION OF ERROR RATE

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ABSTRACT

Much attention has recently been focussed on the use of statistical and probabilistic models in the restoration of digital images corrupted by noise. A possibly multivariate "signal" (data) x_i is observed everywhere on a regular finite lattice, and carries information on a small number of unobserved "labels", or colors' c_i at each pixel i, where $i = 0 \ldots N$ labels the sites of a lattice. The objective is to restore the labels (that is, to classify the pixels) $\underline{c} \equiv \{c_i\}$, given the data $\underline{x} \equiv \{x_i\}$. The key idea is that many (or even all) of the signals are used to classify *every* pixel. This is known variously as image segmentation, image restoration or contextual classification. A number of algorithms are now available for this problem. Many of these, though *ad hoc*, are quite satisfactory in practice. But as such it is impossible to conduct any detailed theoretical analysis of their performance, even in terms of something as apparently fundamental as error rate, and restorations must be regarded as equivalent to point-estimates, unqualified in any way. In this paper we show that a simple proposal of Switzer (1980) can be extended to yield a method which is not only perfectly adequate in at least some important cases but admits of fairly detailed analysis of its properties.

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