Dr. Benjamin M. Ruppik

Topological Deep Learning Researcher — Short biography

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Employment

January 2022 – December 2024 **Postdoctoral Researcher**,
Topological Data Analysis and Topological Deep Learning for Natural Language Processing, Heinrich-Heine-Universität Düsseldorf, Faculty of Mathematics and Natural Sciences, Dialog Systems and Machine Learning Lab at the Computer Science Institute, Chair: Prof. Dr. Milica Gašić, Building 25.12.01, Universitätsstraße 1, 40225 Düsseldorf.

Publications and Preprints

Topological Deep Learning

- Renato Vukovic, Michael Heck, Benjamin Ruppik, Carel van Niekerk, Marcus Zibrowius and Milica Gašić:
  'Dialogue Term Extraction using Transfer Learning and Topological Data Analysis'
  Published at the *23rd Meeting of the Special Interest Group on Discourse and Dialogue (SIGDIAL 2022)*;
  doi:10.18653/v1/2022.sigdial-1.53; arXiv:2208.10448.

Task-oriented Dialogue Systems

- Christian Geishauser, Carel van Niekerk, Nurul Lubis, Hsien-chin Lin, Michael Heck, Shutong Feng, Benjamin Ruppik, Renato Vukovic, Milica Gašić:
  'Learning With an Open Horizon in Ever-Changing Dialogue Circumstances'
  Published in *IEEE/ACM Transactions on Audio, Speech, and Language Processing, vol. 32, pp. 2352-2366 (2024)*;
  doi:10.1109/TASLP.2024.3385289.
- Carel van Niekerk, Christian Geishauser, Michael Heck, Shutong Feng, Hsien-chin Lin, Nurul Lubis, Benjamin Ruppik, Renato Vukovic, Milica Gašić:
  'CAMELL: Confidence-based Acquisition Model for Efficient Self-supervised Active Learning with Label Validation'
  To appear in *Transactions of the Association for Computational Linguistics (TACL)*;
  doi:TBD; arXiv:2310.08944.
- Shutong Feng, Nurul Lubis, Benjamin Ruppik, Christian Geishauser, Michael Heck, Hsien-chin Lin, Carel van Niekerk, Renato Vukovic, Milica Gašić:
  'From Chatter to Matter: Addressing Critical Steps of Emotion Recognition Learning in Task-oriented Dialogue'
  Published at the *24th Meeting of the Special Interest Group on Discourse and Dialogue (SIGDIAL 2023)*;
  doi:10.18653/v1/2023.sigdial-1.8; arXiv:2308.12648.
- Hsien-Chin Lin, Shutong Feng, Christian Geishauser, Nurul Lubis, Carel van Niekerk, Michael Heck, Benjamin Ruppik, Renato Vukovic, Milica Gašić:
  'EmoUS: Simulating User Emotions in Task-Oriented Dialogues'
  Published in *Proceedings of the 46th International ACM SIGIR Conference on Research and Development in Information Retrieval (SIGIR 2023), Association for Computing Machinery, New York, NY, USA*;
  doi:10.1145/3539618.3592092; arXiv:2306.01579.
- Michael Heck, Nurul Lubis, Benjamin Ruppik, Renato Vukovic, Shutong Feng, Christian Geishauser, Hsien-Chin Lin, Carel van Niekerk, Milica Gašić:
  'ChatGPT for Zero-shot Dialogue State Tracking: A Solution or an Opportunity?'
  Published in *Proceedings of the 61st Annual Meeting of the Association for Computational Linguistics (ACL), Toronto, Canada, July 2023*;
  doi:10.18653/v1/2023.acl-short.81; arXiv:2306.01386.

Low-dimensional Topology

- Patricia Cahn, Gordana Matic, Benjamin Ruppik:
  'Algorithms for Computing Invariants of Trisected Branched Covers'
  Submitted;
  arXiv:2308.11689.

- Sarah Blackwell, Robion Kirby, Michael R. Klug, Vincent Longo, Benjamin Ruppik:
  'A group-theoretic framework for low-dimensional topology or, how not to study low-dimensional topology?'
  To appear in *Algebr. Geom. Topol.*;
  arXiv:2301.05685.
- Samantha Allen, Kenan Ince, Seungwon Kim, Benjamin Ruppik, Hannah Turner:
  'Unknotting via null-homologous twists and multi-twists'
  To appear in *Pacific Journal of Mathematics*;
  arXiv:2211.04621.
- Daniel Kasprowski, Johnny Nicholson, Benjamin Ruppik:
  'Homotopy classification of 4-manifolds whose fundamental group is dihedral'
  Published in *Algebr. Geom. Topol. 22(6): 2915-2949 (2022)*;
  doi:10.2140/agt.2022.22.2915; arXiv:2011.03520.
- Michael Klug, Benjamin Ruppik:
  'Deep and shallow slice knots in 4-manifolds'
  Published in *Proc. Amer. Math. Soc. Ser. B 8 (2021), 204-218*;
  doi:10.1090/bproc/89; arXiv:2009.03053.
- Jason Joseph, Michael Klug, Benjamin Ruppik, Hannah Schwartz:
  'Unknotting numbers of 2-spheres in the 4-sphere'
  Published in *J. Topology 14.4 (2021), 1321-1350*;
  doi:10.1112/topo.12209; arXiv:2007.13244.
- Daniel Kasprowski, Mark Powell, Benjamin Ruppik:
  'Homotopy classification of 4-manifolds with finite abelian 2-generator fundamental groups'
  To appear in *Mathematical Proceedings of the Cambridge Philosophical Society*;
  arXiv:2005.00274.

Recent Research Talks

2023-02 **'Exploring the Shape of Word Spaces with Topological Data Analysis'**,
invited talks in the Pitt NLP Seminar, University of Pittsburgh Computer Science department, Pittsburgh, PA, USA, on 2023-03-28; MIT CSAIL Spoken Language Systems Group, Cambridge, MA, USA, on 2023-03-01; and Columbia University NLP Seminar, New York, NY, USA, on 2023-02-17.

2022-12-01 **'Topological Data Analysis in Word Embedding Spaces'**,
invited talk at the Geometry Graduate Colloquium, ETH Zurich, Switzerland.

Recent Conferences & Travel

2022-09 3rd Workshop on Topological Methods in Data Analysis; Heidelberg University, Germany (online); September 28 – 30, 2022;
Lightning talk: 'Detecting relevant terms in word embedding spaces'.

2022-09 SIGDIAL 2022; Heriot-Watt University, Edinburgh, UK; September 07 – 09, 2022;
Talk: 'Dialogue Term Extraction using Transfer Learning and Topological Data Analysis'.

2022-09 18th Workshop on Spoken Dialogue Systems for PhDs, PostDocs & New Researchers (YRRSDS 2022); Heriot-Watt University, Edinburgh, UK; September 05 – 06, 2022;
Poster: 'Topology in Word Embedding Spaces'.

2022-08 Algebraic Topology and Topological Data Analysis: A Conference in Honor of Gunnar Carlsson; Institute for Mathematics and its Applications, Minneapolis, MN USA; August 01 – 05, 2022.

2021-09 MATRIX-MFO Tandem Workshop ID 2136a: Invariants and Structures in Low-Dimensional Topology; Oberwolfach; September 05 – 11, 2021;
Talk: 'Concordances in (non-orientable 3-manifold) $\times [0,1]$'.

Education

October 2018 – June 2022 **PhD in Mathematics, specializing in Low-Dimensional Topology**,
Thesis: 'Casson-Whitney Unknotting, Deep Slice Knots and Group Trisections of Knotted Surface Type', advised by Arunima Ray and Peter Teichner;
member of the Bonn International Graduate School of Mathematics;
funded by the International Max Planck Research School on Moduli Spaces,
Max-Planck-Institute for Mathematics, Vivatsgasse 7, 53111 Bonn,
Graduation: June 2022.

2016 – 2018 **Master of Science in Mathematics**, *University of Bonn*, *Graduation: August 2018*.

2013 – 2016 **Bachelor of Science in Mathematics**, *University of Bonn*, *Graduation: June 2016*.

Teaching

Summer Term 2022 & 2023 **Master's Seminar on Word Embedding Spaces**,
Master CS; Master AI & Data Science, Faculty of Mathematics and Natural Sciences, Heinrich-Heine-University Düsseldorf.

October 2014 – September 2020 **Teaching assistant**, Mathematical Institute of the University of Bonn, Bonn.
Employed as tutor for the lectures *Analysis I, II*, *Linear Algebra I, II, Introduction to Algebra (Galois theory)*, *Introduction to Geometry and Topology*, *Topology I, II (Homology & Cohomology)*, *Algebraic Topology I, II (Introduction to Stable Homotopy Theory; Orthogonal Spectra)*

Experience

2021 **External PhD representative**, *Max-Planck-Institute for Mathematics, Bonn*.

April 2018 – September 2018 **Student associate**, Institute of Computer Science III, Bonn.
Semantic segmentation of RGB-images and point clouds captured by a Velodyne LiDAR;
ben300694/semanticLabelingTool