André Biedenkapp

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Personal Information

Date of birth: 13.07.1992
Nationality: German

Work experience

Position held

Machine Learning Lab — **Albert-Ludwigs-University Freiburg**
Scientific Researcher — *Since 10.2017*

Past positions

Machine Learning Lab — **Albert-Ludwigs-University Freiburg**
Student Assistant — *10.2015 – 09.2017*
Assisting in the implementation of research projects

Chair of Computer Architecture — **Albert-Ludwigs-University Freiburg**
Student Assistant — *04.2014 – 09.2014*
Maintenance of the mobile robots for the Hardware-Labcourse

Research Interests

- Dynamic Algorithm Configuration
- Learning to Learn
- Deep Reinforcement Learning
- Automated Machine Learning and Reinforcement Learning

Education

PhD. Candidate (Computer Science) — **Albert-Ludwigs-University Freiburg**
Machine Learning Lab — *Since 02.2018*
Thesis Working Title: Dynamic Algorithm Configuration by Reinforcement Learning

Summer School — ***Reinforcement Learning Summer SCOOL* (RLSS'19)**
In: Lille, France — *July 2019*
Topics: *Reinforcement Learning and Bandits*

Computer Science — **Albert-Ludwigs-University Freiburg**
Master of Science (M.Sc.), Final Grade: 1.2 — *2014 – 2017*
Thesis: Per Instance Algorithm Configuration (Grade 1.0)
Supervisor: Prof. Dr. Frank Hutter

Computer Science — **Albert-Ludwigs-University Freiburg**
Bachelor of Science (B.Sc.) — *2011 – 2014*
Thesis: Data Analysis for the Selection of Recording Channels on Multielectrode-Arrays (Grade 1.7)
Supervisor: Prof. Dr. Wolfram Burgard

Teaching Experience

Automated Machine Learning — **Massive Open Online Course (MOOC)**
Graduate course — *Published 04.2021*
Creation of coding exercises. Involved in setting up MOOC

Teaching Assistant

Automated Machine Learning **(Flipped Classroom)**
Graduate course *04.2022 – 09.2022*
Creation and grading of exercises & final project.

Automated Machine Learning **(Flipped Classroom)**
Graduate course, Virtual *04.2021 – 09.2021*
Creation and grading of exercises & final project. Setting up online teaching through Zoom and GitHub classroom.

Automated Machine Learning **(Flipped Classroom)**
Graduate course, Virtual *04.2020 – 09.2020*
Creation and grading of exercises & final project. Setting up online teaching through Zoom and GitHub classroom.

Automated Machine Learning
Graduate course *04.2019 – 09.2019*
Creation and grading of exercises & final project

Machine Learning for Automated Algorithm Design
Graduate course *10.2018 – 03.2019*
Creation and grading of exercises & final project

Machine Learning for Automated Algorithm Design
Graduate course *10.2017 – 03.2018*
Creation and grading of exercises & final project

Hardware-Labcourse
Undergraduate course *04.2014 – 09.2014*
Assisting students with practical exercises

Student Supervision

MSc Thesis
Baohe Zhang, Joint supervision with R. Rajan, Published at AISTATS'21 *04.2020 – 10.2020*
On the Importance of Hyperparameter Optimization in Model-based Reinforcement Learning

MSc Project & Thesis
Gresa Shala, Published at PPSN'20 *04.2019 – 05.2020*
Learning to Optimize CMA-ES

MSc Thesis
Furkan Bozkurt *03.2019 – 11.2019*
RL-DCBO: Reinforcement Learning Guided Dynamic Control for Bayesian Optimization

MSc Thesis
Theresa Eimer, Follow up work published at ICML'21 *12.2018 – 09.2019*
Improved Meta-Learning for Algorithm Control through Self-Paced Learning

MSc Thesis
Kevin Hättig *12.2018 – 09.2019*
Model-Based Population Based Training

MSc Thesis
Oliver Brunner, Joint supervision with D. Speck at GKI-Freiburg *11.2018 – 04.2019*
Learning Domain-Independent Heuristics with Deep Neural Networks

MSc Project
Theresa Eimer & Kevin Hättig *04.2018 – 12.2018*
Algorithm State Description for Algorithm Control

Publications

Google Scholar DBLP 0000-0002-8703-8559

Journal & Conference Publications

[1] **A. Biedenkapp***, N. Dang*, M. S. Krejca*, F. Hutter, and C. Doerr. "Theory-inspired Parameter Control Benchmarks for Dynamic Algorithm Configuration". In: *Proceedings of the Genetic and Evolution-*

ary Computation Conference (GECCO'22). **Joint first authorship**, *Conference Rating: A*, *Nominated for Best Paper*. ACM, July 2022.

[2] J. Parker-Holder, R. Rajan, X. Song, **A. Biedenkapp**, Y. Miao, T. Eimer, B. Zhang, V. Nguyen, R. Calandra, A. Faust, F. Hutter, and M. Lindauer. "Automated Reinforcement Learning (AutoRL): A Survey and Open Problems". In: *Journal of Artificial Intelligence Research (JAIR)* 74 (2022), pp. 517–568.

[3] M. Lindauer, K. Eggensperger, M. Feurer, **A. Biedenkapp**, D. Deng, C. Benjamins, R. Sass, and F. Hutter. "SMAC3: A Versatile Bayesian Optimization Package for Hyperparameter Optimization". In: *Journal of Machine Learning Research (JMLR) – MLOSS* 23.54 (2022), pp. 1–9.

[4] **A. Biedenkapp**, R. Rajan, F. Hutter, and M. Lindauer. "TempoRL: Learning When to Act". In: *Proceedings of the Thirty-eighth International Conference on Machine Learning. Acceptance rate: 21.5%, Conference Rating: A**. July 2021, pp. 914–924.

[5] T. Eimer, **A. Biedenkapp**, F. Hutter, and M. Lindauer. "Self-Paced Context Evaluation for Contextual Reinforcement Learning". In: *Proceedings of the Thirty-eighth International Conference on Machine Learning. Acceptance rate: 21.5%, Conference Rating: A**. July 2021, pp. 2948–2958.

[6] T. Eimer, **A. Biedenkapp**, M. Reimer, S. Adriaensen, F. Hutter, and M. Lindauer. "DACBench: A Benchmark Library for Dynamic Algorithm Configuration". In: *Proceedings of the Thirtieth International Joint Conference on Artificial Intelligence (IJCAI'21). Acceptance rate: 19.3%, Conference Rating: A**. ijcai.org, Aug. 2021, pp. 1668–1674.

[7] D. Speck*, **A. Biedenkapp***, F. Hutter, R. Mattmüller, and M. Lindauer. "Learning Heuristic Selection with Dynamic Algorithm Configuration". In: *Proceedings of the Thirty-First International Conference on Automated Planning and Scheduling (ICAPS'21)*. **Joint first authorship**, *Acceptance rate: ~30%, Conference Rating: A**. Aug. 2021, pp. 597–605.

[8] B. Zhang, R. Rajan, L. Pineda, N. Lambert, **A. Biedenkapp**, K. Chua, F. Hutter, and R. Calandra. "On the Importance of Hyperparameter Optimization for Model-based Reinforcement Learning". In: *Proceedings of the International Conference on Artificial Intelligence and Statistics (AISTATS'21). Acceptance rate: 29.8%, Conference Rating: A*. Apr. 2021.

[9] J. KH Franke, G. Köhler, **A. Biedenkapp**, and F. Hutter. "Sample-Efficient Automated Deep Reinforcement Learning". In: *Proceedings of the International Conference on Learning Representations (ICLR'21)*. Published online: `iclr.cc`, *Acceptance rate: 28.7%, Conference Rating: A**. May 2021.

[10] G. Shala*, **A. Biedenkapp***, N. Awad, S. Adriaensen, F. Hutter, and M. Lindauer. "Learning Step-Size Adaptation in CMA-ES". In: *Proceedings of the Sixteenth International Conference on Parallel Problem Solving from Nature (PPSN'20)*. **Joint first authorship**, *Conference Rating: A*. Sept. 2020, pp. 691–706.

[11] **A. Biedenkapp**, H. F. Bozkurt, T. Eimer, F. Hutter, and M. Lindauer. "Dynamic Algorithm Configuration: Foundation of a New Meta-Algorithmic Framework". In: *Proceedings of the European Conference on Artificial Intelligence (ECAI). Acceptance rate: 26.8%, Conference Rating: A*. June 2020, pp. 427–434.

[12] **A. Biedenkapp**, J. Marben, M. Lindauer, and F. Hutter. "CAVE: Configuration Assessment, Visualization and Evaluation". In: *Proceedings of the International Conference on Learning and Intelligent Optimization (LION'18)*. June 2018.

[13] **A. Biedenkapp**, M. Lindauer, K. Eggensperger, C. Fawcett, H. Hoos, and F. Hutter. "Efficient Parameter Importance Analysis via Ablation with Surrogates". In: *Proceedings of the AAAI conference. Acceptance rate: 24.6%, Conference Rating: A**. Feb. 2017, pp. 773–779.

Workshop Publications & Preprints

[14] R. Sass, E: Bergman, **A. Biedenkapp**, F. Hutter, and M. Lindauer. "DeepCAVE: An Interactive Analysis Tool for Automated Machine Learning". In: *Workshop on Adaptive Experimental Design and Active Learning in the Real World (ReALML@ICML'22)*. 2022.

[15] **A. Biedenkapp**, D. Speck, S. Sievers, F. Hutter, M. Lindauer, and J. Seipp. "Learning Domain-Independent Policies for Open List Selection". In: *Workshop on Bridging the Gap Between AI Planning and Reinforcement Learning (PRL@ICAPS'22)*. 2022.

[16] C. Benjamins, T. Eimer, F. Schubert, **A. Biedenkapp**, B. Rosenhan, F. Hutter, and M. Lindauer. "CARL: A Benchmark for Contextual and Adaptive Reinforcement Learning". In: *Workshop on Ecological Theory of Reinforcement Learning (EcoRL@NeurIPS'21)*. Sept. 2021.

[17] S. Izquierdo, J. Guerrero-Viu, S. Hauns, G. Miotto, S. Schrodi, **A. Biedenkapp**, T. Elsken, D. Deng, M. Lindauer, and F. Hutter. "Bag of Baselines for Multi-objective Joint Neural Architecture Search and Hyperparameter Optimization". In: *Workshop on Automated Machine Learning (AutoML@ICML'21)*. May 2021.

[18] S. Müller, **A. Biedenkapp**, and F. Hutter. "In-Loop Meta-Learning with Gradient-Alignment Reward". In: *AAAI workshop on Meta-Learning Challenges (MetaLearning@AAAI'21)*. Feb. 2021.

[19] N. Awad, G. Shala, D. Deng, N. Mallik, M. Feurer, K. Eggensperger, **A. Biedenkapp**, D. Vermetten, H. Wang, C. Doerr, M. Lindauer, and F. Hutter. "Squirrel: A Switching Hyperparameter Optimizer Description of the entry by AutoML.org & IOHprofiler to the NeurIPS 2020 BBO challenge". In: ***arXiv***:*2012.08180* (Dec. 2020). **Winning entry of the BBO Competition@NeurIPS'20 on a meta-learnable search space**.

[20] **A. Biedenkapp**, R. Rajan, F. Hutter, and M. Lindauer. "Towards TempoRL: Learning When to Act". In: *Workshop on Inductive Biases, Invariances and Generalization in RL (BIG@ICML'20)*. July 2020.

[21] T. Eimer, **A. Biedenkapp**, F. Hutter, and M. Lindauer. "Towards Self-Paced Context Evaluation for Contextual Reinforcement Learning". In: *Workshop on Inductive Biases, Invariances and Generalization in RL (BIG@ICML'20)*. July 2020.

[22] S. Adriaensen, **A. Biedenkapp**, G. Shala, N. Awad, T. Eimer, M. Lindauer, and F. Hutter. "Automated Dynamic Algorithm Configuration". In: ***arXiv***:*2205.13881 [cs.AI]* (2022). Under Review.

[23] Carolin Benjamins, Theresa Eimer, Frederik Schubert, Aditya Mohan, André Biedenkapp, Bodo Rosenhan, Frank Hutter, and Marius Lindauer. "Contextualize Me – The Case for Context in Reinforcement Learning". In: ***arXiv***:*2202.04500 [cs.LG]* (2022).

[24] R. Rajan, J. L. B. Diaz, S. Guttikonda, F. Ferreira, **A. Biedenkapp**, and Frank Hutter. "MDP Playground: Controlling Dimensions of Hardness in Reinforcement Learning". In: ***arXiv***:*1909.07750v3* (Oct. 2020).

[25] **A. Biedenkapp**, H. F. Bozkurt, F. Hutter, and M. Lindauer. "Towards White-Box Benchmarks for Algorithm Control". In: *IJCAI 2019 DSO Workshop*. Aug. 2019.

[26] M. Lindauer, M. Feurer, K. Eggensperger, **A. Biedenkapp**, and F. Hutter. "Towards Assessing the Impact of Bayesian Optimization's Own Hyperparameters". In: *IJCAI 2019 DSO Workshop*. Aug. 2019.

[27] M. Lindauer, K. Eggensperger, M. Feurer, **A. Biedenkapp**, J. Marben, P. Müller, and F. Hutter. "BOAH: A Tool Suite for Multi-Fidelity Bayesian Optimization & Analysis of Hyperparameters". In: ***arXiv***:*1908.06756* (Aug. 2019).

Blog Posts

[28] **A. Biedenkapp**, R. Rajan, F. Hutter, and M. Lindauer. "TempoRL - Learning When to Act". In: *Personal Blog* (May 2022). URL: `https://andrebiedenkapp.github.io/blog/2022/temporl/`.

[29] **A. Biedenkapp**, N. Dang, M. S. Krejca, F. Hutter, and C. Doerr. "Theory-Inspired Parameter Control Benchmarks for DAC". In: *Personal Blog* (May 2022). URL: `https://andrebiedenkapp.github.io/blog/2022/gecco/`.

[30] N. Lambert, B. Zhang, R. Rajan, and **A. Biedenkapp**. "The Importance of Hyperparameter Optimization for Model-based Reinforcement Learning". In: *https://bair.berkeley.edu/blog* (Apr. 2021). URL: `https://bair.berkeley.edu/blog/2021/04/19/mbrl/`.

[31] R. Rajan, **A. Biedenkapp**, T. F. Runge, and J. Franke. "AutoRL: AutoML in the Realm of Deep Reinforcement Learning". In: *https://www.automl.org/automl-blog* (Apr. 2021). URL: https://www.automl.org/blog-autorl.

[32] **A. Biedenkapp**. "Learning Step-Size Adaptation in CMA-ES". In: *https://www.automl.org/automl-blog* (Aug. 2020). URL: https://www.automl.org/learning-step-size-adaptation-in-cma-es.

[33] **A. Biedenkapp**. "Dynamic Algorithm Configuration". In: *https://www.automl.org/automl-blog* (Feb. 2020). URL: https://www.automl.org/dynamic-algorithm-configuration.

[34] **A. Biedenkapp** and F. Hutter. "BOHB". In: *https://www.automl.org/automl-blog* (Aug. 2018). URL: https://www.automl.org/blog_bohb.

[35] **A. Biedenkapp**, K. Eggensperger, M. Feurer, and F. Hutter. "2nd AutoML Challenge". In: *https://www.automl.org/automl-blog* (Aug. 2018). URL: https://www.automl.org/blog-2nd-automl-challenge.

Patents

[36] **Biedenkapp, A.**, G. Shala, S. Adriaensen, N. Awad, M. Lindauer, and F. Hutter. "Method and Device for Learning a Strategy and for Implementing the Strategy". U.S. pat. req. 17/305,586. Robert Bosch GmbH. July 9, 2021. Filed.

[37] S. Müller, **Biedenkapp, A.**, and F. Hutter. "Verbesserte Vorrichtung zum Anlernen von maschinellen Lernsysteme für Bildverarbeitung". German pat. DE202021100225. Robert Bosch GmbH. Feb. 12, 2021. URL: https://depatisnet.dpma.de/DepatisNet/depatisnet?action=bibdat&docid=DE202021100225U1.

[38] D. Speck, **Biedenkapp, A.**, R. Matmüller, F. Hutter, and M. Lindauer. "Device and Method for Planning and Operation of a Technical System". U.S. pat. req. 17/242,790. Robert Bosch GmbH. Apr. 28, 2021. Filed.

[39] D. Speck, **Biedenkapp, A.**, R. Matmüller, F. Hutter, and M. Lindauer. "Device and Method for Planning and Operation of a Technical System". European pat. req. EP20178576.3 – 1203. Robert Bosch GmbH. *Also filed requests for US patent and CN patent.* June 1, 2020. URL: http://v3.espacenet.com/textdoc?IDX=EP3920103. Filed.

[40] **Biedenkapp, A.**, H. F. Bozkurt, F. Hutter, and M. Lindauer. "Method, Device and Computer Program for Adjusting a Hyperparameter". European pat. req. EP3748551. Robert Bosch GmbH. June 11, 2020. URL: http://v3.espacenet.com/textdoc?IDX=EP3748551. Filed.

Presentations

Invited Talks & Competitively-Selected Tutorials

Dynamic Algorithm Configuration
ELLIS Meetup Freiburg, Freiburg, Germany *03.2022*

Advances of Dynamic Algorithm Configuration
Bosch Center for Artificial Intelligence, Renningen, Germany *06.2021*

Algorithm Configuration: Challenges, Methods and Perspectives
IJCAI 2020 Tutorial *01.2021*
Jointly with Prof. Marius Lindauer

Algorithm Configuration: Challenges, Methods and Perspectives
PPSN 2020 Tutorial *09.2020*
Jointly with Prof. Marius Lindauer

Challenges of Dynamic Algorithm Configuration
Bosch Center for Artificial Intelligence, Renningen, Germany *03.2020*

Dynamic Algorithm Configuration
Institut für Informationsverarbeitung (TNT), University of Hannover *01.2020*

Conference Presentations

The Genetic and Evolutionary Computation Conference **Online**
GECCO (Joint video presentation with all authors) *07.2022*
Theory-inspired Parameter Control Benchmarks for Dynamic Algorithm Configuration

International Conference on Machine Learning **Online**
ICML (Poster) *07.2021*
TempoRL: Learning When to Act

International Conference on Parallel Problem Solving from Nature **Leiden**
PPSN (Poster), Netherlands *08.2020*
Learning Step-SizeAdaptation in CMA-ES

European Conference on Artificial Intelligence **Santiago de Compostela**
ECAI (Oral), Spain *08.2020*
Dynamic Algorithm Configuration: Foundation of a New Meta-Algorithmic Framework

Learning and Intelligent OptimizatioN Conference **Kalamata**
LION (Oral), Greece *06.2018*
CAVE: Configuration Assessment, Visualization and Evaluation

AAAI Conference on Artificial Intelligence **San Francisco**
AAAI (Poster), California, USA *02.2017*
Efficient Parameter Importance Analysis via Ablation with Surrogates

Workshop Presentations

Bridging the Gap Between AI Planning and Reinforcement Learning **Online**
PRL@ICAPS'22 *06.2022*
Learning Domain-Independent Policies for Open List Selection

Inductive Biases, Invariances and Generalization in Reinforcement Learning **Online**
BIG@ICML'20 *07.2020*
Towards TempoRL: Learning When to Act

Data Science Meets Optimisation **Macau**
DSO@IJCAI'19, Macau (SAR), China *08.2019*
Towards White-box Benchmarks for Algorithm Control

Scholarships, Honors and Awards

Best Paper Award
GECCO'22, Theory-inspired Parameter Control Benchmarks for Dynamic Algorithm Configuration *2022*
GECH Track

Best Reviewers (Top 10%)
ICML'21 *2021*

Black-Box Optimization Competiton@NeurIPS'20 **1st place**
Part of the AutoML & IOHprofiler Team, 1st place on a meta-learning friendly search space *2020*
Leaderboard: `https://bbochallenge.com/altleaderboard`

Black-Box Optimization Competiton@NeurIPS'20 **3rd place**
Part of the AutoML & IOHprofiler Team *2020*
Leaderboard: `https://bbochallenge.com/leaderboard`

Travel Grant
to visit the Thirty-First AAAI Conference on Artificial Intelligence (AAAI-17), *$400* *2017*

Professional Service

2nd AutoML Fall School
2022, Co-Organiser

Journal Reviewing

Computational Intelligence
2022

Journal of the Association for Computing Machinery
2022, 2021

Program Committee Membership at Conferences

AAAI Conference on Artificial Intelligence (AAAI)
2018

AutoML Conference (AutoML-Conf)
2022

European Conference on Artificial Intelligence (ECAI)
2020

European Workshop on Reinforcement Learning (EWRL)
2022

International Conference on Machine Learning (ICML)
2021, 2019

Neural Information Processing Systems (NeurIPS)
2022, 2021

NeurIPS Datasets and Benchmarks (NeurIPS DBT)
2021 (Track 1 & Track 2)

Program Committee Membership at Workshops

ICLR Workshop on Agent Learning in Open-Endedness (ALOE)
2022

ICML Workshop on Automated Machine Learning (AutoML@ICML)
2021, 2020, 2019, 2018

NeurIPS Workshop on Meta-Learning (MetaLearn@NeurIPS)
2019

Programming Skills

Excellent: Python, Bash, LaTeX

Good: C, C#, C++

Basic: Matlab, Java

Selected Open-Source Projects

GitHub Page: `https://github.com/AndreBiedenkapp`

https://github.com/automl/DAC *DAC*
Role: Developer
DAC is the first dynamic algorithm configurator which enables configuration not only to specific problem instances but also at each time-step. To gain insights into the strengths and weaknesses of this reinforcement learning based configurator DAC comes with example white-box benchmarks.

https://github.com/automl/DACBench *DACBench*
Role: Contributor
DACBench is a benchmark library for Dynamic Algorithm Configuration. Its focus is on reproducibility and comparability of different DAC methods as well as easy analysis of the optimization process.

https://github.com/automl/ParameterImportance *PyImp*
Role: Developer
PyImp is an easy to use tool that helps developers to identify the most important parameters of their algorithms. Given the data of a configuration run with SMAC3, PyImp allows for usage of various parameter importance methods to determine which parameters have the most influence on the algorithms behaviour.

https://github.com/automl/SMAC3 *SMAC3*
Former Role: Contributor
Python implementation of SMAC (sequential model-based algorithm configuration). SMAC is a tool for automated algorithm configuration.

Languages

Native: German

Fluent: English

Basic: French