# Cooperative Research Workshop

## Space and Time Extremely High Performance Algorithms and Models for Image Analysis

SUNY Fredonia, USA
Buffalo State College, USA
Shizuoka University, Japan

**Time: 10:00~ on January 29h (Wed), 2014**

**Place: Research Institute of Electronics (Meeting Room, 2nd Floor of RIE)**

### Opening

*Kamen Kanev, Graduate School of Informatics, Shizuoka University, Japan*

### Cooperative Research Projects at RIE: Greeting Address

*Professor Vygantas Mizeikis, Representative of the Research Institute of Electronics, Shizuoka University, Japan*

### Digital Geometry Algorithms and Models for Advanced Imaging Devices

*Reneta Barneva, SUNY Fredonia, USA*

Dr. Reneta Barneva is a professor and chair of the Department of Computer and Information Sciences, State University of New York at Fredonia. Her interests span in several areas of applied and theoretical computer science, such as digital geometry, design and analysis of algorithms, computer graphics, multimedia, and computational biology. She is a recipient of several national and international awards among which Wilkes Award of the British Computer Society, SUNY Chancellor's Award for Scholarship and Creative Activities, and Kasling Award – the most prestigious SUNY Fredonia research distinction. She also served as a vice-chair of the professional organization IAPR TC-18 "Discrete Geometry." Dr. Barneva has published more than 80 refereed papers and has co-edited ten books. She has chaired or served on the program committee of a number of conferences and workshops. In particular, she was a general chair of the International Symposium on Computational Modeling of Objects Presented in Images: Fundamentals, Methods, and Applications (ComplMAGE'10; Buffalo, New York), a program chair of the 13th International Workshop on Combinatorial Image Analysis (IWCIA'09), Mexico and publishing chair of IWCIA'14, Brno, Czech Republic.

Digital geometry emerged as an independent discipline in the second half of the last century. It deals with geometric properties of digital objects and is developed with the ambitious goal to provide rigorous theoretical foundations for devising new advanced approaches and algorithms for various problems of visual computing. Different aspects of digital geometry have been addressed in the literature. This talk will focus on the presentation of the most important digital geometry concepts and algorithms. It will provide a brief survey on historical background, technological issues, nowadays challenges of the modern information society, important algorithmic results and applications, with a focus on the project team concerned with space and time algorithm efficiency.

### Complexity and Approximability Issues in Image Analysis

*Valentin Brimkov, Buffalo State College, USA*

Dr. Valentin Brimkov is a professor in the Mathematics Department of SUNY Buffalo State College. He 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. Dr. Brimkov has been awarded the Wilkes Award of the British Computer Society for 2005, 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 recent years image analysis has become a research field of exceptional significance, due to its relevance to real life problems in important societal and governmental sectors, such as medicine, defense, and security. The explicit purpose of the present talk is to suggest a number of strategic objectives for theoretical research, with an emphasis on the combinatorial approach in image analysis. Most of the proposed objectives relate to the need to make the theoretical foundations of combinatorial image analysis better integrated within a number of well-established subjects of theoretical computer science and discrete applied mathematics, such as the theory of algorithms and problem complexity, combinatorial optimization and polyhedral combinatorics, integer and linear programming, and computational geometry. Strong relations to the joint research project on space and time efficiency of algorithms will be exhibited as well.

### Multi-resolution Encoding in Advanced Vision and Image Information Processing

*Kamen Kanev, Graduate School of Informatics, Shizuoka University, Japan*

Dr. Kamen Kanev is a professor in the Graduate School of Informatics and the Graduate School of Science and Technology, Shizuoka University, Japan. His main research interests are in interactive computer graphics, vision information processing, and user interfaces and surface-based interactions. He is involved in a number of research initiatives, international collaborative efforts, and cooperative research projects with partners from Canada, USA, Italy, Spain, Ireland, Sweden, Bulgaria, Ukraine, and others. He has co-chaired and served on the program committees of many international conferences and workshops and has authored and coauthored more than 100 scientific journal and conference papers and patents. Dr. Kanev is a member of the IEEE, the Association of Computing Machinery (ACM), and the Asia-Pacific Society for Computers in Education (APSCE).

Spatial localization with mobile devices is becoming increasingly important both for humans and mobile agents. This presentation focuses on specialized distance-flexible multi-resolution codes for reliable position and orientation tracking of digitally-enhanced physical objects and for localization and navigation in augmented environments. Efficient surface encoding is achieved through a layered self-similar fractal structure with gradually increasing information density limited only by the physical properties of the code carrier.

## ROUND TABLE

### Possibilities for Joint Research Collaboration and Student Exchange between the State University of New York and Shizuoka University

Moderator: *Reneta Barneva, SUNY Fredonia, USA*

The Research Institute of Electronics at Shizuoka University has been actively collaborating since 2008 with professors from the State University of New York (SUNY) in the framework of the Cooperative Research Projects (CRP). In particular, Profs. Barneva and Brimkov, the CRP leader and a member of the team from SUNY, have visited Shizuoka University several times. Dr. Barneva was an invited speaker at the Fifteenth International Conference on Humans and Computers. Professor Kamen Kanev from Shizuoka University has visited SUNY Buffalo State and SUNY Fredonia three times and has given presentations to faculty and students. A student from SUNY Fredonia, Kaori Sagawa decided to continue her graduate studies in Shizuoka University after the presentation of Prof. Kanev.

Prof. Barneva will present the SUNY structure, introduce SUNY Fredonia and SUNY Buffalo State campuses, their departments, programs, and facilities, and outline possibilities for joint research and collaboration. Opportunities for exchange of faculty and students and possibilities for establishing formal agreements between departments of the two universities will be discussed. After the presentation, all interested participants will have the chance to ask questions and discuss opportunities for establishing contacts with prospective research partners at SUNY.