Dr. Benjamin M. Ruppik

Topological Deep Learning Researcher — Short biography

October 1, 2024
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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, Building 25.12.01, Universitätsstraße 1, 40225 Düsseldorf
Chair: Prof. Dr. Milica Gašić
Employed in the European Research Council project
Dynamic dialogue modelling (DYMO) .

Publications and Preprints

Topological Deep Learning

○ **Benjamin Ruppik**, Michael Heck, Carel van Niekerk, Renato Vukovic, Hsien-chin Lin, Shutong Feng, Marcus Zibrowius, Milica Gašić:
'Local Topology Measures of Contextual Language Model Latent Spaces With Applications to Dialogue Term Extraction'
Published in the *Proceedings of the 25th Annual Meeting of the Special Interest Group on Discourse and Dialogue (SIGDIAL 2024), Kyoto University, Japan*;
`doi:10.18653/v1/2024.sigdial-1.31`; `arXiv:2408.03706`;
Nominated for Best Paper Award at SIGDIAL 2024.

○ 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 in the *Proceedings of the 23rd Annual Meeting of the Special Interest Group on Discourse and Dialogue (SIGDIAL 2022), pages 564-581, Edinburgh, UK*
`doi:10.18653/v1/2022.sigdial-1.53`; `arXiv:2208.10448`.

Task-oriented Dialogue Systems

○ Renato Vukovic, David Arps, Carel van Niekerk, **Benjamin Ruppik**, Hsien-Chin Lin, Michael Heck, Milica Gašić:
'Dialogue Ontology Relation Extraction via Constrained Chain-of-Thought Decoding'
Published in the *Proceedings of the 25th Annual Meeting of the Special Interest Group on Discourse and Dialogue (SIGDIAL 2024), Kyoto University, Japan*;
`doi:10.18653/v1/2024.sigdial-1.33`; `arXiv:2408.02361`

○ Shutong Feng, Hsien-chin Lin, Christian Geishauser, Nurul Lubis, Carel van Niekerk, Michael Heck, **Benjamin Ruppik**, Renato Vukovic, Milica Gašić:
'Infusing Emotions into Task-oriented Dialogue Systems: Understanding, Management, and Generation'
Published in the *Proceedings of the 25th Annual Meeting of the Special Interest Group on Discourse and Dialogue (SIGDIAL 2024), Kyoto University, Japan*;
`doi:10.18653/v1/2024.sigdial-1.60`; `arXiv:2408.02417`

○ 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 in the *Proceedings of the 24th Annual 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'
Published in *Pacific J. Math.330(2024), no.1, 25–41*;
`doi:10.2140/pjm.2024.330.25`; `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

2024-09	25th Annual Meeting of the Special Interest Group on Discourse and Dialogue (SIGDIAL 2024); Kyoto University, Kyoto, Japan; September 18 – 20, 2024; **Talk: 'Local Topology Measures of Contextual Language Model Latent Spaces With Applications to Dialogue Term Extraction'.** Nominated for Best Paper Award.
2024-09	20th Workshop on Spoken Dialogue Systems for PhDs, PostDocs & New Researchers (YRRSDS 2024); Kyoto University, Kyoto, Japan; September 16 – 17, 2024; **Position paper and talk: 'Topological Deep Learning for Term Extraction'.**
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	23rd Annual Meeting of the Special Interest Group on Discourse and Dialogue (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, PhD and Prof. Dr. 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; �онen300694/semanticLabelingTool