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**BRIEF REVIEW OF PROPOSALS FOR SECOND PROJECT ON  
APPLYING GEOSTATISTICS TO REMOTE IMAGERY OF FORT BELVOIR**

First Interim Report (RSSUSA - 2/1)

Dr Margaret A. Oliver and Professor Richard Webster

September 1995 to November 1995

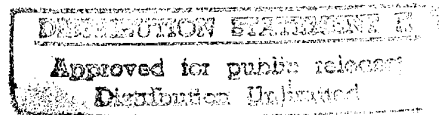
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## ABSTRACT

This first report of the second phase of the project to apply geostatistics to remote imagery summarises the focus of the research. We shall base the preliminary analysis of the image on what we learned in the first phase. The SPOT image will cover Fort Belvoir which has a variety of types of land cover. Based on the resolution required we shall sample the image optimally and use the exhaustive variogram from the whole image to reconstruct the image from the sample values.

## SUMMARY OF PROPOSED SCHEME OF WORK

This is the first report on the second phase of the project to apply geostatistics to remote imagery. The first phase dealt with analysing the spatial structure in the information from three wavebands of a SPOT image for a part of Fort Benning. This was then related to the spatial structure in the ground cover, and it was used to design a sampling scheme for ground survey of the part studied. The second phase will focus on using geostatistics to minimize the amount of data from remotely sensed images that needs to be stored to enable the pattern of variation to be reconstruction at a prescribed precision or resolution.

There is much redundant information in most spectral images, and this can be removed by sampling the image optimally and retaining only the information that is essential to restore the image at a particular spatial resolution. The previous analysis showed that there were two distinct spatial scales of variation in the pixel information and that the shorter scale related to the variation in ground cover. To remove redundant information the image could be sampled optimally in relation to either or both of these spatial scales. This would then dictate the resolution of the reconstructed image. The choice would depend on what detail of information was likely to be required by future users. Ideally a reconstruction based on the shorter scale should be aimed for because this would provide most of the information likely to be required in the future.

Fort Belvoir in Fairfax County, Virginia, has been chosen for the second analysis. At the moment we are waiting for the SPOT image information for the site to arrive (it has been ordered). There are several advantages of working with this site. It is

readily accessible for ground surveys by the staff at TEC who are already based there. Full colour aerial photography of the ground cover is already available. This means that field observation can be minimized, and the photographs can also be used for testing classifications based on the pixel information.

Fort Belvoir covers 8656 acres, and there is a considerable variety in the land use. It includes field training zones, open space and environmentally sensitive areas with forest and a wildlife corridor, recreation areas such as a golf course, an airfield and research areas in which there are three main projects already. In addition there are built up areas that include the research offices and administrative blocks, housing, a hospital and roads. The largest areas include those covered by research (15.5 %), open space and environmentally sensitive areas (26 %), training areas (10.8 %), and built up areas (21 %).

On receipt of the image data we shall do a preliminary analysis in preparation for the main research. This will include computing summary statistics, variogram analyses, correlation analysis and mapping of the wavebands. This will enable us to determine what the spatial structures present in the variation are and whether there is any redundancy in the wavebands. If so we shall concentrate on those bands that are uncorrelated. If there are distinct scales of spatial variation then we shall want project members at TEC to identify the scale or scales that are of interest to them. This will provide the basis for designing the sampling scheme to compare the ground cover information with that in the image. If the ground cover scales reflect those in the image then we can design a sampling scheme to sample the image optimally using the kriging equations that will contain all of the essential information about the variation in ground cover that needs to be saved. By selecting a range of sampling intensities and solving the kriging equations for each a graph of prediction variance against sampling interval can be drawn, and then for any given tolerance the sampling interval can be read from the graph. Based on an optimal sampling interval we should then enable us to reconstruct the image at a resolution that reflects the ground cover or any other resolution that is deemed valuable for restoring information likely to be required.