Geometry and Computer Vision

Dr Roberto Cipolla
Reader in Information Engineering
Department of Engineering
University of Cambridge

The Workshop will cover novel algorithms being developed in the Speech, Vision and Robotics Research group at the University of Cambridge to recover photorealistic models of architectural scenes and sculpture from uncalibrated image sequences. The presentation will provide an overview of the following key topics:

1) Reconstruction from uncalibrated images
2) Visual tracking
3) Visual servoing
4) Computer vision in man-machine interaction

Two very simple and geometrically intuitive methods for recovering the projection matrices for each viewpoint and calibrating the intrinsic camera parameters will be presented (without the need for searching for the absolute conic). Two special cases will be elaborated:

a) In architectural scenes, strong constraints can be derived from parallelism and orthogonality and these can be exploited to reliably bootstrap techniques to estimate the epipolar geometry and the intrinsic camera parameters. An interactive system called PhotoBuilder, which builds VRML models of buildings and rooms from an uncalibrated sequence of images, will be demonstrated.

b) For curved surfaces common in sculpture, the dominant image feature is the apparent contour or silhouette. Although epipolar geometry can also be recovered from apparent contours by searching for epipolar tangencies, there are usually insufficient tangencies in a pair of images. It will be shown that the epipolar geometry can be reliably estimated in the case of circular motion and at least two epipolar tangencies. A novel self-calibration technique will also be presented.

The workshop will conclude with a real time demonstration of tracking and visualization of the recovered 3D models using a vision-based 3D mouse running on a laptop computer.

PROGRAMME

8.45 am	Registration
9.00 am	Opening Address
9.10 am	Commencement of Workshop Session 1
10.30 am	Tea Break
11.00 am	Session 2
12.30 pm	Lunch
2.00 pm	Session 3
3.30 pm	Tea Break
4.00 pm	Session 4
5.00 pm	Question & Answer
5.30 pm	End of Workshop

DETAILS

Date:	Monday, 24th May 1999
Time:	8.30 am to 5.30 pm
Fee:	S$300 per participant 10% discount for early registration
Venue:	The Anderson Room, Boulevard Hotel
Tel:	737 2911

Who Should attend:

Engineers, researchers and managers who are interested in computer vision techniques, algorithms and applications used in the reconstruction, tracking and visualization of 3-D models and data from 2-D images.

REGISTRATION

Participants should submit their registration forms together with their payment, in the form of a crossed cheque made payable to **Robotic Games Society (Singapore),** to:

Ms. Chia Meow Leng
Mechatronics Programme Office
Faculty of Engineering
National University of Singapore
10 Kent Ridge Cresent
Singapore 119260

Registrations received before 15th May 1999 are entitled to a 10% discount on the workshop fee. A letter of confirmation and official receipt shall be sent to you to confirm your participation in the workshop.

Please note that there will be no refund for cancellation of participation. Replacement of participation may be accepted without any additional cost.

For further information, please contact Mr. Austin Goh through e-mail:

Austin_GOH@nyp.gov.sg

Biography of Dr Roberto Cipolla

Roberto Cipolla obtained a B.A. (Engineering) from the University of Cambridge in 1984 and an M.S.E. (Electrical Engineering) from the University of Pennsylvania in 1985. From 1985 to 1988 he studied and worked in Japan at the Osaka University of Foreign Studies (Japanese Language) and Electrotechnical Laboratory, Tsukuba (visiting scientist) and he obtained an M.Eng. (Robotics) from the University of Electro-communications in Tokyo in 1988.

In 1991 he was awarded a D.Phil. (Computer Vision) from the University of Oxford and from 1991-92 was a Toshiba Fellow and engineer at the Toshiba Corporation Research and Development Centre in Kawasaki, Japan. He joined the Department of Engineering, University of Cambridge in 1992 as a Lecturer and a Fellow of Jesus College. He became a Reader in Information Engineering in 1997.

His research interests are in computer vision and robotics and include the recovery of motion and 3D shape of visible surfaces from image sequences; visual tracking and navigation; robot hand-eye coordination; algebraic and geometric invariants for object recognition and perceptual grouping; novel man-machine interfaces using visual gestures and visual inspection. He has authored and co-authored more than 100 papers.

Research projects

- Recovery of motion and 3D shape from image sequences
- Visual guidance of mobile robots, navigation
- Reliable hand-eye co-ordination, visual guided grasping
- Man-machine interfaces using visual gestures, pointing
- Face detection and tracking
- 3D television, stereo vision, image-based view synthesis
- Symmetry detection, perceptual grouping
- Geometric invariants for recognition and matching
- Differential geometry: apparent contours, cusps and frontiers.
- Real-time visual tracking
- Measurement and interpretation of visual motion
- Image segmentation, image storage and retrieval

REGISTRATIOM FORM

GEOMETRY AND COMPUTER VISION

COMPANY DATA

COMPANY:_____

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ADDRESS:_____

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POSTAL CODE:_____

TEL:_____ **FAX:**_____

CONTACT PERSON:_____

PARTICIPANTS FOR THE WORKSHOP

1. **NAME: Mr. /Mrs. / Dr.**_____
   DESIGNATION:_____
   FOOD: Muslim / Vegetarian / Chinese *
2. **NAME: Mr. /Mrs. / Dr.**_____
   DESIGNATION:_____
   FOOD: Muslim / Vegetarian / Chinese *
3. **NAME: Mr. /Mrs. / Dr.**_____
   DESIGNATION:_____
   FOOD: Muslim / Vegetarian / Chinese *

** Cancel where applicable*

Fee enclosed: S$_____. Cheque should be crossed and made payable to **Robotic Games Society (Singapore).** Completed forms and cheques should be sent to:

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Faculty of Engineering
National University of Singapore
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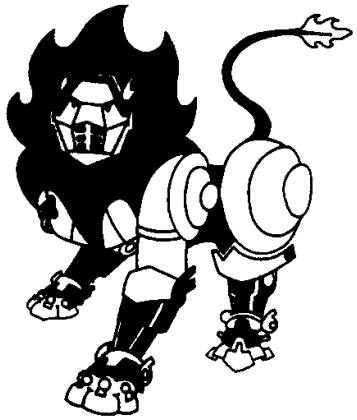

ONE DAY ROBOTIC WORKSHOP
ON

GEOMETRY AND COMPUTER VISION

24th MAY 1999
9.00 AM TO 5.30 PM
BOULEVARD HOTEL

JOINTLY ORGANISED BY

Robotic Games Society (Singapore)
National University of Singapore
Nanyang Technological University
Nanyang Polytechnic
Ngee Ann Polytechnic
Singapore Polytechnic
Temasek Polytechnic
Singapore Science Centre

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