TECHNICAL COMMISSION V - CLOSE-RANGE TECHNIQUES AND MACHINE VISION

President: Hirofumi Chikatsu (Japan)
Secretary : Eihan Shimizu (Japan)

Commission V activities

The following is the first part of the welcome remarks in the SIGGRAPH'97 program: "As a kid growing up in LA, I used to surf the ocean waves, and now I'm surfing the waves of changing digital technology.....". ISPRS members, particularly Commission V members well know that we are now in the midst of changing digital technology. Furthermore, digital photogrammetry is expected to become a useful tool in various fields such as Civil Engineering, Environmental Engineering, Architecture, Medical Engineering, Human Engineering, Biomedical Engineering, Sports Science, Apparel Engineering, Archeology, Agriculture and so on.

In these circumstances, we also should be surfing on the digital waves for the future of Commission V, and Commission V should be developed as an interdisciplinary commission integrated with high technology such as Machine and Robot Vision, VR (Virtual Reality), VE (Virtual Environment), CA (Computer Animation), CG, Multimedia , GPS, INS, and so on.

With this motive, Commission V has been extremely active during the last year with international conferences, workshops, business meetings, setting up of the home page on the Internet WWW and preparation for the Inter-Congress Symposium in Hakodate, Japan from 2 - 5 June, 1998. Especially, several interdisciplinary international conferences and workshops are planned for 1999.

State of science and technology

Commission V is expected to become a leading technology in the industrial world as mentioned above. There are still, however, some issues which need to be resolved before real-time photogrammetry may become operational. These problems include accuracy, measuring speed, imaging and recording, the handling of large volume of data, integration with multimedia etc.. Especially, integration of VR, VE, CA, CG, and multimedia with digital photogrammetry will become indispensable to future development of Commission V technology.

Commission V News

The Inter-Congress Symposium on " Real-Time Imaging and Dynamic Analysis " in Hakodate is scheduled from 2 - 5 June, 1998. As a new experiment, "Young Author Awards" are planned

to be dedicated to five young authors less than 35 years old who submitted excellent papers. The recipients will be admitted free of registration fee and will be provided 200,000 Japanese yen in total which will make it possible to attend the Hakodate Symposium. The applicants for the award are not requested to be first authors, but recipients are requested to present their papers in the Symposium.

For up-to-date information on the Symposium and Commission V from 1996 - 2000, please view the WWW home page: http://planner.t.u-tokyo.ac.jp/ISPRS/

WG V/1 close-range imaging and metrology

Chairperson: Clive S. Fraser (Australia)
Co-chairperson: Horst Beyer (Switzerland)

State of science and technology

- The principal development priority within the technology of off-line and real-time vision metrology systems, over the past year, has been to advance the degree of automation. Continuing research into feature (target) recognition and the solution of the multi-image correspondence problem, coupled with further developments in coded target design and automated, closed-form resection and/or relative orientation, has yielded industry-ready systems.
- Research and development in vision metrology system automation continues in both the academic and commercial sectors, since although robust automated systems are commercially available (there are about 100 in use in the international aerospace, shipbuilding and car industries), a number of theoretical and operational problems/limitations still need to be addressed.

Examples of current research topics are:

i) development of ï¿½vision enginesï¿½ or intelligent cameras

ii) the integration of vision metrology systems with CNC machine tool technology to produce real-time guidance and control of CNC operations

iii) the exploitation of high-resolution CCD chips (e.g. 4K x 4K) in sensors designed for photogrammetric measurement

iv) the use of sequential estimation in the data processing of vision metrology networks (e.g. in bundle adjustment and in solving the image point correspondence problem)

v) closer integration with CAD and model driven object reconstruction

vi) improved mathematical models and algorithms for digital image mensuration, both for targeted and non-targeted features

vii) development of improved quality control mechanisms for automated vision metrology systems.

There are many others, and while the above list is not fully comprehensive it does indicate that virtually all projects are relevant to the Terms of Reference of the Working Group.

Accomplishments of WG V/1

+ Issuance of a WG circular letter early in the year

+ Participation by the WG co-chairman and members in the 1997 Coordinate Measurement Systems Committee (CMSC) conference in Orlando, Florida from July 7-11. This conference, which nowadays has close-range vision metrology as one of its primary topics, comprised technical sessions, a commercial exhibit and user-group meetings.

+ Participation in the Optical 3-D Measurement Techniques IV conference in Zurich, Switzerland from September 29 to October 2, 1997. The WG organised Technical Session 5 on the subject of close-range imaging and metrology. This conference, which also had other sessions with themes relevant of the WG Terms of Reference, drew many researchers and practitioners associated with the WG.

+ An informal WG business meeting was held in Zurich in October, with the main topic being the forthcoming preparation of the WG web site which was subsequently delayed.

WG V/1 news and immediate plans

+ completion of the WWW site

+ preparation for and participation in the ISPRS Commission V Inter Congress Symposium "International Symposium on Real-Time Imaging and Dynamic Analysis", Hakodate, Japan, June 2-5, 1998.

+ further dissemination of information via emailed newsletters.

WG V/2: Integration Of Photogrammetric Systems With CAD/CAM

Chairperson: Juergen Peipe (Germany)
Co-chairperson: Scott Mason (South Africa)

State of science and technology

Approximately 30 papers with a strong CAD/CAM component were presented at the Vienna ISPRS Congress (see a selection of substantial papers in Bibliography). These papers demonstrate the wide range of interest in CAD/CAM aspects. CAD models are applied to the design and simulation of photogrammetric networks and can support the

automatic measurement process. Approximate models are used to semi-automate the production of refined models of industrial and architectural objects. On the other hand, the practical integration of photogrammetric metrology and CAD for object visualization, manipulation, animation etc. makes progress.

Accomplishments of WG V/2

The aim of the WG V/2 is to encourage and coordinate research and activities in CAD/CAM related areas of close range techniques. Over the last year, we have engaged in the analysis and valuation of the amount of WG related papers presented during the Vienna ISPRS Congress, in the establishment of the Working Group and the planning of the forthcoming meetings, mainly the Inter-Congress Symposium in Hakodate in 1998.

Two Commission V related international conferences were held in 1997:

"Videometrics V", 30-31 July 1997, San Diego, USA (attended by the WG V/2 Chairman)

"Optical 3-D Measurement Techniques IV", 29 September - 2 October 1997, Zurich, Switzerland. Only a few papers were presented on WG V/2 topics

WG V/2 News

The future work of WG V/2 includes organizing technical sessions during the Inter-Congress Symposium in Hakodate, 2-5 June 1998, and planning a workshop on WG V/2 topics to be held in Cape Town / South Africa or Munich / Germany in 1999. Closer co-operation with the WGï¿½s V/3 and V/5 on CAD/CAM aspects is intended.

WG V/3: Scene Modeling For Visualization And Virtual Reality

Chairperson: Sabry El-Hakim (Canada)
Co-chairperson: Wolfgang Forstner (Germany)

WG V/3 activities

+ A web site has been established in January 97 as a main vehicle for the

communications between members. It includes links to members Web pages, virtual environment resources, conference announcements, and test data.

+ 50 members, from 16 different countries, have joined the working group. They cover many fields including, photogrammetry, computer vision, and computer graphics.

+Several sets of test data have been provided to the members of the working group to be used for future evaluation of algorithms.

+Three circular letters have been issued.

State of science and technology

The technology of Virtual Environments (VE) is evolving rapidly and will be impossible to cover in this report. However, a short report to show at least the areas of growing trend is given here. Generally, the current focus of research in the technology is on the 'contents' and 'applications' of virtual environments, rather than the technology hardware. However, hardware is and will continue to get faster and cheaper, and tools are getting easier to use. But the main challenges remain in the creation of realistic, accurate, and detailed scenes that can be navigated through and interacted with in real-time. Large and complex 3D models are required for architectural walkthroughs, flight simulators, and other applications of virtual environments. It is not possible to render all of the geometry of these arbitrarily complex scenes at highly interactive rates, even with high-end computer graphics systems. Because of this, researchers have been conducting extensive work in the area of 3D model simplification methods.

One approach is Level-of-detail (LOD) for real-time rendering of complex geometric environments. For example, progressive mesh representation defines for an arbitrary triangle mesh a sequence of approximating meshes optimized for view-independent LOD. Hierarchical dynamic simplification (HDS) is another new approach to the problem of simplifying arbitrary polygonal environments. HDS operates dynamically, retessellating the scene continuously as the user's viewing position shifts, and adaptively, processing the entire database without first decomposing the environment into individual objects. Another approach is to dynamically replace portions of the 3D models with textures.

Actual generation of models of real scenes from real data has become more focused on relatively large sites or environments. Modeling of small objects and sites have already been successfully demonstrated over the past few years using laser scanners and other imaging sensors. However, larger objects and sites remain difficult. This is mainly because obtaining detailed and accurate 3-D data requires a huge number of images that must be collected and registered in a practical manner. To make matters worse, in most cases, one type of sensor is not sufficient to provide all the necessary details. This means that methods for efficient calibration, registration, and integration of different types of data must be developed. Research is these areas have been of interest to those in the computer vision and photogrammetry communities. In the VR or computer graphics communities most algorithms are based on having already corrected and registered 3-D data, regardless of its source. It is therefore important that all these disciplines work closely together since a successful virtual environment application will ultimately require all the links from sensors to the display and interaction.

In the areas of application, VR is finding increasing acceptance as an industrial training tool. A virtual reality simulation can be effectively used to train workers for many factory operations, particularly those involving advanced manufacturing concepts. Training for operations in remote hazardous environments can also be carried out using virtual environments. For example NASA employs the technology to train astronauts for operations on the future International Space Station. Another increasing area of activity is culture, particularly modeling historic objects and sites

then exploring them in a virtual environment. For example, a virtual display at the Museum of Civilization in Ottawa, Canada, places 3-D virtual artifacts in their, also virtual, natural surroundings. Several efforts in this application are also taking place in the UK, Japan, France, Italy, and Israel, to name just a few.

Forthcoming Activities

+ A special theme issue of ISPRS Journal of Photogrammetry and Remote Sensing, titled: Imaging and Modeling for Virtual Reality, on the working group topics is scheduled for December 1998.

+ The main workshop to be organized by the working group is scheduled during the week of January 23-29, 1999 in San Jose, California. It will be part of SPIE Electronic Imaging - Photonics West Symposiums. Call for papers will be prepared early next year.

WG V/4: Human Motion And Medical Image Analysis

Chairperson: Thomas Leemann (Switzerland)
Co-chairperson: Masako Tsuruoka (Japan)

State of science and technology

A previous report by Dr. Harvey Mitchell and Dr. Thomas Leemann, the co-chairs of WG5 -Biostereometrics and Medical Imaging, for the period 1992-1996 (now WG4 - Human Motion and Medical Image Analysis), titled "The state of medical photogrammetry in the digital imaging era" gave reflections on the effectiveness of photogrammetry in the bio-medical world, and on the future directions of medical photogrammetry. The paper outlined the problems medical photogrammetry has faced in the past - that medical photogrammetry, even though much time and effort has been devoted, has not made any great impact on the medical world. At present, many of the developments in the field are made by non-photogrammetrists, who have computer vision capabilities and have been more successful in implementing their systems. A survey was conducted on the usage of photogrammetry, and the responses are included in the paper. The paper concludes, that despite these difficulties in medical photogrammetry, that there are some photogrammetric applications, for which there are no viable alternatives, and where photogrammetric measurements can be effectively and efficiently applied usage rates may be high.

Medical photogrammetrists still face an uphill battle to see their techniques implemented on a regular basis in the medical environment. Communication with the medical community is seen as vital in this process, to determine areas of need and to fully understand the requirements of the medical field. In this process various groups in the medical community need to be identified, such as International Research Society for Spinal Deformities and the International Society of Biomechanics Technical Group on 3-D Analysis of Human Movement for example, and the channels of communication between the various groups and the medical photogrammetrists improved.

Accomplishments of WG V/4

Next 3 societies have co-interests for ISPRS Commission V WG 4.

+ IEEE Engineering in Medicine and Biology Society

+ Science and Technology of Fluctuations Society

+ IEEE System, Man, Cybernetics Society

Working Group Officer Address Updates:

Chairperson changes by end of the year. Mr. Thomas Leemann will leave the Swiss Federal Institute of Technology. His replacement will be:

Mr Felix Margadant, Dr. Eng.
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WG V/5: World Cultural Heritage

Chairperson: Petros Patias (Greece)
Co-chairperson: Wenhao Feng (China)

State of science and technology

Due to the great number of cultural objects wordwide the interest of the photogrammetric community in this objects remains as big as always. CIPA International Symposium in Goteborg, Sweden (Oct. 1-3, 1997), was one of the main events in the reporting period. The topics of the presented works were diversified as expected. Although clear classification is not possible we will try some simple survey statistics. Besides 2 position papers, 3 papers gave input from the user point of view (ICOMOS), about 14 papers dealt with interesting case studies of photogrammetric applications. A large number of papers (about 15) were based at the use of new sensors (ie. CCD-like scanners, laser scanners, satellite imagery or involved new technological aspects (ie. use of non-visible part of spectrum, compression of videogrammetric images). As many as 5 papers were targeted on the clear demand of managing information, and presented different aspects of Information Systems for Architectural and Archaeological objects. Finally, 3 papers presented algorithmic solutions to mapping of special objects like domes, cylindrical surfaces, etc. 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 ICOMOS
+ the clear identification of user needs.

The proceedings of the Symposium include all the 41 presented papers, while a second volume is expected which will contain the round-table discussions. It is coded as International Archives of Photogrammetry & Remote Sensing Vol. XXXII, Part 5C1B, edited by Anders Boberg and Bosse Lagergvist, published by the Swedish Society for Photogrammetry & R.S. (SSFF) and is now available by RICS Books, United Kingdom.

Activities / Events and Accomplishments of WG V/5

For the year 1997-1998 the following activities took place :

1. Set up and updating of the WG V/5 Home page (http:/photo.topo.auth.gr) giving information about :
+ WG Topics
+ Activities
+ Publications
+ Membership and Correspondence
+ Latest News

2. Participation to CIPA Inter. Symposium in Goteborg, Sweden (Oct. 1-3, 1997). On Oct. 9, 1997 an open letter by the WG Chairman has been published into the Web page regarding the conclusions of this Symposium.

Planned activities until 2000 are :

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

2. A Balkan meeting for Architectural Photogrammetry (1998).

3. A workshop on WG V/5 topics in Thessaloniki/Greece (1999)

4. A small working manual for Architectural-Archaeological Photogrammetry, to be written by WG members' contributions and published by the WG (by 2000) .

5. Technical Sessions during the ISPRS Congress in Amsterdam (2000).

WG Members

With the establishment of the WG's Home Page, all interested persons are constantly informed through it. An automatic registration procedure through the web page has been issued. 15 people up to now have been registered.

WG V/5 News

Dissemination of information about the WG Topics and Activities is achieved mainly through the Home Page which is regularly updated.

For more information please visit our page : http:/photo.topo.auth.gr

Intercommission Working Group V/III "Image Sequence Analysis"

Chairperson: Hans-Gerd Maas (Switzerland)
Co-chairperson: Osamu Murakami (Japan)

IWG V/III activities

+ IWG V/III had a Technical Session in the Videometrics V conference during the 42nd SPIE Annual Meeting in San Diego

+ IWG V/III had a Technical Session and several Posters in the 4th Conference on Optical 3-D Measurement Techniques in Zurich

+ A tutorial "Digital Photogrammetry for the 3-D measurement of dynamic processes - fundamentals, potential and applications" was given on the 29. Sept. 1997 in Zurich and was attended by several working group member

State of science and technology

1997 has not shown major breakthroughs concerning the topic of image sequences. So the statements in the 1996 annual report are still valid. On the hardware sector, progressive scan cameras are being offered by a large number of manufacturers now, thus avoiding the problems of interlacing in image sequences acquired with standard videonorm cameras. Some new highspeed cameras have come onto the market, offering significantly improved performance parameters. Several new framegrabbers offer powerful on-board processors, allowing for realtime solutions in image processing tasks. Smart cameras with on-chip processing possibilities may also offer interesting options.

Work performed on low level image sequence processing and spatiotemporal filtering by IWG V/III members can be found on the web site http://klimt.iwr.uni-heidelberg.de/PublicFG/ProjectA/index.html.

New applications stem mainly from the field of computer animation (see special interest group on animation), where e.g. dynamic 3-D models of moving persons are required, and from tasks in car traffic analysis.

Accomplishments of IWG

Web page: A homepage and several sub-pages have been set up on the WWW (http://www.geod.ethz.ch/p02/wg_isprs/WG.V_III/WG.V_III.home.html)

IWG news

+ WG members: IWG V/III has now 30 members

+ A IWG V/III workshop, probably in cooperation with one or two other ISPRS Working Groups, is planned for 1999.

Commission Officer Address Updates

New address of the IWG V/III chairman:
Dr. Hans-Gerd Maas
Delft University of Technology
Faculty of Civil Engineering and Geo Sciences
Thijsseweg 11
2629JA Delft
The Netherlands
e-mail will be automatically forwarded from the old address gerd@geod.ethz.ch

Special Interest Group on "ANIMATION"

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

SIG activities

In a broad sense Computer Animation (in brief: Animation) is concerned with procedures, algorithms, software and hardware for the purpose of synthesizing real world objects and processes, as well as events of phantasy and imagination. As such, animation belongs to the larger fields of VR (virtual reality) or VE (virtual environment). Technically and scientifically the ISPRS Special Interest Group on

"Animation" is mainly concerned with objects under motion (typically humans, animals, plants, etc.), as opposed to topographical and GIS-relevant objects, which are treated by other ISPRS Working Groups.

Since the issue of animation, as it is perceived in this SIG, is fairly new to ISPRS, the prime focus of our group is to build up relations between scientists of the different disciplines, which make up the animation community. The longterm goal would then be to upgrade this SIG to a Working Group, in order to give animation the status it deserves within ISPRS.

After establishing contacts to a number of scientists, who previously have done some work in animation, the first discussion round was held on occasion of the Conference "Optical 3-D Measurement Techniques", Zurich, 30 September 1997. As the main result of this meeting it was agreed that a Workshop should be organized where scientists, system manufacturers and users from both the modeling and visualization and the image analysis communities should be present. This would definitely be a first encounter of a substantial number of relevant people of these areas with the aim of isolating problems, defining requirements, exchanging existing solutions and discussing further steps to be taken in R&D and in organizational matters. It was

suggested to conduct this Workshop at the excellent facilities of Monte Verita, Ascona Switzerland.

A date has not been set up yet. Up to then all activities should be focused on the Commission V Symposium in Hakodate, Japan. Every effort should be undertaken in order to have very good technical presentations on the subject of animation, and to get some of the modeling people to the Symposium. In parallel, ISPRS scientists are encouraged to make presentations at animation-related conferences.

Detailed activities:

+ Animation at the Conference "Optical 3-D Measurement Techniques", Zurich. There was a particular session devoted to "Image Analysis and Animation" with interesting papers given by P. Fua (EPF Lausanne), J.A. Paradiso (MIT Media Lab.) and H. Chikatsu (Tokyo Denki University). For details compare the Conference Proceedings, published in Wichmann Verlag. The Keynote Address in the Opening Session was given by D. Thalmann (EPF Lausanne) on the topic of "Interacting with Autonomous Virtual Humans". The related paper can be accessed through http://ligwww.epfl.ch

+ Business Meeting during the Conference "Optical 3-D Measurement Techniques", Zurich, 30 September 1997

+ Co-organization of the ARIDA-SGPBF Workshop in Zurich, 3 October, 1997

+ Design and preparation of a Homepage

State of science and technology

Among the many research issues in animation, two central problems are of particular interest to this SIG: Motion capture and surface reconstruction (possibly under motion and deformation). There are already quite a number of commercial motion capture systems available, some on magnetic basis (UltraTrak Pro, Flock of Birds, Motion Star), others using optical techniques (Integrated Body Capture, HiRez, VICON, Multi Trax, Face Trax, Face Tracker, Photo4D, APAS, MacReflex, Cyber Sight, Biovision, BioMechanics, Sim Graphics, HISIS 2001, Clovis).

Here is a sample of vendors of motion-capture tools:

+ Adaptive Optics, Cambridge, MA
+ Ascension Technology, Burlington, VT
+ CompInt, Nepeau, Ontario
+ Digital Image Design, New York, NY
+ Elektra Shock, LA
+ Motion Analysis, Santa Rosa, CA
+ Oxford Metrics, Oxford, England
+ Polhemus, Colchester, VT
+ Virtual Technologies Inc., Palo Alto, CA

The optical systems are either tracking devices for a set of (retroreflective) points or systems for reconstructing faces or facial expression.

For 2-D face tracking systems are offered by the following vendors:

+ Adaptive Optics, Cambridge, MA
+ Digits 'n Art, Montreal, Canada
+ Motion Analysis, Santa Rosa, CA
+ Sim Graphics, South Pasadena, CA
+ Vierte Art GmbH, Munich, Germany

For 3-D object reconstruction a number of low-end systems are available, such as:

+ 3D Builder Pro (3D Construction Company, TN)
+ Photo Modeler (Eos Systems, Inc., Vancouver, Canada)
+ 3D Express (3rd Dimension Technologies Inc., CA)
+ Wireframe Express (Synthonics, CA)

Most systems do have in common the fact that very little photogrammetric expertise is incorporated (exceptions: Photo Modeler, Integrated Body Capture, HiRez). Therefore not much is known about performance in terms of both precision and reliability. It should be a vital goal of the photogrammetric community to let the animation people, in particular those concerned with motion capture and surface reconstruction, know about the capabilities of videogrammetric concepts and system realizations.

Accomplishment of SIG

The SIG has compiled a list of animation-related conferences, which are of potential interest to ISPRS people:
SIGGRAPH: Is held every year in LA . It is very competitive, with only 1/6 of papers being accepted
EUROGPRAPHICS: This includes about 20 Workshops on animation, VR, etc.
Computer Graphics International (CGI)
Computer Animation: Was held so far every year in Geneva, but in 1998 it will be in Philadelphia

VR Conferences:
VRAIS (IEEE), VRST (ACM)
Multimedia Conferences:
ACM Multimedia, MMM

Conferences in 1998:
Computer Animation 98 (Philadelphia, USA), MMM 98 (Lausanne, Switzerland), 3IA98 (Limoges, France), Computer Graphics International `98 (Hannover, Germany), ECMAST 98 (Berlin, Germany)
Eurographics 98 (Lisbon, Portugal), International Conference on WEB-Based Modeling and Simulation (San Diego, USA), IEEE Model-Based 3D Image Analysis (Bombay, India), MICAD 98 (Paris, France), Pacific Graphics 98 (Singapore), SIBGRAPI 98 (Rio de Janeiro, Brazil)
Virtual Environments `98 (Stuttgart, Germany), IEEE VRAIS 98 (Atlanta, USA)

SIG news

+ Co-sponsorship of a Workshop of WGV/3 at Videometrics VI, San Jose, CA, 6-12 February 1999

+ Preparation of a Workshop on "Image Analysis and Animation " with the goal of bringing the respective communities together