



Laborator: Sisteme de Calcul de Inspiratie Naturala

(Natural and High Performance Computing Lab. – NHC Lab)

Tematica /istoric: Laboratorul SCIN s-a cristalizat incepand din anul 2002, constituirea si dotarea sa fiind initial finantate de un grant Volkswagen Stiftung (2002-2004) derulat in cooperare cu Universitatea Tehnica Darmstadt, Germania, grant avand ca obiective dezvoltarea unor solutii eficiente pentru integrarea unor algoritmi de inspiratie naturala si constituirea unui laborator de profil in UPB. Laboratorul SCIN concentreaza in special activitatea de cercetare desfasurata impreuna cu membri si colaboratori, doctoranzi si masteranzi afiliati grupului dar si colaborari cu diferite colective din universitati prestigioase de pe mapamond. Tematica laboratorului:

- Arhitecturi si algoritmi de inspiratie naturala (rețele celular neliniare (CNN), automate celulare, rețele neurale artificiale si alte sisteme “machine learning”, sisteme cu logica fuzzy, "swarm intelligence" si alti algoritmi de optimizare de inspiratie naturala, etc.) cu aplicatii in probleme de prelucrare a imaginilor, clasificare si detectie, predictie, optimizare, dezvoltare de senzori inteligenti.
- Aplicatii ale dinamicii in rețele neliniare complexe (criptografie, predictie, modelare si simulare a sistemelor complexe: biologice, sociale, fizice)
- Eficientizarea algoritmilor pentru integrare in platforme computationale diverse (PC, tableta, sisteme FPGA, CUDA, sau circuite specializate)
- Biodinamica neliniară (sisteme dinamice neliniare cu aplicatii in prelucrarea semnalelor si modelare in biologie)

Resurse materiale:

- sala B232 (cercetare, doctoranzi, masteranzi): 4-5 statii de lucru PC / Wireless Acces Point “natcom” / imprimanta/ scanner / proiector / 1 sist. dezvolt. FPGA de complexitate mare (XSB300E / Xilinx), 1 sist. dezvolt. FPGA complexitate mare (Altera - DE2), 2 sist. dezvolt. FPGA complexitate mica (Basys 2 /Xilinx); Osciloscop “soft” SDS200A, sisteme de dezvoltare cu microcontroller (Freescale, Microchip, PSOC);

- sala B125B (didactic, cercetare): 22 locuri / 11 statii de lucru PC + server / proiector / echipamente periferice si software specific diferitelor discipline;

- sala B145: server cu resurse software didactice si de cercetare ale laboratorului (website lab SCIN http://atm.neuro.pub.ro/radu_d/)

Activitati: cercetare, coordonare doctoranzi, indrumare teme licenta masterat doctorat, seminarii stiintifice, prezentari rapoarte de cercetare masteranzi-doctoranzi, activitati didactice si de consultanta aferente disciplinelor laboratorului.

Discipline din planul de invatamant:

Inteligența Computațională Integrată (ETTI-an IVA),
Sisteme Reconfigurabile de Calcul (ETTI-an IVB),
Sisteme de calcul de inspirație naturală (master IISC- an I)
Structura și Dinamica Rețelelor Neliniare (master ITEMS- an II)
Neuroinformatică Aplicată (master IISC și EIA- an II)
Programare Obiect Orientată (ETTI, an IIA)
Tehnici de Programare în Internet (ETTI, an IIIE)
Biodinamică neliniară (FIM, master IMC-an I)

Resurse umane:

Coordonatori: Prof. Dr. ing. Radu Dogaru, Sl.dr.ing. Ioana Dogaru

Doctoranzi: sl.dr.d.ing Valentin Stoica, drd. ing. Ioana Dumitrache, drd.ing. Catalin Mitrea, drd.ing. Raluca Boia, drd. ing. Camelia Moldovan, drd. ing. Mihai Bucurica, drd. ing. Marinela Enache

Postdoc: (visiting) dr.ing. YuLi Xue, Beihang University - Beijing, China

Colaboratori (internazionali): Prof. Hyongsuk Kim (Univ. Chonbuk, Coreea de Sud), Prof. Manfred Glesner (Univ. Tehnica Darmstadt, Germania), Prof. Leon O. Chua (Univ. California Berkeley, SUA), Prof. Kyandoghere Kyamakya (Univ. Alpen Adria - Klagenfurt, Austria), Prof. Alberto Garcia-Ortiz (Univ. Bremen, Germania), Dr. Ricardo Carmona-Galan (Instituto de Microelectrónica de Sevilla, Spania),

Alumni: dr.ing. Ionut MIRONICA (teza doctorat finalizată în iulie 2013)

Publicații recente reprezentative (selectie):

O listă exhaustivă de publicații este disponibilă [aici](#)

(http://scholar.google.ro/citations?hl=ro&user=KZX6kiIAAAAJ&view_op=list_works&sortby=pubdate)

Radu Dogaru and Ioana Dogaru, "*Cellular Automata for Efficient Image and Video Compression*", **Chapter 1 in book "Cellular Automata in Image Processing and Geometry**, (Editors Paul Rosin, Andrew Adamatzky, Xianfang Sun), Springer, **2014**, pp. 1-24, ISBN 978-3-319-06430-7.

R. Dogaru and Ioana Dogaru, "*Applications of Natural Computing in Cryptology: NLFSR based on Hybrid Cellular Automata with 5-cell Neighborhood*", **PROCEEDINGS OF THE ROMANIAN ACADEMY**, Series A, Volume 14, Special Issue **2013**, pp. 365–372.

Ioana Dogaru, R. Dogaru, "JLCNN: An object-oriented Java package for low complexity neural networks", in 4th International Symposium on Electrical and Electronics Engineering (ISEEE), pp. 1-6, 2013, DOI: 10.1109/ISEEE.2013.6674317 (IEEE Xplore)

R. Dogaru, I. Dogaru, "*Binary Synchronization of Complex Dynamics in Cellular Automata and its Applications in Compressed Sensing and Cryptography*", **Chapter 5 in Selected Topics in Nonlinear Dynamics and Theoretical Electrical Engineering**, Studies in Computational Intelligence Volume 459, Springer, **2013**, pp 81-95.

Dogaru, R.; Dogaru, I.; Hyongsuk Kim; "*Chaotic Scan: A Low Complexity Video Transmission System for Efficiently Sending Relevant Image Features*", in **IEEE Transactions on Circuits and Systems for Video Technology**, Volume: 20 , Issue: 2, Page(s): 317 – 321, **2010** (ISI)

Ioana Dogaru, R. Dogaru, "Algebraic normal form for rapid prototyping of elementary hybrid cellular automata in FPGA", in 3rd International Symposium on Electrical and Electronics Engineering (ISEEE), pp. 277-280, 2010, DOI: 10.1109/ISEEE.2010.5628500, (IEEE Xplore)

R. Dogaru, M. Glesner, "A fast and compact classifier based on sorting in an iteratively expanded input space", **INTERNATIONAL JOURNAL OF INTELLIGENT SYSTEMS**, VOL. 23, 607-618, **May 2008**. (ISI)

Dogaru, R.; Julian, P.; Chua, L.O.; Glesner, M., (2002) "The simplicial neural cell and its mixed-signal circuit implementation: an efficient neural-network architecture for intelligent signal processing in portable multimedia applications", in **IEEE Transactions on Neural Networks**, Volume: 13 Issue: 4, **July 2002**, Page(s): 995 –1008. (ISI)

Publicatii recente ale doctoranzilor

Mitrea, C.A. ; Ionescu, B.-E. ; Dogaru, R, "A Pseudo-Random Scan perspective to the motion detection paradigm" 4th International Symposium on Electrical and Electronics Engineering (ISEEE), 2013 , IEEE Xplore.

Dumitrache, I. ; Sultana, A. ; Dogaru, R., "Reaction-diffusion cellular nonlinear networks for feature enhancement in dermatoscopic images", 4th International Symposium on Electrical and Electronics Engineering (ISEEE), 2013 , IEEE Xplore.

Boia, R. ; Dogaru, R. ; Florea, L., "A comparison of several classifiers for eye detection on emotion expressing faces", 4th International Symposium on Electrical and Electronics Engineering (ISEEE), 2013 , IEEE Xplore.

Ionuț MIRONICĂ, Radu DOGARU, A NOVEL FEATURE-EXTRACTION ALGORITHM FOR EFFICIENT CLASSIFICATION OF TEXTURE IMAGES, U.P.B. Sci. Bull., Series C, Vol. 75, Iss. 2, **2013**, ISSN 2286 – 3540.

Monografii cu distributie internationala:

Dogaru R., (2008) *Systematic design for emergence in cellular nonlinear networks – with applications in natural computing and signal processing*, Springer-Verlag, Berlin Heidelberg, **2008**, ISBN: 978-3-540-76800-5, 165 pagini

Radu Dogaru, (2003) *Universality and Emergent Computation in Cellular Neural Networks*, **World Scientific**, 2003, 260 pages, ISBN 981-238-102-3