

Curriculum Vitae



Márton Albert Hajnal

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Research

- 2018- Computational System Neuroscience Lab, GOLAB, MTA Wigner Research Centre for Physics (KFKI), Budapest, Hungary, topics: feedback loops in the visual cortex, top-down and memory.
- 2014 Bernstein Center for Computational Neuroscience, Berlin and Freiburg, School of Medicine: Charité, Berlin, Germany, *three month visit, talk on mini symposium and consultations on research projects*; topics: bifurcation and dynamical systems, dendritic integration, striatal tissue functions, DA, ACh neuromodulators.
- 2011- Rising Sun Association, Nyim Ecocommunity, Hungary, *principal investigator, collaboration organizer, complex systems studies*; topics: water use and ecological systems in dry grasslands, agroforestry, culture plants, soil and subsoil as ecological-chemical-physical systems (in association with Department of Applied Geology, D. of Ecology, Eötvös Loránd University (ELTE), Research Institute of Organic Agriculture (ÖMKI), and Institute of Ecology and Botany of the Hungarian Academy of Sciences (MTA)), social interactions and psychological development in a community (in association with Faculty of Social Sciences and Faculty of Psychology, ELTE)
- 2009- Budapest Computational Neuroscience Group, MTA Wigner Research Centre for Physics (KFKI), Budapest, Hungary, *collaboration on research projects and PhD studies*; topics: ACh and DA effects on the medium spiny neurons of the neostriatum, ionchannels, physiology, morphology, bifurcations and dynamical systems, algorithmic parameter optimization, dendritic integration, active dendritic effects, spines, LTP, local microcircuitry, interneurons.
- 2008- Neural Information Processing Group (NIPG), Eötvös Loránd University (ELTE), Faculty of Information Systems, Budapest, Hungary. *PhD studies*; topics: spiking neural computation properties in the brain, time and phase coding, synchronization, biophysics of synapses, microcircuitry, hippocampus, cortex, basal ganglia, neuromodulation, self-organisation, avalanches, dynamical systems, dynamics vs. plasticity, feature abstraction, perceptual grouping, cross-modality binding, attention, creativity, music;

2006-2008 RAD (Cancer Risk at Low Doses) Foundation, Vác, Hungary. *Research associate, topics:* low dose environmental radiation and cancer risk. *Principal investigator:* physiology, pathology, epidemiology, statistics

2004-2007 Neural Information Processing Group (NIPG), Eötvös Loránd University (ELTE), Faculty of Information Systems, Budapest, Hungary. *Masters thesis, competitions;* topic: artificial neural network algorithms in the model of visual and hippocampal systems; comparison of process recognising and predicting neural algorithms; phase transition in Echo State Networks, information storage increase in critical regime between order and randomness, computation at the edge of chaos

2003 SCKCEN Belgian Nuclear Research Centre, Mol, Belgium. Short-term visit: supercritical water in nuclear reactors

1999-2006 Institute of Human Physiology and Clinical Experimental Research, Semmelweis University of Medicine (SE/SOTE), Budapest, Hungary. *Diploma thesis, competitions, research associate;* topic: spatial and temporal correlations in physiology, fractals and dynamical systems in physiology, microcirculation in the cerebral cortex, noninvasive near infrared absorption of oxi- and deoxy-haemoglobin, human experiments.

Research & Development

Selected projects

2017- Zöldzugoly Cooperative, Nyim Ecocommunity, Hungary, *project founder:* precision organic agriculture, sensor development, know-how assessment, soil biome characterization, carbon dioxide sequestering organic agricultural techniques

2016-2017 Prototype development of a mobile beta-radiation-detector during surgical operations of cancers (further details undisclosed, due to NDA)

2014 Independent validation of proof of concept, myocardial infarct MRI diagnosis with probability imaging (further details undisclosed, due to NDA)

2003-2007 OSSKI National Radiationbiology and Radiational Healthcare Institute, Isotop Research Unit and Joint Research Center of the European Union, Institute for Health and Consumer Protection. *Research associate;* topic: hyperthermal tumor therapy, development of fibreoptical sensors in thermometry

Education

2007- Eötvös Loránd University, Budapest, Faculty of Information Science: PhD Graduate Program in Information Systems

2000-2006 Eötvös Loránd University, Budapest, Faculty of Physics, **Master of Science in Physics**, Specialization: Biophysics

2003-2004 Environmental Management Postgraduate Course, University of California San Francisco, Pázmány Péter Catholic University Budapest

1996-2002 Semmelweis University, Budapest, Faculty of Medicine, **Doctor of Medicine**

1992-1996 Baár-Madas Reformed High School

1988-1992 Trefort Ágoston Primary School

Competitions

2005. OTDK (National Scientific College Student Competition), Informatics Section, 2nd place: Recognition of Processes with Nonlinear Recurrent Neural Networks

1996. OKTV (National High School Competition), Biology, 11th place

Publications

Peer-reviewed Journal Articles and Conference Proceedings

- M.A. Hajnal, Time Coding of Input Strength is Intrinsic to Synapses with Short Term Plasticity *19th International Conference on Artificial Neural Networks*, volume 5768/2009 of *Lecture Notes in Computer Science*, pages 315–324, Springer Berlin / Heidelberg, September 2009. doi:10.1007/978-3-642-04274-4_33
- M.A. Hajnal, Coding Capacity of Synchronous Neuronal Activity: Reliable Sparse Code by Synchrony within a Dendritic Compartment. *Recent Advances in Neural Networks – Proceedings of the WSEAS Int. Conf. on Neural Networks '09*, pages 153–158, WSEAS Press, 2009.
- M.A. Hajnal, E. Tóth, K. Hátori, M. Minda, and G. Köteles. Indoor radon level and lung cancer with lognormal logistic regression: Case-control study in northern Hungary. *Epidemiology*, Submitted
- M.A. Hajnal, K. Hátori, M. Minda, E. Tóth, and G. Köteles. Organising a regional radon-level survey (review). *Indian Journal of Radiation Research*, 4(2):71–, 2007.
- M.A. Hajnal and A. Lőrincz. Critical Echo State Networks. In *Artificial Neural Networks ICANN 2006*, volume 4131/2006 of *Lecture Notes in Computer Science*, pages 658–667. Springer Berlin / Heidelberg, September 2006. doi:10.1007/11840817_69 (times cited 1 – ISI)
- A. Eke, P. Hermán, and M. Hajnal. Fractal and noisy CBV dynamics in humans: influence of age and gender. *Journal of Cerebral Blood Flow and Metabolism*, 26:891–898, 2006. published online November 2005 doi:10.1038/sj.jcbfm.9600243 (times cited 2 – ISI, 4 – Scopus)

Other Conferences

- M.A. Hajnal, E. Tóth, K. Hátori, M. Minda, and G. Köteles. Correlation between radon level and confounders of cancer: a note on epidemiological inference at low doses. In *International Conference on Low Dose Radiation Effects on Human Health and Environment, Budapest, Hungary*, October 2007.
- M.A. Hajnal and A. Lőrincz. Critical Echo State Networks and their Neurobiological Relevance. In *Conference on Large-Scale Random Graph Methods for Modeling Mesoscopic Behavior in Biological and Physical Systems*, Budapest, September, 2006.
- A. Eke, P. Hermán, and M. Hajnal. Effect of age and gender on fractal fluctuations of hemoglobin content and oxygenation in the human brain. In *ISOTT, Philadelphia, PA, USA.*, 2001.
- A. Eke, M. Hajnal, and P. Hermán. Age-dependent fractal fluctuations of hemoglobin content and oxygenation in the human brain cortex. isott, 2000,. In *ISOTT, Nijmegen, The Netherlands*, 2000.

Skills

Experimental: electronic hardware, measurement devices, bespoke control systems, familiarity in live clinical environment, human subject handling, rodent operations

Programming: Python, Matlab, R, SQL, Maple, Neuron, Genesis, Perl, Linux and Windows scripts and systems, C, C++

Soft: excellent rapport and communication skills, trained group facilitator, mental hygiene counsellor, critical project and risk management skills

Languages: Hungarian (expert), English (expert), French (intermediate), Spanish (Basic)