

Dr Nicole Ludwig

Born 21.04.1993 in Ludwigsburg, Germany

✉ nicole.ludwig@uni-tuebingen.de

🐦 [nnludwig](https://twitter.com/nnludwig) 🌐 <https://nicoleludwig.github.io>

Research Experience

Early Career

Research Group Leader

since 11/2020

Cluster of Excellence - Machine Learning for Science

University of Tübingen

Tübingen, Germany

Research group leader for the group “Machine Learning in Sustainable Energy Systems” working on probabilistic machine learning for energy time series, especially forecasting and reinforcement learning with uncertain inputs.

Group Leader (interim),

PostDoc

07/2020 – 10/2020

HelmholtzAI

Karlsruhe Institute of Technology (KIT)

Karlsruhe, Germany

PostDoc and interim research group leader for “Artificial Intelligence for Energy Research” within HelmholtzAI. Working on probabilistic forecasting for electricity demand and wind power supply. Project leader for the open source software-tool py-WATTS.

Research Assistant

06/2019 – 06/2020

Karlsruhe Institute of Technology (KIT)

Karlsruhe, Germany

Research Assistant at the Institute for Automation and Applied Informatics, in the Machine Learning for Time Series and Images group. Working on demand-side flexibility in energy systems and probabilistic forecasting.

Visiting Researcher

02/2019 – 05/2019

University of Oxford

Oxford, United Kingdom

Visiting researcher at the Mathematical Institute, working with Siddharth Arora and James Taylor on probabilistic forecasting with uncertain input.

Graduate Student

06/2016 – 05/2019

Karlsruhe Institute of Technology (KIT)

Karlsruhe, Germany

Graduate student in the DFG Research Training Group 2153: Energy Status Data – Informatics Methods for its Collection, Analysis and Exploitation developing new data-driven methods for demand-side flexibility in energy systems.

Student Research and

Teaching Assistant

06/2014 – 06/2016

Albert-Ludwigs University

Freiburg im Breisgau, Germany

Chair for Information Systems Research of Dirk Neumann. Research work on forecasting electricity prices and deep learning for financial news.

09/2013 – 10/2014
11/2012 – 09/2013

Department of Applied Econometrics of Bernd Fitzenberger.
Institute of Economic Theory and Public Finances of Wolfgang Eggert.

Education

Doctorate
12/2016 – 06/2020

Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany
Dr. rer. nat. Informatics (summa cum laude)
Thesis Title: “Data-Driven Methods for Demand-Side Flexibility in Energy Systems.”

Master of Science
09/2014 – 08/2016

Albert-Ludwigs University, Freiburg im Breisgau, Germany
MSc in Information Systems and Network Economics (with honours)
Thesis Title: “Machine Learning for Unstructured Data”

Exchange Student
08/2015 – 12/2015

University of Oslo, Norway
Erasmus Exchange Student at the Faculty of Mathematics and Natural Sciences (informatics courses) and Faculty of Social Sciences (economics courses)

Bachelor of Science
04/2012 – 08/2014

Albert-Ludwigs University, Freiburg im Breisgau, Germany
BSc in Economics
Thesis Title: “Predictive Analytics for Electricity Prices using Weather Data”

Bachelor of Arts
09/2011 – 03/2012

Albert-Ludwigs University, Freiburg im Breisgau, Germany
English and American Studies (with minor Economics)

Publications, Talks, Awards and Organisation

Publications

Conference proceedings with peer review: 10 (5x first author)
Journal publications with peer review: 6 (3x first author)
Conference proceedings and abstracts without peer review: 4 (3x first author)

Conferences

Oral presentations: 4, poster presentations: 3

Awards

KIT Doctoral Award 2019/2020
DFG Research Training Group Best Paper Award 2018 and 2019
Audience Choice Award: Best Paper at the ACM e-Energy 2018
Best Paper Award at the Energy Informatics Conference, 2017

Invited Talks

Cluster Colloquium “Machine Learning”, Tübingen, 2021
Symposium ‘Machine Learning in Science’, Tübingen, 2020
Use Case Speaker Topic Energy, Helmholtz AI Kick-Off, 2020
SDW Data Science Workshop, Karlsruhe, 2019

Reviewer

Applied Energy Journal (2019 —), Journal of Cleaner Production (2019 —), Renewable & Sustainable Energy Reviews (2020 —), Energy Economics (2020 —)

Organisation

Main Organiser (with Holger Trittenbach) of the Summer School on “Communication Technology and Data Analytics for Future Energy Systems” in cooperation with the University of Passau and the German Informatics Society

Teaching

Lectures

Smart Grid Applications, Parts: Data Analytics in Energy Systems I & II (Winter Term 2018, Karlsruhe Institute of Technology) supporting the lecture Data Analysis for Engineers (Summer Terms 2018, 2019, 2020 Karlsruhe Institute of Technology)

Seminars

Energy Informatics (Winter Terms 2016 – 2020, Karlsruhe Institute of Technology), Optimising Energy in Smart Cities (Summer Term 2017 and Winter Term 2017, Karlsruhe Institute of Technology)

Exercise Sessions

Optimization and Simulation (Summer Term 2016, University of Freiburg), Energy Informatics II Part “Research Corner” (Summer Term 2019, Karlsruhe Institute of Technology)

Tutorials

Econometrics (Winter Term 2014, University of Freiburg), Microeconomics II: Game Theory (Summer Term 2013, University of Freiburg); Mathematics for Economists, (Winter Terms 2012 and 2013, University of Freiburg)

Supervision

Supervision of 16 Computer Science, Mechanical Engineering, Information Systems and Industrial Economics Bachelor’s and Master’s students at Karlsruhe Institute of Technology.

Skills, Qualifications and Other

Languages

German (mother tongue), English (fluent, C2), Norwegian (conversational, B2), French (basic, A2)

Programming

R, Python, PyTorch

Professional Training Courses

Participation in various courses on Leadership, Teaching and Communication offered from the Karlsruhe House of Young Scientists, KIT and Baden-Württemberg Centre for Teaching and Learning

Sports

Head of Competition (2019-2020) and Swimming Coach (2017-2020) at SG Eggenstein-Leopoldshafen
Competitive dancer, World Champion Ballroom Formation Dancing 2007

List of Publications

Conference Proceedings (peer reviewed)

1. Heidrich, Benedikt, Marian Turowski, Nicole Ludwig, Ralf Mikut, and Veit Hagenmeyer (2020). “Forecasting energy time series with profile neural networks”. In: Proceedings of the Eleventh ACM International Conference on Future Energy Systems - e-Energy '20.
2. Karrari, Shahab, Nicole Ludwig, Veit Hagenmeyer, and Mathias Noe (2019). “A Method for Sizing Centralised Energy Storage Systems Using Standard Patterns”. In: 2019 IEEE Milan PowerTech. IEEE, pp. 1–6.
3. Ludwig, Nicole, Lukas Barth, Dorothea Wagner, and Veit Hagenmeyer (2019). “Industrial Demand-Side Flexibility: A Benchmark Data Set”. In: Proceedings of the Tenth ACM International Conference on Future Energy Systems. ACM, pp. 460–473.
4. Barth, Lukas[†], Veit Hagenmeyer, Nicole Ludwig[†], and Dorothea Wagner (2018). “How much demand side flexibility do we need? Analyzing where to exploit flexibility in industrial processes”. In: Proceedings of the Ninth International Conference on Future Energy Systems - e-Energy '18. New York, New York, USA: ACM Press, pp. 43–62.
5. Ludwig, Nicole, Ralf Mikut, and Veit Hagenmeyer (2018). “Auction Design to Use Flexibility Potentials in the Energy - Intensive Industry”. In: 2018 15th International Conference on the European Energy Market (EEM), pp. 1–5.
6. Ludwig, Nicole, Simon Waczowicz, Ralf Mikut, and Veit Hagenmeyer (2018). “Assessment of Unsupervised Standard Pattern Recognition Methods for Industrial Energy Time Series”. In: Proceedings of the Ninth International Conference on Future Energy Systems - e-Energy '18. New York, New York, USA: ACM Press, pp. 434–435.
7. Staudt, Philipp, Nicole Ludwig, Julian Huber, Veit Hagenmeyer, and Christof Weinhardt (2018). “SCiBER: A new public data set of municipal building consumption”. In: e-Energy '18: The Ninth International Conference on Future.
8. Waczowicz, Simon, Nicole Ludwig, Jorge Á. G. Ordiano, Ralf Mikut, and Veit Hagenmeyer (2018). “Demand Response clustering: Automatically finding optimal cluster hyper-parameter values”. In: Proceedings of the Ninth International Conference on Future Energy Systems - e-Energy '18. New York, New York, USA: ACM Press, pp. 429–430.
9. Jakob, Wilfried, Jorge Ángel González Ordiano, Nicole Ludwig, Ralf Mikut, and Veit Hagenmeyer (2017). “Towards coding strategies for forecasting-based scheduling in smart grids and the energy lab 2.0”. In: Proceedings of the Genetic and Evolutionary Computation Conference Companion on - GECCO '17. New York, New York, USA: ACM Press, pp. 1271–1278.
10. Ludwig, Nicole, Stefan Feuerriegel, and Dirk Neumann (2016). “Time Series Analysis for Big Data: Evaluating Bayesian Structural Time Series Using Electricity Prices”. In: Multikonferenz Wirtschaftsinformatik (MKWI) 2016. Vol. III. Ilmenau: Universitätsverlag Ilmenau, pp. 1569–1580.

Journals (peer reviewed)

1. Nicole Ludwig, Siddharth Arora, James W Taylor (2021). “Probabilistic Load Forecasting Using Post-Processed Weather Ensemble Predictions”. In: Journal of the Operational Research Society (under review).

2. Phipps, Kaleb, Sebastian Lerch, Maria Andersson, Ralf Mikut, Veit Hagenmeyer and Nicole Ludwig (2020). "Evaluating Ensemble Post-Processing for Wind Power Forecasts". In: *Wind Energy* (under review, also available on arXiv:2009.14127).
3. vom Scheidt, Frederik, Hana Medinova, Nicole Ludwig, Bent Richter, Philipp Staudt, and Christof Weinhardt (2020). "Data Analytics in the Electricity Sector – A Quantitative and Qualitative Literature Review" In: *Energy and AI*, 1, 100009.
4. Barth, Lukas[†], Nicole Ludwig[†], Esther Mengelkamp[†], and Philipp Staudt[†] (2018). "A comprehensive modelling framework for demand side flexibility in smart grids". In: *Computer Science - Research and Development* 33.13, pp. 1865–2042.
5. González Ordiano, Jorge Ángel, Andreas Bartschat, Nicole Ludwig, Eric Braun, Simon Waczowicz, Nicolas Renkamp, Nico Peter, Clemens Döpmeier, Ralf Mikut, and Veit Hagenmeyer (2018). "Concept and benchmark results for Big Data energy forecasting based on Apache Spark". In: *Journal of Big Data* 5.1, p. 11.
6. Ludwig, Nicole, Stefan Feuerriegel, and Dirk Neumann (2015). "Putting Big Data analytics to work: Feature selection for forecasting electricity prices using the LASSO and random forests". In: *Journal of Decision Systems* 24.1, pp. 19–36.

Conference Proceedings and Abstracts (non peer reviewed)

1. Phipps, Kaleb, Nicole Ludwig, Veit Hagenmeyer, and Ralf Mikut (2020). "Potential of Ensemble Copula Coupling for Wind Power Forecasting" In: *Proceedings 30. Workshop Computational Intelligence*, Berlin.
2. Ludwig, Nicole, Siddharth Arora, and James Taylor (2019). "Modelling Uncertainty: Probabilistic Load Forecasting Using Weather Ensemble Predictions". 39th International Symposium on Forecasting, Thessaloniki, Greece, June 16 -19, 2019.
3. Ludwig, Nicole (2019). "Learning to Increase Demand-Side Flexibility in Energy Systems". 6th Annual Oxbridge Women in Computer Science Conference, Oxford, UK, March 9, 2019.
4. Ludwig, Nicole, Simon Waczowicz, Ralf Mikut, and Veit Hagenmeyer (2017). "Mining Flexibility Patterns in Energy Time Series from Industrial Processes". In: *Proceedings. 27. Workshop Computational Intelligence*. Karlsruhe: KIT Scientific Publishing, pp. 13–32.

Theses

1. N. Ludwig, "Data-Driven Methods for Demand-Side Flexibility in Energy Systems", PhD Thesis, *Karlsruhe Institute of Technology*, 2020.
2. N. Ludwig, "Machine Learning for Unstructured Data", Master's Thesis, *University of Freiburg*, 2016.
3. N. Ludwig, "Predictive Analytics for Electricity Prices using Weather Data", Bachelor's Thesis, *University of Freiburg*, 2014.

[†]equal contribution by the authors

Supervised Theses

1. O. Neumann, "Evaluating Numerical Weather Predictions and Neural Networks for Energy Forecasting", Master's Thesis, *Karlsruhe Institute of Technology*, 2020.
2. M. Beichter, "Predicting the Mismatch between Energy Demand and Supply", Bachelor's Thesis, *Karlsruhe Institute of Technology*, 2020.
3. M. Schedel, "New Demand Side Management Strategies using Reinforcement Learning", Master's Thesis, *Karlsruhe Institute of Technology*, 2020.
4. K. Schmieder, "Meta-Learning for Anomaly Detection in Energy Time Series", Master's Thesis, *Karlsruhe Institute of Technology*, 2020.
5. Y. Tanner, "Probabilistic Deep Learning for Energy Time Series", Master's Thesis, *Karlsruhe Institute of Technology*, 2020.
6. M. Herm, "Evaluating the benefit of grid-based weather information in energy forecasting", Bachelor's Thesis, *Karlsruhe Institute of Technology*, 2019.
7. B. Heidrich, "A new Deep Learning Architecture to Forecast Energy Demand in Buildings", Master's Thesis, *Karlsruhe Institute of Technology*, 2019.
8. K. Phipps, "Probabilistic Forecasting and the Integration of Wind Power into the Swedish Electrical Grid", Master's Thesis, *Karlsruhe Institute of Technology*, 2019.
9. T. Buchner, "Deep Learning in Energy Time Series Forecasting", Master's Thesis, *Karlsruhe Institute of Technology*, 2019.
10. L. Engler, "Impact of Time Resolution on the Analysis of High-Frequency Energy Data", Bachelor's Thesis, *Karlsruhe Institute of Technology*, 2018.
11. L. Faller, "Finding Patterns in Time Series - A Comparison of Unsupervised Learning Methods", Bachelor's Thesis, *Karlsruhe Institute of Technology*, 2018.
12. G. Keppler, "The Impact of Preprocessing on Energy Time Series Analysis", Bachelor's Thesis, *Karlsruhe Institute of Technology*, 2018.
13. A. Misuracu, "Expert Knowledge for Unsupervised Machine Learning in Energy Time Series", Master's Thesis, *Politecnico di Turin & Karlsruhe Institute of Technology*, 2018.
14. M. Pichon, "Agent-based Simulation of Flexibility in Industrial Energy Systems", Bachelor's Thesis, *INSA & KIT*, 2018.
15. D. Chang, "Data Analytics: What's the Influence of Preprocessing?", Master's Thesis, *Karlsruhe Institute of Technology*, 2018.
16. M. Meza Martinez, "Developing a Forecasting Tool for Industrial Energy Time Series", Master's Thesis, *Karlsruhe Institute of Technology*, 2017.