Curriculum Vitae

Personal data and contacts

Name	Gabriele Santin
Citizenship	Italian
Date of birth	02/02/1987
Affiliation	Center for Information and Communication Technology, Fondazione Bruno Kessler
	Cluster of Excellence *Data-integrated Simulation Science* (SimTech), Univ. of Stuttgart
Address	Via Sommarive, 18, 38123 Trento, Italy
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Professional experience

Since 09/2019	Researcher, Center for Information and Communication Technology, Fondazione Bruno Kessler, Trento, Italy Research unit *Mobile and Social Computing*, B. Lepri
Since 10/2018	Junior Participating Researcher, Cluster of Excellence *Data-integrated Simulation Science* (SimTech), Univ. of Stuttgart, Germany Project Network *Machine Learning for Simulation*
11/2015–09/2019	PostDoc (Teaching/Research Assist.), Inst. of Applied Analysis and Numerical Simulation, University of Stuttgart, Germany Research group *Numerical Mathematics*, B. Haasdonk
01/2013–10/2015	PhD student in Computational Mathematics, Doctoral School in Mathematical Sciences, University of Padova, Italy Research group *Constructive Approximation and Applications*, S. De Marchi

Education

01/2013–03/2016	PhD in Computational Mathematics, Doctoral School in Mathematical Sciences, University of Padova Thesis: Approximation in kernel-based spaces, optimal subspaces and approximation of eigenfunctions Advisors: Prof. S. De Marchi, Prof. R. Schaback (University of Göttingen, Germany) Defense date: Padova, 18/03/2016
10/2009–07/2012	Master's Degree in Mathematics (Laurea Magistrale in Matematica), University of Padova Thesis: A new stable basis for Radial Basis Function approximation Advisor: Prof. S. De Marchi.
10/2006–10/2009	Bachelor's Degree in Mathematics (Laurea Triennale in Matematica), University of Padova Thesis: Algebraic cubature on general domains by the software system Chebfun (in Italian) Advisors: Prof. A. Sommariva, Prof. M. Vianello.

Publications

Submitted..

[18]   G. Santin, D. Wittwar, B. Haasdonk, *Greedy regularized kernel interpolation*, (2019).

Accepted ....

[17]   G. Santin, B. Haasdonk, *Kernel Methods for Surrogate Modeling*, Accepted for publication in *Model Order Reduction, Volume 1: System- and Data-Driven Methods and Algorithms*, P. Benner, W. Schilders, S. Grivet-Talocia, A. Quarteroni, G. Rozza, L. M. Silveira Eds. (2020).

[16]   B. Haasdonk, B. Hamzi, G. Santin, D. Wittwar, *Greedy kernel methods for center manifold approximation*, Accepted for publication in the proceedings of ICOSAHOM 2018, Lecture Notes in Computational Science and Engineering (2019).

Published ....

[15]   T. Brünnette, G. Santin, and B. Haasdonk, *Greedy kernel methods for accelerating implicit integrators for parametric ODEs*, Numerical Mathematics and Advanced Applications ENUMATH 2017, F.A. Radu, K. Kumar, I. Berre, J.M. Nordbotten, I.S. Pop, Eds (2019), 889–896.

[14]   D. Wittwar, G. Santin, B. Haasdonk, *Interpolation with uncoupled separable matrix-valued kernels*, Dolomites Res. Notes Approx., Vol. 11 (2018), 23–29.

[13]   M. Köppel, F. Franzelin, I. Kröker, G. Santin, D. Wittwar, S. Oladyshkin, A. Barth, B. Haasdonk, W. Nowak, D. Pflüger, C. Rohde, *Comparison of data-driven uncertainty quantification methods for a carbon dioxide storage benchmark scenario*, Comput. Geosci (2018).

[12]   T. Köppl, G. Santin, B. Haasdonk, R. Helmig, *Numerical modelling of a peripheral arterial stenosis using dimensionally reduced models and kernel methods*, Int. J. Numer. Meth. Biomed. Engng., Vol. 34 (2018), e3095.

[11]   S. De Marchi, A. Iske, G. Santin, *Image reconstruction from scattered Radon data by weighted positive definite kernel functions*, Calcolo, Vol. 55 (2018).

[10]   G. Santin, B. Haasdonk, *Greedy kernel approximation for sparse surrogate modelling*, Reduced-Order Modeling (ROM) for Simulation and Optimization: Powerful Algorithms as Key Enablers for Scientific Computing, W. Keiper, A. Milde, and S. Volkwein, Eds (2018), 21–45.

[9]   S. De Marchi, A. Idda, G. Santin, *A rescaled method for RBF approximation*, Proceedings of "Approximation Theory 15", San Antonio (Texas), Springer Proceedings on Mathematics and Statistics, Vol. 201 (2017), 39–59.

[8]   G. Santin, B. Haasdonk, *Convergence rate of the data-independent P-greedy algorithm in kernel-based spaces*, Dolomites Res. Notes Approx., Vol. 10 (2017), 68–78.

[7]   R. Cavoretto, S. De Marchi, A. De Rossi, E. Perracchione, G. Santin, *Partition of unity interpolation using stable kernel-based techniques*, Appl. Numer. Math., Vol. 116 (2017), 95–107.

[6]   R. Cavoretto, S. De Marchi, A. De Rossi, E. Perracchione, G. Santin, *Approximating basins of attraction for dynamical systems via stable radial bases*, AIP Conf. Proc., Vol. 1738 (1) (2016), 390003.

[5]   G. Santin, R. Schaback, *Approximation of eigenfunctions in kernel-based spaces*, Adv. Comput. Math., Vol. 42 (4) (2016), 973–993.

[4]   S. De Marchi, G. Santin, *Fast computation of orthonormal basis for RBF spaces through Krylov space methods*, BIT, Vol. 55 (2015), 949–966.

[3]   R. Cavoretto, S. De Marchi, A. De Rossi, E. Perracchione, G. Santin, *RBF approximation of large datasets by partition of unity and local stabilization*, CMMSE 2015: Proceedings of the 15th International Conference on Mathematical Methods in Science and Engineering (2015), 317 – 326.

[2]   S. De Marchi, G. Santin, *A new stable basis for radial basis function interpolation*, J. Comput. Appl. Math., Vol. 253 (2013), 1–13.

[1]   G. Santin, A. Sommariva, M. Vianello, *An algebraic cubature formula on curvilinear polygons*, Appl. Math. Comput., Vol. 217(24) (2011), 10003–10015.

Theses ....

PhD Thesis	*Approximation in kernel-based spaces, optimal subspaces and approximation of eigenfunctions*, paduaresearch.cab.unipd.it/9186/ (2016).
MSc Thesis	*A new stable basis for Radial Basis Function approximation*, (2012). Led to publication [2].
BSc Thesis	*Algebraic cubature on general domains by the software system Chebfun*, (2009). Led to publication [1].

Open source software and datasets

2018	Regularized VKOGA – Vectorial Kernel Orthogonal Greedy Algorithm (MATLAB) https://gitlab.mathematik.uni-stuttgart.de/santinge/VKOGA
2017	Datasets and executables of data-driven uncertainty quantification benchmark in carbon dioxide storage (dataset of publication [15]), zenodo.org/record/933827
2016	*P*-greedy algorithm (MATLAB) See link at www.ians.uni-stuttgart.de/institute/team/Santin-00001/
2015	Approximation of eigenfunctions in kernel based spaces (MATLAB) See link at www.ians.uni-stuttgart.de/institute/team/Santin-00001/
2015	Kernel based medical image reconstruction (MATLAB, C++) See link at www.ians.uni-stuttgart.de/institute/team/Santin-00001/
2014	RBF approximation with WSVD-basis and fast WSVD-basis (MATLAB) See link at www.ians.uni-stuttgart.de/institute/team/Santin-00001/

Scientific presentations

Invited presentations ....

07/2019	ICIAM 2019, Valencia (Spain), Talk: *Sparse surrogates with kernel methods* MS: Manifold Sensing and Sparse Recovery
06/2019	MOR Seminar, Stuttgart (Germany), Talk: *Data-based surrogate models by kernel methods*
05/2019	Safety Simulation Framework for Integral Protection Systems, Stuttgart (Germany), Talk: *Kernel methods for data-based surrogate modeling*
07/2018	ICOSAHOM 2018, London (United Kingdom), Talk: *Kernel-based surrogate models for parametric differential equations* MS: Recent advances in Radial Basis Function methods
06/2018	SIAM Conference on Imaging Science, Bologna (Italy), Talk: *Image reconstruction from scattered data by kernel methods* MS: Interpolation and approximation methods in imaging
05/2018	SPAN, Padova (Italy), Talk: *Regularized kernel greedy algorithms*
09/2017	ENUMATH 2017, Voss (Norway), Talk: *Greedy kernel methods for accelerating implicit integrators for parametric ODEs* MS: Reduced order models for time-dependent problems
09/2016	MAIA 2016, CIRM, Luminy (France), Talk: *Non-symmetric kernel-based greedy approximation*
09/2016	DWCAA 2016, Alba di Canazei (Italy), Talk: *Non-symmetric kernel-based greedy approximation* MS: Meshless methods
07/2016	Stuttgart-Tübingen Seminar, Stuttgart (Germany), Talk: *Approximation in kernel-based spaces: optimal subspaces and greedy algorithms*

Contributed presentations

09/2019	DRWA 2019, Alba di Canazei (Italy), Talk: *(Slow but) Dimension independent rates for adaptive interpolation and quadrature* MS: Radial Basis Functions and kernel methods
09/2017	ENUMATH 2017, Voss (Norway), Talk: *Greedy methods for kernel-based approximation* MS: Kernel methods for large scale problems
09/2015	DRWA 2015, Alba di Canazei (Italy), Talk: *Approximation of eigenfunctions*
07/2015	CMMSE 2015, Cadiz (Spain), Talk: *RBF approximation of large datasets by partition of unity and local stabilization*
09/2014	SPAN, Padova (Italy), Talk: *Approximation in kernel based spaces*
09/2014	DRWA 2014, Alba di Canazei (Italy), Talk: *Fast computation of orthonormal bases*
06/2014	First Joint International Meeting RSME-SCM-SEMA-SIMAI-UMI, Bilbao (Spain), Talk: *Bases for Radial Basis Function approximation* MS: Special functions, orthogonal polynomials and applications
11/2013	Multivariate Approximation, Verona (Italy), Talk: *A fast algorithm for computing a truncated orthonormal basis for RBF native spaces*
10/2013	International CAE Conference, Pacengo del Garda (Italy), Talk: *Some tools for fast and stable Radial Basis Function approximation with Scilab*
08/2013	9th ISAAC Congress, Krakow (Poland), Talk: *A orthonormal basis for Radial Basis Function approximation* MS: Integral transforms and reproducing kernels
06/2013	Constructive Theory of Functions, Sozopol (Bulgaria), Talk: *A fast algorithm for computing a truncated orthonormal basis for RBF native spaces*

Poster presentations

03/2016	MORML 2016, Stuttgart (Germany), Poster: *Greedy kernel interpolation surrogate modeling*
10/2013	International CAE Conference, Pacengo del Garda (Italy), Poster: *Kernel methods for Radon transform*
09/2013	DRWA 2013, Alba di Canazei (Italy), Poster: *WSVD basis for RBF and Krylov subspaces*
09/2012	DWCAA 2012, Alba di Canazei (Italy), Poster: *A new stable basis for RBF approximation*

Academic Services

09/2019	Member of the organizing committee of the *DRWA19*, Trento.
06/2019	Member of the program committee of the workshop *Machine Learning and Data Assimilation for Dynamical Systems* at the International Conference on Computational Science, Algarve.
09/2018	Organizer of the mini-symposium *Meshless methods and applications*, DRWA 2018, with E. Perracchione (University of Padova).
03/2018	Member of the organizing committee of the *2nd International Conference in Simulation Technology*, Stuttgart.
09/2017	Organizer of the mini-symposium *Kernel methods for large scale problems*, ENUMATH 2017, with E. Larsson (University of Uppsala).

03/2016	Member of the organizing committee of the *MORML 2018* workshop, Stuttgart.
09/2014	Organizer of the seminars *SPAN - Seminari padovani di analisi numerica* at the Department of Mathematics, University of Padova.
Since 2015	Referee activity for the journals *Advances in Computational Mathematics, BIT-Numerical Mathematics, Calcolo, Computers and Mathematics with Applications, Journal of Mathematical Analysis and Applications, Mathematical and Computational Applications, Numerical Algorithms, Results in Mathematics,* and for the proceedings of the IUTAM symposium *MORCOS 2018*.
2013–2015	PhD students' delegate in the council of the Doctoral School in Mathematics and in the council of the Department of Mathematics.
2012–2015	Organizer of the students' seminars of the research group Constructive Approximation and Applications.

Teaching experience

Lecturer

WS. 2018–2019	*Introduction to Numerics for PDEs,* MSc. in Mathematics (9 ECTS). The course is dedicated to the study of numerical methods for Partial Differential Equations. The main topics are: Classification of PDEs, Finite Difference method for elliptic problems, Finite Elements method for coercive and inf-sup stable problems, Approximation of parabolic problems, Finite Volumes method for hyperbolic conservation equations. The lecture has been <u>evaluated 1.5/5</u> on average (min: 5, max: 1) by the students attending the lecture.
WS. 2017–2018	*Approximation with Kernel Methods,* MSc. in Mathematics (6 ECTS). The course deals with the theory and implementation of various kernel methods for approximation. The main topics are: Introduction to kernel methods, Connection to the corresponding function spaces and general theory, Approximation of scattered data (Greedy procedures, Regression), Pattern recognition (Classification, Support Vector Machines), Numerical approximation of PDEs by collocation. The lecture has been <u>evaluated 1.5/5</u> on average (min: 5, max: 1) by the students attending the lecture.

Teaching assistant

SS. 2018–2019	*Numerische Grundlagen* (Foundations of Numerical Analysis), BSc in Engineering Teaching assistant of Prof. C. Rohde, University of Stuttgart. <u>Main tasks:</u> Preparation of weekly programming exercises through the web-platform ViPLab, including the implementation of the automatic correction code; managing of the Tutors, of the administrative tasks, and of the databases for the ~ 500 students attending the lecture.
SS. 2017–2018	*Numerische Grundlagen* (Foundations of Numerical Analysis), BSc in Engineering Teaching assistant of Prof. D. Göddeke, University of Stuttgart.
SS. 2016–2017	*Numerische Grundlagen* (Foundations of Numerical Analysis), BSc in Engineering Teaching assistant of Prof. D. Göddeke, University of Stuttgart.
WS. 2016–2017	*Numerische Mathematik I* (Numerical Analysis I), BSc in Mathematics Teaching assistant of Prof. B. Haasdonk, University of Stuttgart. <u>Main tasks:</u> Preparation of weekly exercises, managing of the Tutors, of the administrative tasks, and of the databases for the ~ 50 students attending the lecture.
SS. 2015–2016	*Numerische Grundlagen* (Foundations of Numerical Analysis), BSc in Engineering Teaching assistant of Prof. B. Haasdonk, University of Stuttgart.

WS. 2015–2016	*Höhere Mathematik I* (Foundations of Analysis and Linear Algebra), BSc in Engineering Teaching assistant of Prof. M. Stroppel, University of Stuttgart. <u>Main tasks:</u> Preparation of weekly exercises and instruction of the ~ 50 Tutors (the lecture has ~ 1500 students).
SS. 2014–2015	*Calcolo numerico (Foundations of Numerical Analysis)*, BSc in Engineering Teaching assistant of Prof. S. De Marchi, University of Padova. <u>Main tasks:</u> Support to the ~ 200 students during the programming laboratories for the solution of programming exercises.
SS. 2013–2014	*Calcolo numerico (Foundations of Numerical Analysis)*, BSc in Engineering Teaching assistant of Prof. L. Bergamaschi, University of Padova
SS. 2012–2013	*Calcolo numerico (Foundations of Numerical Analysis)*, BSc in Engineering Teaching assistant of Prof. L. Bergamaschi, University of Padova

Theses and projects co-supervision

PhD theses

07/2019–	Tizian Wenzel, *Deep greedy kernel methods for submodel coupling in fluid- and biomechanics* (preliminary title), PhD in Mathematics, University of Stuttgart.

Research projects

2019–	M. F., *Multilayer kernel-based autoencoders*, MSc research project in Simulation Technology, University of Stuttgart.
2018–2019	F. H., *Acceleration of implicit integrators with kernel methods*, MSc research project in Simulation Technology, University of Stuttgart.
2017–2018	M. A., *VKOGA validation and selection by log-marginal likelihood*, BSc research project in Simulation Technology, University of Stuttgart.

MSc theses

2018–	T. W., *Weak kernel based greedy algorithms*, MSc thesis in Mathematics, University of Stuttgart.
2017–2018	S. M., *Inverse Radon Transformation mit Multiskalen-Kernen* (Inverse Radon transform with multiscale kernels), MSc thesis in Mathematics, University of Stuttgart.
2014–2015	A. I., *A comparison of some RBF interpolation methods*, MSc thesis in Mathematics, University of Padova. Led to publication [9].
2013–2014	S. G., *Kernel-based medical image reconstruction from Radon data*, MSc thesis in Mathematics, University of Padova.

BSc theses

2016–2017	T. B., *Kernel methods for accelerating implicit integrators*, BSc thesis in Simulation Technology, University of Stuttgart. Led to publication [13].
2015–2016	S. M., *Interpolation mit Multiskalen-Kernen* (Interpolation with multiscale kernels), BSc thesis in Mathematics, University of Stuttgart.

Research visits

01–02/2015	Visit to R. Schaback, Institute for Numerical and Applied Mathematics, University of Göttingen.
01/2014	Visit to R. Schaback, Institute for Numerical and Applied Mathematics, University of Göttingen.

Funded research projects and awards

2019	Received funding for a PhD position within the Cluster of Excellence *Data-Integrated Simulation Science* (SimTech).
2018	Participating Scientist in the Cluster of Excellence *Data-Integrated Simulation Science* (SimTech), Funding institution: DFG within the Germany's Excellence Strategy.
2018	Recipient of the *SIAM IS-18 Conference Student/Post-doc Travel Awards* to participate to the SIAM Conference on Imaging Science, Bologna.
2016	Participant in the project *Radial basis functions approximations: stability issues and applications*, PI: S. De Marchi, Funding institution: University of Padova.
2013–2014	Participant in the project *Multivariate approximation with application to image reconstruction*, PI: S. De Marchi, Funding institution: University of Padova.

Affiliations to mathematical groups and professional societies

Since 2018	Participating Researcher in the Cluster of Excellence *Data-Integrated Simulation Science* (SimTech).
Since 2017	Associate Researcher in the Cluster of Excellence *Simulation Technology* (SimTech).
Since 2017	Member of SIMAI–Italian society for applied and industrial mathematics.
Since 2017	Member of RITA–Italian research network on approximation.
Since 2013	Member of GNCS–National Italian group on scientific computing.

Other skills

Language	Italian: mother tongue, English: fluent, German: intermediate.
Coding	Matlab: advanced knowledge, Python, C++: basic knowledge.