Vassilis Cutsuridis, M.Sc., M.A., Ph.D

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Division of Engineering
King's College London
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EDUCATION

2006	National University of Athens, Athens, Greece **Ph.D**, Informatics and Telecommunications
2003	Boston University, Boston, MA, USA **M.A**., Cognitive and Neural Systems
1996	Wichita State University, Wichita, KS, USA **M.S.**, Theoretical Physics
1994	Wichita State University, Wichita, KS, USA **B.Sc**., Physics, minor in Mathematics

PROFESSIONAL POSITIONS

Nov 7-11, 2012	Eotvos University, Budapest, Hungary **Lecturer**
Nov 7-11, 2011	Eotvos University, Budapest, Hungary **Lecturer**
Sept 2011 - now	Eotvos University, Budapest, Hungary **Core Faculty of the Budapest Semester in Cognitive Sciences**
May 2011 – now	Division of Engineering, King's College London, U.K. **Research Scientist**
Oct 2008 – now	Information Technologies in Medicine and Biology Program, Department of Informatics and Telecommunications, University of Athens, Greece **Lecturer**
Nov 2-6, 2010	Eotvos University, Budapest, Hungary **Visiting Lecturer**

Oct 2009 – May 2011 Department of Psychology, Boston University, Boston, MA, USA
Visiting Scholar

Nov. 2008 – Feb 2009 Medical School, University of Patras, Greece
Visiting Lecturer

Oct. 2006 – Sept 2009 Department of Mathematics and Computing Science, University of Stirling, UK
Research Fellow

Oct. 2004 – Sept 2006 N.C.S.R. "DEMOKRITOS", Athens, Greece
Research Associate

Dec. 2003 – Oct. 2004 ATKOSoft, SA, Chalandri, Greece
Analyst I

Jan. 2003 – Nov. 2003 BIOVISTA, Ellinikon, Greece
Systems & Algorithms Engineer

Sept. 2000 – Aug. 2001 ONTAR CORPORATION, Andover, MA, USA
Staff Scientist

PUBLICATIONS

Journal Articles

1. Cutsuridis V. Bursts shape the NMDA-R mediated spike timing dependent plasticity curve: Role of burst interspike interval and GABA inhibition. *Cognitive Neurodynamics, accepted for publication*
2. Cutsuridis V. Deciphering the mechanisms of episodic memory from a computational modeler's point of view. *Hippocampus, in press* (commentary)
3. Cutsuridis V, Hasselmo M. (2012). GABAergic modulation of gating, timing and theta phase precession of hippocampal neuronal activity during theta oscillations. *Hippocampus, DOI: 10.1002/hipo.21002*
4. Cutsuridis V, Taylor JG. A Cognitive Control Architecture of Object Shape and Object Location Recognition, Attention, Cognitive Control, Value, Decision Making, Affordances, Planning and Action for Robots and Agents. *Cognitive Computation, accepted for publication*
5. Taylor JG, Cutsuridis V, Hartley M, Althoefer K, Nanayakara T. Observational Learning: Basis, Experimental Results, Models and Implications to Robotics. *Cognitive Computation, accepted for publication*
6. Cutsuridis V, Hasselmo M. (2011). Spatial memory sequence encoding and replay during modeled theta and ripple oscillations, *Cognitive Computation,* 3: 554-74
7. Cutsuridis V. (2011). Origins of a repetitive and co-contractive pattern of muscle activation in Parkinson's disease. *Neural Networks,* 24(6): 592-601
8. Taylor JG, Cutsuridis V. (2011). Saliency, attention, active visual search and picture scanning. *Cognitive Computation*, 3: 1:3
9. Cutsuridis V. (2011). GABA inhibition modulates NMDA-R mediated spike timing dependent plasticity (STDP) in a biophysical model. *Neural Networks*, 24(1): 29-42
10. Cutsuridis V, Heida C, Wlodek D, Doya K. (2011). Neurocomputational models of brain disorders. *Neural Networks*, 24: 513:514
11. Cutsuridis V. (2010). Neural accumulator models of decision making in eye movements. *Adv Exp Med Biol,* 657: 61-72

12. Cutsuridis V, Graham BP, Cobb S. (2010). Encoding and retrieval in the hippocampal CA1 microcircuit model. *Hippocampus,* 20(3): 423-446
13. Cutsuridis V. (2009). A cognitive model of saliency, overt attention and picture scanning. *Cognitive computation*, 1: 292-299 (***invited*)**
14. Cutsuridis V, Wenneckers T. (2009). Hippocampus, microcircuits and associative memory. *Neural Networks,* 22(8): 1120-8.
15. Cutsuridis V, Wennekers T, Graham BP, Vida I, Taylor JG. (2009). Microcircuits: Structure, dynamics and role in brain function. *Neural Networks*, 22: 1037-38
16. Cutsuridis V, Cobb S, Graham BP. (2009). Modelling the STDP symmetry-to-asymmetry transition in the presence of GABAergic inhibition. *Neural Network World*, 19(5): 471-81 (***invited***)
17. Cutsuridis V, Kahol P. (2008). Derivation and Evaluation of the Fourth Moment of NMR Lineshape in Zero-Field. *Solid State NMR,* 34: 191-195
18. Cutsuridis V, Smyrnis N, Evdokimidis I, Perantonis S. (2007). A Neural Network Model of Decision Making in an Antisaccade Task by the Superior Colliculus. *Neural Networks,* 20(6): 690-704*.*
19. Cutsuridis V, Kahramanoglou I, Smyrnis N, Evdokimidis I, Perantonis S. (2007). A Neural Variable Integrator Model of Decision Making in an Antisaccade Task. *Neurocomputing,* 70(7-9): 1390-1402.
20. Cutsuridis V. (2007). Does Abnormal Reciprocal Inhibition Lead to Co-contraction of Antagonist Muscles? A Modeling Study. *International Journal of Neural Systems,* 17(4): 319-327 (***invited***)
21. Cutsuridis V, Perantonis S. (2006). A Neural Model of Parkinson's Disease Bradykinesia. *Neural Networks,* 19(4): 354-374*.*

Journal articles under review and in preparation

22. Cutsuridis V. Interaction of Inhibition and Triplets of Excitatory Spikes Modulates the NMDA-R Mediated Synaptic Plasticity in a Computational Model of Spike Timing Dependent Plasticity. *Under review*

Peer-Reviewed Conference Articles and Book Chapters

23. Cutsuridis V., Grahan B.P., Cobb S., Hasselmo M.E. (2011). Bio-inspired models of memory capacity, recall performance and theta phase precession. Proc. IJCNN, 2011 IEEE, pp. 3141-48.
24. Cutsuridis V, Hasselmo M. (2010). Dynamics and function of a CA1 model of the hippocampus during theta and ripples. In: K. Diamantaras, W. Duch, L.S. Iliadis (Eds.): ICANN 2010, Part I, LNCS 6352, Springer-Verlag Berlin Heidelberg, pp. 230-240, 2010
25. Cutsuridis V. (2010). Action Potential Bursts Modulate the NMDA-R Mediated Spike Timing Dependent Plasticity in a Biophysical Model. In: K. Diamantaras, W. Duch, L.S. Iliadis (Eds.): ICANN 2010, Part I, LNCS 6352, Springer-Verlag Berlin Heidelberg, pp. 107–116, 2010
26. Cutsuridis V. (2010). Neural network modeling of voluntary single joint movement organization. I. Normal conditions. In: Chaovalitwongse WA, Pardalos P, Xanthopoulos P (eds), *Computational neuroscience*, Springer-Verlag, 181-192
27. Cutsuridis V. (2010). Neural network modeling of voluntary single joint movement organization. II. Parkinson's disease. In: Chaovalitwongse WA, Pardalos P, Xanthopoulos P (eds), *Computational neuroscience*, Springer-Verlag, 193-212

28. Graham BP, Cutsuridis V, Hunter R. (2010). Associative Memory Models of Hippocampal Areas CA1 and CA3. In: Cutsuridis V et al. (eds), *Hippocampal Microcircuits: A Computational Modeller's Resource Book*. Springer, USA, 459-494
29. Graham BP, Cutsuridis V. (2009). Dynamical Information Processing in the CA1 Microcircuit of the Hippocampus. In: Heinke D, et al. (Eds.): *Computational Modeling in behavioral neuroscience: Closing the gap between neurophysiology and behavior*. London: Psychology Press, Taylor and Francis Group.
30. Cutsuridis V, Cobb S, Graham BP. (2009). How bursts shape the STDP curve in the presence/absence of GABA inhibition. In: C. Alippi et al. (Eds.): LNCS 5768, Springer-Verlag, 229–238.
31. Cutsuridis V, Cobb S, Graham BP. (2008). Encoding and Retrieval in a CA1 Microcircuit Model of the Hippocampus. In: Kurkova V, et al. (Eds.): Lecture Notes in Computer Science 5164, (Springer-Verlag Berlin Heidelberg 2008), 238–247.
32. Cutsuridis V, Cobb S, Graham BP. (2008). A Ca^{2+} Dynamics Model of the STDP Symmetry-to-Asymmetry Transition in the CA1 Pyramidal Cell of the Hippocampus. In: Kurkova V, et al. (Eds.): Lecture Notes in Computer Science 5164, (Springer-Verlag Berlin Heidelberg 2008), 627-635.
33. Kahramanoglou I, Perantonis S, Smyrnis N, Evdokimidis I, Cutsuridis V. (2008). Modeling the Effects of Dopamine on the Antisaccade Reaction Times (aSRT) of Schizophrenia Patients. In: Kurkova V, et al. (Eds.): Lecture Notes in Computer Science 5164, (Springer-Verlag Berlin Heidelberg 2008), 290-299.
34. Cutsuridis V. (2008). A Bio-Inspired System Architecture of an Active Visual Search Model. In: Kurkova V, et al. (Eds.): Lecture Notes in Computer Science 5164, (Springer-Verlag Berlin Heidelberg 2008), 248-257
35. Cutsuridis V. (2008). Voluntary single joint movement organization (in greek). In: S. Kossida. (ed.), Βιοπληροφορική: Δυνατότητες και Προοπτικές. Ίδρυμα Ιατροβιολογικών Ερευνών της Ακαδημίας Αθηνών.
36. Cutsuridis V. (2006). Neural Model of Dopaminergic Control of Arm Movements in Parkinson's Disease Bradykinesia. In: Kolias S, et al. (Eds.): Lecture Notes in Computer Science 4131, Springer-Verlag, 583-591
37. Cutsuridis V, Kahramanoglou I, Perantonis S, Evdokimidis I, Smyrnis N. (2005). A Biophysical Neural Model of Decision Making in an Antisaccade Task Through Variable Climbing Activity In: Duch W, et al. (Eds.): Lecture Notes in Computer Science 3696, Springer-Verlag, 205-210

Books and journal special issues

38. Cutsuridis V, Hussain A. (2012). Celebrating the legacy of the late Professor John G Taylor. *Cognitive Computation*, *in preparation*
39. Cutsuridis V., Doya K, Heida T., Duch W. (2011). Neurocomputational models of brain disorders. *Neural Networks*, 24(6): 513-678
40. Cutsuridis V, Hussain A, Taylor JG. (2011). *Perception-action cycle: Models, architectures and hardware*, Springer, USA
41. Taylor J., Cutsuridis V. (2011). Saliency, attention, active visual search and picture scanning. *Cognitive Computation*, 3(1): 1-331
42. Cutsuridis V, Graham BP, Cobb S, Vida I. (2010). *Hippocampal Microcircuits: A Computational Modeler's Resource Book*, Springer, USA
43. Cutsuridis V., Wennekers T., Graham B.P., Vida I., Taylor J.G. (2009). Microcircuits – Their structure, dynamics and role for brain function. *Neural Networks*, 22(8): 1037-1200
44. Hussain A, Aleksander I, Smith L, Chrisley R, Barros AK, Cutsuridis V. (2008). *Brain Inspired Cognitive Systems*, Springer, USA

Conference Abstracts

45. Cutsuridis V. GABAergic contributions to theta phase precession in region CA1 of the hippocampus. Brain Circuits Symposium, Karolinska Institutet, Stockholm, Sweden, Oct 27-28, 2011
46. Cutsuridis V. Origins of a repetitive and co-contractive pattern of muscle activation in Parkinson's Disease. Workshop in Computational Neuroscience and Dynamics of Disease States, Leiden, The Netherlands, Aug. 8-12, 2011
47. Cutsuridis V, Hasselmo M. A Computational Microcircuit Model of Encoding and Retrieval of Spatial Memory Sequences in the CA1 Area of the Hippocampus during Theta and Ripples. Society of Neuroscience, San Diego, USA, Nov 13-17, 2010
48. Cutsuridis V, Hasselmo M. Network Dynamics of Encoding and Retrieval of Behavioural Spike Sequences During Theta and Ripples in a CA1 Model of the Hippocampus. 19th Annual Computational Neuroscience Meeting CNS*2010, San Antonio, USA, July 24-30, 2010
49. Cutsuridis V, Hasselmo M. Encoding and Retrieval of Spatial Memory Sequences During Theta and Ripples in a CA1 Model of the Hippocampus. 14th International Conference on Cognitive and Neural Systems, Boston, USA, May 29-June 1, 2010
50. Cutsuridis V, Cobb S, Graham BP. Dynamical information processing in the CA1 microcircuit. 4th Computational Cognitive Neuroscience Conference (CCNC), Boston, USA, Nov 18-19, 2009
51. Cutsuridis V, Graham BP, Cobb S. Modelling the effects of GABA-A inhibition on the spike timing dependent plasticity (STDP) of a CA1 pyramidal cell. Eighteenth Annual Computational Neuroscience Meeting CNS*2009, Berlin, Germany, July 17th – 23rd, 2009
52. Cutsuridis V, Cobb S, Graham BP. A CA1 Heteroassociative Microcircuit Model of the Hippocampus. AREADNE: Research in Encoding and Decoding of Neural Ensembles, Santorini, Greece, June 26-29, 2008
53. Cutsuridis V, Hunter R, Cobb S, Graham BP. Storage and Recall in the CA1 Microcircuit of the Hippocampus: A Biophysical Model. Sixteenth Annual Computational Neuroscience Meeting CNS*2007, Toronto, Canada, July 8th - 12th, 2007. *BMC Neuroscience* 8(Suppl 2):P33.
54. Hunter R, Cutsuridis V, Cobb S, Graham BP. Improving Associative Memory in a Model Network of Two-Compartment Spiking Neurons. Fourth Annual Scottish Neuroscience Group Meeting, University of Edinburgh, August 31, 2007.
55. Kahramanoglou I, Cutsuridis V, Smyrnis N, Evdokimidis I, Perantonis S. Dopamine Effect on Climbing Activity of a Cortico-Tectal Model: Simulating the Performance of Patients with DSM-IV Schizophrenia in the Antisaccade Task. *2nd Computational Cognitive Neuroscience Conference*, Houston, TX, USA, November 16-19, 2006.
56. Cutsuridis V, Kahramanoglou I, Smyrnis N, Evdokimidis I, Perantonis S. Parametric Analysis of Ionic and Synaptic Current Conductances in a Neural Accumulator Model with Variable Climbing Activity. *19th Conference of Hellenic Society for Neuroscience*, Patra, Greece, September 30 - October 2, 2005.
57. Kahramanoglou I, Cutsuridis V, Smyrnis N, Evdokimidis I, Perantonis S. Dopamine Modification of Climbing Activity in a Neural Accumulator Model of the Antisaccade Task. *1st Computational Cognitive Neuroscience Conference*, New Orleans, USA, November 11-13, 2005.
58. Cutsuridis V. A neural network model of normal and Parkinsonian EMG activity of fast arm movements. *18th Conference of Hellenic Society for Neuroscience*, Athens, Greece, October 17-19, 2003.
59. Cutsuridis V, Evdokimidis I, Kahramanoglou I, Perantonis S, Smyrnis N. Neural network model of eye movement behavior in an antisaccade task. *18th Conference of Hellenic Society for Neuroscience*, Athens, Greece, October 17-19, 2003.
60. Cutsuridis V, Smyrnis N, Evdokimidis I, Kahramanoglou I, Perantonis S. Neural network modeling of eye movement behavior in the antisaccade task: validation by comparison with

data from 2006 normal individuals. Program No. 72.13. 2003 Abstract Viewer/Itinerary Planner. Washington, DC: Society for Neuroscience, 2003

61. Cutsuridis V, Bullock D. A Neural Circuit Model of the Effects of Cortical Dopamine Depletion on Task-Related Discharge Patterns of Cells in the Primary Motor Cortex. Poster Session II: Sensory-Motor Control and Robotics, p. xv, *Sixth International Neural Network Conference*, Boston, MA, May 30 - June 1, 2002.
62. Cutsuridis V, Bullock D. A Neural Circuit Model of the Effects of Cortical Dopamine Depletion on Task-Related Discharge Patterns of Cells in the Primary Motor Cortex. Rethymnon, Crete, 17th Conference of Hellenic Society for Neuroscience, Poster 3, p. 39, October 4-6, 2002.

Other publications

63. Cutsuridis V (2006). "Biologically inspired neural architectures of voluntary movement", Dept. of Informatics and Telecommunications, University of Athens, 2006
64. Cutsuridis V (2006). "Biologically inspired neural architectures of voluntary movement in normal and disordered states of the brain". Ph.D dissertation, Department of informatics and telecommunications, University of Athens, 2006
65. Cutsuridis V (1994). "Calculation and study of the fourth moment in zero field NMR". M.S. Thesis, Physics department, Wichita State University, 1994

PROFESSIONAL ACTIVITIES

Editorial

- Book series editor, *Trends in Augmentation of Human Performance*, Springer, 2012-
- Book series editor (with John G. Taylor), *Springer Series in Cognitive and Neural Systems*, 2009-
- Guest editor, *Cognitive Computation*, 2011, 2012
- Guest editor, *Neural Networks*, 2009, 2011
- Editorial board member, *Cognitive Computation*, 2008-
- Associate editor, *Cognitive Computation*, 2008-

Committees

- Workshop chair, "Parkinson's disease", Fields Institute, University of Toronto, May 22-23, 2012
- Program committee member, Brain Inspired Cognitive Systems (BICS) conference, June 11-14, 2012, Shenyang, China
- Program committee member, 13th International Conference on Engineering Applications of Neural Networks (EANN), Sept 20-23, 2012, London, U.K.
- Program committee member, 12th EANN / 7th AIAI Joint Conferences, September 15-18, 2011, Corfu, Greece
- Special session chair, "GENEX: Gene expression", International Conference in Artificial Neural Networks, September 14-17, 2010, Thessaloniki, Greece
- Program committee member, e-Activity and Leading Technologies Conference, November 8-10, 2010, Oviedo, Spain
- Program committee member, 6th International Conference on Natural Computation, August 10-12, 2010, China

- Program committee member, e-Activity and Leading Technologies Conference, June 22-24, 2009, Seville, Spain
- Program committee member, Brain Inspired Cognitive Systems (BICS) conference, June 24-27, 2008, Sao Luis, Brazil
- Program committee member, e-Activity and Leading Technologies Conference, December 3-6, 2007, Porto, Portugal
- Program committee member, 10th European Conference On Principle and Practice of Knowledge Discovery in Databases, Berlin, Germany, 2006
- Scientific panel member, Cognitive Systems Workshop, International Conference of Artificial Neural Networks 2006, September 10-14, 2006, Athens, Greece

Reviewing

Journal reviewing: *Mathematical Biosciences,*
Soft Computing,
Hippocampus,
PLOS Comp Biol,
Journal of Computational Neuroscience,
IEEE Transactions on Neural Networks,
Neural Networks,
Neurocomputing,
Cognitive Computation,
Signal Processing,
International Journal of Neural Systems,
International Journal of Communicating Systems

Conference reviewing: *6th International Conference on Natural Computation.* 2010
7th International Conference on Fuzzy Systems and Knowledge Discovery, 2010
Brain Inspired Cognitive Systems, 2008
International Conference of Artificial Neural Networks, 2008

Grant reviewing: *E.U.- FP7 Framework*, 2007
Netherlands Organization for Scientific Research (NOW), 2008
Research Promotion Foundation (Cyprus), 2009

Book reviewing: *Springer (USA), 2008-*

Memberships

- Society for Neuroscience, 2003-2006, 2010
- Convergent Science Network of Biomimetic and Biohybrid Systems, 2010 - now
- European Network for the Advancement of Artificial Cognitive Systems II, 2009-now
- European Network for the Advancement of Artificial Cognitive Systems, 2007-2009

Organizing symposia, workshops and conferences

- Co-organizer, “Neural oscillations”, Workshop, Annual Computational Neuroscience Conference, July 24-30, 2010, San Antonio, TX, USA
- Co-organizer, “Cortical Microcircuit Models of Information Processing and Plasticity” Workshop, Annual Computational Neuroscience Conference, July 18-23, 2009, Berlin, Germany

- Co-organizer, “Adaptive Mechanisms of the Perception-Action Cycle” Workshop, International Conference of Artificial Neural Networks, September 3-6, 2008, Prague, Czech Republic
- Co-organizer, “Cortical Microcircuits: Structure, Function and Theory” Workshop, Annual Computational Neuroscience Conference, August 8-12, 2007, Toronto, Canada

GRANTS AND RESEARCH SUPPORT

- euCognition Action Network, 6,000 EUR, Organization of the “Adaptive Mechanisms of the Perception-Action Cycle” Workshop in ICANN 2008, Prague, Czech Republic
- Hellenic Ministry of Mercantile Marine, 45,000 EUR, “Development of a Pilot XML Messaging System for Tracking Ship/Boat Sea Courses”, March – May 2004

INVITED TALKS

1. Cognition and Action Group, Eginition Hospital, Medical School, National University of Athens, Athens, Greece, 2005
2. Institute of Informatics and Telecommunications, National Center for Scientific Research “Demokritos”, Athens, Greece, 2006
3. Dept of Computing and Mathematics, University of Stirling, UK, 2006
4. Computational Biology Group, Dept of Computer Science, University of Warwick, UK, 2007
5. Dept of Physiology, University of Bern, Switzerland, 2008
6. School of Engineering, Edinburgh University, U.K., 2009
7. Biomedical Academy of Athens, Greece, 2009
8. Berstein Center for Computational Neuroscience, University of Freiburg, Germany, 2009
9. Center for Theoretical and Computational Neuroscience, University of Plymouth, U.K., 2009
10. Informatics and Telecommunications Institute, N.C.S.R. “Demokritos”, Greece, 2009
11. Center for Robotics and Neural Systems, University of Plymouth, July 18, 2011
12. Dept of Computer Science, Hertfordshire University, Sept 23, 2011
13. Division of Engineering, King's College London, Sept 28, 2011
14. EEG Focus Group, Institute of Psychiatry, King's College London, Oct 19, 2011
15. Dept of Physiology, Ruhr-Universitat Bochum, Feb 13, 2012
16. Fields Institute, University of Toronto, June 1, 2012

CONFERENCE TALKS

1. International Conference for Artificial Neural Networks (ICANN), Warsaw, Polland, 2005 (Title: A Biophysical Model of Decision Making in an Antisaccade Task Through Variable Climbing Activity)
2. International Conference for Artificial Neural Networks (ICANN), Athens, Greece, 2006 (Title: Neural Model of Dopaminergic Control of Arm Movements in Parkinson’s Disease Bradykinesia)
3. International Conference for Artificial Neural Networks, Prague, Czech, 2008 (Title: Encoding and Retrieval in a CA1 Microcircuit Model of the Hippocampus)
4. International Conference for Artificial Neural Networks, Prague, Czech, 2008 (Title: A Ca^{2+} Dynamics Model of the STDP Symmetry-to-Asymmetry Transition in the CA1 Pyramidal Cell of the Hippocampus)

5. International Conference for Artificial Neural Networks, Prague, Czech, 2008 (Title: Modeling the Effects of Dopamine on the Antisaccade Reaction Times (aSRT) of Schizophrenia Patients)
6. International Conference for Artificial Neural Networks, Prague, Czech, 2008 (Title: A Bio-Inspired System Architecture of an Active Visual Search Model)
7. Workshop in "Cortical Microcircuits", CNS 2009 meeting, Berlin, Germany (Title: CA1 Microcircuit models of associative memory; Host: Thomas Wennekers)
8. International Conference for Artificial Neural Networks, Thessaloniki, Greece, 2010 (Title: Dynamics and function of a CA1 model of the hippocampus during theta and ripples)
9. International Conference for Artificial Neural Networks, Thessaloniki, Greece, 2010 (Title: Action Potential Bursts Modulate the NMDA-R Mediated Spike Timing Dependent Plasticity in a Biophysical Model)

TEACHING

Undergraduate level courses

- Cognitive informatics, Eotvos University, Hungary, Nov 7-11, 2012 ***(core lecturer, organizer and coordinator***)
- Cognitive informatics, Eotvos University, Hungary, Nov 7-11, 2011 ***(core lecturer, organizer and coordinator***)
- Cognitive informatics, Eotvos University, Hungary, Nov 2-6, 2010 ***(core lecturer, organizer and coordinator***)
- Computing and the brain, University of Stirling, U.K., 2008 (***co-lecturer***)
- University physics I lab, Wichita State University, USA, 1995-1996 (***core lecturer***)
- University physics II lab, Wichita State University, USA, 1996 (***core lecturer***)
- College physics I lab, Wichita State University, USA, 1995-1996 (***core lecturer***)
- College physics II lab, Wichita State University, USA, 1994-1995 (***core lecturer***)

Graduate level courses

- Neuroinformatics, University of Patras, Greece, 2008 (***core module instructor, organizer and coordinator***)
- Methods and applications of informatics in neurosciences, University of Athens, Greece, 2008 (***core module instructor, organizer and coordinator***)
- Object-oriented software design, University of Stirling, U.K., 2007-2008 (***co-lecturer***)

STUDENTS (CO)-SUPERVISED

Ph.D

1. Yiannis Kahramanoglou, University of Athens, Greece (co-supervised with Dr. Stavros Perantonis)

M.Sc.

1. Katerina Stilou, Dept of Informatics and Telecommunications, University of Athens, Greece, 2008 (supervised)

REFERENCES

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Research Plan

I am interested in unraveling the biophysical mechanisms of neurological and psychiatric disorders. To do so I construct mathematical and computational models of the brain at multiple levels of complexity.

I strongly believe that in order to understand brain information processing is disrupted during a disorder, we ought to study the brain from different spatial and temporal levels of detail and attacked from a number of different angles, in particular by computational modeling heavily supported by neuroscientific experimental data. My approach in computational network modeling is that a top-down theorist. One must begin with the behavioral data first, because the brain has evolved in order to achieve behavioral success. Any successful network model should first be constrained by large amounts of data, before it makes any further theoretical predictions, because otherwise too many plausible alternatives cannot be ruled out. A theory that hopes to link brain to behavior thus needs to discover the computational level on which brain dynamics control behavioral success. I believe a great deal can be learned from the interaction between the local micro circuit activity and the global processing.

My research at University of Brown will be addressing two big questions:

1. How cholinergic innervation of the hippocampus from the medial septum dynamically controls plasticity at the network level, so that new information can be encoded without disrupting existing memory traces and how information recall occurs interleaved with the storage of new memories, and how cholinergic deprivation in the hippocampus leads to the memory loss and cognitive dysfunction seen in Altzheimer's disease?
2. How is brain information processing disrupted in patients suffering from schizophrenia, so that they make more errors in cognitive tasks such as the antisaccade task and their responses are slower and more variable?

My research up-to-now has tackled both questions with considerable success:

<u>Research avenue 1</u>
In Stirling (Scotland) I investigated the dynamics of encoding and retrieval of patterns in a hippocampal microcircuit. The model simulated accurately the timing of firing of different hippocampal cell types relative to the theta rhythm, proposed functional roles for the different classes of inhibitory interneurons in the storage and recall of input patterns, examined the recall performance of the CA1 network as a function of partial completion and input pattern presentation period and made inferences on the temporal strategy of recall used by the hippocampus.

1. **Cutsuridis V**, Cobb S, Graham BP. (2008a). Encoding and Retrieval in a CA1 Microcircuit Model of the Hippocampus. In: Kurkova V, et al. (Eds.): Lecture Notes in Computer Science 5164, (Springer-Verlag Berlin Heidelberg 2008), 238–247.
2. **Cutsuridis V**, Wenneckers T. (2009). Hippocampus, microcircuits and associative memory. *Neural Networks*, 22(8): 1120-8.
3. Graham BP, **Cutsuridis V**. (2009). Dynamical Information Processing in the CA1 Microcircuit of the Hippocampus. In: Heinke D, et al. (Eds.): *Computational Modeling in behavioral neuroscience: Closing the gap between neurophysiology and behavior*. London: Psychology Press, Taylor and Francis Group.
4. Graham BP, **Cutsuridis V**, Hunter R. (2010). Associative Memory Models of Hippocampal Areas CA1 and CA3. In: Cutsuridis V et al. (eds), *Hippocampal Microcircuits: A Computational Modeller's Resource Book*. Springer, USA, 459-494
5. **Cutsuridis V**, Graham BP, Cobb S. (2010). Encoding and retrieval in the hippocampal CA1 microcircuit model. *Hippocampus*, 20(3): 423-446
6. **Cutsuridis V**, Graham BP, Cobb S, Vida I. (2010). Hippocampal microcircuits: A computational modeller's resource book. Springer, New York, USA

In Boston (USA) I investigated how sequence learning of spatial memories is achieved in the hippocampal CA1 region. Particularly interesting was how different spatial representations are chunked together in the absence of recurrent connectivity, how forward and reverse replay of behavioral sequences is accomplished, how phase and rate code of place cells is generated and what functional roles do the various types of inhibitory interneurons play

in the encoding, theta retrieval, ripple forward and reverse replay processes of such sequences as well as in the generation of theta phase precession in the hippocampus.

1. **Cutsuridis V**, Hasselmo M. (2010). Dynamics and function of a CA1 model of the hippocampus during theta and ripples. In: K. Diamantaras, W. Duch, L.S. Iliadis (Eds.): ICANN 2010, Part I, LNCS 6352, Springer-Verlag Berlin Heidelberg, pp. 230-240, 2010
2. **Cutsuridis V**, Hasselmo M. (2011). Spatial memory sequence encoding and replay during modeled theta and ripple oscillations, *Cognitive Computation*, 3: 554-74
3. **Cutsuridis V**, Grahan BP, Cobb S, Hasselmo ME. (2011). Bio-inspired models of memory capacity, recall performance and theta phase precession. Proc. IJCNN, 2011 IEEE, pp. 3141-48.
4. **Cutsuridis V**, Hasselmo M. GABAergic modulation of gating, timing and theta phase precession of hippocampal neuronal activity during theta oscillations. *Hippocampus, DOI: 10.1002/hipo.21002*

My lab at the University of Brown will investigate (1) the biophysical mechanisms of how cholinergic and GABAergic neurons from the medial septum facilitate (or do not facilitate) the encoding, storage and replay of spatial memories in the hippocampus during active waking, quiet waking and slow wave sleep in the presence of various types of inhibitory interneurons, (2) how cholinergic deprivation in the hippocampus, one of the hallmarks of Altzheimer's Disease, leads in memory loss and cognitive slowing seen in AD.

Research avenue 2

Humans and animals are constantly facing the problem of having to choose from a variety of possible actions as they interact with the environment. Both external and internal cues have to be used to guide their selection of a single action from many possible alternatives. Which action to choose in a given context may have important biological consequences to their survival. Decision making is regarded as an accumulation process of evidence about the state of the world and the utility of possible outcomes. Cognitive and behavioural neuroscientists have begun to investigate the neural basis of decision making using various behavioural paradigms. The behavioural paradigm often used is the antisaccade task. During my Ph.D work I've developed a neural network model of the superior colliculus in the antisaccade task, where decisions were formed via stochastic accumulating processes and contrast enhancement of decision signals. The model was successful at explaining why the response times in the antisaccade task are so long and variable and at predicting accurately the shapes of correct and error RT distributions as well as the response probabilities of a large 2006 sample of subjects. The model predicted that there was no need of a top-down inhibitory signal that prevented the error prosaccade from being expressed, thus allowing the correct antisaccade to be released. This finding challenged the currently accepted view of saccade generation in the antisaccade task, which required a top-down inhibitory signal to suppress the erroneous saccade after the correct saccade has been expressed.

1. **Cutsuridis V**, Smyrnis N, Evdokimidis I, Perantonis S. (2007). A Neural Network Model of Decision Making in an Antisaccade Task by the Superior Colliculus. *Neural Networks*, 20(6): 690-704
2. **Cutsuridis V**, Smyrnis N, Evdokimidis I, Kahramanoglou I, Perantonis S. Neural network modeling of eye movement behavior in the antisaccade task: validation by comparison with data from 2006 normal individuals. Program No. 72.13. 2003 Abstract Viewer/Itinerary Planner. Washington, DC: Society for Neuroscience, 2003

Next I attempted to answer the question of what are the biophysical mechanisms underlying the generation of the accumulator-like activity of the decision signals. The model predicted that only the I_{NaP}, I_{NMDA}, and I_{AMPA} currents can produce the observed variability in the climbing activities of cortical decision signals. This work led to a journal and a conference proceedings paper:

1. **Cutsuridis V**, Kahramanoglou I, Perantonis S, Evdokimidis I, Smyrnis N. (2005). A Biophysical Neural Model of Decision Making in an Antisaccade Task Through Variable Climbing Activity In: Duch W, et al. (Eds.): Lecture Notes in Computer Science 3696, Springer-Verlag, 205-210
2. **Cutsuridis V**, Kahramanoglou I, Smyrnis N, Evdokimidis I, Perantonis S. (2007). A Neural Variable Integrator Model of Decision Making in an Antisaccade Task. *Neurocomputing*, 70(7-9): 1390-1402

Since then I have extended this research into the realm of schizophrenia. The work runs in collaboration with Dr. Ulrich Ettinger from Kings College London (UK). Clinical evidence has reported that patients with schizophrenia make more errors in cognitive tasks such as the antisaccade task and their responses are slower and

more variable. It has been proposed that the fundamental dysfunction in schizophrenia reflected in the presence of the negative symptom cluster and cognitive dysfunction involves prefrontal dopaminergic hypoactivity. A student of mine and I have recently extended my previous two models of decision making by studying the effects of a neuromodulator, namely dopamine, on the predicted synaptic (I_{AMPA} and I_{NMDA}) and ionic (I_{NaP} and I_{AHP}) conductances of pyramidal neurons in two cortical networks (posterior parietal cortex (PPC) and prefrontal cortex (PFC)) in order to study the performances of patients suffering from schizophrenia in the antisaccade task. The work is still in progress, but preliminary results indicate that hypodopaminergic modulation of the cortical signals could simulate the behavioral data, i.e. the antisaccade reaction times (aSRT's) and the error prosaccades produced by the SC network

1. Kahramanoglou I, Perantonis S, Smyrnis N, Evdokimidis I, **Cutsuridis V**. (2008). Modeling the Effects of Dopamine on the Antisaccade Reaction Times (aSRT) of Schizophrenia Patients. In: Kurkova V, et al. (Eds.): Lecture Notes in Computer Science 5164, (Springer-Verlag Berlin Heidelberg 2008), 290-299

My lab at the University of Brown will investigate computationally: (1) the effects of D_2 type receptors on the network behavior of the model and compare and contrast the effects of dopamine D_1 vs. D_2 depletion on the antisaccade SRTs of patients suffering from schizophrenia, and (2) the interaction of dopamine and GABA inhibition on the model network behaviour and the antisaccade SRTs and error rates of patients.

Statement of Teaching Interests

Dr. Vassilis Cutsuridis

Throughout my scientific career I have taught many classes from various disciplines (physics, computer science and computational neuroscience) in both undergraduate and graduate level (see "Teaching" section in my CV). I have acquired experience as a course coordinator, sole instructor and a co-lecturer along with my fellow teachers. Below I provide descriptions of some of the courses I've taught and organized:

Cognitive informatics: An undergraduate course taught at Eotvos University (Hungary) every year. The course is part of the curriculum of the "Budapest Semester in Cognitive Sciences" at Eotvos University at which I am a core faculty member. Topics include: elementary principles of computation from studying about the brain, computational principles on how the brain works, levels of investigation, overview of experimental cognitive techniques, overview of the brain: basic structure and functional view, basic neural information processing: what is a biological neuron and how it transmits information, what is an artificial neuron and how it transmits information, introduction to connectionist modelling, psychological studies, biological correlates and computational principles of learning and memory: encoding, storage and retrieval. knowledge representation, visual perception, symbolic cognitive models.

Computing and the brain: An undergraguate course taught at the University of Stirling (U.K.) in 2008. Topics included notions of electrical and biochemical properties of single neurons, the electrical and chemical communication between neurons, the anatomy, physiology and function of each of the major brain structures and systems, Hodgkin Huxley models, integrate and fire models, synaptic plasticity models, artificial neural networks: perceptron, backpropagation, Hopfield, etc. Synaptic plasticity models (Hebbian, STDP, etc). MATLAB, Neuron, etc.

Neuroinformatics: A graduate level course in computational neuroscience tailored to medical students with very little math. The course was taught in the Medical School at the University of Patras (Greece). Topics included notions of electrical and biochemical properties of single neurons, the electrical and chemical communication between neurons, the anatomy, physiology and function of each of the major brain structures and systems and how behavior emerges from their actions. Hodgkin-Huxley models. Integrate and fire models, various types of neural networks, central pattern generators. Synaptic plasticity. MATLAB, Neuron, etc.

Methods and applications of informatics in neurosciences: A graduate level course in computational neuroscience tailored to engineering and informatics students with very heavy math. The course is part of the "Information technologies in medicine and biology" master's programme in the University of Athens (Greece) at which I am a faculty member. Topics included notions of electrical and biochemical properties of single neurons, the electrical and chemical communication between neurons, the anatomy, physiology and function of each of the major brain structures and systems and how behavior emerges from their actions. Emphasis is given on mathematical descriptions and computational techniques used to study and understand neurons and network of neurons such as: Hodgkin-Huxley models, cable theory, integrate-and-fire neurons, multicompartmental modeling, riring rate models, various types of neural networks (feedforward, associative, linear recurrent, stochastic, etc.), central pattern generators, topographic maps, receptive fields, elements of information theory (entropy and mutual information, etc.) spike-train statistics, reverse-correlation methods, rate vs temporal processing, population vector coding, adaptation and learning (Hebbian learning, LTP/LTD, STDP, supervised, unsupervised learning), classical conditioning, reinforcement learning (Markov decision processes, actor-critic model, etc.). MATLAB, Neuron, etc.

Object-oriented software design: A graduate level course taught at the University of Stirling (U.K) in 2007-2008. Topics included software development process. Object concepts. Unified Modelling Language (UML): class diagrams, use case diagrams, interaction diagrams, state diagrams. Use of a CASE tool. Analysis and design models. Case studies in use-case modelling, object-oriented analysis and object-oriented design. Components and re-use in software engineering.

Therefore, my multi-disciplinary teaching experiences I have acquired over the years will allow me to integrate perfectly with the other teaching faculty in your department.