

**IWCIA 2014**  
**16th International Workshop on Combinatorial Image Analysis**  
**Brno University of Technology, Brno, Czech Republic**  
**May 28-30, 2014**

**Wednesday, May 28th**

08:00-08:45		Registration
08:45-10:00		Opening Session <i>Chair: Josef Slapal</i>
	08:45-09:00	Opening Addresses
	09:00-10:00	<i>Keynote: Gabor T. Herman</i> <i>Title: Superiorization for Image Analysis</i>
10:00-10:30		Coffee Break & Registration
10:30-12:10		Discrete Geometry and Topology <i>Chair: Reneta Barneva</i>
	10:30-10:50	Equivalent 2D Sequential and Parallel Thinning Algorithms <i>Kálmán Palágyi</i>
	10:50-11:10	On Intersection Graphs of Convex Polygons <i>Valentin E. Brimkov, Sean Kafer, Matthew Szczepankiewicz, Joshua Terhaar</i>
	11:10-11:30	A Combinatorial Technique for Construction of Triangular Covers of Digital Objects <i>Barnali Das, Mousumi Dutt, Arindam Biswas, Partha Bhowmick, Bhargab B. Bhattacharya</i>
	11:30-11:50	Sufficient Conditions for General 2D Operators to Preserve Topology <i>Péter Kardos, Kálmán Palágyi</i>
	11:50-12:10	Weighted Distances on a Triangular Grid <i>Benedek Nagy</i>
12:10-13:30		Lunch
13:30-15:10		Image Representation, Segmentation, and Reconstruction <i>Chair: Nikolay M. Sirakov</i>
	13:30-13:50	Speed Comparison of Segmentation Evaluation Methods <i>Stepan Srubar</i>
	13:50-14:10	Discovering Features Contexts from Images Using Random Indexing <i>Haiifa Nakouri, Mohamed Limam</i>
	14:10-14:30	Decomposition of a Bunch of Objects in Digital Images <i>Pavel Štarha, Hana Druckmüllerová</i>

	14:30-14:50	Calibrationless Sensor Fusion Using Linear Optimization for Depth Matching <i>László Havasi, <u>Attila Kiss</u>, László Spórás, Tamás Szirányi</i>
	14:50-15:10	Optimal RGB Light-Mixing for Image Acquisition Using Random Search and Robust Parameter Design <i>HyungTae Kim, Kyeongyong Cho, SeungTaek Kim, Jongseok Kim</i>
15:10-15:40		Coffee Break & Picture
15:40-17:40		Theoretical Advancements and Applications <i>Chair: Jan Pavlik</i>
	15:40-16:00	Using a Topological Descriptor to Investigate Structures of Virus Particles <i>Lucas M. Oliveira, Gabor T. Herman, Tat Yung Kong, Paul Gottlieb, Al Katz</i>
	16:00-16:20	An Efficient Algorithm for the Generation of Z-Convex Polyominoes <i>Giusi Castiglione and Paolo Massazza</i>
	16:20-16:40	Tracking Partially Occluded Objects with Centripetal Active Contour <i>Pravinkumar Kandhare, Abdullah Arslan, <u>Nikolay Sirakov</u></i>
	16:40-17:00	Smoothing Filters in the DART Algorithm <i><u>Antal Nagy</u></i>
	17:00-17:20	Comparison of 3D Texture-Based Image Descriptors in Fluorescence Microscopy <i>Tomáš Majtner, David Svoboda</i>
	17:20-17:40	Multifocal Image Processing <i>Dalibor Martišek, <u>Hana Druckmüllerová</u></i>

## Thursday, May 29th

08:00-09:00		Registration
09:00-10:00		Keynote Talk <i>Chair: Kálmán Palágyi</i>
	09:00-10:00	<i>Keynote: <u>Valentin E. Brimkov</u></i> <i>Title: Parallel Algorithms for Combinatorial Pattern Matching</i>
10:00-10:20		Coffee Break
10:20-11:40		Theoretical Advancements <i>Chair: Benedek Nagy</i>
	10:20-10:40	A Variant of Pure Two-Dimensional Context-Free Grammars Generating Picture Languages <i>Zbyněk Křivka, Carlos Martín-Vide, Alexander Meduna, K.G. Subramanian</i>
	10:40-11:00	Shuffle on Array Languages Generated by Array Grammars <i>D.K. Sheena Christy, V. Masilamani, <u>D.G. Thomas</u>, Atulya K. Nagar, T. Robinson</i>

11:00-11:20	Adjunct Hexagonal Array Token Petri Nets and Hexagonal Picture Languages <i>T. Kamaraj, D. Lalitha, <u>D.G. Thomas</u>, T. Robinson, Atulya K. Nagar</i>
11:20-11:40	Iso-Array Rewriting P Systems with Context Free Iso-Array Rules <i>K. Bhunaveswari, T. Kalyani, <u>D.G. Thomas</u>, Atulya K. Nagar, T. Robinson</i>
11:40-12:30	Lunch
12:30-23:00	Social Event – Trip to Lednice and Banquet

## Friday, May 30th

09:00-10:00	Keynote Talk <i>Chair: D.G. Thomas</i>
09:00-10:00	<i>Keynote: <u>Shadia Rifai Habbal</u>, Miloslav Druckmüller, Huw Morgan</i> <i>Title: Role of Image Processing in Solar Coronal Research</i>
10:00-10:20	Coffee Break
10:20-12:20	Applications <i>Chair: Arindam Biswas</i>
10:20-10:40	Segmentation Techniques in X-ray Images for the Analysis of Mango Stem Boring Insects <i>Timothy Crocker, T. Robinson, Atulya K. Nagar</i>
10:40-11:00	Human Body Model Movement Support: Automatic Muscle Control Curves Computation <i>Jana Hájková, Josef Kohout</i>
11:00-11:20	Long-Bone Fracture Detection in Digital X-ray Images Based on Concavity Index <i>Oishila Bandyopadhyay, Arindam Biswas, Bhargab B. Bhattacharya</i>
11:20-11:40	Splitting of Overlapping Cells in Peripheral Blood Smear Images by Concavity Analysis <i>Feminna Sheeba, Robinson Thamburaj, Joy John Mammen, Atulya K. Nagar</i>
11:40-12:00	Boundary Extraction for Imperfectly Segmented Nuclei in Breast Histopathology Images – A Convex Edge Grouping Approach <i>Maqlin Paramanandam, T. Robinson, Marie Theresa Manipadam, Atulya K. Nagar</i>
12:00-12:20	A Noise Adaptive Fuzzy Equalization Method with Variable Neighborhood for Processing of High Dynamic Range Images in Solar Corona Research <i>Miloslav Druckmüller, Hana Druckmüllerová</i>
12:20-12:30	Closing
12:30-13:30	Lunch

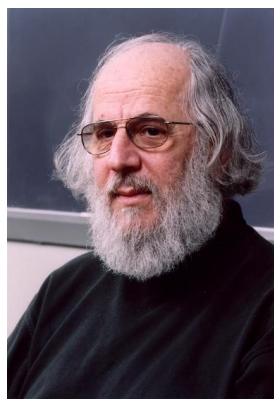
## Keynote Speakers

**Prof. Gabor T. Herman**

**Distinguished Professor**

**Graduate Center, The City University of New York, New York, NY, USA**

***Wednesday, May 28, 2014, 9:00-10:00***



### **Biosketch:**

Professor Herman received a B.S. and M.S. in Mathematics from the University of London, an M.S. in Electrical Engineering from the University of California at Berkeley, and Ph.D. in mathematics from the University of London. He is a pioneer in the field of computerized tomography (an important medical diagnostic procedure) and the author of several books and well over one hundred articles including several classic works in their fields. Prof. Herman is recognized internationally for his major contributions to image processing and its medical applications. He was the leader of successful medical image-processing groups at SUNY Buffalo and at the University of Pennsylvania and has garnered multiple millions of dollars in research funding. His current interests include image processing in biological 3D electron microscopy and in X-ray crystallography of materials, as well as various aspects of discrete tomography.

Prof. Herman is a highly accomplished scientist of international distinction and has been awarded honorary degrees from the universities of Haifa in Israel, Szeged in Hungary, and Linköping in Sweden. Prior to coming to The Graduate Center, he was Hewlett Packard Visiting Research Professor at the Mathematical Sciences Research Institute at the University of California-Berkeley.

**Abstract.** Many scientific, engineering and medical applications of image analysis use constrained optimization, with the constraints arising from the desire to produce a solution that is constraints-compatible. It is typically the case that a large number of solutions would be considered good enough from the point of view of being constraints-compatible. In such a case, an optimization criterion is introduced that helps us to distinguish the “better” constraints-compatible solutions. The superiorization methodology is a recently-developed heuristic approach to constrained optimization. The underlying idea is that in many applications there exist computationally-efficient iterative algorithms that produce solutions that are constraints-compatible. Often the algorithm is perturbation resilient in the sense that, even if certain kinds of changes are made at the end of each iterative step, the algorithm still produces a constraints-compatible solution. This property is exploited in superiorization by using such perturbations to steer the algorithm to a solution that is not only constraints-compatible, but is also desirable according to a specified optimization criterion. The approach is very general, it is applicable to many iterative procedures and optimization criteria. Most importantly, superiorization is a totally automatic procedure that turns an iterative algorithm into its superiorized version. This, and its practical consequences in various application areas, have been investigated for a variety of constrained optimization tasks.

**Valentin E. Brimkov**

**Professor**

**Buffalo State College, State University of New York, Buffalo, NY, USA**

**Thursday, May 29, 2014, 9:00-10:00**



**Biosketch:**

Professor Brimkov has made contributions to several research fields of applied mathematics and theoretical computer science such as discrete geometry, combinatorial optimization, image analysis, combinatorial pattern matching, design and analysis of algorithms, and complexity theory. He has authored or coauthored over a hundred of peer-reviewed research papers, and has edited or co-edited a number of books. He has chaired or co-chaired a number of international conferences and symposia.

Professor Brimkov has been awarded the Wilkes Award of the British Computer Society for 2005, the President's Award for Excellence in Research, Scholarship and Creativity of SUNY Buffalo State College for 2009, and the SUNY Chancellor's Award for Scholarship and Creative Activities for 2012. In 2009 he has been elected as an Honorable Guest Professor of Shizuoka University (Hamamatsu, Japan).

**Abstract.** In this talk he will discuss on parallel computation approach to two-dimensional combinatorial pattern matching. The latter features numerous applications in pattern recognition, low level image processing, computer vision and, more recently, multimedia. After introducing some basic notions and concepts and recalling related key facts, he briefly discusses the basic steps of a parallel algorithm design, illustrating them by author's results on the problem of detecting all two-dimensional repetitions in a two-dimensional array.

**Shadia Rifai Habbal**

**Professor**

**University of Hawaii, Honolulu, HI, USA**

**Friday, May 30, 2014, 9:00-10:00**



**Biosketch:**

Professor Shadia Habbal has adopted a synergistic approach to research throughout her scientific career by complementing modeling with observations of the solar corona and the heliosphere. Her scientific output is almost equally weighted between observations, data analysis and modeling. With over 100 publications in refereed journals, she has explored the role of magneto-hydrodynamic waves in the heating of the corona and the acceleration of the solar wind. She has also embarked on explorations of the source regions of the solar wind. Using both ground-based (visible and radio) and space-based (visible and ultraviolet) observations, she has explored the behavior of heavy ions in the solar corona, which, although a minority constituent of the solar wind, seem, at present, to hold most of the clues to the processes that heat the corona and accelerate the solar wind.

Her early efforts at leading an eclipse expedition to India in 1995, have led to the establishment of a small international group of "solar wind sherpas" as she has nicknamed her group, with a record number of discoveries from observations of five eclipses between 2001 and 2010. In addition to an active research career, she has been involved in teaching at the graduate and undergraduate level, as well as advising and overseeing the theses of four PhD students.

She has also been an active member of the solar and heliospheric community at large. She has served on a number of advisory panels for NASA as well as in the UK when she was a chaired professor at the University of Wales in Aberystwyth. She also served as one of three editors for the Journal of Geophysical Research – Space Physics. She led the organization of two international conferences, and played a key role in the organization of meetings of the Solar Physics Division of the American Astronomical Society for which she is the current Chair. She is currently on the faculty at the Institute for Astronomy of the University of Hawaii, where she also serves as Faculty Chair.

**Abstract.** The wealth of information regarding the structure and distribution of magnetic fields and plasmas embedded in images of the solar corona taken in the visible wavelength range and/or the extreme ultraviolet (EUV), covers several orders of magnitude in brightness, in the radial and azimuthal directions. As such, they present serious visualization challenges. These can only be revealed with the use of image processing tools. This presentation will focus on results from two recently developed approaches: (1) The Adaptive Circular High-pass Filter, ACHF, and the Normalized Radial Gradient Filter, NRGF, which are ideal for limb observations of the corona made in the visible wavelength range during total solar eclipses or with coronagraphs. (2) The Noise Adaptive Fuzzy Equalization (NAFE) and the multi-scale Gaussian normalization process (MGN), suitable for the visualization of fine structures in EUV images. These methods yield artifact-free images and uncover details that are hidden in the original unprocessed images. Such details have led to the discovery of new features that are essential for exploring the dynamics and thermodynamics of structures in the solar corona.