Dorian Aur

DorianAur@gmail.com ; phone (650) 690-8956

Summary: I began my education in physics and mathematics, followed by training in automatic systems, specializing in artificial intelligence and control systems. I've taught different courses in artificial intelligence, computer controlled systems and software engineering. I returned to brain studies as a fellow in computational neuroscience at Western Ontario University then at Barrow Neurological Institute and at Stanford University. Using my previous expertise in signal processing, mathematics and dynamic systems, I have put together several new techniques to analyze biological neurons and brain rhythms. The issues were clear. Despite many advances in neuroscience, there has been no serious attempt to understand powerful computations performed in the brain to incorporate established physical laws and neuroscientific observations.

In spite of the popular acceptance of computational ideas, false hypotheses have generated more controversies than reliable explanations or predictions http://neuroelectrodynamics.blogspot.com/p/myths-about-brain.html http://neuroelectrodynamics.blogspot.com/p/from-spike-timing-dogma-to.html. Example: Predicting seizures using data recordings represents a computational problem. The prediction of seizures started twenty years ago, has generated very little progress and was perceived as a failure. Many scientists have failed to show consistent, reproducible results (-e.g. *Iasemidis at al., have shown that such prediction can be made one hour before seizure generation http://cnd.memphis.edu/mmyers/sdarticle.pdf however,* the existence of nonlinear behavior clearly limits our ability to provide accurate long term predictions http://www.sciencedirect.com/science/article/pii/S0165027011003335. The absence of reliable computational models has generated in this case confusion regarding the prediction outcome.

Every attached publication presents direct experimental results which may contradict theoretical hypotheses (see stereotyped spike, seizure generation). In all cases I have used the same data which have been previously analyzed at MIT, Stanford, Caltech...., and developed new methods. It seems, I have a gift in processing data recordings, interpret the experimental outcome and find the theoretical model which better explains the phenomenon.

Understanding the nature of information processing in the brain has powerful, far-reaching impact in neuroscience and neurology. Inspired by biomedical data analysis, recently, I have started to develop an interdisciplinary sub-field in system biology research (Neuroelectrodynamics). The new model of computation developed in the book provides interesting testable prediction which are commonly unavailable for spike timing theories. The entire temporal coding theory becomes a particular case of

computing by physical interaction (Aur, 2012; Aur et al., 2011). Importantly, this new computational framework provides interesting testable prediction with direct applications in biomedical research and neurotherapy (Epilepsy, Alzheimer, Parkinson). The method developed at Stanford http://otlportal.stanford.edu/techfinder/technology/ID=28515 can be extended to non-invasive treatment in other neurological disorders which can be seen as simple computational models.

PROFESSIONAL EXPERIENCE

2011 Postdoctoral Researcher, Dept. of Mathematics and Statistics, University of Victoria, Canada
2010 Postdoctoral Researcher, Comparative Medicine, Stanford University, Palo Alto, CA
2009- Postdoctoral Researcher, Barrow Neurological Institute, Phoenix AZ
2008 Algebra Instructor, Allan Hancock College, Santa Maria, CA
2003- 2007, Research Associate, Department of Clinical Neurological Sciences. University of Western Ontario, Canada
1997 -2002 Associate Professor (Computer Science), Bucharest AISTEDA University
1995 -1999 Senior Researcher (competitive examination), Defence Industry, Bucharest
1985 -1995 Researcher – Defence Industry, Bucharest (industry experience)

EDUCATION

1990-1995, Technical Academy Bucharest, Ph.D. Automatic Systems
1980-1985, Technical Academy Bucharest, B.S., Electrical Engineering and Computer Science

HONORS & AWARDS

Epilepsy Foundation Identification of Features for a Robust Detection of Preictal Phases, 2010,
Commercialization Award, Lawson Research - Method to Analyze the Treatment of Dyskinesia based on Neuronal Activity, March 2006

INVITED SPEAKER

1.Imaging Neuronal Spikes - Challenges for Brain Computations, Department of Bioengineering, April 2007, Arizona State University
2. Neuroelectrodynamics – A new Model of Computation, April 2009, IDSIA, Lugano, Italy

CURRENT and PREVIOUS RESEARCH

An interdisciplinary research that focuses on complex system interactions in the brain and biological systems

-***Stanford University***: (Epilepsy Research) **solved the problem of seizure prediction based on data recordings (unsolved in the last 20 years)**

- Using artificial intelligence methods and signal processing to understand the mechanism of epilepsy generation;
- Identification and detection of preictal phases, short time seizure prediction and effective close loop neurostimulation;
- New developed algorithms, implementation, and evaluation of nonlinear models and signal processing algorithms - innovative solutions to complex technical problems, electrical stimulation can provide the required regulation: http://www.sciencedirect.com/science/article/pii/S0165027011003335
- The method is useful for the diagnosis, treatment and understanding of mental disorders in addition to therapeutic stimulation in epilepsy;
- *Iasemidis at al., have shown that such prediction can be made half an hour before seizure generation http://cnd.memphis.edu/mmyers/sdarticle.pdf many took for granted his work-- Completely untrue, since experimental data and theoretical model show that the seizure can be accurately predicted only few minutes in advance,* http://otlportal.stanford.edu/techfinder/technology/ID=28515.

Barrow Neurological Institute, Phoenix, AZ: (Neuroengineering) **solved the problem of visual object recognition using intracranial recordings.**

- New developed algorithms to understand neuronal processes that mediate visual perception based on intracranial recordings from medial temporal lobe (MTL) of epileptic patients.
- Electrical patterns within action potentials (APs) discriminate better different categories of visual object recognition. http://dx.doi.org/10.1038/npre.2010.5345.2 ; this observation solves a difficult problem of information integration and the nature of neural code, http://www.sciencedirect.com/science/article/pii/S0165027012001021?v=s5

University of Western Ontario*, (Movement Disorder, Parkinson)* **solved the important problem of behavioral semantics**

- *Contrary to common belief action potentials are not stereotype events, they do not have digital uniformity* http://neuroelectrodynamics.blogspot.com/p/spike-directivity.html
- http://dx.doi.org./10.1016/j.neulet.2006.09.091;
- http://dx.doi.org/10.1007/s11063-006-9029-2 ;
- http://dx.doi.org/10.1007/s11063-006-6266-3;
- http://dx.doi.org./10.1016/j.jneumeth.2006.05.003;
- http://dx.doi.org/10.1038/npre.2007.61.1

- Understanding clinical and theoretical aspects involved in movement disorders, basal ganglia Function, Parkinson, dyskinesia representation, learning, behavior and cognition based on electrophysiological recordings
- Understanding several features that characterize dyskinesia
- All can be used as a platform for new medical therapeutics;
- Advanced signal, image processing and pattern recognition applications;
- Build mathematical and computational models;
- Developed software interface between brains and computers using MATLAB

PREVIOUS RESEARCH EXPERIENCE

Researcher –Defence Industry, Bucharest, Romania 1989 -1999

-Artificial intelligence methods applied to design adaptive and robust control systems for small aircrafts, intelligent robotics and autonomous agents, intelligent systems for speech and visual pattern recognition.
-Experience in medical applications.
-Build mathematical and statistical methods, expertise in statistical decision theory, mathematical pattern recognition
-Develop a framework for noise reduction in speech and image processing, interpolation, noise reduction, estimation theory, knowledge of the human motor control, hearing and visual system
Knowledge and design of analog and digital electronics, communications and control; Software programming, including C and assembler programming for embedded systems

GRADUATE RESEARCH - Technical Academy Bucharest, Romania

Thesis: Design of adaptive and robust control systems.

Develop algorithms for adaptive control systems, noise reduction, estimation theory;

UNDERGRADUATE RESEARCH - Technical Academy Bucharest , Romania

Thesis: Design of adaptive control systems

Selected Refereed Journal Publications

NEW 1. **Aur D,** A Comparative Analysis of Integrating Visual Information in Local Neuronal Ensembles, Journal of Neuroscience Methods, 2012 in print
http://www.sciencedirect.com/science/article/pii/S0165027012001021?v=s5

NEW 2. **Aur D,** Jog MS, Poznanski, R, Computing by physical interaction in neurons, Journal of integrative Neuroscience, vol. 10, Issue: 4, 2011, pp. 413-422 http://www.ncbi.nlm.nih.gov/pubmed/22262533

NEW 3. **Aur D**., From Neuroelectrodynamics to Thinking Machines, DOI: 10.1007/s12559-011-9106-3, Cognitive Computation, 2011, http://www.springerlink.com/content/x1l7388475323758/

NEW 4. **Aur D.**, Understanding the Physical Mechanism of Transition to Epileptic Seizures , Journal of Neuroscience Methods, Volume 200, Issue 1, 30 August 2011, Pages 80-85 http://www.sciencedirect.com/science/article/pii/S0165027011003335

5. Jog M.S and **Aur D.**, A Theoretical Information Processing-Based Approach to Basal Ganglia Function, Advances in Behavioral Biology, 2009, Volume 58, Part 2, 211-222, DOI: 10.1007/978-1-4419-0340-2_17

6.**Aur D,** Jog MS, Neuronal spatial learning, Neural Processing Letters, Vol 25, no 1, pp 31,47 2007, http://dx.doi.org/10.1007/s11063-006-9029-2

7.**Aur D.,** Jog, MS, Building Spike Representation in Tetrodes, Journal of Neuroscience Methods Volume 157, Issue 2 , 30 October 2006, Pages 364-373 , http://dx.doi.org./10.1016/j.jneumeth.2006.05.003

8. **Aur, D.**, Connolly, C.I., and Jog, M.S, (2007), Computing Information in Neuronal Spikes, Neural Processing Letters,Volume 23 , Issue 2,Pages: 183 - 199 , 2006; http://dx.doi.org/10.1007/s11063-006-6266-3

9.**Aur, D.**, Connolly, C.I., and Jog, M.S, (2005), Computing spike directivity with tetrodes, Journal of Neuroscience Methods, Volume 149, Issue 1, 30, pp. 57-63; http://dx.doi.org./10.1016/j.jneumeth.2005.05.006

10. Jog MS, **Aur, D.**, Connolly CI, Is there a Tipping Point in Neuronal Ensembles during Learning? Neuroscience Letters Volume 412, Issue1 ,22, January 2007, Pages 39-44; http://dx.doi.org./10.1016/j.neulet.2006.09.091

11. Balan R., **Aur D.**, An on-line robust stabilizer Journal of Control Guidance and Dynamics, vol. 18, no.3, pp 642-644, 1995

Peer-reviewed Conference Proceedings

NEW 1. Aur D., Jog MS, Why the NeuroElectroDynamic model is Better than Spike timing Models, IJCNN 2011

2 Jog MS, Aur D., A New Approach towards Neuromodulation, URSI Proceedings 2008, http:ursi-test.intec.ugent.be/files/URSIGA08/papers/K04ap1.pdf

3. Aur D, Neural evolution toward conscious states, ANNIE 2002, St Louis, Missouri, November 10-13, 2002

4. Aur D.A new approach of intelligent control System Design, ANNIE 2001, St Louis, Missouri USA November 4-7, 2001

5. Aur D. Improving E-Commerce Security using Speaker Identification, E-COMM-LINE 2000, Bucharest, September 4-5, 2000.

6. Aur D.,Intelligent E-business webpage development, E-COMM-LINE 2001, Bucharest, September 4-5, 2001

7. Aur D. Adaptive Agents Knowledge Transfer, E-COMM-LINE 2001, Bucharest, September 4-5, 2001
8. Aur D, Ghioca T.Artificial Neural Networks with Cooperative Bifurcation Neurons, ICSPAT'99 November 1-4 ,1999, Orlando, U.S.A.
9. Aur D, Ghioca T.,Intelligent speech processing for speaker identification, Proceedings of the IASTED International Conference Signal and Image Processing October 18-21, 1999, Nassau, Bahamas.
10. Aur D, Ghioca T.Neural Network Formation for Cooperative Bifurcation Neurons, Proceedings of the Third International Conference on Cognitive and Neural Systems, May 2, 1999 Boston, U.S.A.
11. Aur D., Culea G.From Emotion to Intelligent Control, EXPERSYS'98, November 16-17, 1998, Virginia, USA
12.Aur D., Intelligent control of dynamic processes. Proceedings of Scientific Symposium AISTEDA May15-16, 1998
13.Aur D, Ghioca T.Neural Modeling of Speech Processing in Human Auditory System SIP'98, October 29-30, 1998, Las Vegas, USA
14. Aur D, Culea GArtificial Neural Networks Design for Synthetic Brains, ICSPAT'98 September 13-16 1998, Toronto, Canada.
15. Aur D, Culea G.Toward Intelligent Biocontrol of Aircraft's International Conference on Artificial Intelligence Application EXPERSYS'97, Sunderland, UK, October, 1997.
16.Aur D. Endes A., System for psychophysical testing, Proceedings of Scientific Symposium for Applied informatics, CCPIACT Bucharest, 2-3 September 1997.
17.Aur D Culea G. Neural Bioadaptive Control System for Aircraft's, 8-th International Conference on Signal Processing Application & Technology, San Diego, USA, 1997.
18.Aur D. Fuzzy Adaptive Controller for Aircraft's 4-th International Workshop Fuzzy-Neuro Systems'97 Soest, Germany, March 12-14, 1997.
19.Aur D.Methods for psychophysics characteristics evaluation. Proceedings of Scientific Symposium XIX-th ICITA, October 1997
20. Aur D., Adaptive Aircraft Control Synthesis based on Artificial Intelligence Techniques, Proceedings of the Eighth International Conference on Artificial Intelligence Application EXPERSYS'96, Paris, October 21- 22 1996.
21. Bajenaru O, Aur D. An Approach for Modeling Auditory System presented to IFAC Conference Modeling and Control in Biomedical Systems 23-26 March 1997, University of Warwick, UK
22. Bajenaru O, Aur D Robot Motion System toward Human Nervous Motor Control Proceedings of the Robotics Towards 2000, 27-th International Symposium on Industrial Robotics, October 1996, Milan Italy.
23. Aur D, Albu A., Independent Speaker Identification for Noise Environment Proceedings of the 4-th UK/Australian International Symposium on DSP for Communications Systems, September 23-27, 1996.
24. Aur D, Bajenaru O, Modeling Human Nervous Motor Control System Proceedings of the World Congress on Neural Networks'96 September, San Diego, U.S.A
25.Culea G, Aur D, Schnakovsky ANeural Adaptive Control with Accumulated Information for Aircraft's Proceedings of the Sixth International Conference on Signal

Processing Applications and Technology, Boston, October 24-26, vol.2, pp.1444-1448, 1995.
26.Culea G, Aur D., Structures of Dates Distributed processing in the CIM Systems 5-th International Symposium Automation and Metrology challenge and chance" Maribor, Slovenia, October 27-29, 1994.
27. Aur D., Aspects regarding synthesis of adaptive control systems with self-tuning filter. Proceedings of Scientific Symposium XXIII-th ICITA, May 29, 1991.
28.Aur D.Stability analyses of nonlinear saturation control systems. Proceedings of Scientific Symposium Technical Academy Bucharest, November 10-14,1990.
29.Aur DMethod for measuring gyroscopic moment. Proceedings of Scientific Symposium XX-th, ICITA,1989.
30.Aur D.Some aspects regarding decision tests for adaptive control system synthesis National Proceedings of Symposium in Radiolocation Bucharest, May 26-27, 1989.
31 Aur D., Issues regarding robustness of adaptive control systems. Proceedings of Scientific Symposium AVIA INCREST, November 15-16, 1988
32.Aur D., Digital methods for measuring control coefficients. Proceedings of Scientific Symposium Technical Academy Bucharest 1987.
33.Aur D., Some aspects regarding adaptive control system synthesis. Proceedings of Scientific Symposium "AVIA 1986" INCREST, Bucharest
34.Aur D., Identification and parameter estimation for photosensitive registration in airplane flight. Scientific Symposium Timisoara, May, 1985.

Non-Peer reviewed abstracts

1. NEW **Aur D**., From spikes to seizures, BaMBA 6 - BaMBA Symposia, Stanford University. Saturday, Nov , 2010
2. NEW **Aur D**, Bower, M, Why are Seizures Difficult to Predict? SFN Meeting Nov 13-17, 2010
3. NEW **Aur D.**, Nonlinear Dynamics of Epileptic Seizures, SINTN Neuroscience Research Conference - October 10 - 12
4. Neuroelectrodynamics –Understanding the brain language, IBAGS Meeting June 20-24, 2010
5.Is spike time coding an ill posed problem? D Aur , C. I Connolly and M. S Jog, (637.5/EEE2) SFN Meeting Nov 3-7, 2007
6. Entropy and information in neuronal spikes - a thermodynamic approach SFN Jog, M.S , Aur, D., and Connolly, SFN Meeting Nov 3-7, 2007 (752.3/HHH30)
7. Spike Directivity, Learning and Behavioral Meaning, D Aur and M. S Jog, P-010, IBAGS, 9th Triennial Meeting of the International Basal Ganglia Society,2nd – 6th, September 2007, Hotel Zuiderduin, Egmond aan Zee, the Netherlands
8. Spike timing – an incomplete description of neural code, D Aur , C. I Connolly and M. S Jog, BMC Neuroscience 2007, 8(Suppl 2):P149 doi:10.1186/1471-2202-8-S2- P149
9. Spike pattern representation within tetrodes Aur, D., Connolly, C.I., and Jog, M.S, SFN Meeting, Atlanta, GA 101.19/PP57, 12-18 October 2006
10. Learning and neuronal tipping point, Jog, M.S , Aur, D., and Connolly, C.I SFN, Meeting, Atlanta, GA 101.23/PP61, 12-18 October 2006

11. The tetrode mirror effect in computing spike directivity, Aur, D., Connolly, C.I.,and Jog, M.S, SFN Meeting Washington DC, 687.19. 2005, 12-16 November 2005.
12. Computing information within neuronal spikes Jog, M.S, Aur, D., and Connolly, C.I.SFN Meeting, Washington DC, 687.20. 2005,12-16 November 2005.

Non-Peer reviewed papers

NEW 1. Aur D, Understanding the Transition to Seizure, available from Nature Precedings http://hdl.handle.net/10101/npre.2010.5398.1

NEW 2. Aur D, Where is the 'Jennifer Aniston neuron'? , available from Nature Precedings, http://dx.doi.org/10.1038/npre.2010.5345.2

3.D Aur, and M Jog. Beyond Spike Timing Theory – Thermodynamics of Neuronal Computation. Available from Nature Precedings http://hdl.handle.net/10101/npre.2007.1254.1 2007

4.D. Aur, and M Jog, Reading the Neural Code: What do Spikes Mean for Behavior?. Available from Nature Precedings <http://dx.doi.org/10.1038/npre.2007.61.1, 2007

5.D. Aur, I. Aron, Neural control systems for aircrafts. ATM Journal nr.1, pp 50-62, 1994 (in Romanian)

6.D.Aur, I.Aron, Self-tuning of a synthesized reference, ATM Journal nr.2, pp 80-88, 1991 (in Romanian)

7. D. Aur, I. Aron, Discrete adaptive system synthesis. ATM Journal nr.3, pp 34-42, 1991(in Romanian)

Books

1. NEW Dorian Aur and Mandar Jog - Neuroelectrodynamics- Understanding The Brain Language , IOS Press 2010, http://dx.doi.org/10.3233/978-1-60750-473-3-i

2. Neural Modeling in Artificial Intelligence, Editor Tabacaru, Bacau, 1997 (book in Romanian)

3. Lectures in Artificial Intelligence an Introduction, Department of Computer Science, University of AISTEDA, Bucharest (in Romanian)

4. Lectures in Computer controlled systems, Department of Computer Science, University of AISTEDA, Bucharest (in Romanian)

5. Lectures in Object Oriented Programming, Department of Computer Science, AISTEDA, University, Bucharest (in Romanian)

Research Support

Principal Investigator

1. Identification of Features for a Robust Detection of Preictal Phases, Epilepsy Foundation, 2010, PI $ 45000

Co-investigator for grants in neuroscience:

2. Multidisciplinary approach to understanding the mechanism of dyskinesia in Parkinson's disease application, The Human Frontier Science Program ,February, 2005

3. Network level changes in the basal ganglia in a rodent model of dyskinesia, Parkinson Society Canada, march 2006
4. Neuronal and network activity changes in the prefrontal cortex in a rodent model of schizophrenia - Ontario Mental Health Foundation, September, 2006

Grants Held in Engineering:

1.Research regarding SCB simulations. Grant SCB, B.T. RRC, 1999

2. Research report regarding PUMA/SOCAT simulator. Grant SPS RRC, 1999

3. Research regarding navigation devices .Grant DNS, B.T. RRC, 1999

4. Research report regarding security mechanisms in control systems. Grant SPS RRC, 1998

5. Research report regarding dynamic system synthesis, Grant SD, B.T. RRC, nr.423, 1994

6. Equipment for measuring dynamic characteristics. Grant: 94B BT, RRC nr. 383, 1993.

7. Digital filter for equilibration machine Grant: FDME, BIDT RRC, 1992

8. Support for equilibration machine. Grant: SMED, BIDT RRC, 1991

9.Study regarding system structure and main technical characteristics for AFP-TCA control systems, 10. Grant: AFP.TCA, BIDT RRC, nr.53001,1992.

11. Research report regarding flight control at constant altitude. Grant nr.11791, BIDT, RRC, 1992.

12. Data acquisition system for moment measurement. Grant nr.92-1 /A-7, 1992

13. Control System Synthesis for small airplane, Grant nr.91-1 /A-7, 1991.

14. Equipment for dynamic equilibration. Grant nr.92-1 /A-7, 1990

15. Installation for computation of control coefficients. Grant: IMCC, BIDT RRC, 1989

16. Aileron design for small airplane Grant: AS, BIDT, RRC 1988

17. Equipment for testing electromechanical flying devices, Grant EVDE, RRC,1988

18. Installation for gyroscope testing. Grant IVG, BIDT, RRC 1987

19.Automatic system for position control. Grant: SAP, BIDT, RRC 1986

20. Installation for aileron testing and measurement. Grant: IVE, BIDT, RRC, 1985

21. Equipment for measuring control coefficients Grant: EPVCC, BIDT, RRC,1985

Patents

1. System and Method for Seizure Prediction and Treatment of Epileptic Seizures, Nov, 2010- (http://otlportal.stanford.edu/techfinder/technology/ID=28515).

2.Method to Analyze the Treatment of Dyskinesia based on Neuronal Activity, London Health Science, provisory patent 2006

3.Method and device for speaker identification. BI nr.115767 O.S.I.M. nr. 96-02245

4.Method and device for measuring and plotting the characteristics of flight devices. BI nr.100552, O.S.I.M. nr.132131

5.Method and system for parameter identification and physical implementation of control flight systems, BI nr.100552, O.S.I.M. nr.139099
6.Magneto- electric system for target tracing. BI nr.103616 O.S.I.M. nr.140784
7.Digital filter for a dynamic machine. BI nr.103616 O.S.I.M. nr.144382
8.Method and installation for resonant frequency determination. BI nr.103616 O.S.I.M. nr.143480

Affiliations :
Member of the Society for Neuroscience since 2004
Member of International Neural Network Society since 2010
Member of the Romanian Federation of Bioengineering since 2000
Member of Stanford Center for Mind Brain and Computation, 2010

REVIEWER FOR:

Journal of Neuroscience Methods (active reviewer since 2006, more than 15 papers)

Neural processing Letters (over 10 papers)

TEACHING EXPERIENCE

Spring 2008 – Algebra Instructor, Allan Hancock College, Santa Maria, CA
1998-2002: Associate Professor, Computer Science Department, AISTEDA University Bucharest , Course: Artificial Intelligence ;Modeling and Simulation; Computer Controlled Systems, Computer Information Systems, Object Oriented Programming, Economic Forecast , Introduction to Computers ; experienced at mentoring and developing a highly functional team, strategic thinking, risk management, and tactical thinking

Distance Education and online Publication through formal posting.

http://neuroelectrodynamics.blogspot.com/
http://neuroelectrodynamics.blogspot.com/p/temporal-coding-realistic-model-of.html
http://neuroelectrodynamics.blogspot.com/p/spike-directivity.html
http://neuroelectrodynamics.blogspot.com/p/cracking-neural-code.html
http://neuroelectrodynamics.blogspot.com/p/concept-cells.html
http://neuroelectrodynamics.blogspot.com/p/computing-by-interaction.html
http://neuroelectrodynamics.blogspot.com/p/from-spike-timing-dogma-to.html
http://neuroelectrodynamics.blogspot.com/p/cognition-and-consciousness.html
http://neuroelectrodynamics.blogspot.com/p/einstein-quotes-adapted.html
http://neuroelectrodynamics.blogspot.com/p/myths-about-brain.html
http://neuronline.sfn.org/SFN/SFN/Home/Default.aspx (requires membership)
www.linkedin.com/groups/Computational-Neuroscience-1376707 (requires

membership)
http://www.linkedin.com/pub/dorian-aur/24/783/763

Experience in...

Bio-inspired intelligence, Cognitive agents and learning agents – Human computer interaction – Brain computation principles -Learning and behavior - Machine Learning - E-Learning- Neural Networks – Genetic an evolutionary algorithms - Artificial Intelligence Knowledge Discovery -Computational Statistics .- Large Datasets - Forecasting &Predictive Modeling - Clustering - Supervised Learning - Training Sets - Density Estimation - Decision Trees - Logistic Regression - Discriminate Analysis - Time Series - Stochastic Processes

Software, environments and languages such as...
Matlab, Java, C/C++/C#, VB, Php,ASP, JSP, Servlets, JDBC, SAS - Sybase - Large Datasets -Oracle - SQL - Splus - R - JMP - Perl - Excel - Access - UNIX - - Visio – PowerPoint- Windows - Unix (Solaris, Linux)
Main author of the developed software:
Software modules for fast data acquisition
SpikeSort: package to assign recorded spikes to corresponding units.
SpikeInf: package to estimate information transfer in local neural networks for recorded spikes.
SpikeDir: package to assign spike directivity for recorded spikes.
SpikeBuilt: package to build 3D spike images using ICA and Newton- Raphson algorithm.

Languages Skills: English and French

1. PAUL BUCKMASTER DVM, PhD, Dept. Comparative Medicine, Stanford University, Email: psb@stanford.edu, Tel (650) 498-4774
2.RADU BALAN, Associate Professor University of Maryland, (301) 405 1217 or 301 405 5492,College Park, MD 20742 Email: rvbalan@cscamm.umd.edu
3.Dr. IFTIMIA NICUSOR Physical Sciences, Inc. Andover, MA 01810 Principal Scientist, (978) 689-8192 Email: iftimia@psicorp.com
4. MANDAR S JOG, MD, Department of Clinical Neurological Sciences, University of Western Ontario, CANADA, (519) 663−3814, Email: Mandar.Jog@LHSC.ON.CA
Since both experimental observations and theoretical models are new, few other scientists are familiar with this development and understand the future impact:
5. Professor Brian J Ford University of Cambridge Biology, +44 (0)1733 350 888 brianjford@virginmedia.com
6. Professor Stuart Hameroff, University of Arizona, Department of Anesthesiology , phone:520-626-5605, hameroff@email.arizona.edu
7. Professor Jack Tuszynski University of Alberta, Division of Experimental Oncology

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January 17, 2010

To Whom It May Concern:

I am happy to recommend Dorian Aur, PhD, for an instructor position at your institution. Dorian worked as a postdoctoral fellow in my laboratory from January 1, 2010 till December 31, 2011. His background includes undergraduate training in electrical engineering and a PhD in computer science. For the next eight years he worked in Romania in the military and then in academia where he developed algorithms for controlling aircraft flight, speech recognition, and visual pattern recognition. In 2003, he moved to Canada and joined Mandar Jog's laboratory in the Department of Clinical Neurological Sciences at the University of Western Ontario. Mandar, who trained with Matthew Wilson at MIT, uses unit recording techniques to study the role of the striatum in movement disorders. Dorian learned to analyze unit data and developed an innovative analysis method called "spike directivity," which extracts additional information from unit data beyond firing rate and synchrony. Dorian was keen to evaluate spike directivity of granule cells in epileptic pilocarpine-treated rats as they experienced spontaneous seizures, which was the principal aim of his successful fellowship application funded by the Epilepsy Foundation under which he worked on last year.

Dorian brought considerable expertise and innovation in data analysis to the laboratory. He attempted to use unit and local field potential data obtained from the dentate gyrus in epileptic pilocarpine-treated rats to predict spontaneous seizures. Seizure prediction is a new area for my laboratory and a challenging topic. He demonstrated creativity and focus and made progress. As an instructor, I am confident that Dorian would work hard, teach enthusiastically, and apply his considerable intellect to important questions. Thank you for considering Dorian's application.

Sincerely,

Paul Buckmaster

Paul Buckmaster, DVM, PhD
Associate Professor

November 3, 2011

www.brianjford.com

REFERENCE FOR DR DORIAN AUR

Dorian Aur has a freshness and novelty of approach that is rooted in diligence, high productivity and—above all—devoted hard work at the topic in hand. He studied computational neuroscience as a university fellow at Western Ontario University then at the Barrow Neurological Institute and subsequently at Stanford University.

The functioning of the brain remains extremely poorly understood. Much of the work currently in vogue follows established and conventional routes. That is not what we need—the entire area requires a root-and-branch reappraisal and Dorian Aur has already introduced a number of brilliant new approaches.

I am sure many universities would say so too, though it is hard to know how one measures this crucial criterion. Dorian is a remarkable man: clear-sighted, open to freshness and novelty, and hugely inventive. There are too many camp-followers in neurological research, whereas Dorian Aur is a gifted innovator.

Few people are studying what happens within the neuron (though we are buried in information on what happens between them, at the synapses). The lack of progress is due to a lack of experimental rationale, so Dr Aur has stepped over the current methodologies and introduced new approaches. His work on semantic structures in the brain is crucial, and nobody else has managed to develop suitable strategies.

He has published key papers in the neurological journals and last year (with Mandar Jog) he published a major book in the field entitled *Neuroelectrodynamics—Understanding Brain Language* (IOS Press, 2010).

Dorian Aur would be bring a fresh approach and, in my view, would be a great asset to a fine University. Of the scientists in his field whose work I know, he stands head and shoulders above the great majority of them.

I would have no hesitation in offering him this post,

Yours sincerely

Brian J Ford
Gonville & Caius, Cambridge University.
Fellow and Member of Court, Cardiff University.

BJF:jms

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http:\\mdc.lhsc.on.ca

December 20, 2007

To Whom It May Concern,

I have had the opportunity to work with Dr. Dorian Aur over the past three years. Let me begin by saying that this three year experience has been one of the most intellectually and professionally rewarding relationships that I have had in a long time. Dr. Aur is an outstanding scientist, not only competent in the methodologies of science but also innovative in all aspects.

It is indeed a shame that I have to write this letter of reference as it implies that Dr. Aur has moved on from our laboratory. However, I will begin by saying that I wish him all the success and I sincerely hope that he continues developing many of the ideas that we have developed together in his three years in my laboratory.

Dr. Aur is an electrical engineer with a PhD in the same field. However, his grasp of neuroscience and the ability to think outside the box has impressed me tremendously. He has diligently worked away at an approach of understanding neural function that is truly groundbreaking. New ideas take an enormous amount of effort and this is what we faced in the work that Dr. Aur and I have done in the laboratory. However, despite initial disappointments, Dr. Aur persisted in the development of a new approach to understanding the methods and process by which neurons communicate with each other. This has led to a series of what I feel are significant advances in the understanding of neural function. Although these papers have not been published in the high impact journals, predominantly due to the innovative nature and the cutting edge aspects that are presented, I feel that over time, the complexity and intricacies of neural function that are being developed in this work are indeed the way to add a substantial amount of advancement to the ability by which how neural networks process information. Dr. Aur has been instrumental in the development of this entire thought process within our laboratory.

When Dr. Aur came to our laboratory, we had initially been sceptical of this approach. However, I realize very quickly the power of the methodology that he was attempting to develop. Indeed he worked away at it single-handedly for many months before I had the first glimpse of the power of what he was developing. Of course, after that there was no stopping the development. For an individual who did not really have sound training in neuroscience to have such a substantial grasp of how neural function might be occurring is truly remarkable.

As an individual, Dr. Aur was pleasant to get along with and I thoroughly enjoyed our professional relationship and to a certain extent, the development of our friendship along the way. I am not exactly sure the future that Dr. Aur wishes to pursue in his quest and move to California. I presume that he has solid ideas as to where he wishes to work and hopefully continues this research. I fully expect that given the opportunity Dr. Aur would continue the development of the process that he has begun in our laboratory. I again, truly wish that whichever employment opportunity that he is offered, he is allowed the ability to have free thought. Indeed, I feel that the scientific curiosity and novelty of thought hidden inside him would help neuroscience to advance to the next level of depth and understanding. I hope that he himself sees this purpose in his abilities and is able to apply them in the future.

He will always be welcomed back in our laboratory.

Sincerely,

(Electronically signed – Dictated but not read)
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RESEARCH STATEMENT

My previous experience in designing intelligent systems for speech and visual pattern recognition has been recently enriched by studying the brain. The brain represents a unique example of complex biological system that processes transfers and stores information. Neurons can be useful models to create brain-inspired sensors, design new computing strategies or build intelligent machines. My research emphasizes relevant interdisciplinary aspects and offers a systemic approach regarding computations performed in the brain.

Many directions can be further developed using this interdisciplinary approach and offers:

- Simple explanation for many unsolved brain mysteries;
- Direct relationship between perception learning, memory and changes at molecular levels (gene, protein level);
- A different model to design new types of computers (non-Turing) that mimic powerful computations performed within neurons;
- Efficient neurotherapy, seizure control in drug-resistant forms of epilepsy, delay neurodegeneration in Alzheimer's Disease or Parkinson using brain computer interfaces (see the patent http://otlportal.stanford.edu/techfinder/technology/ID=28515)

The study of the Brain, Behavior and Cognition

I have used multi-tip electrode recordings technology (nano-scale tips) and developed new methods for data analysis [2], [3], [4], [12]. Previous techniques have hidden important details regarding neuronal activity. Totally "unexpected experimental observations" have challenged the accuracy of previous models regarding information processing in the brain. Since information is processed, transferred in a time domain as small as milliseconds [1][2][3][4] electrical patterns that occur in single spikes provide more information than spike timing methods (firing rate, interspike interval) during behavioral learning or object recognition tasks [1][3] [5] [6].

(i) The action potential (AP) generation is a fast event (1ms) however the neuron does NOT generate digital signals. Every AP is spatially modulated, which is highly dependent on how information is processed within the neuron.

(ii) The variability of AP shapes shows that the fundamental process of computation is hidden inside the cell. The AP event is the moment when different fragments of information regarding our memories are 'read' or 'written' and depends how AP propagates in different axonal or dendritic

branches http://neuroelectrodynamics.blogspot.com/p/spike-directivity.html.

Since the propagation of action potentials (APs) is a fast process (1ms) many electrophysiologists didn't perceive their modulation, they just hypothesized that APs are digital events. This MISTAKE of digital APs was introduced in all textbooks falsely portraying the entire phenomenon as binary signaling.

Direct and indirect consequences

(iii) Recorded temporal patterns do not provide an approximation of computations that occur in neurons

(iv) The similitude between APs and digital signals is irrelevant in terms of computational characteristics. Both phenomena may show similar shapes, however the intrinsic nature of developed computations is completely different.

(v) The experimental outcome (spatial modulated APs) makes temporal coding theory an obsolete model.

(vi) Theoretical constructs regarding Bayes theory, nonlinear dynamics ... HAVE NO REAL VALUE in understanding information processing in the brain if they are attached to a false hypothesis (DIGITAL spike)

(vii) Understanding APs has powerful, far-reaching impact in computer science [9,10] in neuroscience and neurology [6, 7,9]

(viii) My research has highlighted that semantics can be obtained directly from single spikes using "spike directivity" a new developed technique to 'read' hidden information from neurons.

The transition from a relevant experiment to a broad acceptance may take 20 to 30 years, a change in a generation of scientists if related observations contradict an existent theoretical model (see Cajal, Belousov-Zhabotinsky, Shechtman)
This step is more difficult if the mistake (e.g.digital APs) is generalized and included in all textbooks. The attachment to textbook dogma reflects the strong desire of scientists to be part of 'established science', explains this delay (two, three decades).

Toward Bio-Inspired Computers:

This simple observation of spatially modulated action potentials has powerful, far-reaching impact in computer science
http://neuroelectrodynamics.blogspot.com/p/computing-by-interaction.html.The entire biophysical model of the brain is built to maintain continuous interactions in the system to integrate different sources of information. A simple analysis of biological neural networks identifies two different types of interactions. During spike activity 'strong' interactions occur intracellularly within dendrites, soma, axon and 'weak' forms of

interaction occur between neurons. These 'weak' forms of interaction are described by synaptic and non-synaptic interactions (e.g. electric field). The 'strong' interactions that occur intracellularly have been largely neglected in the literature; however they reflect a fast, non-Turing process of computation. The general framework of temporal coding has approximated only a small part of weak interactions and has ignored strong interactions that occur within cells. In general, temporal patterns provide an approximation of 'weak' interactions. In addition, not all interactions can be described by weight type connections. Extrapolating these findings to machine learning models using the model of computing by interaction leads to new non-Turing bio-inspired intelligent systems[9],[10] http://neuroelectrodynamics.blogspot.com/p/computing-by-interaction.html. Computation by interaction describes a more powerful continuous model of computation than the one that consists of discrete steps as represented in Turing Machines [12].For several decades computer science has shaped the research in biology and neuroscience, however, the time has come to build a different approach that can change computing forever, even if most computer scientists don't know it yet.

Systems Science for Health: Statement of Future Plans and Research Impact:

The brain represents the best example of a dynamical highly specialized system. Severe alterations in the dynamics of computational states and information transfer are related to the occurrence of known brain diseases (e. g. Epilepsy, Alzheimer Parkinson, Schizophrenia). New tools and mathematical concepts need to be developed and applied in order to understand how this transition takes place and how it alters information processing and storage in the brain. Even though there is significant progress in understanding the mechanism of epilepsy generation, Alzheimer or Parkinson, there is no definite therapy that can stop the generation of seizure or the progression of neurodegeneration. My work uses advances in signal processing, nonlinear dynamics, information theory and machine learning to explain the complex system dynamics based on recorded experimental data[1][2][4][5][8]. The research in this field offers a unique opportunity to apply skills that I already acquired in control systems to advance in an important area of research and to solve vital clinical problems. My recent work in understanding seizure generation has already led to an original development to provide neuromodulatory techniques that can be directly applied to the seizure focus. http://otlportal.stanford.edu/techfinder/technology/ID=28515.
Exploring the basic control of neuronal mechanisms with machine learning concepts have allowed a faster identification of critical features required to control seizure generation on drug-resistant forms of epilepsy and neurodegeneration in Alzheimer's Disease or Parkinson.
The therapy in this case is equivalent with control system synthesis, for which the theory is known in the field of engineering [11]. Brain diseases represent a complex problem and my long-term goal will be to continue to do research and if possible to design a complete system able to provide neurostimulation ready to be used in clinical application. This project will have an impact to reduce the overall health care costs associated to neurotherapy.

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TEACHING STATEMENT

Since I was born in a family that made from teaching a profession, teaching is one of my passions. Different experiences in research/teaching show that people can pursue a certain theory even though sometimes experimental evidence is far to show a successful path. Therefore, I'm trying to be open-minded to different points of view. Also, I have used several teaching techniques including shared projects separating the class into small groups and student presentations, to provide additional reading materials and to clarify some home works.

I encourage students to use different resources other than standard course materials and lectures. Each student has a different background and by opening things up to discussion even an instructor can gain a different perspective on looking at things I believe that teaching involves not only presenting information to students but also encouraging them to make discoveries on their own. I ask students several questions in the class to know their level of understanding in case of new concepts and help them to develop an interdisciplinary education and a constant interest for learning.

I have more than five years of teaching experience at university level as Associate Professor, including experience of teaching mathematics at the community college level in California. I am familiar with several interdisciplinary topics, and I am confident that my experience and qualifications allows me to teach large classes effectively. Teaching the students of non-English background as well as and the students with rather poor pre-university training often involved a lot of personal attention and pastoral care. I also have experience of successful research students supervision.

I believe that it is my responsibility to provide students with the following:

- a milieu adequate to learning and learning to enjoy the academic discipline;
- learn to develop critical thinking by using materials, opportunities, and a constant feedback;

- improving ways of finding solutions, motivating the students to be successful not only in their studies but also to use learnt knowledge to solve common daily problems;
- working effectively in groups as a team and also competing;

During teaching I follow some simple rules:

1. *Teaching complex subjects require simplification*. Therefore I see no reason, to make science difficult for students and I do my best to keep my favorite subject as simple as I can. (see simple explanations for phantom limb, mirror neurons, sparse coding, concept cells at: http://neuroelectrodynamics.blogspot.com/p/from-spike-timing-dogma-to.html)
2. *It is better to see once*. One way of keeping things simple is visualization. The human brain is built up in such a way that we receive more than 80 percent of information visually. We understand images easier than any cleverest symbolic manipulations. Therefore, I try to illustrate my lectures with as many pictures as I can. Earlier, I usually combined the traditional white-board techniques with pictures on overheads. The modern IT technology offers a much better option: now we can supplement the white board presentation with colorful computer-made illustrations and animations. That gives to a lecturer a huge advantage.
3. *Constant feedback*. It is important to monitor the audience to note the moment when the students get tired or bored. At that moment it is necessary to quickly change the subject, and give an example, or tell an appropriate joke. And then, when students' attention is concentrated again, a lecturer can return to the topic repeating the difficult part.

Teaching goes beyond the classroom hours and it is important to be available also outside of class. In addition, I find important to remain professionally active by developing an active research program, publishing in the field, participating in symposiums, conferences, workshops within or outside of the academic community. Mostly teaching leads to interactions with students, whose curiosity often leads to fresh new looks at familiar topics. That is the reason why I consider teaching as an enriching and fascinating experience which gives great freedom to my scientific thoughts.

Experience

Since becoming a teaching assistant professor in the Department of Informatics, AISTEDA University Bucharest, October 1997, I have taught seven different courses, of which I designed and originally developed three. I have taught courses in computer controlled systems, software engineering and artificial intelligence. For each of the following classes, I had full responsibility, I chose the text and course contents, assignments, and test materials and I have supervised license theses.

Recently, my experience has been enriched by teaching algebra at the community college level at Allan Hancock College, Santa Maria, CA and I discovered that I have the ability to communicate well with students of diverse academic, ethnic and cultural backgrounds. I have enjoyed several opportunities to teach in my career, below is a list of courses:

2008 – **Elementary Algebra and Intermediate Algebra**, Allan Hancock College, Santa Maria, CA
I was responsible for teaching credit courses in mathematics class lectures, lesson planning, exam preparation, grading and classroom management.

Computer Science Department
Course: **Artificial Intelligence**

Provided lectures and led discussion neural connectionist models. These lectures included topics in parallel distributed processing, artificial neural networks (ANN), fuzzy systems and evolutionary algorithms. Wrote and graded homework assignments and exams. Because of its popularity, the course motivated students to attend the classes and they were involved in team projects to develop algorithms for handwritten digits and face recognition, text mining, search engines, web agents, robot movement, sound and speech recognition. They were able to feel the strength of current AI techniques and also their limits. However, I have encouraged them to see beyond the current limits and integrate in their projects novel artificial computational states (motivation, emotion, creativity or consciousness).

Course: **Computer Controlled Systems**

Provided lectures and led discussion on architectural design of open-loop and closed-loop control systems, linear and non-linear system dynamics. The examples are taken from application areas such as vehicles, medical equipment, robotics, space and avionics. Wrote and graded homework assignments and exams

Course: **Modeling and Simulation**

Provided lectures regarding different models and basic methodology used to simulate a mathematical model. These lectures included topics in linear, nonlinear and stochastic model design and simulation. Wrote and graded homework assignments and exams

Course: **Computer Information Systems**

Provided lectures and led discussion on the analysis and design of computer systems, advanced systems development methods, data administration, management of the information systems including database management systems, operating systems wrote and graded homework assignments and exams.

Course: **Object Oriented Programming**

The course covered the traditional material for Java OOP programming creating software agents for the final course project. Since this course was taught after the artificial intelligence course, many students were able to design simple intelligent agents for the World Wide Web.

Course: **Economic Forecast**

Provided lectures and led discussion on basic concepts of the theory of economic forecasting based on time series analysis. Wrote and graded homework assignments and exams

Course: **Introduction to Computers** The course covered general topics of computer basics, from beginner to intermediate level in order to understand hardware and software essentials

Future Course Opportunities

I would enjoy teaching courses with a topic in computer science, bioengineering, biosensors and more specialized courses in artificial

intelligence, machine learning, modeling theory of computation/ natural computation, brain computer interface. Also I will be interested in teaching courses relevant to my research work which may include, but are not limited to:

- **Introduction to Brain Computation**

A course that introduces students to standard tools of new brain/neural models developed in neuroelectrodynamics focused on the understanding of physical principles and experimental foundations of such models. Computation has to explain how information is transferred, how is processed and how is stored in the brain. This course would be of great benefit not only to students attracted by neuroscience but to all students interested in bioengineering and artificial intelligence.

- **Applied course: Introduction to Intelligent Bio-Systems**

This course may provide a broad theoretical and practical knowledge of several computational methods as to complement, but not overlap with similar courses offered at the University. This course crosses methods from several disciplines may allow a new start in this field and covers basic methods and fundamental topics that include learning and memory formation in biological systems

My continuing purpose is to contribute to develop courses that involve an interdisciplinary nature. Therefore, my immediate purpose is to adapt my goals and to contribute to the course selection required within the department. This includes introducing new courses in my research areas as well as to refine previous courses that I have taught.

- **Distance Education and online Publication through formal posting.**

http://neuronline.sfn.org/SFN/SFN/Home/Default.aspx (requires membership)
http://neuroelectrodynamics.blogspot.com/
http://neuroelectrodynamics.blogspot.com/p/temporal-coding-realistic-model-of.html
http://neuroelectrodynamics.blogspot.com/p/spike-directivity.html
http://neuroelectrodynamics.blogspot.com/p/cracking-neural-code.html
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http://neuroelectrodynamics.blogspot.com/p/cognition-and-consciousness.html

www.linkedin.com/groups/Computational-Neuroscience-1376707 (requires membership)