TECHNICAL COMMISSION II:
Systems for data processing, analysis and representation

President: Ian Dowman

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1. State of Science and Technology of Commission Topics

The Commission II Symposium provided an excellent opportunity to review the status of development within the Commission. The main technical issues are discussed in the working group reports however some highlights are reviewed here with some general conclusions.

Automated aerotriangulation is operational. The workshop held at the Symposium discussed this issue fully. The quality of their final results however varies and it depends on the amount of operator intervention. Poor results are usually encountered when there are insufficient good tie points matched, which often happens in mountainous and forestry areas. Further development is needed in order to improve reliability and reduce human intervention.

GPS/INS systems are now capable of determining camera position to a few centimetres and orientation to tens of arc seconds in real time. More efforts are needed to improve the accuracy and reliability of the orientation parameters, to integrate with the latest high-resolution digital imaging system and to develop high speed automated algorithm for data processing. This new development will rival as well as complement the established aerotriangulation techniques for the next few years.

Digital systems are now widely used and are efficient for certain tasks. Some users have the opinion that there is still a long way to go before the systems are really efficient for production. However a lot of work is still being done on automation and feature extraction but this is still essentially in the research stage. This is discussed in the reports of WGs II/6 and II/8. Production activity is concentrated in areas where robust algorithms are developed, such as DEM generation, and where significant cost savings can be made, such as digital orthophoto production.

SAR data is becoming used for various applications and is near operational in some areas such as marine monitoring and terrain subsidence. Manufacturers are developing new software for SAR and this in turn is generating more interest,

The symposium programme was structured to focus on a both technical and policy issues which are relevant to the development and exploitation of image data in the present age. Some specific conclusions can be drawn.

Interest in new data is becoming important, particularly in the high resolution optical data which is still awaited with great anticipation. This data is not expected to replace aerial photography and the multispectral and hyperspectral data are just as important as the 1m panchromatic data. New markets are being explored for new data and new applications are being developed such 3D urban modelling using conventional data sources as well as new data such as Lidar.

Manufacturers are developing more tools to make use of the data easier but as the representative of one large data provider said, 'satellite operators are being forced to move down the chain' . It is quite clear that users want greater ease of data transfer and easier access to data. Systems for delivery of information are being developed at reasonable cost and are being used and speakers at the symposium emphasised that 'institutional issues are the major ones' .

There is considerable interest in new means of data delivery, COTS works well for geospatial data integration, data processing and data delivery and in the future we will see more use of CORBA, Java and Internet tools

Formats and standards for data and metadata are still a problem. GeoTIFF and JPEG are common but development of standards to photogrammetry and remote sensing require effort and co-ordination with other international activities such as CEOS, OpenGIS Consortium and ISO.

Quality control a big issue. Much more work needs to be done for operational use.

The theme of the symposium was data integration but in fact there were not many examples of real data integration to solve problems. Examples which have been developed by researchers include the use of SAR to control other imagery and the use multi temporal and multi sensor data to enhance information extraction. There is encouraging progress on procedures for putting data into common format for common processing systems such as the Laserscan Lamps/SOCET Set integration.

In the future we can be sure that research into automation and use of high resolution data will continue; as will the development of digital systems giving new tools, better quality control and more generic solutions. Means of reducing ground control will continue to have high priority and more tools for data integration will be developed.

The role of Commission II over the next 2 years will be to stress the need for collaboration and to continue to bring all sectors of the community together to develop data integration, common standards and interoperability. We will continue to develop awareness and use of SAR data and other new data products.

Commission II will develop an ISPRS input into data policy in the areas of reception and distribution, ownership and IPR, pricing policy - including the cost of products, reinvestment and the role of government. Other issues include custodianship, including archiving.

2. Accomplishments of Commission during 1998

The ISPRS Commission II symposium was held at Robinson College, Cambridge University, UK on 13 -17 July 1998. This symposium was organised by the Remote Sensing Society and The Photogrammetric Society of UK .

Over two hundred delegates from twenty-five countries attended the symposium. There were forty-six oral presentations and sixteen poster presentations. Three panel discussions were held on special, topical issues. Eight exhibitors displayed their latest products during the symposium and some of them gave presentations. Two tutorials on SAR and data fusion were organised and a workshop on automated triangulation was held just before the main part of symposium started. The social programme included punting on the River Cam and Shakespearean drama at an open-air theatre.

The working groups have been active besides their participation in the planning and attendance at the symposium. These activities are given in detail below. Of particular note is the work of WG II/7 in progressing with the establishment of a standard for image transfer. Other commission activities include discussion with CEOS and plans for joint activities and with OEEPE on collaboration between working groups.

3. Working Group Activities During 1998

WORKING GROUP II/1 Real time mapping technologies

Chair Dr Rongxing Li Co-chair Holger Schade

State of Science and Technology of Working Group Topics

Recent trend in this area can be summarised by the following:

1. In addition to GPS, INS and CCD cameras, integration of laser, SAR and hyper-spectral sensors is becoming evidently advantageous in applications where not only real-time but also all-weather and high accuracy is essential. Research in multisensor and multiplatform based sensor integration and data processing will be an important topic in the next few years. Its applications can be found in emergency management, environmental monitoring, and others.

2. Intelligent processing of mobile mapping data remains a research topic. The knowledge of camera orientation and possible object models in the object space can be very helpful for feature extraction as well as for object recognition. Multiple image based matching has found its application in the mobile mapping processing. Bayesian networks have been actively researched and promise great potential for feature extraction.

3. With increased accuracy of INS, efforts are being made so that the accuracy of ground points determined by an airborne mobile mapping system will be approaching to the traditional aerial triangulation results.

Accomplishments of the WG in 1998

Two real-time mapping sessions at Commission II Symposium in June 1998, Cambridge, UK

Contributed to Duane C. Brown International Summer School on Geomatics in June 1998, Columbus, OH.

Other news on WG activities or plans for the future.

An International Workshop on Mobile Mapping Technology will be held in Bangkok from 21-23 April 1999.

WORKING GROUP II/2 Software and modelling aspects for integrated GIS

Chair Dr Manfred Ehlers Co-chair Mark Gahegan

State of Science and Technology of Working Group Topics

Developments in the area of the working group continue. Interoperability and standards for data exchange dominate much of the activity and this is made more necessary by the extension of image processing systems for digital data and of GIS into new areas of application and into using new types of data. Data fusion is a topic in its own right now and as more data becomes available better interoperability is required.

Accomplishments of WG During 1998

The WG participated as a sponsor for the 10th International Geomatics Conference 'Spatial Data Infrastructures' (SDI '98), June 8 - 11, 1998 in Ottawa, Ontario, and organised a session at the ISPRS Commission II Symposium.

Working Group Plans

The WG is involved DMGIS to be held in Beijing from October 4-6, 1999

WORKING GROUP II/3 Spatial data handling technologies

Chair Henrik Osterlund Co chair Dr Wyn Cudlip

State of science and technology in the WG area

Rapid development is currently ongoing regarding web based services using the Internet. Distributed search and retrieval and distribution or main areas for spatial data. Many new tools, mostly based on Java are being developed. New, fully commercial end to end providers are entering the EO market, providing very high resolution data at high processing levels via the Internet. They will meet the increasing demands of faster satellite data distribution. The lack of globally accepted standards and non-existing co-ordination in related fields leads to different metadata standards, protocols and incompatible services being developed. However, converging efforts are being undertaken.

Future Plans

Joint Workshop with ISPRS WG I/2. Stockholm, August 1999.

WORKING GROUP II/4 Systems for processing SAR data

Chair Dr Douglas Corr Co-chair David Stanley

State of Science and Technology of Working Group Topics

Affordable systems for processing SAR data are now available while research is increasingly active to find the optimal algorithms in order to exploit the full potential of this data source. An accuracy level of 30 m for DEM is shown to be attainable from both interferometry and stereogrammetry, which is sufficient for mapping the unmapped or less mapped areas in the world, and for use as extra data for data integration processing. It is urged that new markets be explored and more applications encouraged, in order to drive the more-use-for-less cycle. Higher accuracy is hoped for when the SRTM is launched and the processing techniques refined. The layover problem should better be solved by modifying the data acquisition system and using data integration principles for processing.

High resolution SAR is a feature of several of the SAR systems now planned. Future systems with 1 m resolution are Radar1 (2001), SkyMed COSMO (2002) and Terra SAR (2004). Radarsat 2 (2001) is now planned to have 3 m resolution. SAR data will then be compatible in terms of resolution with planned optical systems such as IKONOS-1 (1998), OrbView-3 (1999), IKONOS-2 and QUICKBIRD that have resolution of 1 m or better. There still is however the problem of speckle noise in SAR imagery, systems with more than about 12 looks would be required for it not to dominate the appearance of the imagery. This is not practicable in the near term and consequently processing tools to mitigate speckle are desirable.

Tools that are now available offer optimal speckle reduction either at a pixel level or by region growing. These are based on physical models of speckle noise and endeavour to preserve detail while reducing noise. These techniques can be applied to a time series of co-registered images as well as to a single image. When multi-temporal data is examined it is likely that there will be genuine changes in the imagery as well as changes due to speckle. New techniques are being developed to process time series data that preserve changes that are unlikely to be due to speckle. In this way an optimal

speckle reduction can be performed for each image while features that are genuinely unique to a particular image are preserved.

Accomplishments of Working Group During 1998

Working Group Meeting combined with WGII/5 in London on 28 April 1998.

Tutorial held and session organised at Commission II Symposium in Cambridge in July 1998. The tutorial material will be placed on the WG web page.

Future activities

Further activities include population of the web site with information on SAR. This is aimed at the new user. It will include information on SAR fundamentals and key

issues; pointers to other useful sites, and information on working group activities.

A joint meeting is being planned with WG III/6 in late 1999.

WORKING GROUP II/5 Systems for integrated geoinformation production

The future of the working group

Because of changes in personal and employment circumstances the officers of the working group were forced to resign after the Commission symposium. Their efforts in supporting the commission up to that time are much appreciated.

The Commission officers discussed the future of the working group with Council and it was decided to modify the activities of the working group to concentrate on the global and regional aspects of integrated production and to do this by collaboration with the projects of the Integrated Global Observing Strategy (IGOS). In particular the WG has made contact with the Global Observation of Forest Cover (GOFC) and the Hazards project. The objective is to establish collaboration between ISPRS and IGOS and to organise joint meetings at the Congress in Amsterdam. No new working group officers will be appointed and the actions will be taken by the Commission President and Secretary.

Accomplishments of the working group in 1998

A workshop was held on April 28th in London in association WGII/4 and with the Institution of Electrical Engineers.

WORKING GROUP II/6 Integration of image understanding into cartographic systems

Chair Dr David McKeown Chair Olivier Jamet

State of Science and Technology of Working Group Topics

While automated cartographic feature extraction techniques are not yet in widespread use, research trends are showing increasing awareness and consideration of cartographic production requirements.

Photogrammetric techniques are becoming integral components of many computer vision systems, in the form of rigorous camera models, utilisation of image geometry, and covariance estimation and propagation. The shortcomings of fully-automated systems have spurred the development of semi-automated systems, based on a wide range of operator interaction strategies and automated processes. A prerequisite for production use is the capability to meaningfully evaluate the results of an automated or semi-automated process; work in this area is to be featured at our upcoming Workshop. No production system works in a vacuum, so many systems now make use of existing cartographic data to guide feature extraction processes.

There is an increasing use of visualisation for presentation and examination of cartographic data, and a corresponding demand for the production of data to support such visualisation. Models for visualisation are more complex than traditional mapping products, often requiring texture or appearance data, internal building structure, or other attributes.

Future plans

Our workshop is scheduled for April 7-9, 1999, in Paris, France. We are planning a small, focused discussion meeting centred around metrics and evaluation for cartographic feature extraction. Besides evaluation topics, we expect to see interesting papers on extraction and visualisation of geospatial data in complex urban environments. Some panels are being organised with representatives from several

national mapping agencies and we expect a balance of presented papers and topical discussion. The workshop is being organised in co-operation with the Société Française de Photogrammétrie et Telédétection (SFPT) and the Institut Géographique National (IGN). A call for papers and additional information can be found at http://www.ign.fr/sfpt/manifestations/paris_99_us.htm

WORKING GROUP II/7 Practical and implementation issues in digital mapping

Chair John Thorpe Co-chair José Colomer

State of Science and Technology of Working Group Topics

There is widespread confidence in the importance of earth imagery. In the US, Vice President Al Gore is using satellite imagery to advance his vision of an earth in more perfect balance with nature. Major corporations have been making large investments in earth imaging satellites and data delivery systems. On the other hand, today's photogrammetric services and servers tend to be tightly linked to proprietary environments, not designed for shared image-related processes, and often are specific to one family of sensors.

The two main reasons that images cannot be used more effectively are 1) lack of adequate technology and 2) lack of interoperability, which is the ability of processing components to co-operate, even when they are designed independently of each other. With regard to earth images, interoperability means not just reconciliation of diverse formats, and not just a user's ability to quickly find and access useful images, but also network access to technology for viewing, registering, supporting exploitation, etc. Interoperability demands immediate access to any imagery, the image's georeferencing information, and all photogrammetric processes and metadata necessary to just display or exploit the image.

Several organisations are currently working on the development of interoperability standards. The largest international and most influential is the Open GIS Consortium, but also organisations like the ISO TC 211 (Geographic Information ï¿½ Image and grid data) and the American agency NIMA play a major role on this issue.

Bibliography of Outstanding Publications on WG topics

L. Hecht and C. Kottman,

OPENGIS PROGRESS TOWARD INTEROPERABILITY IN PHOTOGRAMMETRY, ISPRS Commission IV Symposium, Stuttgart, Germany, Sept 1998.

Tapani Sarjakoski,

ALTERNATIVES FOR TRANSFERRING ORIENTATION DATA OF DIGITAL AERIAL IMAGES, ISPRS Commission II Symposium, Cambridge, United Kingdom, July 1998,

Accomplishments of Working Group during the Current Year

The WG activities have been focused on promoting an Image Transfer Standard (ITS) for digital photogrammetric systems, which will define the storage of image data as well as the relation between a georeference system (UTM, State Plane, etc) and the measurement system (pixel, image co-ordinates). The ITS should cover images from various sensors, aerial and satellite sensors, as well as processed images like ortho images.

The WG hosted a panel discussion during the ISPRS Commission II Symposium, July 13 to 17 1998 in Cambridge, United Kingdom. The following summarises the issues discussed in the panel session:

- The vendors are the willing to adhere to any standard agreed upon.
- Satellite imagery must be included in the standard.
- The ISPRS WG II/7 should develop the standard, provided that there is support from organisation like OGC and ISO.
- A key point for the success of the standard is that the ISPRS fully endorses it with its authority.
- There is a need for a small task force (with representatives of the users, manufacturers, and academia), which will define the standard.

After the meeting in Cambridge the WG chairmen developed the following action plan:

1. Establishment of a Development Committee to design the Image Transfer Standard (ITS) The goal here is to have a small group (3-4 people) of representatives of academics, vendors, and users, which will design an abstract specification model for the ITS. The Development Committee will closely work together with other groups working on related topics.
2. Distribution of the abstract specification model with a request for comments and information. The abstract specification model will be sent to all the WG members and related groups (OGC) with a request for comments and information.
3. Finalising of the abstract specification model taking the WG input into account.
4. Finding sufficient funding. This should cover the development and the required annual maintenance. Various sources are ISPRS, OGC, ISO, defence contractors, satellite companies, large and small vendors, user contributions, and private contributions

5. Solicitation of proposals from qualified software development organisations. The idea is to find at least three competitive proposals.
6. Selection of the best proposal.
7. Development of the ITS by the chosen organisation under the supervision of the Development Committee.

The Development Committee was established in August 1998, and the first initial meeting took place during the ISPRS Commission IV Symposium in Stuttgart on Thursday Sept 10, 1998. The intention of this meeting was to define the task of this committee and to plan further activities. The committee decided to use the so-called Technology Development Process designed by the OGC and also to establish a close relation to the OGC. Currently the WG Chairmen are establishing a close relation with the Open GIS Consortium and are exploring an approach how to bring the efforts and developments of these two groups together.

Future activities

Future plans are to continue with the action plan as described above. The action plan might be subject to change depending on the result of the collaboration with the OGC. Set up WWW site, host a seminar in Colorado Springs, USA, Summer 1999

WORKING GROUP II/8 Digital systems for image analysis

Chair Dr Christian Heipke Co-chair Dr Tapani Sarjakoski

Terms of reference

State of Science and Technology of Working Group Topics

Recent trend in this area can be summarised by the following:

1. A large number of Digital Photogrammetric Systems (DPS) including input and output devices with different degrees of functionality, user friendliness, and automation potential is commercially available.
2. Vendors of DPS include traditional photogrammetric, but increasingly also remote sensing and GIS companies. A concentration is taking place on the side of the traditional photogrammetric companies.
3. A major trend can be observed to use Windows NT as operating system.
4. Modules for automatic interior and relative orientation and for automatic aerial triangulation are operational and are in daily use in practice.
5. Automatic DTM generation has been accepted by the practice some time ago, but interactive verification and editing is there to stay, especially in difficult terrain, and in large scales.
6. Digital orthoimages are being produced routinely on a daily basis and are being integrated into geographic information systems. There is a need especially for large scale applications to use true orthoimages, i.e. to correct for effects from 3D topographic objects.

7. Semi-automatic extraction of GIS and CAD data is still mostly restricted to research and development. Implemented algorithms combine computer vision approaches with rigorous photogrammetric modelling. Some results indicate that future systems will be equipped with more powerful tools. The human-computer interface is increasingly being seen as an important factor. In practice, GIS and CAD data are often still acquired from film imagery using analytical plotters.

   The term 'semi-automatic' is interpreted in at least two different ways: it is used to mean (1) post-editing of automatically generated results, and (2) a close interrelationship between human operator and computer in the actual data acquisition phase. Clarification of the term is needed.

8. Photogrammetric and remote sensing imagery play a significant role in spatial data base revision. As compared to map revision, there are many more attribute data to be acquired. The research arena is starting to develop integrated updating concepts including various data sources and automation. The work flow in practice is still highly manual and the GIS data capture often occurs from paper plots showing the actual GIS objects, even though digital imagery might be used for acquiring the object geometry.
9. Relatively little attention is being paid to data compression and its effects for photogrammetric and remote sensing processing. It is estimated that this topic will receive more attention once digital cameras will become available.

Accomplishments of the WG in 1998

Other activities: OEEPE/ISPRS Test on 'Performance of tie point extraction in automatic aerial triangulation' in co-operation with the OEEPE, final report submitted for publication in the official OEEPE series.

Future activities of the working group

An ISPRS Conference 'Automatic extraction of GIS objects from digital imagery' will be held from Sept. 6-10, 1999, in Munich, Germany, in co-operation with ISPRS WG II/6, III/1, III/2, III/3 and III/4.

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