Dr. Misha Pavel
Department of Electrical & Computer Engineering
Oregon Graduate Institute
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Jeffery Orchard
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CANADA

July 15, 2002

Dear Dr. Pavel,

I am interested in attaining a faculty position at OGI, and have already applied to the Department of Computer Science and Engineering. On Friday July 12th, I visited the CSE department and spoke with Wu-Chi Feng, Wu-Chang Feng, and David Maier. It was brought to my attention that a Department of Biomedical Engineering is being formed. After speaking with Xubo Song, I feel that this new department creates an excellent opportunity for me.

I am nearing the end of my Ph.D. in the School of Computing Science at Simon Fraser University, under the supervision of Dr. Stella Atkins. My specialty is medical image processing. I expect to have satisfied all of my degree requirements by December 2002, taking me a total of three years and four months from start to finish.

My Ph.D. thesis deals with motion detection and correction techniques for functional MRI. I designed an algorithm that increases the accuracy of alignment by combining two previously separate image-processing steps, incorporating their interdependence. This work is a creative departure from the standard, sequential processing paradigm, and introduces the idea of solving these coupled problems simultaneously.

A joint appointment between CSE and BME would be an exceptional environment for me to continue my research. Also, my knowledge of brain imaging and functional MRI are relevant to the Neuroradiology Division. I look forward to such collaboration opportunities at OHSU.

I am a confident person with a sense of humor and a genuine respect for others. I feel comfortable in leadership roles and am adaptable, creative, and ambitious: all qualities necessary to achieve success in research and teaching.

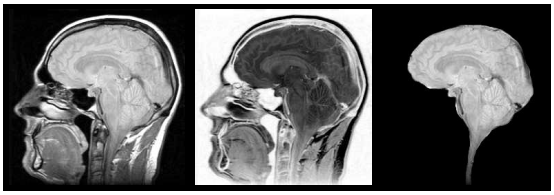
I have included my curriculum vitae, and would be happy to forward any further material upon request. I can be contacted at (604) 936-1489 or by e-mail at jjo@cs.sfu.ca.

Sincerely,

Jeff Orchard

Jeffery J. Orchard

Computer Scientist / Mathematician



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Education

Candidate for Doctor of Philosophy
- Computing Science (Medical Imaging)
- Simon Fraser University, Burnaby, BC
- Expected to complete December 2002

Master of Science
- Applied Mathematics (Dynamical Systems)
- University of British Columbia, Vancouver, BC
- Completed September 1996

Honors Co-op Bachelor of Mathematics
- Applied Mathematics
- University of Waterloo, Waterloo, Ontario
- Completed May 1994

Professional Development

- Medical Image Registration, SPIE Short Course (2002)
- Speed Reading, Vancouver School Board (2002)
- Presentation Skills Workshop, SFU (2001-2002)
- Texture Analysis in Medical Imaging, SPIE Short Course (2000)
- Time Management, Franklin (1997)
- Instructional Skills Workshop, UBC (1995)

Awards

- Graduate Fellowship, SFU (2001-2002)
- CSS/FAS Scholarship, SFU (2001)
- Best Poster Award, CSS, SFU (2001)
- Communication Award, BC ASI (2001)
- NSERC Postgraduate Scholarship (1999-2001)
- Graduate Scholarship, BC ASI (1999)
- Special Graduate Entrance Scholarship, SFU (1999)
- DOFASCO Work-Term Report Award (1991)
- Canada Scholarship (1989-1994)
- René Descartes Fellowship, Waterloo (1989-1994)

Activities

- Member, SPIE
- Member, International Society for Magnetic Resonance in Medicine
- Computer System Administrator, Medical Computing Lab, SFU (2001-2002)
- President, Computing Science Graduate Student Association, SFU (2000-2002)
- President, Triathlon Club, UBC (1995-1996)

Interests

- Completed the Ironman Canada Triathlon (1996)
- Computer graphics, playing guitar, electronic gadgets, maps and aerial photographs, human cognition, evolution

Key

ASI	Advanced Systems Institute
CSS	Center for Systems Science
SFU	Simon Fraser University
SPIE	International Society for Optical Engineering
UBC	University of British Columbia

Publications

- **J. Orchard**, C. Greif, G.H. Golub, M.S. Atkins, “Simultaneous Registration and Activation Detection in fMRI”, *Magnetic Resonance in Medicine* (submitted).
- **J. Orchard**, M.S. Atkins, "Theoretical Analysis of the Effect of fMRI Brain Activation on Motion Correction", *Proceedings of the International Society for Magnetic Resonance in Medicine 10* (one-page abstract, in press), (May 2002, Honolulu).
- **J. Orchard**, M.S. Atkins, "Improved Motion Correction Using AIR Iteratively", *Proceedings of the International Society for Magnetic Resonance in Medicine 10* (one-page abstract, in press), (May 2002, Honolulu).
- M.S. Atkins, **J. Orchard**, B. Law, M.K. Tory, "Robustness of the Brain Parenchymal Fraction for Measuring Brain Atrophy", *SPIE Conference on Medical Imaging* (in press), (Feb. 2002, San Diego).
- M.S. Atkins, K. Siu, B. Law, **J. Orchard**, W.L. Rosenbaum, "Difficulties of T1 Brain Image Segmentation", *SPIE Conference on Medical Imaging* (in press), (Feb. 2002, San Diego).
- M.S. Atkins, **J. Orchard**, "Evaluation of Brain Atrophy Measures", *IEEE Engineering in Medicine and Biology Society Conference*, (Oct. 2001, Istanbul).
- **J. Orchard**, T. Möller, "Accelerated Splatting using a 3D Adjacency Data Structure", *Graphics Interface Conference*, pp. 191-200, (June 2001, Ottawa).

Posters, Presentations and Others

- "Read My Mind: Visualizing Brain Activation using MRI", Poster, BC Advanced Systems Institute Exchange, March 13, 2001.
- "Real-Time fMRI Processing at BC's Children's Hospital", presented at the Functional Brain Imaging Symposium, SFU, Oct. 18, 2001.
- "Medical Computing in a Nutshell", presented to the Division of Industrial and Applied Physics, Univ. of Victoria, June 15, 2001.
- "The Amazing World of Fractal Image Compression", presented to the Univ. of Alberta Mathematics Dept., April 26, 1999, and to the Centre for Educational and Constructive Mathematics, SFU, April 7, 1999.
- "Dispelling Some Developmental Biology Magic", presented to the Univ. of Victoria Mathematics Dept., Dec. 7, 1998.
- My M.Sc. work is described in: Faraday Discussion no. 120, “Nonlinear Chemical Kinetics: Complex Dynamics and Spatiotemporal Patterns”, General discussion comment by L.G. Harrison, published by The Faraday Division, Royal Society of Chemistry, London, pp. 345-346, 2001.

Work Experience

Mathematics Instructor **Aug. 1997 – May 1999**
Okanagan University College, Kelowna, BC
- Instructed mathematics courses ranging from 1st to 3rd year level
- Courses instructed include Differential Equations, Real Analysis, Calculus, and Finite Math

Mathematics Consultant **Oct. 1997 – May 1999**
- Resolved a problem involving seismic remote sensing
- Verified financial projections involving annuities with interest and inflation
- Designed and coded Excel macros to supply statistical summaries of large data sets

Software Test Engineer **Jan. 1997 – Aug. 1997**
Hughes Aircraft of Canada Limited, Richmond, BC
- Designed and executed software tests for the Canadian Automated Air-Traffic System (CAATS)
- Performed mathematical analysis on flight paths

Research Assistant **April 1993 – Sept. 1994**
Atomic Energy of Canada Limited, Pinawa, Manitoba
- Investigated the validity of a reactor-modeling software package against test reactor experimental results
- Author of two internal AECL technical reports

Research Assistant **Sept. 1992 – Dec. 1992**
Defense and Civil Institute of Environmental Medicine, Downsview, Ontario
- Aided in analysis of physiological data
- Involved in research and development of integrated tactical life support systems for high-performance jet pilots

Research Assistant **Jan. 1992 – April 1992**
Atmospheric Environment Services, Downsview, Ontario
- Analyzed satellite images of sea ice
- Designed algorithms to extract texture measurements

Mission Analyst **Jan. 1990 – Aug. 1991**
Telesat, Ottawa, Ontario
- Member of Anik E1 mission team and several launch simulation teams
- Awarded for work report documenting a model to calculate the wobble angle of a spinning, mass-asymmetric satellite
- Implemented dynamical system model to simulate solar array deployment

Research Interests

Jeffery J. Orchard

My main research interest is image processing, particularly medical imaging. However, my curiosity includes many other intertwined branches.

I have a deep fascination with the fundamental nature of life. The theory of evolution and the interpretation of organisms as chemical machines form the foundation for my philosophy. My M.Sc. thesis involved a study of a system of reaction-diffusion **partial differential equations** designed to mimic, and possibly explain, the spontaneous emergence of vertebrae in developing salamander embryos. The research includes a bifurcation analysis, numerical study, and a computer simulation, and suggests an embryological experiment that could either refute or support the model for pattern self-organization.

After completing my M.Sc., I embarked on an implementation of an **artificial life** simulation that combines **neural networks** and **genetic algorithms** to demonstrate the emergence of purposeful behavior. This project was based on a paper published by Dr. Jeff Elman of the University of California, San Diego. Dr. Elman subsequently used my code as a classroom demonstration.

Apart from the projects mentioned above, image processing is the predominant theme throughout my work. After having studied dynamical systems under Dr. Ed Vrscay at the University of Waterloo, I became interested in **fractal image compression**, and successfully implemented a previously published algorithm. I decided to spread my enthusiasm for fractal image compression, and presented the project to the math departments at the University of Alberta and Simon Fraser University (before becoming a student there).

A project with a similar flavour to fractal image compression is image **photo-mosaics**, a way of composing a large image out of many smaller images. I designed and implemented my own photo-mosaic algorithm which I exhibited at the 2000 BC Advanced Systems Institute Exchange.

I published a paper with Dr. Torsten Möller on **direct volume rendering** for visualization of medical imaging data. The idea of the paper has been adopted and extended by Daniel Koch at the University of Waterloo for his M.Sc. thesis.

My Ph.D. research focuses on rigid-body **motion correction** and registration techniques in magnetic resonance imaging (MRI). In particular, I look for ways to improve the alignment of sequential volumes for functional MRI. Functional MRI processing usually includes motion detection, followed by the detection of activation, both of which are often posed as least squares minimizations. My thesis addresses a problem with this processing, as pointed out by Freire *et al.* (IPMI 2001, page 246-258). While registering a series of fMRI volumes, the intensity changes due to brain activation disrupt the least squares registration algorithm, and result in the erroneous detection of stimulus correlated motion. After “motion correction” is applied to the dataset, false-positive activation is often present near high-contrast edges.

I have developed a novel algorithm in collaboration with Dr. Gene Golub (Stanford) and Dr. Chen Greif that combines the motion-detection and activation-detection least squares problems into a single least squares problem. Hence, the effects of motion and activation can be solved for simultaneously. Furthermore, this algorithm is general and can be applied to other problems in which local signal variation confounds registration.

As part of my research in fMRI data processing, I enjoyed implementing a **near-real-time fMRI processing** system at British Columbia’s Children’s Hospital by integrating and optimizing existing software. To my knowledge, this is the first pediatric near-real-time fMRI processing implementation in Canada.

In the future, a number of other promising areas in image processing interest me. I particularly like the mathematical formulation and efficient implementation available in **level set methods**. I also see an under-abundance of **wavelet methods** in MRI processing. A fascinating keynote address given by Dr. Michael Unser at the 2002 SPIE International Symposium on Medical Imaging outlined the many links between wavelets and **splines**. I believe that these methods open the door to novel analyses and the development of new image processing algorithms. My solid background in applied mathematics, combined with my knowledge of medical imaging, form an explosive mix for research in these areas.

My father was an excellent high-school math teacher. From him, I inherited the gift of communication. My aptitude and love for teaching is an integral piece of my desire to be a university professor. Hence, I see teaching as an opportunity, not a burden.

Between the completion of my M.Sc. degree and the start of my Ph.D., I worked for two years as an instructor in the math department at the Okanagan University College (OUC) in Kelowna, British Columbia. A typical course load was three courses per semester, involving about 100 students in total. At one point, I was voted the most popular OUC instructor in a student initiated, on-line (albeit unscientific) poll.

I particularly enjoyed teaching first-year math to non-math majors. I have a demeanor that inspires my students to overcome their fear of the subject, and gain confidence as they learn. Subtle differences in the delivery of a lecture can have a very significant impact on its success. My style of teaching, based on genuineness and emotional contact, fosters respect between my students and me and creates a relaxed environment that encourages two-way communication. My experiences at OUC were very positive, and I look forward to the opportunity to teach again.

I believe that we are in an age of classroom reform. Preconceived notions of the "lecture" are not necessary conditions for learning. Through a number of workshops, I have honed my speaking performance to engage my audience no matter what the content of my message. Inhibition and fear of risk are not part of my teaching philosophy. Instead, I challenge myself to find innovative ways to evoke my students' natural curiosity.

I eagerly look forward to supervising graduate students. Mutual respect is of utmost importance, and my philosophy for graduate student supervision involves a bi-directional exchange of ideas. It is essential for a supervisor to believe in the student's inherent value, and allow that student the opportunity to exercise his or her own judgement as much as possible. I understand that the success or failure of a graduate student must ultimately rest on the student's shoulders. Some students may fail despite my best efforts to motivate them, while others will flourish with or without me. I envision my supervisory role as facilitating the development of research skills in the student, according to their goals and degree requirements.

One of my ultimate teaching goals is to become a public "scientific correspondent". In doing so, I see myself giving public seminars about science, or motivational science talks to high-school students. I welcome the opportunity to take part in outreach programs that serve to raise public interest in a fascinating field such as computer science. My gift for speaking is an exceptional asset to any academic department, and can be used in a multitude of ways.

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