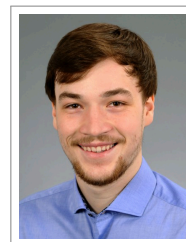


Jacobus Conradi

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Education

- 2014 **Abitur**, *Amos-Comenius-Gymnasium (secondary school)*, Bonn
- 2020 **Master in Computer Science**, *Rheinische Friedrich-Wilhelms-Universität*, Bonn
Overall grade: 1.2
Thesis: '*k*-shortcut Fréchet distance: Hardness and Approximations'
Supervisor: Prof. Dr. Anne Driemel
Thesis award by Bonner Informatik Gesellschaft (BIG)
- 2020 **Master in Mathematics**, *Rheinische Friedrich-Wilhelms-Universität*, Bonn
Overall grade: 1.4
- expected 2025 **PhD in Computer Science**, *Rheinische Friedrich-Wilhelms-Universität*, Bonn
Supervisor: Prof. Dr. Anne Driemel
Main research focus: Design and analysis (both theoretical and empirical) of algorithms and data-structures for practically motivated problems such as clustering, nearest-neighbor, or core-set construction on spatio-temporal data under both the Fréchet and dynamic-time-warping distance
Funding: Deutsche Forschungsgemeinschaft, Research Unit 2535, Project Trajectory Forecasting; Lamarr Institute for Machine Learning and Artificial Intelligence; the iBehave Network: Sponsored by the Ministry of Culture and Science of the State of North Rhine-Westphalia.

Employment

- 2013–2018 **Research assistant**, *Fraunhofer FKIE*, Wachtberg/Bonn
Department: Human Factors
Development of applications testing experimentees
- 2018–2020 **Research assistant**, *Rheinische Friedrich-Wilhelms-Universität*, Bonn
Department: Autonomous Intelligent Systems Group
Development of applications for visual odometry
- 2019–2020 **Research assistant**, *Fraunhofer FKIE*, Wachtberg/Bonn
Department: Cyber Analysis & Defense
Development of applications for static code analysis
- 2021–2025 **Full-time researcher**, *Rheinische Friedrich-Wilhelms-Universität*, Bonn
Department: Algorithms and Complexity
- since 2025 **Postdoctoral researcher**, *University of Copenhagen*, København
Department: Basic Algorithms Research Copenhagen (BARC)

Languages

- German Level: Native
English Level: C2

Technical skills

Proficiencies \LaTeX , Python, C/C++, Java, High-Performance Computing

Other Interests

- Cello/Tuba I play the Cello since 2006 and participated in various competitions. Since 2015 I am a member of the orchestra '*Collegium Musicum Bonn*' comprised solely of students of the University of Bonn. Since 2022 I am a member of its *steering committee* overseeing finances and planing and organizing trips to Italy and Poland. Since its inception in 2023 I play the Tuba in the wind orchestra '*ABO*'.
- Sports I regularly participate in Marathons and Triathlons (up to Ironman 70.3 distance).

Conference Talks

- 2022 **ICALP**, *Paris, France*
On Computing the k -Shortcut Fréchet Distance
- 2022 **ESA**, *Potsdam, Germany*
Faster Approximate Covering of Subcurves under the Fréchet Distance
- 2023 **EuroCG**, *Barcelona, Spain*
($1 + \varepsilon$)-ANN Data Structures for Curves vua Subspaces of Bounded Doubling Dimension
- 2023 **SoCG:YRF**, *Dallas, Texas (USA)*
Subtrajectory Clustering for Human Motion Data
Revisiting the Fréchet distance between piecewise smooth curves
- 2024 **EuroCG**, *Ioannina, Greece*
Fast Approximations and Coresets for (k, ℓ) -Median under Dynamic Time Warping
- 2024 **SoCG**, *Athens, Greece*
Fast Approximations and Coresets for (k, ℓ) -Median under Dynamic Time Warping
- 2025 **EuroCG**, *Liblice, Czech Republic*
Finding Complex Patterns in Trajectory Data via Geometric Set Cover
- 2025 **SoCG**, *Kanazawa, Japan*
Computing Non-Obtuse Triangulations with Few Steiner Points
- 2025 **ESA**, *Warsaw, Poland*
Subtrajectory Clustering and Coverage Maximization in Cubic Time, or Better

Teaching Experience

- 2018–2020 **Teaching Assistant (computational Intelligence)**
Teaching assistant for the undergrad courses 'Vorlesung Computational Intelligence'
- 2018–2020 **Teaching Assistant (Robotics)**
Teaching assistant for the undergrad courses 'Vorlesung Grundlagen der Robotik'
- 2022 **Teaching Assistant (computational Topology)**
Teaching assistant for the graduate course 'Computational Topology'
- 2023 **Teaching Assistant (computational Geometry)**
Teaching assistant for the undergrad course 'Grundlagen der Algorithmischen Geometrie'

2024 **Teaching Assistant (Seminar on computational Geometry)**

Teaching assistant for the graduate seminar 'Discrete Optimization: String and Curve Matching Algorithms'

Selected Publications

- 2024 **$(1+\varepsilon)$ -ANN Data Structure for Curves via Subspaces of Bounded Doubling Dimension.**
with Anne Driemel and Benedikt Kolbe. *Computing in Geometry and Topology Volume 3 No. 2 (Special Issue of Selected Papers from the 39th European Workshop on Computational Geometry (EuroCG 2023))*
Efficiently identifying the nearest neighbor of a trajectory within a large set of trajectories is a fundamental problem with many applications. We study this problem where the distance between trajectories is given by the Fréchet distance. We provide an approximation of the space of all trajectories which, unlike the proper space of all trajectories, has bounded doubling dimension. This enables well-established approximate nearest neighbor techniques resulting in a data-structure that answers nearest neighbor queries, with a query time logarithmic in the cardinality of the large set of trajectories.
- 2024 **Fast Approximations and Coresets for (k, ℓ) -Median Under Dynamic Time Warping.**
with Benedikt Kolbe, Ioannis Psarros and Dennis Rohde. *40th International Symposium on Computational Geometry, SoCG 2024*
Clustering any sort of data is a fundamental problem in machine learning, of which clustering spatio-temporal data under the dynamic-time-warping distance is an important variant. We study the (k, ℓ) -Median clustering problem which for a given set of trajectories asks to identify at most k center-trajectories of complexity at most ℓ minimizing the total sum of distances of input trajectories to its nearest center-trajectory. We show that the dynamic-time-warping distance permits an approximation whose range space of metric balls has bounded VC-dimension. From this we present a construction of a small subset of input trajectories (a core-set) which suffices to respect when constructing the center-trajectories, and with it an efficient approximation algorithm for the (k, ℓ) -Median problem.
- 2022 **Faster Approximate Covering of Subcurves Under the Fréchet Distance.**
with Frederik Brünig and Anne Driemel. *30th Annual European Symposium on Algorithms, ESA 2022*
Subtrajectory clustering is an important variant of the trajectory clustering problem, where the start and endpoints of trajectory patterns within the collected trajectory data are not known in advance. We study this problem in the form of a set cover problem for a given polygonal curve: find the smallest number k of representative curves such that any point on the input curve is contained in a subcurve of the input curve that has Fréchet distance at most a given Δ to a representative curve. We present a probabilistic approximation algorithm for this problem by restricting any potential representative curve to a simplification of the trajectory data.

Publications

- [1] Frederik Brünig, Jacobus Conradi, and Anne Driemel. Faster Approximate Covering of Subcurves Under the Fréchet Distance. In *30th Annual European Symposium on Algorithms, ESA 2022*, volume 244 of *LIPIcs*, pages 28:1–28:16. Schloss Dagstuhl – Leibniz-Zentrum für Informatik, 2022.
- [2] Jacobus Conradi and Anne Driemel. Finding Complex Patterns in Trajectory Data via Geometric Set Cover. *CoRR*, abs/2308.14865, 2023.
- [3] Jacobus Conradi and Anne Driemel. On Computing the k -Shortcut Fréchet Distance. *ACM Trans. Algorithms*, 20(4):29:1–29:37, 2024.

- [4] Jacobus Conradi, Anne Driemel, and Benedikt Kolbe. $(1+\epsilon)$ -ANN Data Structure for Curves via Subspaces of Bounded Doubling Dimension. *Comput. Geom. Topol.*, 3(2):6:1–6:22, 2024.
- [5] Jacobus Conradi, Anne Driemel, and Benedikt Kolbe. Revisiting the Fréchet distance between piecewise smooth curves. *CoRR*, abs/2401.03339, 2024.
- [6] Jacobus Conradi, Benedikt Kolbe, Ioannis Psarros, and Dennis Rohde. Fast Approximations and Coresets for (k,l) -Median Under Dynamic Time Warping. In *40th International Symposium on Computational Geometry, SoCG 2024*, volume 293 of *LIPICs*, pages 42:1–42:17. Schloss Dagstuhl - Leibniz-Zentrum für Informatik, 2024.
- [7] Jorge de Heuvel, Nathan Corral, Benedikt Kreis, Jacobus Conradi, Anne Driemel, and Maren Bennewitz. Learning Depth Vision-Based Personalized Robot Navigation From Dynamic Demonstrations in Virtual Reality. In *IROS*, pages 6757–6764, 2023.