

Brian Christian DuSell

CONTACT INFORMATION	Email	brian.dusell@inf.ethz.ch
	Home Page	bdusell.com
	Google Scholar	https://scholar.google.com/citations?user=1AkLaFIAAAAJ
	GitHub	https://github.com/bdusell
RESEARCH INTERESTS	Natural Language Processing, Neural Networks, Formal Language Theory	
EDUCATION	University of Notre Dame , Notre Dame, IN	Aug 2016 to May 2023
	M.S. and Ph.D., Computer Science	
	Dissertation: <i>Nondeterministic Stacks in Neural Networks</i>	
	Advisor: David Chiang	
	University of Notre Dame , Notre Dame, IN	Aug 2009 to May 2013
	B.S., Computer Science, <i>magna cum laude</i>	
PUBLICATIONS	Tim Vieira, Ben LeBrun, Mario Giulianelli, Juan Luis Gastaldi, Brian DuSell , John Terilla, Timothy J. O'Donnell, Ryan Cotterell. From Language Models over Tokens to Language Models over Characters. Preprint. 2024.	
	Alexandra Butoi, Ghazal Khalighinejad, Anej Svete, Josef Valvoda, Ryan Cotterell, and Brian DuSell . Training Neural Networks as Recognizers of Formal Languages. Preprint. 2024.	
	Juan Luis Gastaldi, John Terilla, Luca Malagutti, Brian DuSell , Tim Vieira, and Ryan Cotterell. The Foundations of Tokenization: Statistical and Computational Concerns. Preprint. 2024.	
	Mario Giulianelli, Luca Malagutti, Juan Luis Gastaldi, Brian DuSell , Tim Vieira, and Ryan Cotterell. On the Proper Treatment of Tokenization in Psycholinguistics. In <i>Proc. EMNLP</i> . 2024.	
	Stephen Bothwell, Brian DuSell , David Chiang, and Brian Krostenko. PILA: A Historical-Linguistic Dataset of Proto-Italic and Latin. In <i>Proc. LREC-COLING</i> . 2024.	
	Brian DuSell and David Chiang. Stack Attention: Improving the Ability of Transformers to Model Hierarchical Patterns. In <i>Proc. ICLR</i> . 2024. Spotlight paper (awarded to 5% of submitted papers) .	
	Brian DuSell . <i>Nondeterministic Stacks in Neural Networks</i> . Ph.D. dissertation, University of Notre Dame. 2023.	
	Brian DuSell and David Chiang. The Surprising Computational Power of Nondeterministic Stack RNNs. In <i>Proc. ICLR</i> . 2023.	
	Alexandra Butoi, Brian DuSell , Tim Vieira, Ryan Cotterell, and David Chiang. Algorithms for Weighted Pushdown Automata. In <i>Proc. EMNLP</i> . 2022.	
	Brian DuSell and David Chiang. Learning Hierarchical Structures with Differentiable Nondeterministic Stacks. In <i>Proc. ICLR</i> . 2022. Spotlight paper (awarded to 5% of submitted papers) .	
	Brian DuSell and David Chiang. Learning Context-Free Languages with Nondeterministic Stack RNNs. In <i>Proc. CoNLL</i> . 2020. Acceptance rate: 23% .	

Kenton Murray, **Brian DuSell**, and David Chiang. Efficiency through Auto-Sizing: Notre Dame NLP’s Submission to the WNGT 2019 Efficiency Task. In *Proc. Workshop on Neural Generation and Translation*. 2019.

- INVITED TALKS
- “Stack Attention: Improving the Ability of Transformers to Model Hierarchical Patterns” Apr 2024
Seminars on Formal Languages and Neural Networks
Recording: <https://www.youtube.com/watch?v=NrKLnGfEeeg>
 - “Stack Attention: Improving the Ability of Transformers to Model Hierarchical Patterns” Feb 2024
ZurichNLP Meetup
URL: <https://zurich-nlp.ch/event/zurichnlp-meetup-8/>
 - “Nondeterministic Stacks in Neural Networks” Oct 2022
Seminars on Formal Languages and Neural Networks
Recording: https://www.youtube.com/watch?v=tkj6E9_n82U
 - “Stack Nondeterminism in Neural Networks” Nov 2021
Notre Dame NL+
URL: <https://nlp.nd.edu/nlplus/2021/11/10/dusell.html>
 - “How to Install Literally Anything: A Practical Guide to Singularity.” May 2019
XSEDE Campus Champions Tech Talk
Recording: <https://www.youtube.com/watch?v=D5pe4ewtDe8>

- RESEARCH POSITIONS
- Postdoc** Nov 2023 to present
ETH Zürich
Department of Computer Science
Rycolab
Supervisor: Ryan Cotterell
 - Postdoctoral Research Associate** Jun 2023
University of Notre Dame
Department of Computer Science and Engineering
Natural Language Processing Group
Supervisor: David Chiang
 - Research Assistant** Aug 2016 to May 2023
University of Notre Dame
Department of Computer Science and Engineering
Natural Language Processing Group
Supervisor: David Chiang
 - Applied Scientist Intern** Jun to Sep 2021
Amazon Web Services
Team: Amazon Translate
Manager: Georgiana Dinu
Mentors: Xing Niu and Anna Currey
 - Applied Scientist Intern** Jun to Sep 2020
Amazon Web Services
Team: Amazon Translate
Manager: Georgiana Dinu
Mentors: Xing Niu and Greg Hanneman

	<p>Research Assistant University of Notre Dame Department of Computer Science and Engineering Cooperative Computing Lab Supervisor: Douglas Thain Summary: Contributed to BioCompute, a distributed computing environment for bioinformatics accessible via a web interface.</p>	Sep 2011 to May 2013
TEACHING EXPERIENCE	<p>Instructor of Record CSE 30151: Theory of Computing University of Notre Dame Department of Computer Science and Engineering Designed and led an in-person course in formal language and complexity theory for a class of over 80 undergraduate students. I received a median course instructor feedback score of 4, on a scale from 0 to 5, which is the unofficial threshold for excellent teaching used in making tenure decisions at Notre Dame.</p> <p>Teaching Assistant CSE 40657/60657: Natural Language Processing University of Notre Dame Department of Computer Science and Engineering Instructor: David Chiang</p> <p>Teaching Assistant CSE 30151: Theory of Computing University of Notre Dame Department of Computer Science and Engineering Instructor: David Chiang Received the department's Outstanding Graduate TA award.</p> <p>Teaching Assistant CSE 30151: Theory of Computing University of Notre Dame Department of Computer Science and Engineering Instructor: Peter Kogge Received an Honorable Mention for the department's Outstanding Graduate TA award.</p> <p>Teaching Assistant CSE 30331: Data Structures University of Notre Dame Department of Computer Science and Engineering Instructors: Paul Brenner and Raul Santelices</p> <p>Tutor University of Notre Dame Academic Services for Student-Athletes Tutored a student-athlete for the courses CSE 30151: Theory of Computing and CSE 40113: Design and Analysis of Algorithms.</p>	Spring 2022 Fall 2018 Spring 2017 Fall 2016 Fall 2012 Spring and Fall 2012
MENTORING	<ul style="list-style-type: none"> • Octave Arevian, ETHZ master's thesis project • Pascal Müller, ETHZ master's thesis project (co-supervised) 	Sep 2024 to present Jul 2024 to present
PROFESSIONAL SERVICE	<ul style="list-style-type: none"> • ICLR 2025, Reviewer • ACL 2024, Reviewer • ICML 2024, Reviewer • EMNLP 2023, Reviewer • NeurIPS 2023, Reviewer (top reviewer) 	Oct to Nov 2024 Feb to Mar 2024 Feb to Apr 2024 Jul to Sep 2023 May to Aug 2023

	<ul style="list-style-type: none"> • ACL 2023, Reviewer Feb to Apr 2023 • EMNLP 2022, Reviewer Jun to Aug 2022 • EMNLP 2021, Reviewer Jun to Aug 2021 • Organizing Committee for Midwest Speech and Language Days May 2018
AWARDS	<ul style="list-style-type: none"> • Notebaert Premier Fellowship 2016 University of Notre Dame Graduate School The most prestigious fellowship for graduate students at Notre Dame. • First Place, Chinese Speech Contest (2nd Year Chinese) Apr 2019 University of Notre Dame Department of East Asian Languages • Outstanding Graduate Teaching Assistant May 2018 Department of Computer Science and Engineering University of Notre Dame • Honorable Mention, Outstanding Graduate Teaching Assistant May 2017 Department of Computer Science and Engineering University of Notre Dame • B.S. <i>magna cum laude</i>, University of Notre Dame 2013 • Member, Tau Beta Pi Engineering Honor Society 2012 • Member, Upsilon Pi Epsilon Computing Honor Society 2012 • College of Engineering Dean's List Fall 2010 to Spring 2013 University of Notre Dame
CAMPUS SERVICE	<ul style="list-style-type: none"> • Mentor, Graduate Resilience Alliance at Notre Dame Jan to Apr 2023 Mentored a group of first-year Notre Dame graduate students. • Graduate Orientation Ambassador, University of Notre Dame 2017 to 2019 Organized the fall orientation program for incoming graduate students. • Graduate Representative, University of Notre Dame 2019 Recruited fellowship awardees for the Graduate School. • CSE Peer Mentor, University of Notre Dame 2018 to 2019 Mentored first-year graduate students in the Computer Science and Engineering Department.
INDUSTRY EXPERIENCE	<p>Software Developer May 2014 to Aug 2016 Oak Financial Software Corp Developed Chapulfn, a hybrid mobile and web application for executing international money transfers to Latin America. Implemented frontend and contributed to backend functionality, tools for analytics, and test automation. Technologies used: JavaScript, Cordova, Python, Node.js.</p> <p>Member of Technical Staff Jul 2013 to May 2014 NetApp, Inc. Performed quality assurance for data replication software included in the Data ONTAP storage OS. Technologies used: Perl, Jenkins.</p> <p>Software Engineer, Intern May to Aug 2012 Wolverine Trading, LLC Developed a high-performance Syslog daemon with a configurable message handling system and real-time GUI client. Achieved 300-fold improvement in message processing rate over previous tool. My code was deployed to 80 production servers within the next two months. Technologies used: C++, C#, WPF, XAML.</p>
PROGRAMMING SKILLS	<p>Proficient in Python, PyTorch, Bash scripting, Docker, JavaScript/Node.js, frontend/backend web development.</p> <p>Very familiar with C, C++, Java, PHP, SQL, MXNet.</p>

Neural Network Recognizers (<https://github.com/rycolab/neural-network-recognizers>)

PyTorch code for training RNNs, LSTMs, and transformers as recognizers of formal languages. Supports multi-task learning and implements efficient generation of both positive and negative examples.

Rau (<https://github.com/bdusell/rau>)

Language modeling and sequence-to-sequence pipeline for PyTorch.

Stack Attention (<https://github.com/bdusell/stack-attention>)

PyTorch implementation of transformers with stack attention, including a full machine translation pipeline.

Nondeterministic Stack RNN (<https://github.com/bdusell/nondeterministic-stack-rnn>)

PyTorch implementation of my Nondeterministic Stack RNN model, as well as other Stack RNN models.

Semiring Einsum (<https://bdusell.github.io/semiring-einsum/>)

Efficient PyTorch implementation of einsum (a generalization of matrix multiplication) in multiple semirings.

QFunnel (<https://github.com/bdusell/qfunnel>)

Command-line tool for efficiently queueing large numbers of experiments on Notre Dame's research computing cluster.

dockerdev (<https://github.com/bdusell/dockerdev>)

Shell scripts for easily managing development environments in Docker containers.

rougescore (<https://github.com/bdusell/rougescore>)

Python implementation of the ROUGE metric.

Jishosen (jishosen.com)

A Japanese-English dictionary website based on freely available data.

pycfg (<https://github.com/bdusell/pycfg>)

Implementation of several context-free grammar algorithms, including Tomita's GLR parsing algorithm.

romaji-cpp (<https://github.com/bdusell/romaji-cpp>)

C++ library for transliterating Japanese phonetic characters to Latin letters.

kgreek (<https://github.com/bdusell/kgreek>)

Java library for dealing with orthography in ancient Greek.

xlator (<https://github.com/bdusell/xlator>)

Programmable machine translation system based on syntactic transfer.