ILYA RAVKIN

EXPERIENCE:

October 2005 – Present ***Consultant*** ilya@ravkin.net, www.ravkin.net

- Digital pathology, high-content cell analysis, image analysis, computer vision, machine learning, deep learning, data science and statistical data analysis, microscopy automation.

Recent projects:

- Deep learning algorithms for segmentation of images of cell nuclei.
- Analysis of multiplexed fluorescence images in Digital Pathology. Cell segmentation, measurement and classification using mathematical morphology and machine learning. Removal of autofluorescence. Determination of cell phenotypes and their interaction. Consulted for two market leaders in Digital Pathology.
- Object and face detection and tracking in security videos with emphasis on knives and guns.
- Analysis software for image-based droplet digital PCR, including segmentation of images into millions of droplets and measurement of fluorescence in them.
- Image analysis and data extraction for highly multiplexed DNA/RNA tests in detection chambers, including analyzing and registering sequences of images of probe arrays from real time PCR and DNA hybridization and subsequent statistical and model-based analysis of amplification curves.
- Software for slide scanner for Digital Pathology: identification of scan areas from the whole-slide image, focusing and focus map for scan areas, flat-field correction, global contrast and color enhancement, stitching of high-resolution images.
- Software for decoding and fluorescence measurement of BioCode particles in Array Tape format.
- Software for finding fetal cells in maternal blood prepared in suspension using custom illumination in transmitted light and multispectral fluorescence.
- Software device drivers for micro-manager microscope control system for thermo-cycler, filter wheel, focus drive, scanning stage, LED light source.
- Software for image analysis and feature extraction of fluorescent lateral flow immunoassays.

July 2003 – September 2005 Vitra Bioscience, Inc. (formerly Virtual Arrays, Inc.) www.vitrabio.com

Chief Technology Officer, Director

- Responsible for Vitra Bioscience's intellectual property development.
- Responsible for development of Vitra Bioscience's core multiplexing platform technologies.
- Responsible for development of image and data analysis capabilities – core competencies of Vitra Bioscience.

Feb. 2001 – July 2003 Virtual Arrays, Inc.

VP Engineering, Director

- Responsible for Virtual Arrays' intellectual property development.
- Responsible for development of Virtual Arrays' platform based on carriers and other multiplexing methods.
- Responsible for development of image acquisition system for microtiter plates.
- Responsible for development of image analysis and data reduction/visualization software for the CellCard™ platform.

Feb. 2000 – Jan.2001 Virtual Arrays, Inc.

Founder, VP Engineering (40% of time)

- Development and patenting of Virtual Arrays' inventions.

- Proof of concept of encoded carrier technology.
- Business development and fundraising.

Feb. 2000 – Jan.2001 Scimagix, Inc., Redwood Shores, California.

Senior Imaging Scientist (60% of time)

- Development of Image Informatics methodology.
- Design of the image analysis aspects of the Scientific Image Management System (SIMS).
- Development of image analysis algorithms of 2-dimensional protein gels electrophoresis images.
- Engineering support of Business Development.

1996-2000 Applied Imaging Corporation, Santa Clara, California.

Engineering Manager

Responsible for instrumentation development for the Cancer (Micrometastasis Detection) and Prenatal (Fetal Cells in Maternal Blood) Diagnostics lines of products, including: system specifications, overall system design, solving engineering and interdisciplinary problems, management of the engineering team and of the outside consultants, tight interaction with the in-house and outside biological research groups, prototyping of new applications for business development, compliance with FDA regulations for system and software development, engineering support for 510K submissions to FDA, representation of projects at conferences, in scientific publications and patenting, deployment at clinical trial sites and continuing support.

1989-1996 Applied Imaging Corporation, Santa Clara, California.

Project leader

- Design and implementation of automated microscopy system for screening of blood specimens for prenatal detection of genetic abnormalities in fetuses, based on DNA probes.
- Design and implementation of computer-based video densitometer LYNX for quantitation of various types of autoradiograms and fluorescent gels in Molecular Biology.
- Design and development of automated image acquisition and analysis system for reading DNA sequencing films SPEEDREADER.

1988-1989 Applied Imaging Corporation, Santa Clara, California.
Senior software engineer

- Development of karyotyping system GENEVISION for cytogenetic laboratories.

1982-1988 Dept. of Pathology. 1-st Medical School, St.Petersburg, Russia.
Head of research group

- Image analysis of histological and histochemical cell and tissue samples.
- Specialized languages for image analysis.
- Control and analysis software for scanning optical microscope-photometer.
- Specifications and software model of an image processing computer.
- Computer and statistical services and support for physicians.

1975-1982 Computer Science Lab. 1-st Medical School, St.Petersburg, Russia.
Software engineer

- Statistical analysis in biomedical research.
- Mathematical models of cell proliferation.

EDUCATION:

1998 Training in FDA regulation of software development, Noblitt&Rueland, Irvine, CA
1978-1981 Ph.D. Computer Science, Electrical Engineering Institute, St.Petersburg, Russia
(Thesis: "Data and Image Analysis for Morphological Research in Biology")

1972-1975 M.S. Applied Mathematics, Electrical Engineering Institute, St.Petersburg, Russia
1969-1972 B.S. Computer Science, Electrical Engineering Institute, St.Petersburg, Russia

PROFESSIONAL:

- Member of Society on Imaging Science and Technology, International Society on Analytical Cytology, Microscopy Society of America, Society for Laboratory Automation and Screening.
- Have seven issued patents, over 20 pending patent applications, and over 20 publications.

RELEVANT SKILLS:

- Extensive knowledge of image analysis, especially of cell and tissue objects.
- Knowledge of computer vision, machine learning and deep learning.
- Programming in Python, MATLAB, C/C++, Visual Basic, VB.NET, LabVIEW, and other languages.
- Knowledge of data science and statistical data analysis.
- Knowledge of mechanical, control and programming aspects of motion control and robotics.
- Understanding of biomedical problems and terminology.
- Understanding of patenting rules, procedures and prosecution.

PERSONAL: Born in Russia in 1952, naturalized US citizen, married, 2 children.

SELECTED PUBLICATIONS AND PRESENTATIONS:

"Statistical properties of algorithms for analysis of cell images" – invited talk at IBC's Inaugural Conferece on High-Content Analysis, November 17-18, 2005, Washington DC.

Ilya Ravkin, Vladimir Temov "Comparison of several classes of algorithms for cytoplasm to nucleus translocation" – poster P02025 at the 11-th Annual Conference of the Society for Biomolecular Screening in 2005 (this poster won the Best Poster award in Imaging Technologies category)

Ilya Ravkin, Vladimir Temov, Aaron D. Nelson, Michael A. Zarowitz, Matthew Hoopes, Yuli Verhovsky, Gregory Ascue, Simon Goldbard, Oren Beske, Bhagyashree Bhagwat, Holly Marciniak "Multiplexed high-throughput image cytometry using encoded carriers", *Proc. SPIE* Vol. 5322, pp. 52-63, 2004 (Imaging, Manipulation, and Analysis of Biomolecules, Cells, and Tissues II; Dan V. Nicolau, Joerg Enderlein, Robert C. Leif, Daniel L. Farkas; Eds.)

Ilya Ravkin, Vladimir Temov, Aaron D. Nelson, Michael A. Zarowitz, Matthew Hoopes, Yuli Verhovsky, Gregory Ascue, Simon Goldbard, Oren Beske, Bhagyashree Bhagwat, Holly Marciniak "Multiplexed cell analysis on CellCards for drug discovery", *Proc. SPIE* Vol. 5328, pp. 18-29, 2004, (Microarrays and Combinatorial Techniques: Design, Fabrication, and Analysis II; Dan V. Nicolau, Ramesh Raghavachari; Eds.)

O. Beske, J. Guo, J. Li, D. Bassoni, K. Bland, H. Marciniak, M. Zarowitz, V. Temov, I. Ravkin, S. Goldbard "A novel encoded particle technology that enables simultaneous interrogation of multiple cell types", *J. Biomol. Screening*, 2004: 173-185.

Borgen, E., Naume, B., Nesland, J. M., Nowels, K. W., Pavlak, N., Ravkin, I. & Goldbard, S. "Use of Automated Microscopy for the Detection of Disseminated Tumor Cells in Bone Marrow Samples" *Cytometry,* v. 46, No. 4, pp. 215–221, 2001.

I. Ravkin, V. Temov, "Automatic counting of FISH spots in interphase cells for prenatal characterization of aneuploidies", *Proceedings of SPIE* (Advanced Techniques in Analytical Cytology III), Vol. 3604, pp. 208-217, 1999.

Irene M. de Graaf, Marja E. Jakobs, Nico J. Leschot, Ilya Ravkin, Simon Goldbard, Jan M. N. Hoovers "Enrichment, identification and analysis of fetal cells from maternal blood: evaluation of a prenatal diagnosis system", Prenatal Diagnosis, v. 19, No. 7, 1999, pp. 648-652.

I. Ravkin, V. Temov, "Automated microscopy system for detection and genetic characterization of fetal nucleated red blood cells on slides", *Proceedings of SPIE* (Optical Investigation of Cells In Vitro and In Vivo), v. 3260, pp. 180-191, 1998.

Jan C. Oosterwijk, Cecile F. H. M. Knepflé, Wilma E. Mesker, Hans Vrolijk, Willem C. R. Sloos, Hans Pattenier, Ilya Ravkin, Gert-Jan B. van Ommen, Humphrey H. H. Kanhai, and Hans J. Tanke "Strategies for Rare-Event Detection: An Approach for Automated Fetal Cell Detection in Maternal Blood", *Am. J. Hum. Genet. 63:1783–1792, 1998*

I. Ravkin, V. Temov “Bit representation techniques and image processing”, Applied Informatics, v.14, pp. 41-90, Finances and Statistics, Moscow, 1988 (in Russian)

PATENTS:

US 7,557,070 **-** Multiplexed cell analysis system

US 7,381,375 - Assay systems with adjustable fluid communication

US 7,338,773 - Multiplexed assays of cell migration

US 7,253,435 - Particles with light-polarizing codes

US 6,908,737 - Systems and methods of conducting multiplexed experiments

GB20020384777A - Multiplexed cell analysis system

US 6,633,662 - Identification of objects of interest using multiple illumination schemes and finding overlap of features in corresponding multiple images

US 5,254,845 - Automatic focusing system using focal length-changing element