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THE USE OF PRIOR PROBABILITIES IN MAXIMUM LIKELIHOOD CLASSIFICATION

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The use of prior information about the expected distribution of classes in a final classification map can be used to improve classification accuracies. Prior information is incorporated through the use of prior probabilities--that is, probabilities of occurrence of classes which are based on separate, independent knowledge concerning the area to be classified. The use of prior probabilities in a classification system is sufficiently versatile to allow (1) prior weighting of output classes based on their anticipated sizes; (2) the merging of continuously varying measurements (multispectral signatures) with discrete collateral information datasets (e.g., rock type, soil type); and (3) the construction of time-sequential classification systems in which an earlier classification modifies the outcome of a later one.

The prior probabilities are incorporated by modifying the maximum likelihood decision rule employed in a Bayesian-type classifier to calculate à posteriori probabilities of class membership which are based not only on the resemblance of a pixel to the class signature, but also on the weight of the class which is estimated for the final output classification. In the merging of discrete collateral information with continuous spectral values into a single classification, a set of prior probabilities (weights) is estimated for each value which the discrete collateral variable may assume (e.g., each rock type or soil type). When maximum likelihood calculations are performed, the prior probabilities appropriate to the particular pixel are used in classification. For time-sequential classification, the prior classification of a pixel indexes a set of appropriate conditional probabilities reflecting the confidence of the investigator in the prior classification.