

# Christopher Brix

Student at RWTH Aachen University

## Personal Info

### Address

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Germany

### Phone

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### E-Mail

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### LinkedIn

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### GitHub

[www.github.com/ChristopherBrix](http://www.github.com/ChristopherBrix)

### Website

[www.christopher-brix.de](http://www.christopher-brix.de)

## Skills

### Programming Languages

Python (advanced)  
C (good)  
TensorFlow (good)

### Spoken Languages

German (native)  
English (fluent)  
French (basic)

## Honors

**ICT Young Researcher Award**  
2020 (1.500€)

**Scholarship "Deutschlandstipendium"**  
2016, 2018 (3.600€ each)

**Dean's List**  
2016, 2017

## Interests

### Ballroom Dancing

Competitive dancing for 2 years

**Cooking**  
Hobbyist

Computer science Ph.D. student with a focus on **neural network verification** and extensive experience in **neural machine translation**. Wrote **first-author publication** in top tier conference ACL. Designed **novel network architectures**. Proved more precise **network verification** technique in the master thesis.

## Education

- Mar 2021 - **RWTH Aachen University, Computer Science, Ph.D.**  
Department for Software Modeling and Verification, Prof. Dr. Ir. Dr. h. c. Katoen
- Will work on the verification of neural networks
- Apr 2018 - **RWTH Aachen University, Computer Science, M.Sc.**  
Aug 2020
- Master thesis "Proving Non-Existence of Imperceptible Adversarial Examples in Deep Neural Networks using Symbolic Propagation with Error Bounds", grade 1.0
  - Graduated with final grade 1.5
- Oct 2014 - **RWTH Aachen University, Computer Science, B.Sc.**  
Mar 2018
- Bachelor thesis "Extension of the Attention Mechanism in NMT", grade 1.2
  - Graduated with final grade 1.6

## Experience

- Sep 2020 - **Research SWE Intern, Google Zurich**  
Jan 2021 Zurich, Switzerland (remotely, due to COVID-19)
- Fine-tuned BERT models for Named Entity Recognition (Python)
  - Wrote data augmentation pipeline to improve small datasets (C++, Bazel)
  - Final result: Increased key metrics by up to 25 percentage points (57% → 82%)
  - Side project: Managed program to pair interns for approx. 700 1:1 meetings
- Jan 2020 - **Invited Talk at Fraunhofer IAIS**  
Fraunhofer Institute for Intelligent Analysis and Information Systems
- Presented novel 2D-LSTM architecture for machine translation
  - Described current state of the art research
  - Attendees: ~15 researchers, head of department
- Nov 2016 - **Student Research Assistant**  
Feb 2020 RWTH, Human Language Technology and Pattern Recognition, Professor Ney
- Analyzed alternatives for the attention mechanism in NMT
- Implemented Theano and TensorFlow support for 2D-LSTM cells using C/CUDA
  - Integration into inhouse machine learning framework (RETURNN)
  - Designed and extended 2D-LSTM to support bidirectional translation
- Jul 2019 - **LxMLS, Monitor**  
Lisbon Machine Learning Summer School, Portugal
- Supervised and taught participating students during daily practical lab sessions
  - Topics: classification, structured prediction of sequences, trees and graphs, parsing, deep learning
- Jun 2019 - **Google NLP summit**  
Zurich, Switzerland
- Attended talks of Google researchers about cutting-edge NLP technology
  - Discussed current open problems and presented research ideas
  - Total number of accepted attendees: 90
- Apr 2016 - **Tutor**  
Sep 2016 RWTH, Data structures and algorithms
- Weekly training for students, grading of homework and exams
  - Topics: Runtime analysis, formal proof of correctness, sorting algorithms

## Additional Projects

- Jan 2016 - **Möbelfirst**  
Jul 2016 Möbelfirst offers an online marketplace for exhibition furniture
- Programmed the online marketplace
- Aug 2012 - **Own online business simulation game**  
Jun 2014
- Project planning and game design
  - Guidance and training of the other 2 team members

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## Publications

- Nov 2020 Coauthored "Two-Way Neural Machine Translation: A Proof of Concept for Bidirectional Translation Modeling using a Two-Dimensional Grid" (P. Bahar, **C. Brix**, H. Ney), published at the IEEE Spoken Language Technology Workshop 2021
- Proposed to use 2D-LSTMs to incorporate bidirectional translation into the network architecture
- Jun 2020 Authored "Debona: Decoupled Boundary Network Analysis for Tighter Bounds and Faster Adversarial Robustness Proofs" (**C. Brix**, T. Noll), preprint on arXiv
- Proposed tighter bounds for network verification
  - Decreased verification runtime by up to 94%
  - Summarizes results of the master thesis
- Jun 2020 Authored "Successfully Applying the Stabilized Lottery Ticket Hypothesis to the Transformer Architecture" (**C. Brix**, P. Bahar, H. Ney), published in ACL 2020 Proceedings; acceptance rate 22.7%, 5 citations
- Proposed novel pruning technique to reach high sparsity levels
  - Compared existing pruning techniques applied to large transformer models
- Oct 2018 Coauthored "Towards Two-Dimensional Sequence to Sequence Model in Neural Machine Translation" (P. Bahar, **C. Brix**, H. Ney), published in EMNLP 2018 Proceedings; acceptance rate 23.2%, 18 citations
- Proposed novel 2D-LSTM based architecture for NMT, without explicit decoder
- Jun 2017 Coauthored "Empirical Investigation of Optimization Algorithms in Neural Machine Translation" (P. Bahar, T. Alkhouli, J.-T. Peter, **C. Brix**, H. Ney), published in the PBML Proceedings, 28 citations
- Compared and evaluated optimizations algorithms and combinations thereof