CENTER FOR
MACHINE PERCEPTION

CZECH TECHNICAL
UNIVERSITY

ACTIVITY REPORT

Center for Machine Perception

http://cmp.felk.cvut.cz

ACTIVITY REPORT 2004

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Center for Machine Perception

1 Executive summary

The Center for Machine Perception (abbreviated CMP) is a research unit active in the fields of computer vision, pattern recognition, and mathematical modeling of uncertainty. The CMP, established in 1996, is a part of the Department of Cybernetics of the Czech Technical University (CTU), Prague. CMP is funded partially by the CTU and through a number of national, European and industrial grants.

Main CMP research interests lie currently in the following areas:

	contact person	*more info*
◆ reconstruction of scenes from multiple images	T. Pajdla	Sec. 3.1
◆ omnidirectional vision, non-classical cameras	T. Pajdla	Sec. 3.2
◆ stereo matching and surface reconstruction	R. Šára	Sec. 3.3
◆ sonographic image analysis	R. Šára	Sec. 3.4
◆ object recognition and wide baseline matching	J. Matas	Sec. 3.5
◆ face detection	J. Matas	Sec. 3.6
◆ pattern recognition	V. Hlaváč	Sec. 3.7
◆ quantum and fuzzy logic, digital topology	M. Navara	Sec. 3.8
◆ medical imaging	J. Kybic	Sec. 3.9
◆ multicamera systems for recognition	T. Svoboda	Sec. 3.10

Achievements in 2004:

- CMP organized the prestigious international *European Conference on Computer Vision*, May 11-14, 2004, Prague, and associated workshops. `http://cmp.felk.cvut.cz/eccv2004`
- CMP organized the *Cognitive Computer Vision Colloquium*, January 12, 2004, Prague. `http://cmp.felk.cvut.cz/cmp/events/colloquium-12-Jan-04`
- CMP secured three long-term (3.5-4.5 years) national grants funding basic research: Automatic 3D Virtual Model Builder from Photographs, Multi-camera system for modeling and recognition of events, Artificial Intelligence Methods in Diagnostics from Medical Images.
- CMP is a part of COSPAL (Cognitive Systems using Perception-Action Learning), a cognitive vision project funded by EU that started in August 2004. `http://www.cospal.org`
- 10 journal papers by CMP members were published.
- Jiří Matas and Mirko Navara were awarded *"The best scientific results of the Czech Technical University Prize"* in the years 2003 and 2004, respectively.
- Tomáš Pajdla was invited to become an ICCV 2005 area chair and Jiří Matas a CVPR 2005 and ECCV 2006 area chair.
- 4 out of 4 papers submitted to CVPR 2005 were accepted.
- CMP organized the *Autumn Pattern Recognition and Computer Vision Colloquium*, Oct 7, 2004. `http://cmp.felk.cvut.cz/cmp/events/colloquium-7-Nov-02`
- CMP organized the *Workshop on Nonstandard Logics*, May 28th, 2004.

  `http://cmp.felk.cvut.cz/~navara/one_day`
- Braňo Mičušík defended his PhD thesis on Two-View Geometry of Omnidirectional Cameras.

2 The CMP Research Group

The CMP group comprises twenty members of academic and research staff, nine full-time PhD students, two group administrators and a system manager.

Academic and Research Staff

Prof. Václav Hlaváč	head, professor
Prof. Pavel Pták, DrSc.	professor (part time)
Dr. Mirko Navara, DrSc.	senior lecturer

Dr. Jan Kybic	senior research fellow	Dr. Jiří Matas	senior research fellow
Dr. Tomáš Pajdla	lecturer	Vladimír Smutný	lecturer
Dr. Tomáš Svoboda	senior research fellow	Dr. Radim Šára	senior research fellow
Hynek Bakstein	research fellow	Vojtěch Franc	research fellow
Juan D. Garcia	research fellow	Ondřej Chum	research fellow
Jana Kostková	research fellow	Dr. Pavel Krsek	research fellow
Daniel Martinec	research fellow	Martin Matoušek	research fellow
Štěpán Obdržálek	research fellow	Dr. Martin Urban	research fellow
Dr. Tomaš Werner	research fellow		
Radka Kopecká	group administrator	Eva Matysková	group administrator
Daniel Večerka	system administrator		

Doctoral students

	supervisor	*proposed thesis title*
Martin Barva	V. Hlaváč	Automatic object localization from 3D ultrasound data
Jan Čech	R. Šára	Accurate stereoscopic matching
Pavel Křížek	V. Hlaváč	Feature selection based on the training set manipulation
Michal Perďoch	J. Matas	Object recognition and categorization
Jan Petr	V. Hlaváč	Parallel Magnetic Resonance Imaging Reconstruction
Milan Petrík	M. Navara	Fuzzy control
Jan Šochman	J. Matas	Time constrained recognition
Martin Švec	R. Šára	Discriminable and Stable Feature Selection for Computer-aided Diagnosis from Sonographic Images
Karel Zimmermann	J. Matas	Modelling and recognition of objects and events

CMP group (in alphabetical order)


Hynek Bakstein


Martin Barva


Jan Čech


Vojtěch Franc


Juan D. Garcia


Václav Hlaváč


Ondřej Chum


Radka Kopecká


Jana Kostková


Pavel Krsek


Pavel Křížek


Jan Kybic


Daniel Martinec


Jiří Matas


Martin Matoušek


Eva Matysková


Mirko Navara


Štěpán Obdržálek


Tomáš Pajdla


Michal Perďoch


Jan Petr


Pavel Pták


Vladimír Smutný


Tomáš Svoboda


Radim Šára


Jan Šochman


Martin Švec


Martin Urban


Daniel Večerka


Tomaš Werner


Karel Zimmermann

3 Research

3.1 Reconstruction of 3D scenes from multiple images

Projective factorization has been used to reconstruct scenes from many 180° field-of-view images [45] with significant occlusions and mismatches. The same technique has been used to calibrate a large camera system for dense stereo reconstruction [24]. **Contact person:** Tomáš Pajdla.

3.2 Omni-directional vision

Two-view geometry has been derived for perspective-concentric image pairs [42] and an estimation technique has been developed. Robust epipolar geometry estimation has been extendended to central and slightly noncentral wide-field-of-view diptric and catadioptric cameras [17, 43, 44]. Image based synthesis using non-central cameras has been studied and light-ray space construction has been designed and verified [18, 58] **Contact person:** Tomáš Pajdla.

3.3 Stereo matching and surface reconstruction

We published results of dense multi-view surface reconstruction from small number of images (12) from a handheld uncalibrated camera [24]. The method consists of three steps: (i) sparse matches are found between all image pairs, (ii) all cameras are calibrated so that they are consistent with all images, (iii) dense matches are found in suitable image pairs using the calibrated cameras and merged into a consistent dense reconstruction.

Then, a completely new method for scene reconstruction was developed which is already capable of reconstructing hundreds of images. The new method has a very good numerical behaviour as it searches for such a reconstruction that minimizes a reasonable error which is close to the reprojection error. Moreover, it turned out to be very fast. Thus, real-time applications on video-sequences e.g. in robotics are possible. An article has been accepted to the CVPR conference. **Contact person:** Radim Šára.

3.4 Sonographic Image Analysis

We found a significant correlation between serum levels of thyroid antibodies and texture features [9]. These findings suggest the possibility of using sonographic quantitative indicators not only for classification but also as predictors of thyroid antibodies in patient's blood.

We analysed optimal features that distinguished healthy tissue of thyroid gland from Hashimoto Lymphocytic thyroiditis with a success rate of 100%. We proposed a method to measure sensitivity of these features to changes influencing the scanning process, i.e. sonograph gain setting, type of segmentation and different scan type [57, 56]. **Contact person:** Radim Šára.

3.5 Object Recognition and Wide Baseline Matching

The MSER-LAF recognition method based on efficient description of photometric information on local affine frames computed on maximally stable extremal regions was further developed [40]. The efficiency of the method was improved and a near-real time demonstrator (response time below 1 second) capable of recognising objects from a large range of viewpoints in the presence of background clutter, oclussion has been developed.

In wide baseline matching, our work focussed on efficient epipolar geometry (EG) estimation via improved RANSAC. We observed that RANSAC in EG estimation is not following the theoretical model. An extension of the RANSAC procedure is proposed in [22]. By adding a selectively applied generalized model optimization to RANSAC an algorithm with the following desirable properties is obtained: a near perfect agreement with theoretical (i.e. optimal) performance and lower sensitivity to noise and poor conditioning. The efficiency of epipolar geometry estimation by RANSAC was further improved by

exploiting the oriented epipolar constraint [23]. The orientation test is simple to implement, is universally applicable and takes negligible fraction of time compared with epipolar geometry computation and brings up to a two-fold speed-up. **Contact person:** Jiří Matas.

3.6 Face detection

An extension of the AdaBoost learning algorithm is proposed in [54]. The novel totally corrective algorithm reduces aggressively the upper bound on the training error by correcting coefficients of all weak classifiers. The correction steps are proven to lower the upper bound on the error without increasing computational complexity of the resulting detector. The approach is tested on a face detection problem and improved efficiency w.r.t standard AdaBoost is observed.

In [71], an algorithm with near optimal time-error rate trade-off, called WaldBoost is proposed. The optimality is achieved by integrating the AdaBoost algorithm for measurement selection and ordering and the joint probability density estimation with the optimal sequential probability ratio test.

3.7 Pattern Recognition

Both statistical and structural pattern recognition methods were developed. The Statistical Pattern Recognition toolbox was extended and documented (thanks to ECVision network support) [64]. The statistical learning can be converted to quadratic optimization problem. We studied and found a feasible method for the large-scale problems (unpublished yet). Being encouraged by Prof. M.I. Schlesinger from Kiev, Ukraine, we were attracted by consistent labelling problem and its approximations. This is ongoing work.

In many computer vision classification problems, both the error and time characterizes the quality of a decision. In [71], it is show that such problems can be formalized in the framework of sequential decision-making. If the false positive and false negative error rates are given, the optimal strategy in terms of the shortest average time to decision (number of measurements used) is the Wald's sequential probability ratio test (SPRT). The work builds on the optimal SPRT test and shows how to enlarge its capabilities to problems with dependent measurements. **Contact person:** Václav Hlaváč.

3.8 Quantum and fuzzy logic

We studied the abilities of different fuzzy logical connectives [1, 3, 4, 21]. Our contribution to fuzzy control has found an application in medical diagnosis [51]. Among theoretical results, we extended the classical Cantor–Bernstein theorem to fuzzy and quantum structures [2, 25] and we contributed to the probability theory of fuzzy events [52]. **Contact person:** Mirko Navara.

3.9 Medical imaging

We started to study the problem of estimating elastic properties of tissues from standard medical ultrasound sequences. We proposed a new image similarity criterion for image registration, based on high-dimensional mutual information [33]. We continued our work on brain activity reconstruction from MEG/EEG [34]. A new project on lung noduli detection was started. **Contact person:** Jan Kybic.

3.10 Multicamera systems for recognition

We develped an algorithm, called virtual editor, which process multiple video streams and simultaneously analyzes action in the scene and produces a smooth output for a distant observer [26]. We advanced our selfcalibration method that estimates complete geometric calibration of a multicamera setup from just 1-point object, a journal article has been accepted. We started to work on estimation of articulated models. **Contact person:** Tomáš Svoboda.

4 Projects

(Labeled as basic research, applied R & D, or collaboration promoting grants and industrial projects.)

Cognitive Systems using Perception-Action Learning (acronym COSPAL) *basic research*
IST-004176 (STREP)

Contact person: Václav Hlaváč

Funding: EU project, 6th Framework programme, IST

Duration: 2004–2007.

Description: COSPAL project designs a new learning architecture perception-action feedback at several levels in the system. The CMP role is in investigating associations of percepts and symbolic states in a bidirectional way. We contribute to object recognition in images too.

`http://www.cospal.org`

Interpreting and Understanding Activities of Expert Operators for Teaching and Education (acronym ActIPret) *basic research*
IST-2001-32184

Contact person: Václav Hlaváč

Funding: EU project, 5th Framework programme.

Duration: 2001–2004

Description: The objective of ActIPret (Activity InterPretation) project is to devise a vision methodology to interpret, understand and record the actions of a person handling an object. The tasks considered are observable by video stream. The goal is to understand the activities such that they can be stored in an activity plan for later reference by the user. The focus of the developments is on active observation and interpretation of the activities, extraction of the essential activities and their functional dependence, and parsing the sequences into constituent behavior elements.

Machine Intelligence Research and Application Centre for Learning Excellence *collaboration*
ICA 1-CT-2000-70002 (Miracle)

Contact person: Václav Hlaváč

Funding: EU project

European Research Network for Cognitive Computer Vision Systems *collaboration*
IST-2001-35454

Contact person: Václav Hlaváč

Funding: EU research and training network, 5th Framework Programme, IST

Duration: 2001–2005

Description: ECVision is a research network which was formed to promote research, education, and application systems engineering in cognitive computer vision. ECVision is funded by the European Commission under the IST Programme (Project 35454).

Being There - Without Going *basic research*
IST-2001-39184 (BeNoGo)

Contact person: Tomáš Pajdla

Funding: EU project

Description: New recording and visualisation technologies for virtual presence. CMP contributes to space-time volume (lightfield, lumigraph) acquisition and its rendering by non-central cameras. http://benogo.dk/

Transdisciplinary Biomedical Engineering Research *applied R&D* MSM 210000012

Contact person: Radim Šára

Duration: 2005–2011

Funding: Czech Ministry of Education

Description: Large-scope project led by S. Konvičková (Faculty of Mechanical Engineering). CMP is responsible for applications of image processing and 3D computer vision methods in medical diagnostics and prosthetics.

Centre for Applied Cybernetics *applied R&D* LN00B096

Contact person: Václav Hlaváč

Funding: Czech Ministry of Education.

Duration: 2000–2004.

Description: The project aims at the transfer of research results to industry. Project pays four full time researchers, encourages cooperation with a group similar to CMP at Brno University of Technology and two spin-off companies Neovision s.r.o. (Prague) and Camera s.r.o. (Brno). For instance, bigger contracts with companies Samsung, Korea and Toyota Motor Company, Japan are partly outcome of this project.

Artificial Intelligence Methods in Diagnostics from Medical Images *basic research* 1ET101050403

Contact person: Jan Kybic

Funding: Grant Agency of the Czech Academy of Sciences

Duration: 07/2004-12/2007

Description: Development of metehods for tissue elasticity characterisation from ultrasound sequences. Ultrasound image segmentation and classification for thyroid and liver.

Partners: Faculty of Medicine I, Charles University

Automatic 3D Virtual Model Builder from Photographs *basic research* 1ET101210406

Contact person: Radim Šára

Funding: Grant Agency of the Czech Academy of Sciences

Duration: 2004–2008

Description: Development of methods for automatic 3D reconstruction of large scale and complex free-form objects from an unorganized and uncalibrated set of photographs.

Multi-camera system for modeling and recognition of events *basic research* 1ET101210407

Duration: 07/2004-12/2008

Contact person: Tomáš Svoboda

Funding: Grant Agency of the Czech Academy of Sciences

Description: Development of theoretically well established methods for modeling an recognition of events. The system will use multiple cameras that will observe scene from different perspectives.

Recognition of Faces (in unconstrained environments) from a single example image
basic research
GACR 102/02/1539

Contact person: Jiří Matas

Funding: Grant Agency of the Czech Republic

Description: The use of sequential decision making was applied to the problem of face detection and recognition.

Recognizing human activities for automated video surveillance
applied R&D
GACR 102/03/0440

Contact person: Václav Hlaváč

Funding: Grant Agency of the Czech Republic.

Duration: 2003–2005.

Description: The project attempts to find methods analyzing video sequences with the aim to detect motion and track objects (persons).

Many-valued logics for soft-computing
basic research
GACR 201/02/1540

Contact person: Mirko Navara

Funding: Grant Agency of the Czech Republic

Duration: 2002–2004.

Description: Research of mathematical methods of fuzzy logic and fuzzy control with applications to soft-computing.

Quantifying the Relation between Breathing Movements and the Function of the Spine
applied R&D
NK/7735-3

Contact person: Radim Šára

Funding: Grant Agency of the Czech Ministry of Health

Duration: 2003–2005

Description: Developing photogrammetric system for measuring 3D real-time breathing movements in-vivo.

Partners: Faculty of Sports, Charles University Prague.

Computer Aided Diagnosis of Diffuse Parenchyme Processes by Texture Analysis of Ultrasound Images
applied R&D
NO/7742-3

Contact person: Radim Šára

Funding: Grant Agency of the Czech Ministry of Health

Duration: 2003–2005

Description: Texture analysis and pattern recognition methods for computer-aided diagnosis of thyroid gland based on sonographic B-mode images.

Partners: 1st Faculty of Medicine, Charles University Prague.

Detection of Lung Noduli from CT Images *applied R&D*
NR8314-3/2005

Contact person: Jan Kybic

Funding: Grant Agency of the Czech Ministry of Health

Description: Developing of a detection and classification algorithms.

Fuzzy Control *collaboration*
CEEPUS SK-042

Contact person: Mirko Navara

Funding: Czech Ministry of Education

Duration: 1996–2005.

Description: Education, mobility between universities studying fuzzy logic and fuzzy control.

Robust and adaptive approaches to scene and object *colaboration*
CONEX GZ 45.535

Contact person: Václav Hlaváč

Funding: Austrian government.

Duration: 2003–2005.

Description: The project fosters scientific cooperation in computer vision and pattern recognition among Austrian, Slovenian and Czech partners, in particular Graz University of Technology (Prof. Horst Bischof) and University of Ljubljana (Prof. Aleš Leonardis).

Computer vision and the development of seeing machine *collaboration*
Dur IG2003-2 062 (STINT)

Contact person: Václav Hlaváč

Funding: The Swedish Foundation for International Cooperation in Research and Higher Education.

Duration: 2003–2007.

Description: The project finances direct cooperation between CMP and KTH (Royal Institute of Technology) Stockholm, Sweden. The partner is Prof. Jan Olof Eklundh. Project covers exchange mainly longer term study stays of MSc. and PhD. students. Solving a diploma thesis at the partner institution is a typical case. Shorter visit of academics either aim at a specific research cooperation or giving a series of lectures to students at partner institution.

Pattern recognition in genomic informatics *collaboration*
Kontakt ME 678

Contact person: Václav Hlaváč

Funding: Czech Ministry of Education

Duration: 2003–2004

Description: The aim of the project is to promote research collaboration with Chiba University, Chiba, Japan (Prof. Atsushi Imiya) and National Institute of Informatics, Tokyo, Japan (Prof. Akihiro Sugimoto). There have been two streams of interest in the project, (a) genomic informatics, (b) three-dimensional computer vision with the stress to omni-directional vision and automatic range image registration.

Localization of surgical tools *collaboration*
Barrande 2005-06-007-1

Contact person: Jan Kybic
Funding: Czech and French Ministry of Education
Duration: 2005–2006
Description: Localization of micro-surgical tools in soft tissue from ultrasound data.
Partners: INSA Lyon, France.

Cervical Image Registration *applied R&D*
STI

Contact person: Jan Kybic
Funding: Industrial project (STI Medical Systems, Hawaii, U.S.A.)
Description: Developing an elastic image registration algorithm for color colposcopic images.

Honeywell *basic research*
Honeywell

Contact person: Václav Hlaváč
Funding: Industrial project.
Description: The aim of the project was to design and implement motion detection and object tracking methods in video sequences.

Samsung *applied R&D*
Samsung

Contact person: Jiří Matas
Funding: Industrial project
Description: Face detection in still images.

Toyota *applied R&D*
Toyota

Contact person: Jiří Matas
Funding: Industrial project
Description: Visual recognition methods.

Hitachi *applied R&D*
Hitachi

Contact person: Jiří Matas
Funding: Industrial project
Description: Face detection in video.

Xerox *applied R&D*
Xerox

Contact person: Jiří Matas
Funding: Industrial project
Description: Precise delineation of facial features.

Technical University Liberec, Czech Republic *applied R&D*
TUL

Contact person: Jiří Matas
Funding: Industrial project
Description: Automatic registration and composition of microphotograps of textiles.

Hydrometeorological Institute *applied R&D*
HMU

Contact person: Martin Urban
Funding: Industrial project
Description: Meteorology situation analogy analysis.

5 Teaching

In 2004, CMP members taught the following courses:

Course name	*level*[a]	*language*	*lecturer*
Introduction to algebra	MSc/1	ENG	P. Pták
Mathematics 4 [complex functions, probability, first order differential equations]	MSc/2	ENG	P. Pták
Robotics	MSc/4	CZ, ENG	V. Smutný
Computer vision for informatics	MSc/4	CZ	T. Pajdla
Signal and image processing	MSc/4	CZ	V. Hlaváč
Signal and image processing	MSc/4	ENG	T. Svoboda
Pattern recognition	MSc/4	CZ	J. Matas
Mathematics 6F [statistics and fuzzy logic]	MSc/4	CZ, ENG	M. Navara
General systems theory	MSc/5	CZ, ENG	R. Šára
Digital Image Processing	MSc/5	CZ	J. Matas J. Kybic
Computer vision and virtual reality	MSc/5	CZ	V. Hlaváč
Intelligent robotics	MSc/6	CZ, ENG	T. Pajdla
Introduction to computer vision and pattern recognition [for students of the Faculty of Mathematics and Physics, Charles University in Prague]	MSc/1-5	CZ	V. Hlaváč
Numerical methods	MSc/1-5	CZ	M. Navara
Computer algebraic systems	MSc/1-5	CZ	M. Navara
Mathematics for cybernetics	PhD	CZ	P. Pták
Introduction to computer vision	PhD	CZ	V. Hlaváč
Fuzzy logic	PhD	CZ, ENG	M. Navara
Pattern recognition	PhD	CZ	V. Hlaváč
3D computer vision	PhD	ENG	R. Šára

[a] Indicates whether the course is intended for PhD or MSc students. For MSc courses, the marker is followed by the recommended year.

Currently, the CMP offers students the opportunity to study abroad for periods ranging from 3 weeks to 10 months. The receiving institutions are laboratories in Finland, the United Kingdom, Austria, Slovenia, Slovakia, Hungary, Poland, Serbia and Montenegro, Greece, and the Netherlands. A full list, with details on funding, is available at

`http://cmp.felk.cvut.cz/cmp/opport.html`

6 CMP visitors (ordered by the length of the visit)

name	institution	country	duration
Björkman Mårten	Royal Institute of Technology	SE	3 months
Schaffalitzky Frederik	Univerzity of Oxford	UK	1 month
Dobrakovová Jana	STU Bratislava	SK	1 month
Koreňová Božena	TU Zvolen	SK	1 month
Katsuhiro Sakai	Toyota Motor Engineering & Manufacturing	JP	1 month
Minagawa Takuya	Kizna Corporation Japan	JP	18 days
Sugimoto Akihiro	National Institute of Informatics	JP	12 days
Sakai Katsuhiro	Toyota Motor Engineering & Manufacturing	JP	11 days
Saminger Susanne	Jonannes Kepler Universität Linz	AT	11 days
Mundici Daniele	University of Florence	IT	10 days
Caputo Barbara	KTH Stockholm	SE	10 days
Imiya Atsushi	Chiba University	JP	9 days
Bayro-Corrochano Eduardo	CINVESTAV	ES	9 days
Chevalier Georges	Universite Claude Bernard, Lyon	FR	8 days
Skočaj Danijel	University of Ljubljana	SI	6 days
Matsumoto Katsutoshi	Kizna Corporation Japan	JP	5 days
Weber Hans	Universita degli Studi di Udine	IT	5 days
Hanbury Allan	Vienna University of Technology	AT	5 days
Petrou Maria	University of Surrey	UK	5 days
Gregor Berginc	University of Ljubljana	UK	5 days
Bauer Joachim	TU Graz	AT	4 days
Elbischger Pierre	TU Graz	AT	4 days
Perko Roland	TU Graz	AT	4 days
Klaus Andreas	TU Graz	AT	4 days
Fraundorfer Friedrich	TU Graz	AT	4 days
Peleg Shmuel	The Hebrew University	IL	4 days
Dorfer Gerhard	Technische Universität Wien	AT	4 days
Savchynskyy Bogdan	Ukrainian Academy of Sciences	UKR	4 days
Shekhovtsov Alexander	Ukrainian Academy of Sciences	UKR	4 days
Beleznai Csaba	Advanced Computer Vision GmbH	HU	4 days
Zillich Michael	Vienna University of Technology	AT	3 days
Vincze Markus	Vienna University of Technology	AT	3 days
Ayromlou Minu	Vienna University of Technology	AT	3 days
Biegelbauer Georg	Vienna University of Technology	AT	3 days
Pirri Fiora	Universita di Roma “La Sapienza”	IT	3 days
Nagel Hans-Helmut	Universität Karlsruhe	DE	3 days
Pinz Axel	TU Graz	AT	3 days
Miyazawa Takeo	Kizna Corporation Japan	JP	3 days
Schlesinger Dimitrij M.	Technische Universität Dresden	DE	3 days
Roslund Mari-Anna	Royal Institute of Technology	SE	3 days
Riečanová Zdena	STU Bratislava	SK	3 days

name	institution	country	duration
Kôpka František	Žilinská univerzita	SK	3 days
Chovanec Ferdinand	Military Academy, Liptovský Mikuláš	SK	3 days
Jurečková Mária	Military Academy, Liptovský Mikuláš	SK	3 days
Drobná Eva	Military Academy, Liptovský Mikuláš	SK	3 days
Kalina Martin	STU Bratislava	SK	3 days
Lorentzen Lisbeth W.	Aalborg University Esbjerg	DK	3 days
Fua Pascal	Swiss Federal Institute of Technology	CH	3 days
Ftáčník Milan	UK Bratislava	SK	3 days
Di Nola Antonio	University of Salerno	IT	3 days
Dickinson Sven	University of Toronto	IT	2 days
Caroll Fiona	Napier University	FR	2 days
Smyth Michael	Napier university	FR	2 days
Rother Carsten	Microsoft Research Cambridge	UK	2 days
Sturm Peter	INRIA	FR	3 days
Fitzgibbon Andrew	University of Oxford	UK	2 days
Kropatsch Walter	Technical University Wien	AT	2 days
Eklundh Jan-Olof	Royal Institute of Technology	SE	2 days
Csontó Július	TU Košice	SK	1 day

Student visits:

name	level	institution	country	duration
van der Veen Coen	MSc	Delft University of Technology	NL	9 months
Dalazoana Haroldo	MSc	Université Pierre et Marie Curie	FR	6 months
Torri Akihito	MSc	Chiba University	JP	3 months
José Manuel Pérez Lorenzo	MSc	University of Malaga	ES	3 months
Konečná Zuzana	MSc	STU Bratislava	SK	2 months
Sarkóci Peter	PhD	STU Bratislava	SK	1 month
Hyčko Marek	PhD	Slovak Academy of Sciences, Bratislava	SK	1 month
Muresan Leila	MSc	Johannes Kepler Universität Linz	AT	1 month
Horvath Robert	PhD	Technical University of Budapest	HU	23 days
Feldman Doron	PhD	The Hebrew University	IL	2 days
Lendelová Katarína	PhD	Univerzita Mateja Bela, Banská Bystrica	SK	2 days

7 Events held at CMP

The CMP has been organising regular meetings on computer vision and pattern recognition. Furthermore, in 2004 CMP organized:

- 8^{th} European Conference on Computer Vision (ECCV), May 11–15, 2004.
  `http://cmp.felk.cvut.cz/eccv2004`
- Cognitive Computer Vision Colloquium, May 12, 2004.
  `http://cmp.felk.cvut.cz/cmp/events/colloquium-12-Jan-04/`
- Autumn Pattern Recognition and Computer Vision Colloquium, Oct 7, 2004.
  `http://cmp.felk.cvut.cz/cmp/events/colloquium-7-Nov-02`
- Workshop on Nonstandard Logics, May 28th, 2004.
  `http://cmp.felk.cvut.cz/~navara/one_day`

Selected seminars held at CMP (apart from the one- or two-day meetings):

A. Fitzgibbon	University of Oxford, UK	Applied natural image statistics for computer vision
G. Chevalier	University Lyon I, France	Wigner type theorems for projections
W. Kropatsch		Hierarchies relating Topology and Geometry
P. Sturm	Inria Rhône-Alpes	Multi-View Geometry for Non-Central Cameras
M. Björkman	Royal Institute of Technology, Stockholm, Sweden	Vision in the Real World: Finding, Attending and Recognizing Objects
S. Saminger	Johannes Kepler Univ. Linz	Fuzzy Relations in Evaluation of Computer-Assisted Assessment
B. Caputo	Royal Institute of Technology, Stockholm, Sweden	Categorizing Materials
A. Shekhovtsov	Ukrainian Akademy of Sciences, Kiev	Algorithms for Markov Random Trees: marginal probabilities, learning, tuning.
L. Muresan	Johannes Kepler University, Linz	Particle Tracking in Microscopy Images
F. Schaffalitzky	University of Oxford, UK	"How long is the fish?"
M. Poissonnier	University of Oxford, UK	X-ray mammography for breast cancer diagnosis
D. Ramanan	U.C. Berkeley, USA	Kinematic Tracking and Annotation
A. Sugimoto	National Institute of Informatics, Japan	Range Image Registration Preserving Local Structures of Object Surfaces
M. Matoušek	Charles University in Prague, The Czech Republic	Preimages of Boolean algebras under orthomodular morphisms I.-II.
S. Dickinson	University of Toronto, Canada	Many-to-Many Feature Matching in Object Recognition
R. Frič	MÚ SAV Košice, MÚ AV Praha	Remarks on fuzzy random variables
J. Miteran	Universite de Bourgogne, France	Detection of Curvilinear Regions
B. Riečan	Univ. Mateja Bela, Banská Bystrica	Entropy on MV-algebras
D. Schlesinger	Technical University Dresden, Germany	Transforming an arbitrary (min,+) problem into a binary one
T. Kroupa	Academy of Sciences of The Czech Republic	Conditional probability on MV-algebras
J. Neustupa	Charles University in Prague, The Czech Republic	Geometrical morphometric

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