Wilder Lopes

Research Scientist (Machine Learning and Signal Processing)

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I am a research scientist (machine learning and signal processing) with focus on design of statistical-learning algorithms. Currently, I am at UCit (www.ucit.fr) where I carry out applied research on machine-learning algorithms for optimization of high-performance computing. In 2016 I earned a Ph.D. in Electronics Engineering (signal processing) from the University of Sao Paulo, Brazil. My interests include signal processing, adaptive filtering, artificial intelligence, machine learning, optimization, computer vision, applied mathematics, and high-performance computing.

Experience

2017–on course **Applied Research Scientist**. *UCit (www.ucit.fr)*, Paris, France.
Research and development of machine learning-based algorithms for optimization of high-performance computing (HPC) systems. Data analysis of HPC clusters performance logs. Design of artificial neural networks for modeling HPC job schedulers. My algorithms lie at the core of UCit's products, e.g., Analyze-IT and Predict-IT.

2016–2017 **Postdoc Researcher**. *Thales Group (Research and Technology)*, Palaiseau, France.
Design of artificial-intelligence algorithms for data partitioning in high performance computing platforms composed by heterogeneous devices, e.g., CPUs and GPUs. Supported by a Marie Curie Research Fellowship, European Union's Seventh Framework Programme (FP7-PEOPLE-2012-ITN, PITN-GA-2012-317446-INFIERI).

2014–2015 **Visiting Ph.D. Researcher**. *TU Munich*, Munich, Germany.
Year-long research stay. Design of adaptive-filtering algorithms for computer-vision applications, especially 3D registration of point clouds, using the Point Cloud Library (PCL).

2009–2010 **Analog and Mixed-Signal IC Engineer**. *LSITec*, Sao Paulo, SP - Brazil.
Design of analog and mixed-signal integrated circuits. Some circuits/blocks designed: Digital-to-Analog converters (DAC), Operational amplifiers, Frequency oscillators.

2007–2008 **Internship in Audio Engineering**. *Audium*, Salvador, BA - Brazil.
Design, simulation, and installation of electro-acoustics systems.

2007–2007 **Internship in Electronics Engineering**. *Squadra*, Salvador, BA - Brazil.
Design and fabrication of communication hardware (RS-232, RS-485, fiber optic). Programming of microcontrollers (embedded C).

Education

Degrees

2012–2016 **Doctorate (Ph.D.) in Electronic Systems Engineering**. *University of Sao Paulo*, Sao Paulo, SP - Brazil.
Dissertation: Geometric-Algebra Adaptive Filters.

2010–2012 **M.S. in Electronic Systems Engineering**. *University of Sao Paulo*, Sao Paulo, SP - Brazil.
Thesis: Incremental Strategies in Combination of Adaptive Filters.

2003–2008 **B.S. in Electrical Engineering**. *Federal University of Bahia*, Salvador, BA - Brazil.
Final Work: Digital Audio Signal Processing Using Wavelet Transform (in Portuguese).

Complementary Courses

2012 **CLTP 3 - CanSat Leader Training Program**. *Tokyo Metropolitan University*, Tokyo - Japan.
Five-weeks course on picosatellites. Construction and test of a Can Satellite (CanSat) with fully functional circuitry.

2008–2009 **Analog and Mixed-Signal IC Design (IC Brazil)**. *CTI Renato Archer*, Campinas, SP - Brazil.
Specialization course (6 months) on design of analog and mixed-signal integrated circuits. Training on Cadence Design Systems tools.

Doctoral (Ph.D.) Dissertation

Title *Geometric-Algebra Adaptive Filters*

Supervisors Prof. Cassio Guimaraes Lopes, Ph.D. and Prof. Dr.-Ing. Eckehard Steinbach

Description My research was focused on exploiting Geometric (Clifford) Algebra theory – which generalizes linear algebra and vector calculus for hypercomplex variables – in order to devise a new class of statistical-learning algorithms, namely Geometric-Algebra Adaptive Filters (GAAFs).

Master's Thesis

Title *Incremental Strategies in Combination of Adaptive Filters*

Supervisor Prof. Cassio Guimaraes Lopes, Ph.D.

Description A new strategy for combination of adaptive filters (statistical-learning algorithms) was introduced. Inspired by incremental schemes and cooperative adaptive filtering, the standard convex combination of parallel-independent filters was rearranged into a series-cooperative configuration, while preserving computational complexity.

Computer skills

Programming **Python, C/C++, Matlab, Java, Cuda, HTML, CSS**

ML Tools **scikit-learn, PyTorch, Keras, TensorFlow**

Hardware **Raspberry Pi, BeagleBone Black, Texas Instruments MSP430**

Editors **Atom, Vim, Qt Creator**

O.S. **Linux, Windows**

Other **LaTeX, Git, SVN, Docker, CMake, Point Cloud Library, LPSolve, MS Office, Eclipse, Cadence**

Languages

Portuguese **Native**

English **Fluent**

German **Intermediate**

French **Intermediate**

Spanish **Basic**

Publications

Lopes, Wilder B.; *Lopes, Cassio G.* "*Geometric-Algebra Adaptive Filters*". Preprint arxiv:1608.03450 [MATH.OC], 2016.

Lopes, Wilder B.; *Al-Nuaimi, Anas; Lopes, Cassio G.* "*Geometric-Algebra LMS Adaptive Filter and its Application to Rotation Estimation*" IEEE Signal Processing Letters, 2016.

Al-Nuaimi, Anas; ***Lopes, Wilder B.***; *Steinbach, Eckehard; Lopes, Cassio G.* "*6DOF Point Cloud Alignment using Geometric Algebra-based Adaptive Filtering*" IEEE WACV 2016 - Lake Placid, NY, USA.

Al-Nuaimi, Anas; ***Lopes, Wilder B.****; Zeller, Paul; Garcea, Adrian; Lopes, Cassio G.; Steinbach, Eckehard "Analyzing LiDAR Scan Skewing and its Impact on Scan Matching"* IEEE IPIN 2016 - Madrid, Spain.

Lopes, Wilder B.*; Lopes, Cassio G. "Incremental Combination of RLS and LMS Adaptive Filters in Nonstationary Scenarios"* IEEE ICASSP 2013 - Vancouver, Canada.

Chamon, Luiz F. O.; ***Lopes, Wilder B.****; Lopes, Cassio G. "Combination of Adaptive Filters with Coefficients Feedback"* IEEE ICASSP 2012 - Kyoto, Japan.

Lopes, Wilder B.*; Lopes, Cassio G. "Incremental-Cooperative Strategies in Combination of Adaptive Filters"* IEEE ICASSP 2011 - Prague, Czech Republic.

Conferences and Workshops

March 2017 **IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP 2017)**. *The world's largest and most comprehensive technical conference on signal processing and its applications. Poster presentation of Signal Processing Letters paper "Geometric-Algebra LMS Adaptive Filter and its Application to Rotation Estimation".* New Orleans, USA.

Jan./Feb. 2017 **4th Summer School on Intelligent Signal Processing for Frontier Research and Industry (INFIERI Summer School)**. *Two weeks-long summer school. It provided lectures, laboratory practice, and poster sessions on the most advanced technologies in the fields of semiconductors, very deep submicron and 3D technologies, advanced packaging and interconnects, telecommunications, real-time signal processing, filtering and massive parallel computing. Such topics cover the signal-processing demands of new Physics domains to be explored. Poster presentation of postdoc research at Thales: "Techniques for Dynamic Workload Partitioning in High-Performance Heterogeneous Computing Platforms".* Sao Paulo, Brazil.

Oct. 2016 **INtelligent, Fast, Interconnected and Efficient devices for Frontier Exploitation in Research and Industry (INFIERI) 8th Workshop**. *Periodic meeting of INFIERI network. Seminaries on technologies for astrophysics, medical physics, and particle physics. Visit to facilities of the Fermi National Accelerator Laboratory (Fermilab). Oral and poster presentation of postdoc research at Thales: "Techniques for Dynamic Workload Partitioning in High-Performance Heterogeneous Computing Platforms".* Fermilab – Chicago, USA.

April 2016 **INtelligent, Fast, Interconnected and Efficient devices for Frontier Exploitation in Research and Industry (INFIERI) 7th Workshop**. *Periodic meeting of INFIERI network. Seminaries on technologies for astrophysics, medical physics, and particle physics. Oral presentation of Ph.D. research: "Signal Processing and Adaptive Filtering: Overview and Applications".* Lisbon, Portugal.

March 2016 **IEEE Winter Conference on Applications of Computer Vision (WACV 2016)**. *One of the main conferences for computer vision applications and systems. Oral and poster presentation of paper "6DOF Point Cloud Alignment using Geometric Algebra-based Adaptive Filtering".* Lake Placid, USA.

May 2013 **IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP 2013)**. *The world's largest and most comprehensive technical conference on signal processing and its applications. Poster presentation of paper "Incremental Combination of RLS and LMS Adaptive Filters in Nonstationary Scenarios".* Vancouver, Canada.

August 2012 **Noshiro Space Event**. *CanSats (Can Satellites) and amateur rocket competition. Launching and test of my own CanSat designed during the CLTP 3 course at Tokyo Metropolitan University. Poster presentation: "An Overview of the Research Activities in the Signal Processing Laboratory at University of Sao Paulo".* Noshiro, Japan.

March 2012 **IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP 2012)**. *The world's largest and most comprehensive technical conference on signal processing and its applications. Poster presentation of paper "Combination of Adaptive Filters with Coefficients Feedback".* Kyoto, Japan.

May 2011 **IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP 2011)**. *The world's largest and most comprehensive technical conference on signal processing and its applications. Poster presentation of paper "Incremental-Cooperative Strategies in Combination of Adaptive Filters".* Prague, Czech Republic.

Grants

Marie Curie Research Fellowship (FP7-PEOPLE-2012-ITN, PITN-GA-2012-317446-INFIERI). *From April 2016 to January 2017.* Funded by the INFIERI network (an European Training Network) as an Experienced Researcher (ER) to carry out postdoctoral research at Thales Research and Technology. This is one of Europe's most prestigious grants.

CAPES-PDSE (number BEX14601/13-3). *From May 2014 to May 2015.* Funded by the Brazilian Ministry of Science and Technology to carry out part of my Ph.D. research at TU Munich.

CAPES-DS, Programa de Demanda Social. *From March 2012 to March 2014, and from June 2015 to February 2016.* Funded by the Brazilian Ministry of Science and Technology to carry out Ph.D. research at the University of Sao Paulo.

PRPG-USP Travel Grant. *From October 2013 to November 2013.* Funds of the University of Sao Paulo to cover expenses during a one month-long research stay at TU Munich.

IEEE Signal Processing Society Travel Grant. *May 2013.* IEEE grant to support student's travel expenses to attend the ICASSP 2013 in Vancouver, Canada.

PAE-USP. *From February to June 2013.* Funds of the University of Sao Paulo to support my activities as a Graduate Teaching Assistant.

PAE-USP. *From July to November 2012.* Funds of the University of Sao Paulo to support my activities as a Graduate Teaching Assistant.

IEEE Signal Processing Society Travel Grant. *March 2012.* IEEE grant to support student's travel expenses to attend the ICASSP 2012 in Kyoto, Japan.

PRPG-USP Travel grant. *May 2011.* Funds of the University of Sao Paulo to cover the travel expenses to attend the ICASSP 2011 conference.

Projects and Collaborative Networks

July 2016 – on course OpenGA.org - Open-source Geometric Algebra (OpenGA) is a hub for tools and algorithms devised in light of Geometric (Clifford) Algebra (GA). This website was first released as a complementary material to my doctoral dissertation. GA encompasses many of the standard algebraic systems used for describing geometric transformations, e.g., linear/matrix algebra, complex algebra, quaternions etc. GA-based algorithms benefit from the intrinsic mathematical generality of GA. OpenGA is for researchers, engineers, and developers willing to apply GA in their projects.

Apr. 2016 to Jan. 2017 INtelligent, Fast, Interconnected and Efficient devices for Frontier Exploitation in Research and Industry (INFIERI) - INFIERI is a multi and inter-disciplinary European ITN project (FP7-PEOPLE-2012-ITN, PITN-GA-2012-317446-INFIERI, February 2013-January 2017), to train young physicists and engineers in the new domain of intelligent devices and tools for frontier applications in Astrophysics, Particle and Medical Physics, and Telecommunications. The network comprises 5 academics, 4 European laboratories, and 2 companies (Philips and Thales) as full partners, all leading, in their respective fields. Associated partners in Europe (CERN, and some leading companies and Universities), the USA (Fermilab) and Korea (Seoul University and Samsung) bring advanced and complementary technical capabilities. INFIERI awarded me with a Marie Curie Research Fellowship to carry out postdoctoral research at Thales.

Courses Taught

Two semesters in 2012–2013 **Experimental Electronics I**. *Graduate teaching assistant*, from July to November 2012 and from February to June 2013 at the Electronic Systems Department of University of Sao Paulo. Discipline outline: transistors (BJT, JFET, MOSFET), rectifiers, voltage and current sources, switching transistors, power transistors, differential amplifiers, operational amplifiers, small-signal amplifiers. Responsibilities: undergrad students tutoring, preparation of laboratory equipment, periodic review of the experimental procedures, grading reports and exams. Average of 6 hours per week.

2012 **Experimental Electronics I**. *Graduate teaching assistant*, from July to November 2012 at the Electronic Systems Department of University of Sao Paulo. Discipline outline: transistors (BJT, JFET, MOSFET), rectifiers, voltage and current sources, switching transistors, power transistors, differential amplifiers, operational amplifiers, small-signal amplifiers. Responsibilities: undergrad students tutoring, preparation of laboratory equipment, periodic review of the experimental procedures, grading reports and exams. Average of 6 hours per week.

Journal Referee

Started 2016 **IEEE Signal Processing Letters**.

Started 2017 **Autonomous Robots, Springer**.

Started 2018 **IEEE Access**.

Started 2018 **IEEE Transactions on Aerospace and Electronic Systems**.