Paul Irofti

Associate Professor PhD
Anomaly Detection
Operating Systems
Antivirus Technologies
Security Applications
Signal Processing
GPU Parallel Algorithms

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Education

Ph.D. in Systems Engineering,
thesis *"Parallel Dictionary Learning Algorithms for Sparse Representations"*,
University Politehnica of Bucharest, Bucharest, 2011–2016

Engineer, Faculty of Automatic Control and Computers,
University Politehnica of Bucharest, Bucharest, 2003-2008

Mathematics and Computer Science, Saint Sava National College, Bucharest, 1999-2003

Waldorf School, Bucharest, 1991-1998

Fields of Interest

Reverse Engineering, Static and Dynamic Analysis, Operating Systems,
Signal Processing, Parallel Algorithms

Experience

University of Bucharest

Associate Professor in the Department of Computer Science
at the Faculty of Mathematics and Computer Science,
February 2021 – Present

Researcher and Founding Member of The Research Center for Logic, Optimization and Security (LOS)
of the Department of Computer Science at the Faculty of Mathematics and Computer Science,
September 2020 – Present

Vice Dean of the Faculty of Mathematics and Computer Science,
In charge of Research, IT, and Industry Relations.
February 2020 – Present

Lecturer in the Department of Computer Science at the Faculty of Mathematics and Computer Science,
February 2018 – February 2021

University Politehnica of Bucharest

Postdoc at Faculty of Automatic Control and Computers, "Implementation and development of algorithms
for the dynamic motion planning of robotic systems", CEC 2017 project, 2017

Navigation algorithms for robotic systems

Generate trajectories which fulfill optimally costs

ROS-based Gazebo implementation for TurtleBot

Postdoc at Faculty of Automatic Control and Computers, "Set-theoretic approaches for fault tolerant control of complex systems", TE 2015 project, September 2015 - December 2017

Sensor placement using sparse representations and dictionary learning

Applications in water distribution networks

Research Assistant at Faculty of Automatic Control and Computers, "Sparse representations in signal processing", IDEI 2011 project, January 2014 - September 2016

Parallel algorithms for sparse and redundant representations for dictionary learning and training

Applications in image processing (reconstruction, compression, noise reduction etc.)

Heterogenous implementations on the GPU and CPU via OpenCL

FileMedic

Project Lead: AntiMalware Emulator Implementation, 2011-2013

Build, Test and Report Infrastructure, autumn 2011 - spring 2012

Internal Telephony Infrastructure Setup, spring 2011

Static Antivirus Engines Development, winter 2010 - 2011

Developing a Generic Server/Router Security Solution, 2010

OpenBSD

Adapt kernel and libc for timecounting in userland, summer 2020

Add TSC synchronization for multiprocessor machines, autumn 2019

libunwind IP-based caching implementation with O(logn) lookup, spring 2019

httpd(8) FastCGI params support, spring 2019

New semaphore implementation making sem_post async-safe, summer 2018

net80211 improve wireless network scanning, spring 2018

Standardize and fix various threading and concurrency issues, 2017-2018

ACPI resource parsing improvements, autumn 2016

Intel Extreme Tuning driver acpixtu(4), autumn 2016

Flash memory driver conforming to CFI specifications, summer 2015

Octeon-specific driver for the USB Host Controller Interface, summer 2014

Broadcom PHY driver for BCM53115 found on the Octeon DSR-500, spring 2014

Driver implementation for the DS1337 TOD clock for the Octeon platform, winter 2014

USB device drivers clean-up, autumn 2014

Driver implementation for the hardware random number generator on the Octeon platform, autumn 2014

Porting OpenBSD to the Octeon-based D-Link DSR-500, summer 2013

Hibernate support for the Loongson platform, summer 2013 (work in progress)

Statistic clock support for the Loongson platform, winter 2013

CPU scaling support for the Loongson CPU, 2010-2013

Porting the System for the Itanium Platform, 2011 (work in progress)

Futex Implementation, summer 2011

Expanding the Emulation Layer for Linux Binaries, 2010-2011

Suspend/resume support for the Loongson Platform, 2010-2011

Porting Mathematical Applications: Octave, GiNaC, CLN and others, 2009-2010

Driver Implementation for Sony Specific Functionality, acpisony(4), 2010

Generic Kernel Framework for suspend/resume, 2009-2010

Expansion of the Device Autoconfiguration Framework, autumn 2009

Real-mode Emulator Kernel Integration for the Video BIOS, 2009

Driver Implementation for Power Resource Management, acpipwrres(4), summer 2009

Driver Implementation for Video Adjustment, acpivout(4), 2008 - summer 2009

Driver Implementation for Multiple Video Output, acpivideo(4), 2008 - summer 2009

ACPI Framework Development, 2008-2010

BitDefender

64-bit JIT support for the emulator, summer 2010

IEEE 754 Floating Point Support, 2010

Themida Unpacker, 2009

Native Decryption methods for SVKP unpacking, spring 2009

Vmprotect Unpacker, winter 2008-2009

API Emulation: VB.NET, VBScript, 2008

tELock Unpacker, summer 2008

Unidec

Project Lead: Implementing a Generic Telephony-server Solution, 2007-2008

IVR Implementation, 2007

VoIP Protocol Implementation (IAX2, SIP), 2006

VoiceMail Solutions Development for NEC America, 2005-2006

Collaborations

MTier, Oil Industry: Native Binary Emulation of Linux Executables on OpenBSD, 2010, 2012; Security and Operating Systems consultant, 2016–2020

Bitfusion.io, I.T. Supercomputing Industry: Optimiziation and scaling of OpenCL workloads, 2015

Parta, I.T. Security Industry: Driver implementation and application porting for OpenBSD, 2014, 2015

Scholarships and Research Grants

Coordinator of the "Solutions" consortium project "NetAlert – Automatic tools for detecting abnormal behavior in computer networks" (30SOL/2021), 2021-2023

Principal investigator of the "Postdoctoral Research Projects" project "DDNET – Data Driven Fault Accommodation for Distribution Networks" (PD12/2020), 2020-2022

Responsible for the "Proiect Experimental Demonstrativ" project "Graphomaly: software package for anomaly detection in graphs modeling financial transactions" (PED287/2020), 2020–2022

BRD Data Science Research Fellowships, 2019

BSD Fund: Futex Implementation for OpenBSD, 2011

Academic Research

Publications

Books

1. B. Dumitrescu and **P. Irofti**, *Dictionary Learning Algorithms and Applications*, Springer, 2018 (**Granted the Romanian Academy Award "Grigore Moisil"**)

Chapters

1. A. Pătrașcu, C. Păduraru, and **P. Irofti**, "Stochastic Proximal Gradient Algorithm with Minibatches. Application to Large Scale Learning Models," in *Enabling AI applications in Data Science*, pp. 3–25. Springer, 2020

2. **P. Irofti**, A. Băltoiu, and A. Pătrașcu, "Fraud Detection in Networks," in *Enabling AI applications in Data Science*, pp. 517–536. Springer, 2020

Journal

1. **P. Irofti**, L. Romero-Ben, F. Stoican, and V. Puig, "Learning Dictionaries from Physical-Based Interpolation for Water Network Leak Localization," *IEEE Transactions on Control Systems Technology*, pp. 1–12, 2023

2. A. Pătrașcu and **P. Irofti**, "On finite termination of an inexact Proximal Point algorithm," *Applied Mathematics Letters*, vol. 134, pp. 108348, 2022

3. A. Pătrașcu and **P. Irofti**, "Stochastic proximal splitting algorithm for composite minimization," *Optimization Letters*, pp. 1–19, 2021

4. **P. Irofti**, F. Stoican, and V. Puig, "Fault Handling in Large Water Networks with Online Dictionary Learning," *Journal of Process Control*, vol. 94, pp. 46–57, 2020

5. F. Stoican and **P. Irofti**, "Aiding Dictionary Learning Through Multi-Parametric Sparse Representation," *Algorithms*, vol. 12, no. 7, pp. 131, 2019

6. B. Dumitrescu and **P. Irofti**, "Regularized K-SVD," *IEEE Signal Processing Letters*, vol. 24, no. 3, pp. 309–313, March 2017

7. **P. Irofti**, "Efficient Parallel Implementation for Single Block Orthogonal Dictionary Learning," *Journal of Control Engineering and Applied Informatics*, vol. 18, no. 3, pp. 101–108, 2016

8. **P. Irofti**, "Efficient Dictionary Learning Implementation on the GPU Using OpenCL," *U.P.B. Scientific Bulletin, Series C*, vol. 78, no. 3, pp. 39–50, 2016

Conference

1. **P. Irofti**, "Pinky: A Modern Malware-oriented Dynamic Information Retrieval Tool," in *International Conference on Information Technology and Communications Security (SecITC)*. Springer, 2023, pp. 1–14

2. A. Stancu, **P. Irofti**, and I. Leuștean, "OpenBSD formal driver verification with SeL4," in *International Conference on Information Technology and Communications Security (SecITC)*. Springer, 2023, pp. 1–13

3. R. Bălucea and **P. Irofti**, "Software Mitigation of RISC-V Spectre Attacks," in *International Conference on Information Technology and Communications Security (SecITC)*. Springer, 2023, pp. 1–18

4. **P. Irofti**, A. Pătrașcu, and A.I. Hîji, "Unsupervised Abnormal Traffic Detection through Topological Flow Analysis," in *2022 14th International Conference on Communications (COMM)*. 2022, pp. 1–6, IEEE

5. **P. Irofti**, L. Romero-Ben, F. Stoican, and V. Puig, "Data-driven Leak Localization in Water Distribution Networks via Dictionary Learning and Graph-based Interpolation," in *CCTA 2022 - 2022 IEEE International Conference on Control Technology and Applications (CCTA)*. 2022, pp. 1265–1270, IEEE

6. **P. Irofti**, C. Rusu, and A. Pătrașcu, "Dictionary Learning with Uniform Sparse Representations for Anomaly Detection," in *ICASSP 2022 - 2022 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*. 2022, pp. 3378–3382, IEEE

7. C. Rusu and **P. Irofti**, "Efficient and Parallel Separable Dictionary Learning," in *Proceedings of the IEEE 2021 27th International Conference on Parallel and Distributed Systems (ICPADS)*. 2021, pp. 1–6, IEEE Computer Society

8. **P. Irofti** and A. Băltoiu, "Unsupervised Dictionary Learning for Anomaly Detection," in *International Traveling Workshop on Interactions Between Sparse Models and Technology*, 2020, pp. 1–3

9. A. Băltoiu, A. Pătrașcu, and **P. Irofti**, "Graph Anomaly Detection Using Dictionary Learning," *The 21st World Congress of the International Federation of Automatic Control (IFAC-PapersOnLine)*, vol. 53, no. 2, pp. 3551–3558, 2020

10. **P. Irofti** and A. Băltoiu, "Malware Identification with Dictionary Learning," in *27th European Signal Processing Conference*, 2019, pp. 1–5

11. **P. Irofti** and B. Dumitrescu, "Pairwise Approximate K-SVD," in *Acoustics Speech and Signal Processing (ICASSP), 2019 IEEE International Conference on*, 2019, pp. 3677–3681

12. **P. Irofti** and F. Stoican, "Dictionary Learning Strategies for Sensor Placement and Leakage Isolation in Water Networks," in *The 20th World Congress of the International Federation of Automatic Control*, 2017, pp. 1589–1594

13. B. Dumitrescu and **P. Irofti**, "Low Dimensional Subspace Finding via Size-Reducing Dictionary Learning," in *2016 IEEE International Workshop on Machine Learning for Signal Processing (MLSP)*, 2016, pp. 1–6

14. **P. Irofti**, "The Effect of Atom Replacement Strategies on Dictionary Learning," in *International Traveling Workshop on Interactions Between Sparse Models and Technology*, 2016, pp. 10–11

15. **P. Irofti** and B. Dumitrescu, "Overcomplete Dictionary Learning with Jacobi Atom Updates," in *39th International Conference on Telecommunications and Signal Processing*, 2016, pp. 421–424

16. **P. Irofti** and B. Dumitrescu, "Regularized Algorithms for Dictionary Learning," in *2016 International Conference on Communications (COMM)*, 2016, pp. 439–442

17. **P. Irofti**, "Sparse Denoising with Learned Composite Structured Dictionaries," in *19th International Conference on System Theory, Control and Computing*, 2015, pp. 331–336

18. **P. Irofti** and B. Dumitrescu, "Cosparse Dictionary Learning for the Orthogonal Case," in *19th International Conference on System Theory, Control and Computing*, 2015, pp. 343–347

19. **P. Irofti** and B. Dumitrescu, "Overcomplete Dictionary Design: the Impact of the Sparse Representation Algorithm," in *The 20th International Conference on Control Systems and Computer Science*, 2015, pp. 901–908

20. **P. Irofti** and B. Dumitrescu, "GPU Parallel Implementation of the Approximate K-SVD Algorithm Using OpenCL," in *22nd European Signal Processing Conference*, 2014, pp. 271–275

Preprints

1. L. Romero-Ben, **P. Irofti**, F. Stoican, and V. Puig, "Nodal Hydraulic Head Estimation through Unscented Kalman Filter for Data-driven Leak Localization in Water Networks," pp. 1–6, 2023

2. A. Pătrașcu and **P. Irofti**, "Computational complexity of Inexact Proximal Point Algorithm for Convex Optimization under Holderian Growth," pp. 1–42, 2021

Projects

Principal Investigator "NetAlert – Automatic tools for detecting abnormal behavior in computer networks", SOL4 project, 2021-2023

Principal Investigator "DDNET – Data Driven Fault Accommodation for Distribution Networks", PD project, 2020-2022

Principal Investigator "Graphomaly: software package for anomaly detection in graphs modeling financial transactions", PED project, 2020–2022

"Innovation Hub for Advanced Cyber-Security Technologies", PCCDI project 2018-2020

"Implementation and development of algorithms for the dynamic motion planning of robotic systems", CEC 2017 project, 2017

"Set-theoretic approaches for fault tolerant control of complex systems", TE 2015 project, 2015-2017

"Sparse representations in signal processing", IDEI 2011 project, 2014-2016

Teaching Classes

"Numerical Analysis",
Bachelor Program "Computer Science",
Faculty of Mathematics and Computer Science
University of Bucharest, 2021-present

"Signal Processing",
Bachelor Program "Computer Science",
Faculty of Mathematics and Computer Science
University of Bucharest, 2020-present

"Static Analysis",
Master Program "Security and Applied Logic",
Faculty of Mathematics and Computer Science
University of Bucharest, 2019-present

"Operating Systems: Design and Security",
(**Received the ANIS Cybersecurity Award**)
Master Program "Security and Applied Logic",
Faculty of Mathematics and Computer Science
University of Bucharest, 2018-present

"Using Operating Systems",
Bachelor Program "Computer and Information Tehnology",

Faculty of Mathematics and Computer Science
University of Bucharest, 2017-present

"Operating Systems", Bachelor Program "Computer Science",
Faculty of Mathematics and Computer Science
University of Bucharest, 2017-present

"Computation for Complex Systems", (with Prof. B. Dumitrescu),
Master Program "Complex Systems",
Faculty of Automatic Control and Computers
University Politehnica of Bucharest, 2017-2018

"Numerical Methods" (Prof. B. Dumitrescu),
Bachelor Program "Automatic Control and Systems Engineering",
Faculty of Automatic Control and Computers
University Politehnica of Bucharest, 2014-2018

"Parallel and distributed processing of data and knowledge" (with Prof. B. Dumitrescu),
Master Program "Intelligent Systems Control",
Faculty of Automatic Control and Computers
University Politehnica of Bucharest, 2012-2017

"Modelling and Simulation" (Lecturer. F. Stoican),
Bachelor Program "Automatic Control and Systems Engineering",
Faculty of Automatic Control and Computers
University Politehnica of Bucharest, 2015-2016

Conference and Seminar Presentations

Dictionary Learning Applications in Control Theory (slides)

Recent Advances in Artificial Intelligence, Bucharest, Romania June 19-20, 2017

Making OpenBSD Useful on the Octeon Network Gear (video)

European BSD Conference, Sofia, Bulgaria September 25-28, 2014

Dynamic Analysis: Knowing When to Stop

Dagstuhl Seminar
Challenges in Analysing Executables: Scalability, Self-Modifying Code and Synergy (14241)
Schloss Dagstuhl, Leibniz-Zentrum fur Informatik,
Leibniz, Germany, June 9-13, 2014

Porting OpenBSD on the MIPS64-based Octeon Platforms

BSDCan Conference, Ottawa, Ontario, Canada, May 14-17, 2014

Emulator Design, Traps and Pitfalls

Dagstuhl Seminar Analysis of Executables: Benefits and Challenges (12051)
Schloss Dagstuhl, Leibniz-Zentrum fur Informatik,
Leibniz, Germany, January 29th - February 3rd, 2012

OpenBSD's New Suspend and Resume Framework (presentation)

European BSD Conference, Maarssen, Utrecht, Netherlands, October 6-9, 2011

Asian BSD Conference, Tokyo, Japan, March 17-20, 2011 (canceled due to natural disasters)

On the Linux Compatibility Layer in OpenBSD 5.0

Slackathon Conference, Stockholm University, Stockholm, Sweden, August 6th, 2011

Image Processing with Wavelet Transformations (in romanian)

> Faculty of Automatic Control and Computers,
> University Politehnica of Bucharest,
> Bucharest, Romania, June, 2008

Organized Conferences and Workshops

Ports Hackathon, Faculty of Computer Science and Mathematics,
University of Bucharest, Romania, Nov 5-12, 2019

Conferences and Workshops Attended

Ports Hackathon, Epitech École d'Informatique, Nantes, France, April 23-29, 2018

Ports Hackathon, IN-Berlin, Berlin, Germany November 1-6, 2017

General Hackathon, Computer Laboratory, Cambridge, UK August 30th - September 5th, 2016

Ports Hackathon, Epitech École d'Informatique, Nantes, France, April 25-29, 2016

General Hackathon, SAIT Polytechnic, Calgary, Canada July 15-21, 2015

European General OpenBSD Hackathon, Ljubljana, Slovenia July 8-14, 2014

General Hackathon, University of Toronto, Toronto, Canada May 29th - June 5th, 2013

Network Hackathon, University of Otago, Dunedin, New Zealand January 13-19, 2013

Hardware Hackathon, Coimbra University, Coimbra, Portugal November 14-20, 2012

Network Hackathon, Starnberg, Germany September 17-21, 2012

General OpenBSD Hackathon, Budapest, Hungary July 7-14, 2012

Rthreads Hackathon, Henri Poincaré Institute, Paris, France April 10-14, 2012

Ports Hackathon, Budapest, Hungary November 12-18, 2011

European General OpenBSD Hackathon, Ljubljana, Slovenia September 16-23, 2011

General OpenBSD Hackathon, University of Alberta, Edmonton, Canada July 2-9, 2011

OpenBSD Kernel Hackathon, Hafnarfjordur, Iceland April 1-7, 2011

Ports Hackathon, Budapest, Hungary, October 23-29, 2010

Japan General Hackathon, Akiyamago, Sake Mura, Nagano, Japonia September 19-25, 2010

General OpenBSD Hackathon, University of Alberta, Edmonton, Canada June 25th - 3rd July, 2010

Hardware OpenBSD Hackathon, Coimbra University, Coimbra, Portugal November 21-27 2009

Ports Hackathon, Budapest, Hungary October 9-16, 2009

General OpenBSD Hackathon, University of Alberta, Edmonton, Canada, May 30th - June 7th, 2009

Ports Hackathon, Budapest, Hungary October 24-31, 2008

Awards

Romanian Academy Award "Grigore Moisil" (together with Prof. Dr. Bogdan Dumitrescu) for the book "Dictionary Learning Algorithms and Applications" published at Springer in 2018

ANIS Cybersecurity Award for the "Operating Systems: design and security" course introduced in 2020 at the Security and Applied Logic Master Program of the University of Bucharest

Other Activities

NewOrder Security Site Administrator.

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