

# Janin Jäger

## Curriculum vitae

KU Eichstätt-Ingolstadt  
Mathematical Institute for  
Machine Learning and Data Science (MIDS)  
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🌐 <https://orcid.org/0000-0002-2209-7240>

### Position

01.2023–present **Akademische Rätin auf Zeit (Lecturer and researcher)**,  
*Catholic University Eichstätt-Ingolstadt, Ingolstadt*  
Working at the chair of applied mathematics of Prof. Marcel Oliver.

### Education

11.2014–12.2018 **Dr. rer. nat.**, *Justus-Liebig-Universität, Giessen*  
thesis title *Advances in radial and spherical basis function interpolation*  
supervisor Prof. Dr. Martin Buhmann  
grade Summa cum laude

04.2012–10.2014 **Master of Science in Mathematics**, *Justus-Liebig-Universität, Giessen*,  
Thesis title: "Reconstruction of electroencephalographic-data using radial basis functions"

10.2008–03.2012 **Bachelor of Science in Mathematics**, *Justus-Liebig-Universität, Giessen*

### Previous Positions

07.2021–12.2022 **Principal Investigator (Eigene Stelle)**, *Justus-Liebig-Universität, Giessen*, in  
a research project funded by the DFG  
Project number: JA 3033/2-1, Title: "Kernel interpolation on Riemannian manifolds"

05.2019–06.2021 **Just'Us Scholar, Postdoctoral Fellow**, *Justus-Liebig-Universität, Giessen*,  
Topic: Gegenbauer coefficients of positive definite spherical basis functions

05.2014–04.2019 **Research and teaching assistant**, *Justus-Liebig-Universität, Giessen*

01.2012–12.2018 **Mathematics teacher**, *Schule für medizinische Dokumentation, Giessen*  
Teaching mathematics at a vocational school for students training for a certificate in  
medical documentation.

### Internships

08.2011–09.2011 **Intern**, *Statistisches Bundesamt (DESTATIS), Wiesbaden*  
Project: Further development of a software (in Delphi) for solving linear optimization  
problems in the context of data security.

08.2009–10.2009 **Development Traineeship**, *Bibir Intervida (NGO), Tamale, Ghana*  
Project: Building an Access-database for the library. The stay was funded by the  
cultural exchange project 'Konkreter Friedensdienst'.

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## Research interests

Approximation theory, meshfree approximation methods, anisotropic kernel methods, approximation on spheres and manifolds and their application in geoscience and medical technology, quasi-interpolation using splines and radial basis functions, high-dimensional approximation, mathematical foundations of machine learning.

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## Successful funding record:

- TRR 181 – Energy Transfers in Atmosphere and Ocean, Project Leader in the subproject M3: "Towards consistent subgrid momentum closure" together with Prof. S. Danilov, Prof. M. Oliver and Prof. S. Juricke (third phase 2024), including funding for a 4 year PhD position at KU.
- Travel funds for research stay in Granada as part of BayIntAn (2024), granted by Bayerische Forschungsallianz
- Funding for the Conference on Approximation Theory, March 2023, Rauschholzhausen Germany, granted by the DFG. As co-organiser together with Prof. M. Buhmann and Prof. O. Davydov.
- DAAD-PPP: "Theoretical research on deep learning from a mathematical approximation theory viewpoint", Giessen/Hong Kong, as Co-Investigator, with PIs: Prof. Dr. D.-X. Zhou and Prof. Dr. M. Buhmann, funding was granted but execution was cancelled due to COVID-19.
- Travel Grant for the participation in the 8TH European Congress of Mathematics, granted by the EWM, 2021
- DFG–Sachbeihilfe Projekt: "*Kernel interpolation on Riemannian manifolds*", Project number: 461449252, including position as Principal Investigator, 2021
- Just'Us scholar, Full fellowship granted by the Justus-Liebig-Universität plus project funds, 2019–2021,

## Fellowships & Honors:

- Invited participant of the 9th Heidelberg Laureate Forum, September 2022, Heidelberg.
- Fellow of the interdisciplinary research center ZIF Bielefeld (Junges ZIF), 2021-2025
- Selected participant of the mentoring program ProCareerDoc by Mentoring Hessen, 2019

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## Positions of responsibility

- Member of the European-Women in Mathematics travel grant committee since 2022
- Elected member of the Direktorium of the mathematical institute (Research Staff Representative), Giessen, 2015–2017 and 2021-2022
- Appointment committee for professorship, W2 (Tenure Track W3) "Mathematik mit Schwerpunkt Statistik", (Research Staff Representative), Giessen, 2018
- Appointment committee for professorship, W2, "Numerische Mathematik und Wissenschaftliches Rechnen", (Student Representative), Giessen, 2012

## Reviewer for

*Journal of Approximation Theory (2x), Mathematics of Computation, Journal of Computational and Applied Mathematics, Computational and Applied Mathematics, Proceedings of the AMS, IMA Journal of Numerical Analysis, Journal of Mathematical Analysis and Application (2x), Communications on Pure and Applied Mathematics, Numerical Algorithms (2x), Mathematical Inequalities & Applications, Dolomite Research Notes on Approximation, Jaen Journal on Approximation theory, Stochastic Environmental Research and Risk Assessment, Journal of Geodesy, Journal of Applied Probability, Mathematical Reviews*

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## Skills

Tools Octave, Matlab, Python, Maple, Mathematica, C++, Delphi  
Languages German (native), English (fluent), French (basic)

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## Memberships

- EWM, *European Women in Mathematics*
- DMV, *Deutsche Mathematiker-Vereinigung*
- Mentoring Hessen, *Network for the promotion of women in science and industry*

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## Teaching qualification and experience

### Teaching at KU Eichstätt:

- SS 24 **Introduction to Numerical Analysis**,  
*Study programme: B.Sc. Mathematics, Students in teacher training, Hours: 4 per week*
- SS 24 **Seminar series of the MIDS (Mathematical Institute for machine learning and data science)**,  
*with Prof. M. Oliver, Hours: 2 per week*
- WS 23/24 **Introduction to non-linear and integer optimisation**,  
*Study programme: B.Sc. Mathematics, Hours: 4 per week*
- SS 23 **Algorithms and Data Structures (in english)**,  
*Study programme: B.Sc. Data Science, Hours: 4 per week*
- SS 23 **Revision course on ordinary differential equations (Staatsexamensvorbereitung)**,  
*Study programme: Students in teacher training, Hours: 2 per week*
- WS 22/23 **Numerical Methods for ODE's**,  
*Study programme: M.Sc. Mathematics, Hours: 4 per week*

## Teaching as a lecturer at the JLU Giessen

- SS 22 **Mathematics of Neural Networks**,  
*Study programme: B.Sc. and M.Sc Mathematics, Hours: 4 per week*
- WS 20/21 **Seminar 2 (Numerical Analysis)**,  
*Study programme: Students in teacher training, Hours: 2 per week*
- WS 20/21 **Seminar Numerik: "Grundlagen der mathematischen Bildverarbeitung" (Mathematical foundations of image processing)**,  
*Study programme: B.Sc. and M.Sc. Mathematics , Hours: 2 per week*
- SS 2020 **Seminar Numerical Analysis**,  
*Study programme: B.Sc. and M.Sc Mathematics, Hours: 2 per week*
- WS 19/20 **Gitterfreie Methoden in der Numerik (Meshfree Methods)**,  
*Study programme: M.Sc. Mathematics and Physics, Hours: 4 per week*

## Theses supervision

- Bachelor theses, Title: "*Trust-region methods*", ongoing
- Master theses, Title: "*On approximations by the Bernstein-Durrmeyer Operator and its shape-preserving properties*", 2022.
- Bachelor theses, Title: "*Numerical methods for stiff ordinary differential equations*", 2024

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## Conferences, talks and posters

- Talks Plenary speaker at the CSE Workshop 2024 "*Introduction to Quasi-interpolation*", Groß Schwansee, Germany, March 2024
- Plenary speaker at the Dolomites Research Week on Approximation, "*Quasi-interpolation*", San Vito di Cadore, Italy, September 2023
  - ICIAM 2023 Tokyo, "*Generalised Wendland functions for the sphere*" (remote, invited), Tokyo, August 2023
  - International Conference on Multivariate Approximation theory, "*Sparse-grid Gaussian convolutions approximation*", Rauschholzhausen, Germany, March 2023
  - SIAM CSE 2023, "*Theoretical Foundations of strictly positive kernels on compact manifolds*", Amsterdam, March 2023 (invited)
  - Oberseminar KU Eichstätt, "*Classes of strict positive definite kernels*", Ingolstadt, February 2023
  - Seminar der TU München, "*Kernel methods on Riemannian manifolds: Strict positive definiteness of non-radial kernels*", München, November 2022 (invited)
  - BIRS-CMO: 'Applied Functional Analysis', "*Strict positive definiteness: From compact Riemannian manifolds to the sphere*" (Remote), Oaxaca, August 2022
  - 2022 SIAM Annual Meeting, "*Kernel Interpolation on Compact Riemannian Manifolds*" (Remote), Pittsburgh, July 2022 (invited)

- 5th Dolomites Workshop on Constructive Approximation and Applications, "*Strict positive definiteness of non-radial kernels on compact two-point homogeneous spaces*", (Remote), Canazei, Italy, September 2021
- 8th European Congress of Mathematics, "*Strictly positive definite kernels on  $(d - 1)$ -dimensional spheres*", (Online), Portorož, Slovenia, June 2021
- Multivariate Approximation: Theory and Applications - MATA 2020, "*Monotonicity properties of (conditionally) strictly positive definite functions on Hilbert spheres*", Perugia, Italy, January 2020
- From Approximation Theory to real world Applications, "*Multiply monotone functions for spherical interpolation*", Sanya, China, December 2017 (invited)
- VII MAMERN, "*Radial basis function interpolation on spheres with application to EEG-data*", Oujda, Morocco, May 2017 (invited)
- 23. Deutsches EEG/EP Mapping Meeting, "*Rekonstruktion von EEG Daten mittels radialer Basisfunktionen*", Rauschholzhausen, Germany, October 2014

Posters INI Workshop 'Multivariate approximation, discretization, and sampling recovery (DREW01), "*Sparse grid Gaussian convolution approximation for multi-dimensional periodic functions*", Cambridge, UK, July 2024

- Oberwolfach Workshop on 'Transport and Scale Interactions in Geophysical Flows', "*Non-radial kernel based interpolation for the sphere*", August 2023
- MAIA 2022: Multivariate Interpolation and Approximation with Applications, "*Strictly Positive Definite Non-radial Kernels on  $d$ -spheres*", Fulda, Germany, September 2022 (invited)
- HDA 2019: 8th Workshop on High-Dimensional Approximation, "*Characterisation of conditionally positive definite kernels on Hilbert spheres*", Zürich, Switzerland, September 2019

### Conference and Meeting organisation:

- Two-day Workshop on Approximation theory, September 2023, Giessen, Germany, as organiser with Prof. M. Rodriguez.
- Conference on Multivariate Approximation theory, March 2023, Giessen, Germany, as co-organiser with Prof. M. Buhmann and Prof. O. Davydov.
- Spring meeting of the young ZIF 2022, Bielefeld Germany, as organiser with Dr. F. Günther.

### Research visits:

- Newton Institute program participant in the program "Discretization and recovery in high-dimensional spaces" (DRE), Cambridge, UK, July 2024 (2 weeks)
- University of Granada invited by Prof. Miguel Rodriguez, Granada, Spain, November 2022 (1 week)
- University of Jaen invited by Prof. Joaquin Jodar, Jaen, Spain, December 2022 (1 week)

## Publications in peer-reviewed Journals

- [1] M. Buhmann, J. Jäger, J. Jodar and M. Rodriguez (2024), "New methods for quasi-interpolation approximations: resolution of odd-degree singularities", *Mathematics and Computers in Simulation*, <https://www.sciencedirect.com/science/article/pii/S0378475424001125>
- [2] X. Emery, J. Jäger and E. Porcu (2024) "Positive semidefinite kernels that are axially symmetric on the sphere and stationary in time: spectral and semi-spectral theory, and constructive approaches", *Stochastic Environmental Research and Risk Assessment* 38, <https://link.springer.com/article/10.1007/s00477-024-02681-8>
- [3] Yuan Xu, M. Buhmann and J. Jäger (2024), " $\ell^1$ -summability and Fourier series of B-splines with respect to their knots", *Mathematische Zeitschrift*, Volume 306, Article number: 53, <https://link.springer.com/article/10.1007/s00209-024-03440-9>
- [4] J. C. Guella and J. Jäger (2024), "Strictly positive definite non-isotropic kernels on two-point homogeneous manifolds: The asymptotic approach", *Positivity*, Volume 28, Article number: 4, <https://link.springer.com/article/10.1007/s11117-023-01022-3>
- [5] S. Hubbert and J. Jäger (2023), "Generalised Wendland functions for the sphere", *Advances in Computational Mathematics*, 49, Article number: 3, <https://link.springer.com/article/10.1007/s10444-022-10005-z>
- [6] S. Hubbert, J. Jäger and J. Levesley (2023), "Convergence of sparse grid Gaussian convolution approximation for multi-dimensional periodic function", *Applied and Computational Harmonic Analysis*, 62, p.453-474 <https://doi.org/10.1016/j.acha.2022.10.005>
- [7] M. Buhmann and J. Jäger (2022), "Strict positive definiteness of convolutional and axially symmetric kernels on  $d$ -dimensional spheres", *Journal of Fourier Analysis and Applications* 28, 1-25 <https://link.springer.com/article/10.1007/s00041-022-09913-x>
- [8] M. Buhmann and J. Jäger (2022), "Strictly positive definite kernels on the 2-sphere: From radial symmetry to eigenvalue block structure", *IMA Journal of Numerical Analysis* 42, 1500-1525, <https://doi.org/10.1093/imanum/drab012>
- [9] M. Buhmann and J. Jäger (2020), "Multiply monotone functions for radial basis function interpolation: Extensions and new kernels", *Journal of Approximation Theory* 256, Article number:105434, <https://doi.org/10.1016/j.jat.2020.105434>
- [10] M. Buhmann and J. Jäger (2020), "Pólya-type criteria for conditionally strict positive definiteness of functions on spheres", *Journal of Approximation Theory* 257, Article number 105440, <https://doi.org/10.1016/j.jat.2020.105440>
- [11] J. Jäger (2019), "A note on the derivative of isotropic positive definite functions on Hilbert spheres", *SIGMA* 15, Article number 081, <https://doi.org/10.3842/SIGMA.2019.081>
- [12] J. Jäger, A. Klein, M. Buhmann and W. Skrandies (2016), "Reconstruction of electroencephalographic data using radial basis functions", *Clinical Neurophysiology* 127: 1978-1983, <https://doi.org/10.1016/j.clinph.2016.01.003>

### Book

- [1] M. Buhmann and J. Jäger , "Quasi-interpolation", Cambridge University Press, (2022), <https://doi.org/10.1017/9781139680523>

### Thesis

Dissertation (2018), "Advances in radial and spherical basis function interpolation", Justus-Liebig-Universität, Giessen, <http://geb.uni-giessen.de/geb/volltexte/2019/13953/>

(last updated September 9, 2024)