Reprinted from

Symposium on

Machine Processing of

Remotely Sensed Data

June 21 - 23, 1977

The Laboratory for Applications of
Remote Sensing

Purdue University
West Lafayette
Indiana

IEEE Catalog No.
77CH1218-7 MPRSD

FEATURE SPACE TRANSFORMATION FOR IMPROVED INTERPRETABILITY OF COLOR IMAGES

H. K. RAMAPRIYAN
Computer Sciences Corporation, Systems Sciences Division, 8728 Colesville Road, Silver Springs, Maryland 20910

Several mappings of the feature space are in vogue for generating user-oriented products from remotely sensed data. A classification map with different colors assigned to each of the say, n, classes of interest may be looked upon as a result of a nonlinear transformation of the feature space into n points in the "color" space. This is a useful mapping in areas such as land use or water resources studies. However, in areas such as interpretation of geological images, the analyst is generally interested in preserving the texture of the image and analyzing the information manually. Therefore, other methods of enhancing the interpretability of the image such as principal components and canonical analyses are employed.

The principal components analysis provides a linear mapping such that the "information" along each of the transformed axes is maximized. Canonical analysis obtains a linear transformation based on maximizing the separation among given categories along the coordinate axes. These transformations, while useful in reducing dimensionality, tend to produce different tones in the same color, rather than different colors, for the most separable classes.

The purpose of this paper is to develop a linear transformation which assigns data from different chosen categories, modeled parametrically or nonparametrically, into specified colors. The approach taken is to specify that the given categories be mapped into given vectors in the "color" space and minimize the mean squared error between the transformed data and the given vectors. When the specific colors say C_1, C_2, C_3, C_4, assigned to given classes say P_1, P_2, P_3, P_4, are irrelevant, the mean squared error can be reduced by considering all combinations of assignments such as $[(P_1 \longrightarrow C_1)$ $(P_2 \longrightarrow C_2)$, $(P_3 \longrightarrow C_3)$, $(P_4 \longrightarrow C_4)]$, $[(P_1 \longrightarrow C_2)$, $(P_2 \longrightarrow C_1)$, $(P_3 \longrightarrow C_3)$, $(P_4 \longrightarrow C_4)]$ and so on.

Experimental results are shown to illustrate the transformation.

This work was performed under Contract No. NAS5-11999 from NASA, Goddard Space Flight Center, Greenbelt, Maryland