

## ABSTRACT

Theme shapes, dimensions, inter and intra relationships in several bands of satellite imagery are utilized for the interpretation of these frames in terms of their thematic significance to several disciplines of science and technology.

This subject is borne out of the technological advances registered in the past few decades which witnessed remarkable triumphs in space vehicle launching, flight path stabilities, registration of imagery with spectral scanning units, high rates of bit transmission to ground stations and equally important data handling fast computers, vision and graphics systems.

Analyses of digital values, however, is still based on empirical formulae without a rigid theoretical basis. Concepts based on time series methods such as fourier transforms, frequency based filtering techniques

splitting of the total spectral output into noise and signal fractions and reconstruction of the images that represent the signal components are generally being attempted. Multivariate statistical techniques are being utilized for the study of several bands of the imagery.

The present thesis attempts at the usage of Spatial statistics based on Regionalized Variable Theory of Matheron, Serra, Sandjivy, Journel, Lantuejoul and the other french scientists of Fontainebleau school, who in the last two decades have pioneered this subject under the term Geostatistics and Mathematical Morphology.

The Regionalized Variable Theory based on the estimate of a central value from the neighbourhood is utilized to explain the enhancement and linear detection procedures and in order to obtain invariant linear features, recursive filtering and non parametric filtering techniques are suggested in the thesis.

Domain size place an important and crucial role in the theory of estimation and is generally based on an empirical observation by W. Scott Hazen that variance reduces with volume is investigated using both simulated profiles and satellite imagery and its utility in theme detection is emphasized.

Detection has an implicit relation to pixel size, which represent the domain size of the grey level value. One can detect features at various levels by aggregation of grey level values so as to increase the domain size. It is argued that the imagery needs interpretation at several levels of aggregation. While the imagery acquired represent a specific level, by interpolation and compositing, imagery at several levels can be computed.

Theme, neighbourhood, zones of influence, context, volume and nature of information are some of the terms associated with nebulous definitions. A rigorous definition is not yet possible, however, these terms have been utilized in a descriptive manner, indicating their fuzzy nature.

In case of availability of multiple bands of imagery, one has to utilize the multivariate statistics at several levels. Each imagery can generate several levels of information. In this thesis, the theory of aggregation with its concepts in multivariate, multimodal situations is possible with a similar methodology.

While spatial statistics is helpful for theme detection, Mathematical morphological techniques can be utilized for theme measurements and modification.

Since compositing techniques display information at several levels, the theme hierarchy needs to be established and it is suggested that Atkins 'Q' analyses (1974) will be a useful technique which needs adoption in the imagery studies.

In this thesis, several interesting aspects of imagery analyses have been discussed and the present attempt is more explanatory in nature in the development of Spatial statistics for digital image processing studies.

But for the guidance and supervision of Prof. S.V.L.N. Rao who is one of the leading scientists in the field of estimation theory, this work would not have taken this present shape. The short discussion between the author and Dr. Lantuejoul, Centre for Geostatistics and Mathematical Morphology, Fontainebleau, France and Prof. Rao's stay at Fontainebleau on their invitation for ten weeks in the summer of 1984 have contributed vastly to the refinement of the methods adopted in this thesis.



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