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A Result from Studies of Transformed Divergence

by

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The purpose of this memorandum is simply to convey briefly and quickly to LARSYS users a result derived from some recent studies of the relation between transformed divergence and classification accuracy. These studies were carried out under the author's direction by Roger C. King, an undergraduate in Electrical Engineering. A detailed publication describing the investigation will be forthcoming shortly.

The results which are of interest to LARSYS users are conveyed in the attached figure, which shows the relation, experimentally determined, between transformed divergence (as implemented in LARSYS) and classification accuracy. The figure may be interpreted in either of two ways. First, suppose you have found that two classes have a transformed divergence of, say, 1750. Then these two classes will be classified (relative to each other) with an accuracy between 85 and 98 percent (the boundaries of the dotted area), but on the average with an accuracy of 94 percent (the solid curve value at 1750).

Or, suppose you wish to classify two classes with an accuracy (with respect to each other) of at least, say, 90 percent. Then you must find a set of features yielding a transformed divergence of at least 1125 (the leftmost boundary of the dotted area).

A related result which is not explicitly shown in the figure has to do with the average transformed divergence over many class pairs. The figure was produced by generating thousands of sets of artificial data (based on actual remote sensing data statistics) and computing the transformed divergence and classification accuracy for each set. Thus, every set produced a single point in the dotted area; and the solid curve was produced by averaging the correct recognition values obtained for any given value of divergence (roughly speaking). Interestingly, when we averaged all transformed divergences and all classification accuracies produced, the resulting point on the plot fell almost exactly on the solid curve. It can be argued that this explains why the average transformed divergence (over all class pairs in a given analysis) provides a reasonable indication of overall classification accuracy (actually, an indication of the lower bound on accuracy).

*** LIMITATIONS ***

The data used to generate these results had multivariate Gaussian statistics and the results apply only in the multivariate Gaussian case.

The figure should be used only to infer training field results.

The extent to which the results can be applied to test fields in a given instance depends on how representative the training statistics are of the test fields.

Empirical Relation Between Transformed Divergence and Correct Recognition (1-6 Features)