

TECHNICAL COMMISSION V: Close-Range Techniques and Machine Vision

By Hirofumi Chikatsu, Commission V President

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State of Science and Technology

Recent rapid progress in digital photogrammetric system have opened exciting application fields for Commission V. such as Civil Engineering, Environmental Engineering, Architecture, Medical Engineering, Human Engineering, Biomedical Engineering, Sports Science, Apparel Engineering, Archaeology, Agriculture, Forensic Science, Industry, Entertainment and so on. In these circumstances, Commission V should be the center of excellence attractive enough to involve the whole community of "Vision-Based Techniques in Close-Range", and should be a focal point to communicate those scientists of other working groups within ISPRS and other societies, in particular in the fields of medical engineering, image metrology, animation of human body or face, Virtual Reality, Environment and so on. To this end, Commission V should create new discipline or fields of study with a new concept that has not been identified in conventional photogrammetry.

Main Accomplishment in 1998

The Inter-congress Symposium of ISPRS Commission V on "Real-Time Imaging and Dynamic Analysis" took place in Hakodate, Japan, on June 2-5, 1998. I am pleased to report that the Symposium made headlines in the Newspapers and Television and we had 431 participants (full registered 286, students 29, accompanying persons 29, Visitors 87) from 25 countries and 163 papers were presented in 26 technical and 2 poster sessions. Also, the Commercial Exhibition was supported by 16 commercial companies.

In order to steer the Hakodate symposium to the success, I concentrated on establishing relationships with related societies, particularly those concerned with issues outside Photogrammetry because it was my strong hope to hold an interdisciplinary symposium supported by the united effort of related fields for the future development of the Commission V. As a result, 95 papers were presented from a wide range of interests in Japan, 31 papers were presented by members of the Japan Society of Photogrammetry and Remote Sensing (JSPRS) which was the host organization, and it should be remarked that the other 64 papers were presented by non-members of the JSPRS.

It was noticeable in this symposium that there were many new applications with Multi-image, Multi-sensor, Laser applications, Virtual Reality and Computer animation.

Commission V News

As related Commission V events, following workshops are planned in 1999.

1. Videometrics VI (San Jose/USA, January 23-29). Related WG: WG V/3, SIG
2. International Workshop on Mobile Mapping Technology (Bangkok/Thailand, April 21-23). Related WG: WG V/1, IWG V/III
3. International Workshop on Photogrammetric Measurement, Object Modelling and Documentation in Architecture and Industry (Thessaloniki/Greece, July 7-9). Related WGs are WG V/2 and V/5
4. International Workshop on Vision-based techniques in Visualization and Animation (Onuma/Japan, October 14 - 16). Related WGs are SIG, WG V/4, IWG V/III

For further details, please visit the Commission V. web site (<http://planner.t.u-tokyo.ac.jp/ISPRS/>).

WG V/1 CLOSE-RANGE IMAGING AND METROLOGY

By Chair: Clive S. Fraser (Australia)

Co-chair: Horst Beyer (Switzerland)

State of Science and Technology

The principal development themes in close-range imaging and vision metrology continue to focus upon automation in all phases of the photogrammetric process. Specific examples comprise the continuing developments in "intelligent" cameras, further advances being made in target and feature recognition with associated solutions to the multi-image correspondence problem, and new developments in models and procedures for automated sensor orientation. Also witnessed over the past year has been a resurgence in the development of integrated systems where the vision metrology component is used as a real-time dimensional control mechanism, be it for machining, milling or cutting control. This area of development has also lead to further work on the integration of vision metrology and CAD, and on model driven object reconstruction. Generally, the state of the science and technology of vision metrology could be characterised as reasonably mature in terms of fundamentals, with considerable development attention being given to advances in system performance, reliability and productivity.

Main Accomplishments in 1998

The focus of working group activity in 1998 concerned participation in the very successful 'International Symposium on Real-Time Imaging and Dynamic Analysis' which was held in Hakodate, Japan from June 2-5. Of all the working groups in Commission V, WG V/1 draw the most papers, namely 37. Of these, 26 were oral presentations whereas 11 were posters. Six technical sessions were assigned to the working group. The very strong response to the call for papers for WG V/1 once again reinforced the fact that much activity was occurring in the theme areas of the working group, even in the absence of defined 'working group problem areas'. The core themes

of the working group, namely on-line and off-line systems configurations, sensor calibration, and systems application and performance evaluation cover a broad field. The diversity of topics covered by the presented papers from WG V/1 exemplified this.

A second activity of note, which involved a number of working group members, as well as the co-chairperson, Dr Horst Beyer, was the 1998 Coordinate Measurement Systems Committee (CMSC) conference held in St Louis in early July. This 5-day meeting, which has become the principal annual forum for practitioners in industrial measurement, and especially optical 3D coordinate measurement, drew more than 150 participants. Of the papers presented, eight dealt with vision metrology systems and were thus relevant to the terms of reference of WG V/1. Further information on the CMSC is available at the following website: www.cmssc.org.

Plans for 1999

Working Group V/1 is one of the sponsors for the 'International Mobile Mapping Technology Workshop' to be held in Bangkok from April 21-23. This meeting focusses on mobile mapping research and applications, and will attract papers from the broad fields of photogrammetry, GIS and geodesy. Of special interest to WG V/1 members will be the topics of sensor integration and calibration, and methodology for accuracy enhancement. Strong support for this workshop is anticipated from researchers and practitioners in S.E. Asia, Japan and Australia. Information on the workshop can be obtained from the following website: <http://gscrl.eng.ohio-state.edu/wg2-1/index.html>.

Plans for 1999 also include participation by WG V/1 members in Videometrics VI, which will be held on January 28 and 29 as part of the SPIE Photonics West conference in San Jose, California (see www.spie.org/info/ei/). Three of the eight technical sessions are of direct relevance to the WG. Plans at this stage also include more involvement in the next CMSC meeting, and initiating the necessary work to ensure a successful WG V/1 program of papers at the 2000 ISPRS Congress in Amsterdam.

WG V/2 INTEGRATION OF PHOTOGRAMMETRIC SYSTEMS WITH CAD/CAM

By Chairperson: Juergen Peipe (Germany)

Co-chairperson: Stuart Robson (United Kingdom)

State of Science and Technology

CAD can be considered a discipline somewhere between engineering and computer science/computer graphics. Over the last 20 or so years the meaning of CAD has changed increasingly from computer aided drafting and the design of three-dimensional objects to a central part of the manufacturing process. CAD systems provide a computer internal representation of the product/object characteristics (geometry data and user dependent information). They can guarantee the communication between all the process steps (construction, manufacturing, testing, control, maintenance etc.) performed by some other computer aided techniques such as CAP (Computer Aided Work Planning), CAM (Computer Aided Manufacturing),

CAT (Computer Aided Testing), CAQ (Computer Aided Quality Assurance). That development has been important also for the interrelation between CAD and Photogrammetry. Vision systems yield 3-d data to generate CAD models, eg for as-built documentation of plants or architectural objects, quality inspection, visualization, etc. On the other hand, CAD models contain a priori object information and can support the planning of the photogrammetric survey and the object recognition and measurement process.

WG activities

In 1998, the efforts and activities of WG V/2 were centered on the mid-term symposium "Real-Time Imaging and Dynamic Analysis" held 2-5 June, 1998 at Hakodate/Japan. 20 papers were presented on WG topics such as CAD based object recognition and measurement, as-built documentation, image archives, 3-d object reconstruction and visualization, quality control of workpieces in industry, and also on sensor and data fusion (e.g. GPS + INS + image data). In addition, some papers on CAD based modelling and applications were given during the sessions of WG V/3 and WG V/5.

WG News

WG V/2 will organize a workshop jointly with WG V/5 in Thessaloniki/Greece, 7-9 July 1999.

WG V/3 SCENE MODELING FOR VISUALIZATION AND VIRTUAL REALITY

By Chairperson: Sabry El-Hakim (Canada)

Co-chairperson: Wolfgang Forstner (Germany)

State of Science and Technology

There is an increased demand for models of objects and sites for virtual environment (VE) applications, such as virtual museums, historical sites documentation, mapping of hazardous sites and underground tunnels (mine automation), and as-built modelling of industrial and power plants for design verification and modification. The main problems include: the practical and precise sensor calibration, the registration of images particularly in large indoor sites in the absence of external positioning tools, the complete and accurate coverage of all details, and maintaining realism during real-time display. Modelling of small and medium size object is currently well established and there are many successful demonstrations with existing sensors and software tools. On the other hand, environment or site modeling is proving to be more difficult than object modeling because of the size and complexity. Furthermore, it is usually impractical or difficult to acquire data with good geometric configuration, and the site is often without closure which makes the registration based only on the overlapping 3D data more difficult and less accurate. Another problem is that a complete coverage of all details will require a large number of images often from different type of sensors, which requires that the data be integrated properly.

Activities and Conference Report

1. Commission V Symposium in Hakodate showed that Virtual reality is becoming the technology of preference for representing and manipulating 3D data. Several papers described systems for creating accurate and photo-realistic virtual reality models of indoor sites using data from CCD cameras, range sensors, or both. CAD information is also utilized in some applications along with the collected data to help reconstruct the complete model. The realistic-look was achieved by placing real-image-based texture maps on the geometric model. Planning and documenting of urban and historic sites is one of the most popular areas of application for VR technology in published photogrammetric papers.

2. A theme issue of the ISPRS Journal on the topics of the WG, titled: Imaging and Modelling for Virtual Reality, is being prepared for publication. Due to page constraint and good participation, we split the accepted papers between two issues. Six are published in the December 1998 issue and two in the February 1999 issue. We attempt to cover many of the bases of creating virtual environments, primarily: data acquisition, processing, registration, modelling, and rendering.

3. Four circular letters were issued including one in 1998. A web site has been established in January 1997 and is continuously updated. It links to the members web pages and e-mail, evaluated VR useful sites, related conferences, and various types of raw data provided by some of the WG members. The group has about 50 members from 16 countries, almost evenly divided between the Photogrammetry, computer graphics, and computer vision communities. Most of the members are active in VR and have web sites that include their projects and publications.

Future Plans

1. The official WG workshop is Videometrics VI, Part of SPIE Photonics West - Electronic Imaging 99, San Jose, California, January 23-29, 1999. Thirty-two papers are submitted covering the topics of this working group and the SIG on animation.

2. The Second International Conference on 3-D Imaging and Modelling will take place in Ottawa, Canada, in October 4-8, 1999. Although not officially a WG workshop, many of the WG members are on the program and organizing committees and a significant number will be attending and presenting papers, including one of the keynote papers. The conference will look at recent advances in 3-D sensor systems, geometric data processing, geometric modelling, and applications.

3. In cooperation with SIG animation, WG V/4, and WG V/III, The International Workshop on Vision-based techniques in Visualization and Animation, is planned for Onuma, Japan in October 14 - 16, 1999.

WG V/4 Human Motion and Medical Image Analysis

By Chairperson: Felix Margadant (Switzerland)

Co-chairperson: Masako Tsuruoka (Japan)

State of Science and Technology

Advanced technology in the field of human motion analysis has made a significantly contribution and is now essential for orthopaedic surgeons, bio-medical engineers,

therapists, and researchers. Medical imaging modalities such as computerized tomography (CT), magnetic resonance imaging (MRI), ultra-sound, and positron emission tomography (PET) have become important in bio-engineering to assist in medical field. Recent advances in biomedical image analysis have shown a great potential for computer aided analysis and diagnosis for better characterization and understanding of pathology.

Accomplishment of WG V/4 and WG Activities

ISPRS Commission V Symposium, "Real-Time Imaging and Dynamic Analysis" was held in June 2-5, 1998, Hakodate, Japan. The 19 papers were presented on WG Topics. The symposium impressively showed that medical imaging (five contributions) is a heterogeneous field whose disciplines only marginally overlap. The problems of camera systems, microscopes, CAT scanners and catheter positioning deal with thoroughly different approaches on their algorithmic side. In the field of human motion analysis, the emphasis in Hakodate was:

Significant effort has been put in (five contributions) on on-line human expression recognition which probably represents its need for more user guidance in advanced user interfaces, with one exception that aims at medical biometry.

Another trend is the development of low-cost or multipurpose measurement equipment (four submissions). Naturally the trend here goes towards PC based evaluation of the raw data by means of sophisticated software. The drawback of intelligent algorithms in this field is that they almost always lack real-time behaviour, i. e. the data is recorded and evaluated afterwards.

Three contributions deal with jaw and joint movement and also make use of finite element-like computation to calculate forces and acceleration in space.

Societies which have similar interests to ISPRS WG V/4

- "IEEE System, Man, Cybernetics Society"

- "EUROPTO", which is a joint venture between the EOS - The European Optical Society and SPIE - The International Society for Optical Engineering.

WG news

The web-space that was allocated for WG IV is
<http://www.margadant.ch/ISPRS/WG4> (Available space exceeds 1GB).

(2) The international workshop on "Vision-based techniques in Visualization and Animation", SIG, WG V/3,V/4,IC V/III, is planned for Onuma, Japan in October 14-16,1999.

WG V/5 WORLD CULTURAL HERITAGE

By Chairperson: Petros Patias (Greece)

Co-chairperson: Wenhao Feng (China)

State of science and technology

As a discipline, architectural photogrammetry is currently undergoing profound changes. New technologies and techniques for data imaging, processing, modelling, visualization and archiving, are leading to novel systems, processing methods and results. Since the main event in 1998 was the Hakodate Symposium, the current status in Progress, Needs, Trends and Developments, regarding the WG topics, had the opportunity to show up there. More specifically at the symposium there were :

- + 4 presentation sessions where 20 papers were presented

- + 2 Poster sessions where 12 posters were presented

In addition, research related to other WG topics besides WG V/5, has been presented in other sessions.

The topics of the presented works were largely diversified, as expected, and cover topics like :

- + Imaging with new sensors (ie. CCD-like scanners, laser scanners, digital cameras, video, etc.)

- + Data fusion (ie. use of GPR, thermal sensors, MRI, etc.)

- + Modelling and Reconstruction (ie. texture, artifacts, etc.)

- + Processing (ie. vanishing lines, super-wide-angle lens distortion, edge detection, texture matching, simple software, emphasis in digital aspects, etc.)

- + Visualization and Virtual Environments

- + Information Systems for documentation

- + Use of Internet and Multimedia for Research and Education

The clear trends of the Symposium were:

- + the use of new digital technology

- + the need for Information Managing Systems

- + the enhancement of communication between ISPRS and other scientific disciplines

Regarding the current needs in mapping and documentation of the world cultural heritage, we should note that :

- + There is a clear need for using technologically advanced tools, which offer wider flexibility and reduced costs.

- + There is a clear need in developing simple but efficient tools.

+ There is a clear need to adapt the widely used aerial photogrammetric algorithms and tools to terrestrial applications.

+ There is also a need to manage the recorded information. The development of Monument Information Systems (MIS) becomes vital.

Accomplishments of WG in 1998 - Plans for 1999

+ Active participation to the ISPRS Com. V Inter-Congress Symposium in Hakodate / Japan (June 2-5, 1998).

+ Active maintenance and information fusion through the WG V/5 Home page <<http://photo.topo.auth.gr>>

Planned activities in 1999

1. A joint workshop with WG V/2 in Thessaloniki/Greece (7-9 July 1999)
2. A small working manual for Architectural-Archaeological Photogrammetry, to be written by WG members and published by the WG by 2000.
3. Technical Sessions during the ISPRS Congress in Amsterdam (2000).

Intercommission Working Group V/III "IMAGE SEQUENCE ANALYSIS"

By Chairperson: Hans-Gerd Maas (Switzerland)

Co-chairperson: Osamu Murakami (Japan)

State of Science and Technology

Looking at the contents of the IWG V/III-related papers of the Hakodate symposium, one can see some trends concerning the core topic of image sequence processing within ISPRS. Most papers at the Hakodate symposium were dealing with applications, while only few were dealing with fundamental algorithmic aspects of image sequence processing. The spectrum of the applications shown shows a very wide variety, containing many fields, which are new for photogrammetry. This does also show in the composition of the IWG V/III members, many of whom are non-photogrammetrists with various backgrounds. Despite the continuous increase of computer performance, real real-time applications are still rare. Most researchers work off-line on image sequences which have been grabbed and intermediately stored prior to processing, or do not exploit the full temporal resolution of cameras. The potential which is lately being offered by hardware vendors (especially framegrabbers with powerful on-board processing capabilities) is not extensively being used by photogrammetrists yet.

Bibliography during last one year publications on WG topics

Papers and tutorial notes in the proceedings of the Hakodate symposium.
Accomplishments of Working Group during last one year. We see one of our tasks in

bringing together researchers from different fields in ISPRS. The composition of the presentations at the Hakodate symposium shows that this goal could be achieved.

WG activities in 1998

IWG V/III had 32 papers at the Hakodate symposium, which were distributed over five technical sessions and two poster sessions.

WG News

The following events with IWG V/III contribution are planned for 1999:

Videometrics VI (within SPIE Electronic Imaging '99, San Jose / California, 23.-29. January 1999)

Joined ISPRS Workshop on Mobile Mapping Technology (Bangkok, Thailand, April 21-23, 1999)

Joined ISPRS Workshop on Vision-based techniques in Visualization and Animation (Onuma International Seminar House, Japan, October 14 - 16, 1999).

Other Relevant Information

Update information, especially on the events mentioned under (5), can be found on the IWG V/III webpage
(http://www.geod.ethz.ch/p02/wg_isprs/WG.V_III/WG.V_III.home.html).

Commission Officer Address Updates

Current addresses of WG V/III chairmen:

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Special Interest Group on "ANIMATION"

By Chairperson: Armin Gruen (Switzerland)
Co-chairperson: Shunji Murai (Japan)

SIG Activities

+ The main activities were centered around the preparation and conduction of the Symposium of Commission V in Hakodate, Japan. The issues of SIG were well covered there, in particular by participants from outside the field of photogrammetry.

+ SIG has provided a Keynote Speaker (Dr. Pascal Fua: Realistic Human Body Modelling) for the Fifth International Symposium on the 3-D Analysis of Human Movement, ISB, Chattanooga, Tennessee, USA, 2-5 July 1998. The conference was attended by 80 delegates. Proceedings have been published including 43 contributions. A list of contents and ordering details can be found on: www.utc.edu/Human-Movement/3-d/proceeds.htm

Forthcoming Activities

+ Preparation of two Technical Sessions at the SPIE Conference Videometrics VI, San Jose, CA, 28-29 January 1999

+ Organization and Preparation of a Workshop "Vision-based techniques in Visualization and Animation", Onuma International Seminar House, Onuma, Hokkaido, Japan, 14-16 October 1999. Cooperating Organisations:

ISPRS WG V/3 Scene Modelling for Visualization and Virtual Reality

ISPRS WG V/4 Human Motion and Medical Image Analysis

ISPRS IC WG V/III Image Sequence Analysis

JSPRS (Japan Society for Photogrammetry and Remote Sensing)

JAS (Japanese Association of Surveyors)

ARIDA (Association for Real-time Imaging and Dynamic Analysis)