Report of the 1990 Inter-Congress Symposium of ISPRS Commission III

Wuhan, China
20–25 May 1990

THE INTER-CONGRESS SYMPOSIUM of ISPRS Commission III was held 20-25 May 1991 in Wuhan, China. This was the first ISPRS International Symposium to be held in China. The Chinese Society of Geodesy, Photogrammetry and Cartography (GSGPC) and Wuhan Technical University of Surveying and Mapping (WTUSM) were hosts for the meeting with the National Bureau of Surveying and Mapping of China (NBSM), National Natural Science Foundation of China (NNSF), and Hubei Association for Science and Technology (HAST) serving as co-sponsors. Please note that this correspondent did not actually attend the meeting in Wuhan so that this report is based primarily on a study of the Symposium *Proceedings*, supplemented by conversations with people who did attend the Symposium.

The Symposium was attended by 115 participants, ten accompanying persons, and 20 postgraduate students for a total of 145 people from 24 different countries. One hundred and twenty nine abstracts had been received from which 40 were chosen for oral presentation at the technical sessions. The meeting began with six sessions of tutorials followed by nine technical sessions, three business meetings, and a board meeting.

ISPRS Commission III is organized into the following six Working Groups:

WG III/1 Geographic Information Theory
    Chairman, Martien Molenar
    Co-chairman, Richard Groot
WG III/2 Object Reconstruction and Location by Image Analysis
    Chairman, Wolfgang Förstner
    Co-chairman, Robert M. Haralick
WG III/3 Thematic Information Extraction from Digital Images
    Chairman, Tony Schenk
    Co-chairman, Bernd-Siegrfried Schulz
WG III/4 Knowledge Based Systems
    Chairman, N.J. Mulder
    Co-chairman, Tapani Sarjakoski
WG II/III Design and Algorithmic Aspects of Digital Photogrammetric Systems
    Chairman, Heinrich Ebner
    Co-chairman, Ian Dowman
WG III/VI Tutorials on Mathematical Aspects of Digital Photogrammetric Systems
    Chairman, Luigi Mussio
    Co-chairman, T. Bouloucos

The Tutorials on (1) Geographic Information Theory (GIT), (2) Image Processing and Feature Extraction, and (3) Object Location and Image Interpretation were given in six sessions on Sunday and Monday. Prof. Dr. Ing. M. Molenaar, Prof.Dr.-Ing. W. Förstner, and Dr. Y.C. Lee were the invited lecturers for these tutorials which were designed to instruct the participants as well as to provide a basis for the technical sessions that followed.

After the tutorials on Sunday, there was a "Book Presentation Ceremony" in which Professor Wang Zhizhuo presented his English Edition of *Principles of Photogrammetry (With Remote Sensing)* to the Council Members of ISPRS and to Dr. Mueller Wirth of the Wichmann Press (FRG). Then Dr. Wirth presented 1000 copies of a special issue of ZPF (in Chinese) to the Chinese Society of Geodesy, Photogrammetry and Cartography. This was done on behalf of the Society of Photogrammetry and Remote Sensing of the F.R.G. in honor of the 80th birthday of Professor Wang Zhizhuo of WTUSM.

At the opening session on Tuesday, welcoming addresses were given by Deren Li of WTUSM, Chairman of the Symposium; Yang Kai, Vice President of the Chinese Society of Geodesy, Photogrammetry and Cartography; Ning Jinsheng, President of WTUSM; Xiang Kejia, Vice President of Hubei Association for Science and Technology; Kennert Torlegård, President of ISPRS; Shunji Murai, Secretary General of ISPRS; and Hu Yuju, Vice President of the International Cartographic Association (ICA). The keynote speech was given by Wang Zhizhuo, Honorary President of the Chinese Society of Geodesy, Photogrammetry, and Cartography and Professor Emeritus of WTUSM.

In his speech, Professor Zhizhuo noted that photogrammetry is undergoing enormous changes. Even the traditional name is inadequate to describe the activities now occurring in "photogrammetry and remote sensing" which is now used to describe our discipline for lack of a better term. In addition, the activities of our field have broadened to include work done in many other disciplines such as correlation techniques, image processing, computer vision, and geographic information systems. Consequently, interdisciplinary activities are in order because we have much to learn from experts in those fields and they can also learn from us. This Symposium is on "Progress in Data Analysis." The preceding tutorial set the stage for the sessions to follow in which experts from photogrammetry and remote sensing and specialists from other relevant disciplines discussed contemporary theories of data analysis.

TECHNICAL SESSIONS

Naturally, the presentations which followed reflected the Working Group emphases. However, the organization of the Symposium was such that the papers given in the nine technical sessions can be classified into the following areas of interest:

- Point Densification Using Aerial and Space Data.
- Thematic Information Extraction from Digital Images.
- Geographic Information Theory.
- Application of Geographic Information Theory.
- Object Reconstruction and Location by Image Analysis (two sessions).
- Knowledge Based Systems.
- Digital Terrain Models.
- New Techniques and Algorithms.

Some comments will be made on each of these areas of interest.

POINT DENSIFICATION USING AERIAL AND SPACE DATA

Five papers were given in this initial session mostly concentrated on establishing and densifying ground control by kinematic GPS combined with bundle adjustment, geometric

processing of SPOT imagery (two presentations), a method for simultaneous adjustment of space photography, and "differential photogrammetry" using differenced equations to eliminate systematic errors in the imagery.

THEMATIC INFORMATION EXTRACTION FROM DIGITAL IMAGES

Several topics were covered in this second session including the use of radar block adjustments for the production of radar mosaics and radar image maps; an investigation of the radiometric content of SAR and how it can be used to supplement other types of imagery; methods for classification of MSS and other kinds of imagery and how to link remote sensing classifications with GIS; and the development of a method for using remotely sensed data to create displayed landscapes useful for design with an emphasis on the aesthetic effects.

GEOGRAPHIC INFORMATION THEORY

The phrase, Geographic Information Theory (GIT), was apparently devised to describe the work of those involved in digital image processing and Geographic Information Systems (GIS) and their attempts to provide an interface between the two systems and arrive at a viable formulation for the process. This field generated a lot of interest with oral presentations being given in two sessions on GIT and applications of GIT. Topics covered included data structure for three-dimensional vector maps, relational data structure for single valued vector maps, automated interface for digital space imagery and GIS, GIS guided linear feature extraction, object oriented GIS, combined data structures for vector and raster data, integrated processing of geographic information, application of an object oriented digital database for topographic and relief information, and development of a land resources investigation information system. The first five of these presentations were quite theoretical while the last three illustrated straightforward applications to practical problems.

OBJECT RECONSTRUCTION AND LOCATION BY IMAGE ANALYSIS

In another area of much interest, ten papers were given on methods of determining shape and position using the radiometric properties of the digital data. Methods discussed included shape from shading and specular reflectance; use of the finite element method along with a DTM; use of a scale-space parameter introduced into least-squares matching; application of information theory, maximum entropy, and geometric conditions to digital image matching, interest point matching, and feature extraction (three presentations); a general approach using geometric and radiometric information to provide planimetric details for applications in mapping; multiple image matching using geometric and radiometric models along with an object surface described by the finite element method; and use of the neural network approach and dynamic programming for stereo matching and extracting height information from a stereopair (two presentations). Six of these proposed methods were tested with aerial imagery while the remaining four were designed primarily for computer vision systems.

KNOWLEDGE BASED SYSTEMS

These four presentations dealt with a general experimental framework for a system to permit understanding and recon-

structing urban and suburban scenes from aerospace views, an evaluation of the handling of uncertainty in expert systems, steps taken to identify objects by tracking of the object in image sequences, and a data merging scheme to allow use of data from different remote sensors by a color transform method and by direct calculation.

DIGITAL TERRAIN MODELS

The session on Digital Terrain Models included presentations on use of the transfer function to estimate the accuracy of interpolation within a grid, automatic generation of a triangulated irregular network (TIN) by mathematical morphology, automatic raster/vector conversion from CCD scanned topographic maps, use of image digitizing at the British Ordnance Survey with a Digital Correlation Comparator System (DCCS), and use of these methods for digital photogrammetric revision of maps.

NEW TECHNIQUES AND ALGORITHMS

This final session included discussions on a review of concepts and algorithms for digital photogrammetric systems, relative orientation of a pair of photographs using a two-dimensional projective transformation, and use of a CCD camera for map digitization and geometric data transfer.

SUMMARY

The emphasis in the technical sessions of this Symposium shifted almost overwhelmingly into the realm of image processing as a tool for the reconstruction of objects from digital data and the analysis, interpretation, and understanding of these data by using both radiometric and geometric information.

Some significant results evident from these discussions are

- GPS combined with the bundle adjustment is a practical approach for establishing and densifying control.
- A Geographic Information Theory was proposed to allow use of digital spatial imagery with GIS.
- Geometric and thematic information extraction will be faster and more reliable.
- Knowledge-based systems are being developed but there is a long way to go and a new generation of computers may be needed.
- Digital photogrammetric systems are still in the developmental process. A fully automatic system will include computer graphics, computer vision, and knowledge-based systems.

A lot has been accomplished so far and much still needs to be done. It would appear that, in the future, most of the work of Commission III will be within the realm of information science.

Those interested in the details of the topics mentioned in this report may acquire a copy of the Symposium Proceedings which can be obtained for $ 80.00 from

Press of Wuhan Technical University of
Surveying and Mapping
39 Loyu Road
Wuhan 430070, P.R. China

—James M. Anderson
Department of Civil Engineering
University of California
Berkeley, CA 94720

FIRST AUSTRALIAN PHOTOGRAMMETRIC CONFERENCE

7-9 November 1991
University of New South Wales
Sydney, Australia

• Featuring sessions on activities of Working Group V/2, Commission V ISPRS •

Topics include: research and practical aspects of aerial and space photogrammetry, conventional and digital mapping, instrumentation, and close range photogrammetry and machine vision.

Contact: Ms. Lindy Burns, TUNRA LTD., Metallurgy Building, University of Newcastle, Newcastle, NSW 2308 AUSTRALIA, tel. +61 49 671811; FAX +61 49 67 4946.