

Anne Driemel

Prof. Dr. Anne Driemel
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Current Position

Associate Professor (tenured) of Computer Science at the University of Bonn
Member of the Hausdorff Center for Mathematics

Education

- 2013 **PhD in Computing Science**, *Utrecht University*, The Netherlands.
PhD-Thesis: “Realistic Analysis for Algorithmic Problems on Geographical Data”
Advisors: Prof. Marc van Kreveld, Utrecht University
Prof. Mark de Berg, TU Eindhoven
- 2009 **Diplom in Computer Science**, *Free University*, Berlin, Germany.
MSc-Thesis: “Multiscale Curvature Matching for Smooth Polylines”
Advisor: Prof. Helmut Alt, Free University of Berlin
- 2002 **Abitur (Secondary School)**, Fürstenwalde, Germany.

Employment

(I worked part-time where indicated because of parental leave for two children)

- since **Associate Professor (W2, tenured)**, *University of Bonn*, Germany.
Dec 2018 *Group*: Computational Geometry, Theoretical Computer Science
- Jan 2015 – **Assistant Professor (0.8 fte)**, *TU Eindhoven*, the Netherlands.
Dec 2018 *Group*: Data Mining, Prof. Mykola Pechenizkiy
- Apr 2014 – **Postdoc (0.8 fte)**, *TU Eindhoven*, the Netherlands.
Jan 2015 *Group*: Information Systems/ Web Engineering, Prof. Paul de Bra
- Oct 2013 – **Wissenschaftlicher Mitarbeiter (0.75 fte)**, *TU Dortmund*, Dortmund, Germany.
Mar 2014 *Group*: Algorithms and Complexity, Prof. Christian Sohler
- Sep 2009 – **Assistent in opleiding (AIO)**, *Utrecht University*, Utrecht, the Netherlands.
Sep 2013 *Group*: Multimedia and Geometry, Prof. Remco Veltkamp
- Sep 2008 – **Studentische Hilfskraft**, *Free University*, Berlin, Germany.
Mar 2009 Instructor for “Algorithms and Programming III”
- Sep 2004 – **Studentische Hilfskraft**, *Free University*, Berlin, Germany.
Aug 2007 Dept. of Computer Science and Dept. of Comparative Literature

Awards and Grants

- 2018 **Bonn Junior Fellow.**
Five-year appointment at the Hausdorff Center for Mathematics in Bonn.
Funded by the Excellence Initiative of the DFG (German Research Foundation).
- 2016 **KNAW Visiting Professor Program, 10,000 EUR.**
Financing travel and subsistence of my visitor Rob Hyndman from Monash University.
Funded by the Royal Netherlands Academy of Arts and Sciences (KNAW).
- 2014 **Innovational Research Incentives Scheme Veni, 240,000 EUR.**
Project title: “Clustering time series and trajectories”
Funded by the Netherlands Organization for Scientific Research (NWO).
- 2007 **FU Berlin Direct Exchange Scholarship, 18,300 USD.**
To spend nine months at the *University of Pennsylvania (UPenn)*

Workshops and Schools (co-organized)

- June 2020 **(scheduled) Hausdorff School Algorithmic Data Analysis.**
Hausdorff Center for Mathematics, Bonn, Germany
Organized together with:
- Melanie Schmidt, University of Cologne, DE
- Apr 2019 **Computational Geometry (Seminar 17171).**
Schloss Dagstuhl - Leibniz Center for Informatics, Wadern, Germany
Organized together with:
- Siu-Wing Cheng, HKUST – Kowloon, HK
- Jeff Erickson, University of Illinois, US
- Feb 2018 **Analysing large collections of time series.**
NII Shonan Meeting, Shonan Village Center, JPN
Organized together with:
- Rob Hyndman, Monash University, AU
- Galit Shmueli, NTHU, Taiwan
- Apr 2017 **Computational Geometry (Seminar 19181).**
Schloss Dagstuhl - Leibniz Center for Informatics, Wadern, Germany
Organized together with:
- Otfried Cheong, KAIST - Daejeon
- Jeff Erickson, University of Illinois, US
- Nov 2016 **Eurandom-SIKS Masterclass: Forecasting with R.**
Lecturer: Rob Hyndman (Monash University)
Venue: EURANDOM/TU Eindhoven, the Netherlands
Shortcourse targeted at students and practitioners organized in the context of the KNAW visiting professor program

Program Committees

- 2020 **YRF**, *Computational Geometry: Young Researchers Forum.*
- 2020 **IWOCA**, *International Workshop on Combinatorial Algorithms.*
- 2020 **SODA**, *SIAM Symposium on Algorithms and Data Structures.*
- 2019 **EuroCG**, *European Workshop on Computational Geometry.*
- 2017 **ESA**, *25th European Symposium on Algorithms.*
- 2017 **SODA**, *SIAM Symposium on Algorithms and Data Structures.*

- 2016 **ICTOPEN**, *ICT.OPEN–The Conference for ICT-Research in the Netherlands.*
- 2016 **APPROX**, *19th International Workshop on Approximation Algorithms for Combinatorial Optimization Problems.*
- 2015 **SOCG**, *31st International Symposium on Computational Geometry.*
- 2015 **ECML-PKDD**, *European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases.*

Invited Talks

- May 2020 **(scheduled) Clustering Curves under the Fréchet distance.**
Fixed Parameter Computational Geometry III
Lorentz Center, Leiden, NL
- Sep 2019 **Clustering Curves under the Fréchet distance.**
Anticipating Human Behavior Workshop
Bonn, DE
- Jul 2017 **Algorithms for Structures in Spaces of Curves.**
Workshop on Geometry and Machine Learning (part of CG Week 2017)
Brisbane, AUS
- May 2016 **Two decades of algorithms for the Fréchet distance.**
NII Shonan Meeting: Theory and Applications of Geometric Optimization
Shonan Village Center, JPN
- Sep 2016 **Lower Bounds for Fréchet Range Reporting.**
Host: Rasmus Pagh, Professor of Computer Science at ITU Copenhagen, DK
- Aug 2014 **Datastructures for Trajectories.**
Host: Lars Arge, Professor of Computer Science at Aarhus University, DK

Research Visits

- Oct 2017 **Monash University**, Melbourne, AU.
Host: Rob Hyndman, Professor of Statistics
Duration: 7 days
- Jul 2017 **The University of Sydney**, Sydney, AU.
Host: Joachim Gudmundsson, Associate Professor (Computer Science)
Duration: 5 days
- Sep 2016 **ITU Copenhagen**, Copenhagen, DK.
Host: Francesco Silvestri, Postdoc at ERC Scalable Similarity Search (Rasmus Pagh)
Duration: 4 days
- Aug 2014 **Aarhus University**, Aarhus, DK.
Host: Peyman Afshani, Associate Professor at MADALGO (Lars Arge)
Duration: 12 days
- Jan 2013 **Tulane University**, New Orleans, LA, USA.
Host: Carola Wenk, Professor of Computer Science
Duration: 10 days
- Aug 2010 **University of Illinois at Urbana-Champaign**, Urbana, IL, USA.
Host: Sariel Har-Peled, Professor of Computer Science
Duration: 3 weeks
- Jul 2010 **University of North Carolina at Chapel Hill**, Chapel Hill, NC, USA.
Host: Jack Snoeyink, Professor of Computer Science
Duration: 3 days

Selected Publications

- 2019 **Approximating (k,l)-center clustering for curves.**
with Kevin Buchin, Joachim Gudmundsson, Michael Horton, Irina Kostitsyna, Maarten Löffler, and Martijn Struijs. *Proceedings of the 30th ACM-SIAM Symposium on Discrete Algorithms, SODA*.
We study variants of k-center clustering problems for polygonal curves under the Fréchet distance. We substantially extend and improve the known approximation bounds for curves in dimension 2 and higher.
- 2018 **On the complexity of range searching among curves.**
with Peyman Afshani. *Proceedings of the 29th ACM-SIAM Symposium on Discrete Algorithms, SODA*.
Given n polygonal curves S in \mathbb{R}^d , preprocess S into a data structure that answers queries with a query curve q and radius ρ for the curves of S that have Fréchet distance at most ρ to q . We initiate a comprehensive analysis of the space/query-time trade-off for this data structuring problem, proving upper and lower bounds.
- 2017 **Locality-sensitive hashing of curves.**
with Francesco Silvestri. *Proceedings of the 33rd International Symposium on Computational Geometry, SoCG*.
We study data structures for storing a set of polygonal curves in \mathbb{R}^d such that, given a query curve, we can efficiently retrieve similar curves from the set, where similarity is measured using the discrete Fréchet distance or the dynamic time warping distance. To this end we devise the first locality-sensitive hashing schemes for these distance measures.
- 2016 **Clustering time series under the Fréchet distance.**
with Amer Krivošija and Christian Sohler. *Proceedings of the 27th ACM-SIAM Symposium on Discrete Algorithms, SODA*, pages 766-785.
We study variants of k-center and k-median clustering problems for time series under the Fréchet distance. To the best of our knowledge, our algorithms are the first clustering algorithms for the Fréchet distance which achieve an approximation factor of $(1 + \varepsilon)$ or better.
- 2016 **On the expected complexity of Voronoi diagrams on terrains.**
with Sarel Har-Peled and Benjamin Raichel. *Transactions on Algorithms (TALG)* 12(3): 37, 2016. Also appeared in *Proceedings of the 28th ACM Symposium on Computational Geometry, SoCG*, pages 101-110.
We investigate the combinatorial complexity of geodesic Voronoi diagrams on polyhedral terrains using a probabilistic analysis. We show that under reasonable assumptions, the expected complexity is linear in the size of the terrain and the number of sites (as opposed to quadratic in the worst case).
- 2013 **Jaywalking your dog: computing the Fréchet distance with shortcuts.**
with Sarel Har-Peled. *SIAM Journal on Computing*, 42(5):1830-1866, 2013.
Also appeared in: *Proceedings of the 23rd Annual ACM-SIAM Symposium on Discrete Algorithms, SODA*, p.318-337, 2012.
We introduce a notion of a partial Fréchet distance, where one is allowed to shortcut from and to any point along one of the curves. We give near-linear time $(3 + \varepsilon)$ -approximation algorithms for specific cases.
- 2012 **Approximating the Fréchet distance for realistic curves in near linear time.**
with Sarel Har-Peled and Carola Wenk. *Discrete & Computational Geometry*, 48(1):94-127. Also appeared in *Proceedings of the 26th ACM Symposium on Computational Geometry, SoCG*, p.365-374, 2010.
We present a simple and practical $(1 + \varepsilon)$ -approximation algorithm for the Fréchet distance between two polygonal curves in \mathbb{R}^d , which runs in near-linear time for realistic input curves. We show that our algorithm has near-linear running time for c -packed polygonal curves, and similar results for other input models, such as low-density polygonal curves.

Publications

Refereed Conference Publications

- [1] Anne Driemel, Jeff M. Phillips, and Ioannis Psarros. The VC dimension of metric balls under Fréchet and Hausdorff distances. In *Proceedings of the 35th International Symposium on Computational Geometry, SoCG*, pages 28:1–28:16, 2019.
- [2] Kevin Buchin, Anne Driemel, Joachim Gudmundsson, Michael Horton, Irina Kostitsyna, Maarten Löffler, and Martijn Struijs. Approximating (k,l) -center clustering for curves. In *Proceedings of the Thirtieth Annual ACM-SIAM Symposium on Discrete Algorithms, SODA*, pages 2922–2938, 2019.
- [3] Matteo Ceccarello, Anne Driemel, and Francesco Silvestri. FRESH: Fréchet similarity with hashing. In *Proceedings of Algorithms and Data Structures - 16th International Symposium, WADS*, pages 254–268, 2019.
- [4] Anne Driemel and Amer Krivosija. Probabilistic embeddings of the Fréchet distance. In *Approximation and Online Algorithms - 16th International Workshop, WAOA 2018*, pages 218–237, 2018.
- [5] Peyman Afshani and Anne Driemel. On the complexity of range searching among curves. In *Proceedings of the 29th ACM-SIAM Symposium on Discrete Algorithms, SODA*, pages 898–917, 2018.
- [6] Anne Driemel and Francesco Silvestri. Locality-sensitive hashing of curves. In *Proceedings of the 33rd International Symposium of Computational Geometry, SoCG*, pages 37:1–37:16, 2017.
- [7] Anne Driemel, Amer Krivošija, and Christian Sohler. Clustering time series under the Fréchet distance. In *Proceedings of the 27th ACM-SIAM Symposium on Discrete Algorithms, SODA*, pages 766–785, 2016.
- [8] Maike Buchin, Anne Driemel, and Bettina Speckmann. Computing the Fréchet distance with shortcuts is NP-hard. In *Proceedings of the 30th Symposium on Computational Geometry, SoCG*, pages 367–376, 2014.
- [9] Boris Aronov, Anne Driemel, Marc van Kreveld, Maarten Löffler, and Frank Staals. Segmentation of trajectories on non-monotone criteria. In *Proceedings of the 24th ACM-SIAM Symposium on Discrete Algorithms, SODA*, 2013.
- [10] Anne Driemel, Sariel Har-Peled, and Benjamin Raichel. On the expected complexity of Voronoi diagrams on terrains. In *Proceedings of the 28th ACM Symposium on Computational Geometry, SoCG*, pages 101–110, 2012.
- [11] Anne Driemel and Sariel Har-Peled. Jaywalking your dog: computing the Fréchet distance with shortcuts. In *Proceedings of the 23rd Annual ACM-SIAM Symposium on Discrete Algorithms, SODA*, pages 318–337, 2012.
- [12] Atlas F. Cook, Anne Driemel, Sariel Har-Peled, Jessica Sherette, and Carola Wenk. Computing the Fréchet distance between folded polygons. In *Algorithms and Data Structures - 12th International Symposium, WADS*, pages 267–278, 2011.
- [13] Anne Driemel, Herman Haverkort, Maarten Löffler, and Rodrigo I. Silveira. Flow computations on imprecise terrains. In *Algorithms and Data Structures - 12th International Symposium, WADS*, pages 350–361, 2011.

- [14] Daniel Chen, Anne Driemel, Leonidas J. Guibas, Andy Nguyen, and Carola Wenk. Approximate map matching with respect to the Fréchet distance. In *Proceedings of the Workshop on Algorithm Engineering and Experiments, ALENEX*, pages 75–83, 2011.
- [15] Maike Buchin, Anne Driemel, Marc van Kreveld, and Vera Sacristán. An algorithmic framework for segmenting trajectories based on spatio-temporal criteria. In *18th ACM SIGSPATIAL International Conference on Advances in Geographic Information Systems*, pages 202–211, 2010.
- [16] Anne Driemel, Sariel Har-Peled, and Carola Wenk. Approximating the Fréchet distance for realistic curves in near linear time. In *Proceedings of the 26th ACM Symposium on Computational Geometry, SoCG*, pages 365–374, 2010.

Refereed Journal Publications

- [17] Anne Driemel, Sariel Har-Peled, and Benjamin Raichel. On the expected complexity of Voronoi diagrams on terrains. *ACM Transactions on Algorithms*, 12(3):37:1–37:20, April 2016.
- [18] Boris Aronov, Anne Driemel, Marc Van Kreveld, Maarten Löffler, and Frank Staals. Segmentation of trajectories on nonmonotone criteria. *ACM Transactions on Algorithms*, 12(2):26:1–26:28, December 2015.
- [19] Atlas F. Cook IV, Anne Driemel, Jessica Sherette, and Carola Wenk. Computing the Fréchet distance between folded polygons. *Computational Geometry*, 50:1 – 16, 2015.
- [20] Anne Driemel and Sariel Har-Peled. Jaywalking your dog: computing the Fréchet distance with shortcuts. *SIAM Journal on Computing*, 42(5):1830–1866, 2013.
- [21] Anne Driemel, Herman Haverkort, Maarten Löffler, and Rodrigo Silveira. Flow computations on imprecise terrains. *Journal of Computational Geometry*, 4(1):38–78, 2013.
- [22] Anne Driemel, Sariel Har-Peled, and Carola Wenk. Approximating the Fréchet distance for realistic curves in near linear time. *Discrete & Computational Geometry*, 48(1):94–127, 2012.
- [23] Maike Buchin, Anne Driemel, Marc van Kreveld, and Vera Sacristán. Segmenting trajectories: A framework and algorithms using spatiotemporal criteria. *Journal of Spatial Information Science*, 3(1):33–63, 2011.

Theses

- [24] Anne Driemel. *Realistic analysis for algorithmic problems on geographical data*. PhD thesis, Utrecht University, 2013.
- [25] Anne Driemel. Multiscale curvature matching for smooth polylines. Master’s thesis, Free University of Berlin, 2009.