"International Space Year Workshop on Data Analysis Methods and Applications"
presented by ISPRS and United Nations, Office of Outer Space Affairs

WORKSHOP SESSIONS

Session IS-1 - **Data Formats, Basic Processing and Image Enhancement Techniques**
August 6, 1992, 08:30-12:00
Session Reporter: D. G. Goodenough
Chairman: Dr. David G. Goodenough (Canada)

Ade A. Abiodun (United Nations) - **United Nations Opening Statement**

Three key points were addressed: (1) The working relationship between the UN and ISPRS, (2) the aim of the workshop, and (3) the speakers and their presentations.

This workshop is a result of Prof. Shunji Murai's initiative in 1988 when he invited the Outer Space Affairs Division, which is now called Office for Outer Space Affairs (OOSA), of the United Nations to participate in the XVIth ISPRS Congress in Kyoto. That initiative was followed by the admission of ISPRS, as an observer, into the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS).

At the invitation of the XVIIth ISPRS Congress Director, Dr. Larry Fritz, OOSA agreed to co-sponsor this workshop in order to focus attention on algorithms, software development and systems, and the hardware employed in the reduction and analysis of data and their application, including emphasis on practical solutions to the problems of real data treatment.

Speakers, who are experts in their individual chosen fields, have been recommended by the relevant Presidents of ISPRS Commissions.

K. Rasmussen (Denmark) - **Methodologies and Software for Satellite Image Processing: User Needs and Development Trends**

Three key points were addressed: (1) Optical satellite remote sensing methodologies will become accessible to local level natural resource management institutions, due to the technological development; (2) satellite image processing software will have to become integrated into natural resource management procedures, support non-expert users, and allow combination with other data; and (3) new models for collaboration between institutions in developing countries and technologically advanced countries are required.

Jo Wu (China-Taipei) - **Image Correction/Enhancement Techniques with Emphasis on: Basic Geometric and Radiometric Processing; Radiometric Calibration and Multisensor Equalization**

Two key points were addressed: (1) Space resection with SPOT imagery, and (2) integrated approach to image matching and 3D positioning.

A report under the title "Geometric and Radiometric Models in Processing SPOT Imagery for Object-Space Surfaces" was filed. For space resection, it was concluded that fewer than ten ground control points are quite enough. Explanations were given with respect to important features of relative image matching with 3D object-space positioning. Accuracies in terms of RMS errors were reported on the basis of real panchromatic 1A stereo SPOT images, and the way to arrive at automatic generation of orthographic (sub-) images was shown. More realistic 1D and 2D interpolation models had to be investigated in order that geometric image analyses turn out to be more accurate and reliable.

John Trinder (Australia) - **Levels of Image Processing with Emphasis on: Edge and Feature Extraction; Linear Feature Extraction; General Segmentation; Image Matching, Object Reconstruction**

Three key points were addressed: (1) Principles of combining filters with images, (2) methods of image matching, and (3) object reconstruction.

The presentation discussed methods of noise removal, image enhancement, and edge extraction on digital images using a range of image filters. Demonstrations were given of the results of applying these filters to digital photographs and satellite images. Methods of image matching were also discussed by cross-correlation and least-squares methods. Demonstrations were given of the results of object reconstruction based on the above methods.

Ladson Hayes (United Kingdom) - **Image Analysis Software**

Two key points were addressed: (1) Software systems for image analysis, and (2) software functionality for image analysis.

Image analysis software is considered from the perspective of the systems available, their architecture, and their constraints. Attention is given to the explicit and implicit costs of ownership of image analysis software.

Session IS-2 - **Computer Assisted Data Interpretation and Digital Mapping**
August 6, 1992, 13:30-16:45
Session Reporter: B. Forster
Chairman: Dr. Bruce Forster (Australia)

D. G. Goodenough (Canada) - **Image Analysis at CCRS**

Three key points were addressed: (1) Systems must be designed for ease of interaction with user, (2) methods for accuracy assessment are very important, and (3) the number of prompts required by the operator needs to be reduced.

Discussion of the history and development of image analysis at the Canadian Centre for Remote Sensing was followed by developments in the SHERI expert system for monitoring forests in Canada. Particular emphasis was placed on the need for these systems to be simple for the user and to incorporate accuracy assessment. Other systems are available such as PIKES for aiding the training of photo interpreters and SEIDAM for optimizing data selection.

Girard Guyot (France) - Radiometric Corrections for Quantitative Analysis of Multispectral, Multitemporal and Multisystem Satellite Data

Two key points were addressed: (1) Remote sensing data from satellites and aircraft can be usefully employed only after various corrections; and (2) errors due to atmosphere, spectral bands, topography, MTF, and bi-directional reflectance can be of the order of 1% to 60% error under certain conditions.

Corrections due to sensor MTF, position of spectral bands in different sensors, atmospheric effects, slope and aspect of the topography, and the directional aspects of bi-directional reflectance were discussed and explained and the importance of applying these corrections was stressed. Examples of the errors due to these effects were given for multisensor and multitemporal data on sites in the south of France.

Nanno J. Mulder (Netherlands) - Multivariate Analysis Techniques

Two key points were addressed: (1) Common sense may be better than statistical analysis, and (2) information theory should be linked to visual experience rather then variance.

Spatial properties of single-band images were discussed in the context of principal component analysis. A comparison of principal components and Taylor's expansion was made, with the suggestion that the Taylor expansion more closely replicated the human visual experience. A brief account of normalizing in multiband data was also given.

Tapani T. Sarjakoski (Finland) - Image Scanners and Interactive Workstations for Semi-Automatic Mapping, with Emphasis on Low-Cost Solutions

Three key points were addressed: (1) Low cost computerized stereo workstations must be robust in operational use; (2) systems must be tailored to user needs, and be multipurpose workstations; and (3) interactive means will still be used for many years.

Low cost digital photogrammetric workstations were discussed, particularly for large scale mapping using aerial photographs. Low cost scanners were also discussed, and it was indicated that results better than 10 micrometers in position could be achieved after correction. It was considered that fully automated systems would not be available in the near future, and interactive systems would be available for a long period.

Dieter Fritsch (Germany) - Updating of Vector Coded GIS Using Remotely Sensed Data

Three key points were addressed: (1) Today there is a need to handle both vector and raster data together, (2) quadtree decomposition of raster images has some useful features; and (3) the density of the quadtree structure along boundary edges can allow for the derivation of vector data for updating.

Hybrid (raster/vector) databases are becoming more common. It is possible to use remote sensing raster data to update vector databases if the remote sensing data is first arranged in quadtree form. The smaller the quadtree structure (e.g., along edges), the easier it is to deduce vector information. The speaker concluded with useful tabulations of the benefits of GIS and some of the reasons for the still slow take-up by users.

Emmanuel Baltsavias (Switzerland) - Extraction of Metric Information from Remote Sensing Data and Integration into GIS

Three key points were addressed: (1) Stereo views of SPOT do not match because of various reasons, (2) various filters can improve the situation, and (3) use of a simulated epipolar line to constrain searching and matching is very beneficial.

The author described the effect of various filters (Kratky and Wallis) and recommended the use of gradient magnitude values rather than gray scale values for matching. He also described how to simulate an epipolar line in the imagery, and he presented some interesting examples of erroneous matching which could be avoided by its use.

S. Takeuchi (Japan) - Integration of Sea Surface Temperature Data Sets Using MOS-1 Satellite Data

Three key points were addressed: (1) The trial combines VTIR, MSR, and MESSR data from the MOS-1 satellite; (2) four trial areas centered on ocean buoys recording sea surface temperature (SST) were used; and (3) the aim is to monitor the movement of the Kuroshio current along the Pacific Coast of Japan.

The major problem encountered was the lack of cloud free scenes at the exact location of the buoys and discrimination between cloud covered and cloud free areas. Discrimination procedures can wrongly interpret some SST patterns as evidence of cloud presence. In the future, SSTs may not adequately represent currents because, especially in summer, SSTs tend to be stable. It is difficult for infrared sensors to solve these problems. SAR may have more success. The MSR/VTIR combination achieved some improvement but the VTIR/AVHRR selection had little effect. Future progress may be with a combination of microwave and radar images.

D. S. Alves (Brazil) - Hybrid Databases for GIS and Remote Sensing

Three key points were addressed: (1) There is serious deforestation in Amazonia, (2) there is a good series of Landsat images from 1984 to 1991, and (3) there are large data quantities but limited resources.

The solution is to produce overlays of change against the base year 1984 using best available scenes for each year. These are digitized and geocoded by reference to 1:250,000-scale maps. Visual interpretation of deforestation is preferred because the margin of error in such processes is greater than the amount of change to be expected.

Session IS-4 - Discussion and Conclusions
August 7, 1992, 13:30-17:00
Session Reporter: Charlotte E. O'Brien
Chairman: Miss Charlotte E. O'Brien (World Bank)

Three key points were addressed: (1) Better analysis of user demand is essential; (2) "South-South" collaboration is very valuable and must be promoted; and (3) education and training must receive more, and long-term support both technical and financial.

The three workshops which were discussed and summarized in this session dealt with (1) data formats, basic processing, and image enhancement techniques; (2) computer assisted data interpretation and digital mapping; and (3) integration of remote sensing data and GIS. About 35 people participated.

The main points raised (not in order of importance):
1. A better and comprehensive analysis of user demand is essential.
2. "South-South" collaboration is very valuable, durable, and effective; it must be promoted.

3. Education and training in developing countries (universities, regional centers) **must** be supported and funded to a greater extent.
4. Data analysis methods such as remote sensing and GIS must be integrated to fulfill their potential.
5. The costs and benefits of the methods must be calculated
6. There is a need for institutional strengthening in developing countries.
7. There is a need for commitment to **long term** sustained/renewable support of development activities.
8. Overselling of methods continues.
9. In-country capacity/talents must be used and encouraged (both government and private sector).
10. The "absorption capacity" of developing countries must be considered. The advanced methods are not always appropriate. With adequate funding, simple methods are often adequate.
11. Resources must be shared fairly: in particular, the increased use of resources in Central/Eastern Europe to the detriment of other, even poorer, developing countries should be discouraged.
12. Information exchange is important.
13. The UN has a useful role to play.
14. The three working sessions did provide a useful condensed presentation of data analysis methods.
15. Data must be carefully selected/rejected as required.
16. More ground receiving stations are needed in Africa.

The group recommends that ISPRS establish a working group on **technology transfer** (including institutional strengthening) within Commission VI. In the context of the discussion, short presentations were made on remote sensing in the UN system: RECTAS, RCSSMRS, and OACT. The following issues were also viewed: the former USSR provides a good source of data/experts, marketing of services should not be underestimated, and simpler equipment should be used where adequate.