Sara Garbarino

Curriculum Vitae

Research Interests

Theoretical — mathematical modelling, inverse problems, graph theory, regularization theory, compartmental analysis

Methodical — computational modelling, variational Bayes methods, optimization

Applications — mechanistic and data–driven models for the progression of neurological diseases, biomedical imaging and computing

Position

Apr 2018 – to date — **Research Fellow of the Excellence Programme of Université Côte d'Azur**, EPIONE TEAM-PROJECT, *Inria*, with the project "A data-driven model of mechanistic brain Atrophy Propagation in Dementia (AtroProDem)".

Research Experience

Mar 2016 – Mar 2018 — **Research associate**, CMIC GROUP, *Computer Science Department, University College London*, on the H2020 European Projects "European Progression Of Neurodegenerative Disease initiative" (EuroPOND), supervisor: Prof. Daniel Alexander.

Feb 2015 – Feb 2016 — **Postdoctoral research fellow**, MIDA GROUP *Mathematics Department, Università di Genova*, on the project "Computational and inversion methods with applications to biomedical data", supervisor: Prof. Michele Piana.

Research Groups Membership

2018 – to date — **Member of "Epione team-project"**, *Inria*, www.inria.fr/epione.

2016 – 2018 — **Member of "Centre for Medical Image Computing (CMIC) group"**, *UCL*, www.ucl.ac.uk/cmic.

2012 – 2016 — **Member of "Methods for Image and Data Analysis (MIDA) group"**, *Unige*, www.mida.dima.unige.it.

2012 – to date — **Research associate of GNCS – INdAM**.

2012 – 2016 — **Research associate of CNR – SPIN**.

Education

2012 – 2014 — **PhD in Mathematics and Applications**, *Università di Genova*.

work: room 207, second floor, Fermat Building – INRIA Sophia Antipolis
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2009 – 2011 **MSc in Applied Mathematics**, *Università di Genova*, 110/100 magna cum laude.

2006 – 2009 **BSc in Pure Mathematics**, *Università di Genova*, final grade: 108/110.

2001 – 2006 **Secondary education (maturità scientifica)**, *Liceo L. Lanfranconi*, 100/100.

PhD Thesis

Title *Compartmental analysis in nuclear medicine: an inverse problem approach*

Supervisor Prof. Michele Piana

Reviewers Prof. Michele Piana and Dr. Stephen Nekolla

Sub./Defense Dec 2014 / 22.04.2015

Permalink `http://fermat.dima.unige.it/~garbarin/images/PhDthesis_garbarino.pdf`

Awards

2019 **Francois Erbsmann Prize**, *best paper presented at IPMI 2019*, for the paper "Modelling and inference of spatio-temporal protein dynamcis across brain networks".

Projects and Grants

PI

2019 **EWM European Women in Mathematics travel grants**, *400 Euro*.

2019 **IPMI travel scholarship for young researchers**, *1100 USD*.

2018 **LYSM International Associated Laboratory grant for conferences**, *750 Euro*.

2018 **UCA Individual Support for Young Researchers**, *103k Euro*.

2018 **EPSRC platform grant - CMIC pump priming award**, *9k GBP*.

2015 **GNCS (National Group for Scientific Computation) Young Researcher Grant**, *950 Euro*.

2013 **GNCS Young Researcher Grant**, *700 Euro*.

2012 **GNCS Young Researcher Grant**, *900 Euro*.

2012–2014 **PhD-Scholarship**, *Italian Ministry of Education, University and Research*.

Participation

2016–2018 **Co-Scientific Manager**, *for the H2020 European Projects "European Progression Of Neurodegenerative Disease initiative" (EuroPOND)*, PI: Prof. Daniel Alexander.

2015-2016 **Participation**, *in the "Software for LIDAR data analysis project" funded by ALA S.r.l (Advanced Lidar Applications, Napoli) (PI: Prof. Michele Piana)*.

Software

2018 **Mechanistic profiles of neurodegenerative diseases**, *Matlab and python2.7 software implementing techniques to estimate the combination of biological mechanisms underlying neurodegeneration in a variaty of condition, such as Alzheimer's Disease, Multiple Sclerosis, or ageing from Magnetic Resonance Imaging data: https://github.com/sgarbarino/mechanistic-profiles,*.

2015 **Inversion of LIDAR data**, *Matlab and C# software developed for Advanced Lidar Applications (ALA) SrL, implementing inversion techniques for reconstruction of aerosol particles properties from LIDAR data.*

2012 **Denoising of MRI images**, *Matlab software developed for Paramed SrL, implementing post-processing denoising of Magnetic Resonance images.*

Publications

Submitted

2019 **S. Garbarino, M. Lorenzi, N. Oxtoby, E. Vinke, R. Marinescu, A. Eshaghi, M. Ikram, W. Niessen, O. Ciccarelli, F. Barkhof, J. Schott, M. Vernooij, D. Alexander**, *Differences in topological progression profile among neurodegenerative diseases from imaging data*, eLife.

Published

2019 **S. Garbarino and G. Caviglia**, *Multivariate Regularized Newton method for tumor hypoxia in kinetic framework*, Comm. App. Ind. Math. 10(2), 47-53.
DOI: 10.2478/caim-2019-0006

2019 **R. Marinescu, A. Eshaghi, M. Lorenzi, A. Young, N. Oxtoby, S. Garbarino, S. Crutch, D. Alexander**, *DIVE: A spatiotemporal progression model of brain pathology in neurodegenerative disorders*, NeuroImage 4(192), 166-177.
DOI: 10.1016/j.neuroimage.2019.02.053

2018 **F. Delbary and S. Garbarino** *, *Compartmental analysis of dynamic nuclear medicine data: regularization procedure and application to physiology*, Inverse Problems in Science and Engineering.
DOI: 10.1080/17415977.2018.1512603

2018 **M. Scussolini, S. Garbarino, M. Piana, G. Sambuceti and G. Caviglia**, *Reference Tissue Models for FDG-PET Data: Identifiability and Solvability*, IEEE Trans. Rad. Plasma Med. Sciences, 1-10.
DOI: 10.1109/TRPMS.2018.2801029

2017 **M. Scussolini, S. Garbarino, G. Sambuceti, G. Caviglia and M. Piana**, *A physiology–based parametric imaging method for FDG–PET data*, Inverse Problems 33, 125010.
DOI: 10.1088/1361-6420/aa9544

2017 **N. Oxtoby, S. Garbarino, N. Firth, J. Warren, M. Schott, D. Alexander**, *Data driven model of structural brain connectivity changes in sporadic Alzheimer's Disease*, Frontiers in Neurology 8, 580.
DOI: 10.3389/fneur.2017.00580

2017 **G. Denevi, S. Garbarino and A. Sorrentino**, *Iterative algorithms for a non–linear inverse problem in atmospheric lidar*, Inverse Problems 33, 085010.
DOI: 10.1088/1361-6420/aa7904

2016 **F. Delbary, S. Garbarino, V. Vivaldi** *, *Compartmental analysis of dynamic nuclear medicine data: models and identifiability*, Inverse Problems 32, 125010.
DOI: 0.1088/0266-5611/32/12/125010

2016 **S. Garbarino, A. Sorrentino, A. M. Massone, A. Sannino, A. Boselli, X. Wuang, N. Spinelli and M. Piana**, *Expectation Maximization and the retrieval of the atmospheric extinction coefficients by inversion of Raman LIDAR data*, Optics Express, 24(19), 21497–21511.
DOI: 10.1364/OE.24.021497

2015 **S. Garbarino, V. Vivaldi, F. Delbary, G. Caviglia, M. Piana, C. Marini, S. Capitanio, I. Calamia, A. Buschiazzo and G. Sambuceti**, *A new compartmental method for the analysis of liver FDG kinetics*, EJNMMI Res. 2015, 5–35.
DOI: 10.1186/s13550-015-0107-1

2014 **S. Garbarino, G. Caviglia, G. Sambuceti, F. Benvenuto and M. Piana**, *A novel description of FDG excretion in the renal system: application to metformin-treated models*, Phys. Med. Biol. 59, 2469–2484.
DOI: 10.1088/0031-9155/59/10/2469

2013 **S. Garbarino, G. Caviglia, M. Brignone, M. Massollo, G. Sambuceti and M. Piana**, *Estimate of FDG excretion by means of compartmental analysis and Ant Colony Optimization of nuclear medicine data*, Comput. Math. Method M. 2013, 793142.
DOI: 10.1155/2013/793142

* the authors are listed in alphabetical order.

Conference proceeding

2019 **S. Garbarino, M. Lorenzi**, *Modeling and inference of spatio-temporal protein dynamics across brain networks*, Information Processing in Medical Imaging. Lecture Notes in Computer Science 11492, 37-69.

2018 **S. Garbarino, M. Lorenzi, N. Oxtoby, E. Vinke, R. Marinescu, A. Eshaghi, M. Arfan Ikram, W. Niessen, O. Ciccarelli, F. Barkhof, M. Vernooij, D. Alexander**, *Mechanistic profiles of neurodegeneration: a study in Alzheimer's disease, healthy ageing and primary progressive multiple sclerosis*, Alzheimer's and Dementia 14(7), P1280-P1281.

2017 **R. Marinescu, S. Primativo, A. Young, N. Oxtoby, N. Firth, A. Eshaghi, S. Garbarino, J. Cardoso, K. Yong, N. Fox, M. Lehmann, T. Shakespeare, S. Crutch, D. Alexander**, *Analysis of the heterogeneity of Posterior Cortical Atrophy: data-driven model predicts distinct atrophy patterns for three different cognitive subgroups*, Alzheimer's & Dementia 13(7), P1379-P1380.

2017 **R. Marinescu, A. Eshaghi, M. Lorenzi, A.Young, N. Oxtoby, S. Garbarino, T. Shakespeare, S. Crutch and D. Alexander**, *A vertex clustering model for disease progression: Application to cortical thickness images*, Information Processing in Medical Imaging. Lecture Notes in Computer Science 10265, 134-145.

2015 **A. Buschiazzo, G. Sambuceti, A. Orengo, S. Ravera, F. Fais, S. Bruno, E. Monteverde, L. Garaboldi, G. Bottoni, L. Raffaghello, G. Bianchi, M. Piana, S. Garbarino, G. Caviglia and C. Marini**, *Effect of Metformin on Cancer Glucose Metabolism: Correlation Between FDG Escape and Glucose-6-Phosphatase Activity in the Endoplasmatic Reticulum*, Eur. J Nucl. Med. Mol. Imag. 42, S454–S454.

2014 **F. Bongioanni, F. Fiz, R. Piva, S. Garbarino, G. Bottoni, M. Riondato, C. Campi, F. Frassoni, A. Bacigalupo, C. Marini, M. Piana and G. Sambuceti**, *Compact bone erosion and bone marrow metabolic stunning in multiple myeloma treated by transplantation of autologous hematopoietic stem cells*, Eur. J Nucl. Med. Mol. Imag. 41, S183–S184.

Workshop organisation

Feb 19, 2018 **POND2018**, *2nd International Workshop on Progression of Neurodegenerative Diseases*, Campus Biotech, Geneva.

Invited Seminars

Jul 25, 2017 **Asclepios Research team-project, INRIA Sophia Antipolis**, *Mechanistic models of atrophy progression*, INRIA Sophia Antipolis.

Feb 10, 2017 **INdAM Mathtech Workshop: A place where mathematics, clinics, and industry meet Biomedical Imaging**, *Modelling the progression of neurological diseases*, Università La Sapienza, Roma.

Jan 22, 2016 **Vision and Imaging Science Group, CMIC Seminar programme**, *An inverse problem approach to compartmental analysis in Positron Emission Tomography*, UCL, London.

Aug 12, 2015 **2015 LIDAR atmosphere data applications academic discussion**, *Retrieval of optical coefficients of the atmosphere by inversion of LIDAR data*, Beihang University, Beijing.

Talks on Conferences

Jul 8, 2019 **2019 AIP**, *Spatio-temporal dynamics of protein propagation in neurodegenerative diseases: an inverse problem approach*, Universitè Grenoble-Alpes, Grenoble.

Jul 1, 2019 **2019 NeuroMod meeting**, *Modeling and inference of protein dynamics in neurodegenerative diseases*, Villa Clithia, Frejus.

Jun 3, 2019 **2019 IPMI**, *Modeling and inference of spatio-temporal protein dynamics across brain networks*, The Hong Kong University of Science and Technology, Hong Kong.

Jul 3, 2018 **2018 Simai Conference**, *Data-driven profiles of neurodegeneration across multiple subject groups*, Università La Sapienza, Roma.

Jun 6, 2018 **2018 SIAM Conference on Imaging Science**, *Predicting brain atrophy progression from the healthy brain connectome*, Università di Bologna, Bologna.

Dec 9, 2015 **2015 Inverse Days**, *An inverse problem approach to compartmental analysis in Positron Emission Tomography*, Lappeenranta Technical University, Lappeenranta.

Aug 10, 2015 **2015 ICIAM International Congress on Industrial and Applied Mathematics**, *Image reconstruction and interpretation in Positron Emission Tomography for small animals*, Beijing.

May 13, 2014 **2014 SIAM Conference on Imaging Science**, *Quantification of Glucose Metabolism with Nuclear Medicine PET data*, Hong Kong.

Apr 5, 2013 **CIMAB GASVA SIMAI: Workshop on Theoretical Approaches and Related Mathematical Methods in Biology, Medicine and Environment**, *A Computational Approach to Compartmental Analysis of Nuclear Medicine data based on Maximum Likelihood: application to renal physiology*, University of Milan, Milan.

Participation in meetings/workshops/schools

Nov 2018 **SophI.A. Summit, Springboard for Artificial Intelligence**, *Sophia Antipolis*.

Jun 2018 **2nd C@UCA meeting**, *Frejus*.

Apr 2018 **STATLEARN2018**, *Nice*.

Sep 2015 **1st Applied Mathematics Symposium Münster: Variational Methods for Dynamic Inverse Problems and Imaging**, *Münster*.

Jun 2015 **Calcolo scientifico e modelli matematici alla ricerca delle cose nascoste attraverso le cose manifeste**, *Genoa*.

Jun 2013 **TECNOBIONET Conference: themes and problems in stem cells and imaging tools and development**, *Genoa*.

Jun 2013 **MPF 2013: Modelling of Physiological Flows**, *Cagliari*.

Mar 2013 **Application course in PMOD software**, *Zürich*.

Jun 2012 **Simai Conference 2012**, *Turin*.

Poster

July 2019 **AAIC 2019**, *Los Angeles*.

July 2018 **AAIC 2018**, *Chicago*.

June 2018 **2nd C@UCA meeting**, *Frejus*.

Feb 2018 **POND2018**, *Geneva*.

Jul 2017 **AAIC 2017**, *London*.

Oct 2014 **EANM 2014**, *Göthenburg*.

Research visits

Jun 26 – Jul 7, 2017 **Erasmus Medical Centre**, *Rotterdam, The Netherlands*, Reference: Prof. Meike Vernooij.

Supervision

2017 **MSc Thesis in Machine Learning at UCL**, *Mr. Ban Chao*.

2016 **BSc Thesis in Medical Physics at UCL**, *Mr. Ashkan Pakzad*.

2016 **MSc Thesis in Mathematics at Unige**, *Mrs. Giulia Denevi*.

2016 **MSc Thesis in Mathematics at Unige**, *Mr. Andrea Raffo*.

2015 **MSc Thesis in Mathematics at Unige**, *Mrs. Mara Scussolini*.

2014 **BSc Thesis in Mathematics at Unige**, *Mr. Giovanni Chiappori*.

Teaching

2015/6 **Numerical Analysis**, *Department of Computer Science*, Unige, lab exercises.

2014/5 **Mathematics in Medicine**, *Department of Mathematics*, Unige, lectures and lab exercises.

2013/4 **Mathematical Analysis and Geometry**, *Department of Mechanical Engineering*, Unige, class exercises.

2012/3 **Mathematical Analysis and Geometry**, *Department of Mechanical Engineering*, Unige, tutoring first and second year students.

2011/2 **Fourier Analysis**, *Department of Mathematics*, Unige, lab exercises.

2011/2 **Mathematical Analysis and Geometry**, *Department of Mechanical Engineering*, Unige, tutoring first and second year students.

2009/10 **Mathematics**, *Department of Biology*, Unige, tutoring first year students.

Related scientific activities

2019 – to date **Member of the "European Women in Mathematics" international association**.

2016 – 2018 **Post–doc representative at the "Athena Swan for Gold Award Committee" for promotion of gender equality and women in science**, *Computer Science Department, University College London (UCL)*.

2014 – to date **Revisor**, *for Inverse Problems, Inverse Inverse Problems in Science and Engineering, Journal of Chemical Information and Modeling, Scientific Reports, International Journal for Numerical Methods in Biomedical Engineering, International Journal of Computer Vision*.

Computer skills

Basic C#, JAVA

Intermediate C/C++, HTML

Advanced MATLAB, PYTHON LaTeX, GNU/Linux

Languages

Italian Mother–tongue

English Professional

French Basic

References

Prof. Daniel Alexander, *Professor of Imaging Science, Director of Research in UCL-CS and Chair of the board of Directors of CMIC*, d.alexander@ucl.ac.uk.

Prof. Michele Piana, *Professor of Numerical Analysis at Università di Genova*, piana@dima.unige.it.

MD Prof. Gianmario Sambuceti, *Head of Nuclear Medicine Laboratory at Università di Genova and IRCCS-IST San Martino of Genova*, sambuceti@unige.it.