Boguslaw Obara

BioImage Informatics

Oxford e-Research Centre
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Research interests

My interdisciplinary research focuses on advancing the state of the art in development and application of new image analysis and processing technologies aimed at a better understanding of the complex biological processes which occur at the cellular and sub-cellular level. My work includes analyzing, processing and understanding the biological images obtained by confocal, scanning laser, atomic force, differential interface contrast, optical and polarized microscopy.
For more information, please visit: http://boguslawobara.net/

Research experience

- development and application of image analysis and processing in biology, medicine, material science, geosciences and monument conservation,
- microscopy and imaging,
- design and development of image databases,
- software programming and website application programming.

Education

2001–2007 **PhD in Computer Science**, *AGH University of Science and Technology*, Krakow, Poland.

1996–2001 **MSc in Physics**, *Jagiellonian University*, Krakow, Poland.

Appointments

2009–2012 **Postdoctoral Researcher**, *Oxford e-Research Centre and Oxford Centre for Integrative Systems Biology, University of Oxford*, Oxford, UK.

2007–2009 **Postdoctoral Researcher**, *Center for BioImage Informatics and Vision Research Laboratory, Electrical and Computer Engineering, University of California*, Santa Barbara, USA.

2002–2003 **Research Assistant**, *Computer Vision Laboratory, ETH*, Zurich, Switzerland.

2000–2007 **Research Assistant**, *Polish Academy of Sciences*, Krakow, Poland.

Short research trainings

2011 **Microscopy**, *Nikon Instruments*, London, UK.

2005 **Microscopy**, *Basel University*, Basel, Switzerland.

2005,2006 **Image Analysis and Processing**, *Centre National de la Recherche Scientifique*, Grenoble, France.

2005,2006 **Image Analysis and Processing**, *Academy of Sciences of the Czech Republic*, Ostrava, Czech Republic.

Selected presentations

2011 **Analysis and Understanding of Fungal Tip Growth**, *European Conference on Mathematical and Theoretical Biology*, Krakow, Poland.

2010 **Tracing Curvilinear Structures in Live Microscopy Images**, *The British Machine Vision Association*, London, UK.

2010 **Advanced Computational Image Analysis in Systems Biology**, *The 4th Annual BBSRC Systems Biology Grant Holders Workshop*, Edinburgh, UK.

2009 **Image Analysis and Processing for Systems Biology**, *National Institutes of Health (NIH)*, Bethesda, MD, USA.

2009 **High-Throughput High-Resolution Image Analysis of The Trypanosome Cell Cycle**, *Oxford Centre for Integrative Systems Biology, University of Oxford*, Oxford, UK.

2009 **Bio-Image Informatics in Systems Biology**, *Department of Biochemistry, University of Oxford*, Oxford, UK.

2008 **Bio-Image Informatics**, *Veeco Instruments Inc*, Santa Barbara, CA, USA.

2008 **Shape Matching**, *Center for BioImage Informatics, University of California*, Santa Barbara, CA, USA.

2007 **3D Morphometry of Ascidian Notochord Cells**, *Center for BioImage Informatics, University of California*, Santa Barbara, CA, USA.

2005 **Image Analysis and Processing in Geoscience**, *Impact of the Human Activity on the Geological Environment EUROCK*, Brno, Czech Republic.

2005 **Zapracovani Obrazu a Vizualizace Dat**, *Academy of Sciences of the Czech Republic*, Ostrava, Czech Republic.

2004 **Image Analysis and Processing in Medicine**, *Imaging, Image Processing in Industrial Information Technology - Methods and Applications*, Warsaw, Poland.

Contributions to teaching and student support

2011 **Biomedical Images and Signals - Analysis and Applications**, *Life Sciences Interface, Systems Biology, Systems Approaches to Biomedical Science Industrial Doctoral Training Centres, University of Oxford, University of Oxford*, Oxford, UK.

2011 **Introduction to Image Processing**, *Life Sciences Interface, Systems Biology, Systems Approaches to Biomedical Science Industrial Doctoral Training Centres, University of Oxford, University of Oxford*, Oxford, UK.

2010 **Image Analysis and Processing for Mathematical, Physical and Life Sciences Module**, *Computing Laboratory, University of Oxford*, Oxford, UK.

2009,2010 **Biomedical Image Processing Module**, *Life Sciences Interface, Systems Biology, Systems Approaches to Biomedical Science Industrial Doctoral Training Centres, University of Oxford*, Oxford, UK.

2010 **Biophysics Practical Module: Single Particle Tracking From Microscopy Data**, *Life Sciences Interface, Systems Biology, Systems Approaches to Biomedical Science Industrial Doctoral Training Centres, University of Oxford*, Oxford, UK.

2011– **Sameer Sengupta - BioImage Informatics for BRCA1 and metastatic breast cancer**, *University of Oxford*, Oxford, UK, (with Dr D. Vaux).

2010– **Georg Hochberg - BioImage Informatics for Microbial Biology**, *University of Oxford*, Oxford, UK, (with Dr M. Fricker).

2007–2008 **Jae Hyeok Choi - Ascidian Notochord Cell Segmentation Using Network Snakes**, *University of California*, Santa Barbara, USA, (with Prof. B.S. Manjunath).

2007 **Mar-Iam Nieves (Polytechnic University of Puerto Rico) and Sadot Banuet (California State University of San Bernardino) - UCSB Research Fellowship**, *University of California*, Santa Barbara, USA, (with Prof. B.S. Manjunath).

2006–2008 **Marek Blaszk - Time Estimation Capacity vs. Personality in Humans**, *Institute of Applied Psychology, Jagiellonian University*, Krakow, Poland, (with Prof. R. Przewlocki).

Awards & Grants & Funding

2006–2007 **Junior Fulbright Advanced Research Grant**, *American Fulbright Commission*, Santa Barbara, CA, USA, [USD 12.000].

2006 **Scholarships for Young Scientists**, *KAZATO Foundation*, Sapporo, Japan, [JPY 110.000].

2006 **IMC16 Students Registration Support Scholarships**, *The Organizing Committee*, Sapporo, Japan, [JPY 14.000].

2006 **Conference Scholarship**, *European Geosciences Union*, Vienna, Austria, [EUR 370].

2006 **Research Grant for Young Scientists**, *Carl Zeiss*, Poznan, Poland, [PLN 1.000].

2005 **Conference Scholarship for Young Scientist**, *Foundation For Polish Science*, Warsaw, Poland, [PLN 1.400].

2004 **The Best Research Work In SMRI**, *Director of SMRI*, Krakow, Poland, [PLN 1.000].

Review of journals/conferences/grants

- IEEE Transactions on Pattern Analysis and Machine Intelligence.
- IEEE Transactions on Image Processing.
- Bioinformatics.
- Image and Vision Computing.
- Journal of Mathematical Imaging and Vision.
- International Journal of Applied Mathematics and Computer Science.
- International Journal of Computer Assisted Radiology and Surgery.
- Computers in Biology and Medicine.
- Computers & Geosciences Journal.
- International Journal of Rock Mechanics and Mining Sciences.
- Independent Nondestructive Testing and Evaluation International Journal.
- 15th European Signal Processing Conference, 2007.
- 5th IEEE International Symposium on Biomedical Imaging, 2008.
- The Programme Innovative Economy, European Commission, 2008, 2009
- The European Regional Development Fund, European Commission, 2010.

Member

2010– **Oxford University Consulting**.

2010– **Oxford Biomedical Imaging Network**.

2009– **Oxford Integrative Quantitative BioSciences Network**.

2005– **Association for Image Processing**.

2005– **International Society for Rock Mechanic**.

2002– **Institute of Electrical and Electronics Engineers (IEEE)**.

Personal development

2009 **Owning Your Future**, *Oxford Learning Institute*, University of Oxford, UK.

2009 **Academic Consulting**, *Isis Innovation Limited*, Oxford University Consulting, UK.

Language competencies

Polish	**native**
English	**fluent**
Russian	**passive**

Computer skills

Operating Systems	UNIX (Linux, IBM, Sun), Windows (DOS through 7), MacOS	Programming	Matlab, Java, C#, C++, C, Visual Basic, FORTRAN
Web Development	XHTML, XML, CSS, JavaScript, PHP, Python	Databases	MySQL, SQL

Referees

Prof. David Gavaghan, Computing Laboratory, University of Oxford, Parks Road, Oxford OX1 3QD, UK, Tel: +44 1865 273838, E-mail: david.gavaghan@comlab.ox.ac.uk
Dr Vicente Grau, Institute of Biomedical Engineering, University of Oxford, Headington, Oxford OX3 7DQ, UK, Tel: +44 1865 617673, E-mail: vicente.grau@oerc.ox.ac.uk
Dr Mark Fricker, Department of Plant Sciences, University of Oxford, South Parks Road, Oxford OX1 3RB, UK, Tel: +44 1865 275015, E-mail: mark.fricker@plants.ox.ac.uk
Prof. B. S. Manjunath, Center for Bio-image Informatics, Electrical and Computer Engineering Department, University of California, Santa Barbara, CA 93106, USA, Tel: +1 805 8937112, E-mail: manj@ece.ucsb.edu
Prof. William Smith, Department of Molecular, Cell and Developmental Biology, University of California, Santa Barbara, CA 93106, USA, Tel: +1 805 8937698, E-mail: w_smith@lifesci.ucsb.edu
Prof. Ryszard Tadeusiewicz, Laboratory of Bio-Cybernetics, Institute of Automatic Control, Systems Engineering and Telecommunications, AGH University of Science and Technology, Al. Mickiewicza 30, 30-059 Krakow, Poland, Tel: +48 12 6341568, E-mail: rtad@agh.edu.pl
Prof. Rafal Kozubski, Institute of Physics, Jagiellonian University, Ul. Reymonta 4, 30-059 Krakow, Poland, Tel: +48 12 6635716, E-mail: rafal.kozubski@uj.edu.pl

Publications

In Preparation

Boguslaw Obara, Dmitry Fedorov, Chris D. Banna, Kristian Kvilekval, Adrienne H. K. Roeder, Steven K. Fisher, Elliot M. Meyerowitz, and B. S. Manjunath. "Web-based system for automated detection of cell nuclei in 3D CLS microscopy imagery". In: (2011)

Submitted

Boguslaw Obara, Mark Fricker, David Gavaghan, and Vicente Grau. "Contrast-independent curvilinear structure detection in biomedical images". In: *IEEE Transactions on Image Processing* (2011)

Boguslaw Obara, Alexander Lichius, Nick Read, Vicente Grau, and Mark Fricker. "Visualisation and quantitative analysis of hyphal tip dynamics". In: *Botanical Microscopy*. Wageningen, Netherlands, 2011

Boguslaw Obara, Vicente Grau, and Mark Fricker. "Contrast-independent curvilinear edge and junction detection in biomedical networks". In: *Botanical Microscopy*. Wageningen, Netherlands, 2011

Boguslaw Obara, Mark Fricker, Alexander Lichius, Nick Read, David Gavaghan, and Vicente Grau. "Analysis and understanding of fungal tip growth". In: *European Conference on Mathematical and Theoretical Biology*. Krakow, Poland, 2011

In Press

Boguslaw Obara, Michael Veeman, Jae Hyeok Choi, William Smith, and B. S. Manjunath. "Segmentation of ascidian notochord cells in DIC timelapse images". In: *Microscopy Research and Technique* (2010). doi: 10.1002/jemt.20950

Journal Articles

Boguslaw Obara, Alena Kožusníková, and Jiri Scucka. "Automatic identification of microcracks observed on microscopic images of coarse-grained sandstone". In: *International Journal of Rock Mechanics and Mining Sciences* 48.4 (2011), pp. 681–686

Diego Piedrahita, Israel Hernandez, Alejandro Lopez-Tobon, Diego Alzate, Frank LaFerla, Beverly Davidson, Dmitry Fedorov, Boguslaw Obara, B. S. Manjunath, Kenneth Kosik, Gallego-Gomez Juan Carlos, and Cardona-Gomez Gloria Patricia. "Silencing of CDK5 reduces neurofibrillary tangles in transgenic Alzheimers mice". In: *The Journal of Neuroscience* 30.42 (2010), pp. 13966–13976

Adrienne H. K. Roeder, Vijay Chickarmane, Alexandre Cunha, Boguslaw Obara, B. S. Manjunath, and Elliot M. Meyerowitz. "Variability in the control of cell division underlies sepal epidermal patterning in Arabidopsis thaliana". In: *PLoS Biology* 8.5 (2010), e1000367

Kris Kvilekval, Dmitry Fedorov, Boguslaw Obara, Ambuj K. Singh, and B. S. Manjunath. "Bisque: A Platform for Bioimage Analysis and Management". In: *Bioinformatics* 26.4 (2010), pp. 544–552

Elisa Drelie Gelasca, Boguslaw Obara, Dmitry Fedorov, Kris Kvilekval, and B. S. Manjunath. "A biosegmentation benchmark for evaluation of bioimage analysis methods". In: *BMC Bioinformatics* 10.1 (2009), p. 368

Arkadiusz Chworos and Boguslaw Obara. "Automatic analysis of conjugated polyelectrolytes - DNA interactions based on sequential analysis of AFM imaging". In: *IEEE Transactions on Nanotechnology* 8.4 (2009), pp. 457–462

Tomasz Stepien and Boguslaw Obara. "The cycloid and skeletonization methods for morphometric analysis of fetal brain vessels". In: *Folia Neuropathologica* 46.4 (2008), pp. 278–285

Tomasz Stepien, Boguslaw Obara, T. Wierzba-Bobrowicz, and P. Kreczmanski. "Morphometric methods in analysis of vessels in cortical grey matter". In: *Folia Neuropathologica* 45.4 (2007), p. 264

Boguslaw Obara. "A new algorithm using image colour system transformation for rock grain segmentation". In: *Mineralogy and Petrology* 91.3-4 (2007), pp. 271–285

Boguslaw Obara and Alena Kožusníková. "Utilisation of the image analysis method for the detection of the morphological anisotropy of calcite grains in marble". In: *Computational Geosciences* 11.4 (2007), pp. 275–281

Boguslaw Obara. "Identification of transcrystalline microcracks observed in microscope images of dolomite structure using image analysis methods based on linear structuring element processing". In: *Computers & Geosciences* 33.2 (2007), pp. 151–158

Boguslaw Obara. "An image processing algorithm for the reversed transformation of rotated microscope images". In: *Computers & Geosciences* 33.7 (2007), pp. 853–859

Jacek Sobczyk, Boguslaw Obara, Piotr Fraczek, and Joanna Sobczyk. "Application of the image analysis in non-invasive research of historical objects". In: *Acta Universitatis Nicolai Copernici* XXXVI (2007). in Polish, pp. 163–167

Jacek Sobczyk, Boguslaw Obara, Piotr Fraczek, and Joanna Sobczyk. "Application of the image analysis in non-invasive research of historical objects. Selected examples". In: *Protection of Monuments* 2 (2006). in Polish, pp. 69–78

Boguslaw Obara. "Application of the image analysis method to the detection of transcrystalline microcracks observed in microscope images of dolomite and granite structures". In: *Archives of Mining Sciences* 50.4 (2005), pp. 537–551

Conference Proceedings

Boguslaw Obara, Steve Kelly, Bill Wickstead, Keith Gull, David Gavaghan, and Vicente Grau. "High-throughput high-resolution image analysis of the trypanosome cell cycle". In: *Microscopic Image Analysis with Applications in Biology*. www.miaab.org. Bethesda, MD, USA, 2009

Elisa Drelie Gelasca, Jiyun Byun, Boguslaw Obara, and B. S. Manjunath. "Evaluation and benchmark for biological image segmentation". In: *IEEE International Conference on Image Processing*. San Diego, CA, USA: IEEE Signal Processing Society, 2008, pp. 1816–1819

Jean François Gamond, Mariusz Młynarczuk, and Boguslaw Obara. "Une adaptation du traitement d'images numériques de lames minces à l'analyse de la structure d'un grès à divers stades de la compression". In: *18ème Congrès Français de Mécanique*. in French, http://hdl.handle.net/2042/15466. Grenoble, France, 2007

Boguslaw Obara. "Application of the image analysis method to the detection of transcrystalline microcracks observed in microscope images of rock structures". In: *Geophysical Research Abstracts*. Vol. 8. Vienna, Austria, 2006, p. 16

Boguslaw Obara. "Identification of transcrystalline microcracks observed in polarizing microscope images of rock structures using image analysis". In: *The 16th International Microscopy Congress*. Sapporo, Japan, 2006, p. 960

Boguslaw Obara and R. T. Niżankowski. "Application of image analysis methods to vascular blood flow analysis in angiographic imaging". In: *Image Processing in Industrial Information Technology - Methods and Applications*. Warszawa, Poland, 2004, pp. 76–78

Conference Abstracts

Boguslaw Obara, Mark Fricker, David Gavaghan, and Vicente Grau. "Contrast-independent curvilinear structure detection in biomedical images". In: *Oxford Biomedical Imaging Festival*. Oxford, UK, 2010

Boguslaw Obara, David Gavaghan, and Vicente Grau. "Tracing curvilinear structures in live microscopy images". In: *Microscopy Image Analysis for Biomedical Applications, The British Machine Vision Association*. London, UK, 2010

Boguslaw Obara, Mark Fricker, Steve Kelly, Bill Wickstead, Vicente Grau, Keith Gull, and David Gavaghan. "Advanced computational image analysis in systems biology". In: *The 4th Annual BBSRC Systems Biology Grant Holders' Workshop*. Edinburgh, UK, 2010

Boguslaw Obara, Mark Fricker, Steve Kelly, Bill Wickstead, Vicente Grau, Keith Gull, and David Gavaghan. "Bioimage informatics for systems biology". In: *Quantitative Imaging for Systems Biology*. Oxford, UK, 2009

Boguslaw Obara, Steve Kelly, Bill Wickstead, Vicente Grau, Keith Gull, and David Gavaghan. "Image analysis and processing for systems biology". In: *Interdisciplinary Research Forum on Integrated Quantitative BioSciences*. Oxford, UK, 2009

Adrienne H. K. Roeder, Vijay Chickarmane, Alexandre Cunha, Boguslaw Obara, Tigran Bacarian, Aida Sun, B. S. Manjunath, Eric Mjolsness, and Elliot M. Meyerowitz. "Timing of cell division determines the relative cell size pattern in Arabidopsis". In: *20th International Conference on Arabidopsis Research*. Edinburgh, Scotland, UK, 2009

Elisa Drelie Gelasca, Jiyun Byun, Boguslaw Obara, and B. S. Manjunath. "Benchmark for evaluating biological image analysis tools". In: *Workshop on Bio-Image Informatics: Biological Imaging, Computer Vision and Data Mining*. Santa Barbara, CA, USA, 2008

Michael Veeman, Boguslaw Obara, Jae Hyeok Choi, William Smith, and B. S. Manjunath. "Morphomic analysis of a simple chordate". In: *Workshop on Bio-Image Informatics: Biological Imaging, Computer Vision and Data Mining*. Santa Barbara, CA, USA, 2008

Boguslaw Obara, Jiyun Byun, Dmitry Fedorov, and B. S. Manjunath. "Automatic nuclei detection and dataflow in Bisquik system". In: *Workshop on Bio-Image Informatics: Biological Imaging, Computer Vision and Data Mining*. Santa Barbara, CA, USA, 2008

Boguslaw Obara and Arkadiusz Chworos. "Understanding of conjugated polyelectrolytes - DNA interactions based on sequential analysis of AFM imaging". In: *Workshop on Bio-Image Informatics: Biological Imaging, Computer Vision and Data Mining*. Santa Barbara, CA, USA, 2008

Boguslaw Obara, Michael Veeman, William Smith, and B. S. Manjunath. "Segmentation and analysis of notochord cells in 3D microscope data". In: *Workshop on Bio-Image Informatics: Biological Imaging, Computer Vision and Data Mining*. Santa Barbara, CA, USA, 2008

Kris Kvilekval, Dmitry Fedorov, Boguslaw Obara, Brian Ruttenberg, B. S. Manjunath, and Ambuj K. Singh. "Bisque: Bio-Image Semantic Query User Environment". In: *Workshop on Bio-Image Informatics: Biological Imaging, Computer Vision and Data Mining*. Santa Barbara, CA, USA, 2008

Boguslaw Obara and Arkadiusz Chworos. "Understanding of conjugated polyelectrolytes - DNA interactions based on sequential analysis of AFM imaging". In: *RNA in Biology, Bioengineering and Nanotechnology*. Minneapolis, MN, USA, 2007

Michael Veeman, Yuki Nakatani, Carolyn Hendrickson, Boguslaw Obara, Vivian Ericson, Clarissa Lin, B. S. Manjunath, and William Smith. "Chongmague reveals an essential role for laminin-mediated boundary formation in chordate convergence and extension movements". In: *Biology in Motion*. Evian Royal Ermitage, Evian-les-Bains, France, 2007

J. Sobczyk, B. Obara, P. Fraczek, and J. Sobczyk. "Application of computer image analysis to non-destructive research of historic objects". In: *The International Council of Museums - Conservation Committee, UPHOLSTERY*. in Polish. Krakow, Poland, 2007

Books

Boguslaw Obara. "The research and development of computer image analysis algorithms for the identification of discontinuity classes observed on microscopic images of rock structures". in Polish. PhD in Computer Science. Krakow, Poland: Laboratory of Biocybernetics, Institute of Automatics, AGH University of Science and Technology, 2007

Boguslaw Obara. "Resistometric measurement stand". in Polish. MSc in Physics. Krakow, Poland: Institute of Empirical Computer Physics at Department of Physics, Jagiellonian University, 2001

Book Chapters

Boguslaw Obara. "Developing of the image segmentation methods to rock microcracks analysis". In: *Impact of the Human Activity on the Geological Environment*. Impact of the Human Activity on the Geological Environment. London, UK: A.A. Balkema Publishers, 2005, pp. 429–432

Boguslaw Obara and Mariusz Młynarczuk. "Application of image analysis methods to automatize the process of description of transcrystalline cracks geometry in dolomite from Redziny". In: *Geotechnique and Special Architectural Engineering*. Geotechnique and Special Architectural Engineering. Krakow, Poland: AGH, 2004, pp. 319–329

Technical Reports

Elisa Drelie Gelasca, Jiyun Byun, Boguslaw Obara, and B. S. Manjunath. *Evaluation and benchmark for Biological image segmentation*. Tech. rep. University of California Santa Barbara, CA, USA, 2008

Other Publications

Boguslaw Obara. "Resistometric measurement stand". In: *Measurement Automation and Monitoring* 10 (2005). in Polish, pp. 17–19

Boguslaw Obara and Mariusz Młynarczuk. "Application of image analysis methods to detection of microcracks on microscope images of rock structures". In: *Transactions of the SMRI* 5 (2004). in Polish, pp. 155–161

Mariusz Młynarczuk and Boguslaw Obara. "Automatic segmentation of transcrystalline microcracks in dolomite from Redziny - an algorithm and it's application". In: *Transactions of the SMRI* 5 (2003). in Polish, pp. 399–409

Boguslaw Obara. "An algorithm for automatic analysis of cracks in granite from Strzelin". In: *Transactions of the SMRI* 5 (2003). in Polish, pp. 155–159

Boguslaw Obara. "Grains segmentation based on image local homogeneity and RGB do CIELab colour system transformation". In: *Transactions of the SMRI* 5 (2003). in Polish, pp. 389–399

Boguslaw Obara and Jacek Sobczyk. "Evaluation of compatibility of the quantitative estimations of rock fractures morphology done by means of two methods: laser profilometry and stereological analysis". In: *Transactions of the SMRI* 4 (2002). in Polish, pp. 77–86

Boguslaw Obara. "Computer system to support stereological analysis of microscope rock structures". In: *Transactions of the SMRI* 3 (2001). in Polish, pp. 331–337