

Brian Christian DuSell

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	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	Taiga Someya, Anej Svete, Brian DuSell , Timothy J. O'Donnell, Mario Giulianelli, and Ryan Cotterell. Information Locality as an Inductive Bias for Neural Language Models . In <i>Proc. ACL</i> . 2025. Oral + Panel Discussion (awarded to 0.8% of accepted papers).	
	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 . In <i>Proc. ICML</i> . 2025. Spotlight paper (awarded to 2.6% of submitted papers).	
	Tim Vieira, Tianyu Liu, Clemente Pasti, Yahya Emara, Brian DuSell , Benjamin LeBrun, Mario Giulianelli, Juan Luis Gastaldi, Timothy J. O'Donnell, and Ryan Cotterell. Language Models over Canonical Byte-Pair Encodings . In <i>Proc. ICML</i> . 2025.	
	Alexandra Butoi, Ghazal Khalighinejad, Anej Svete, Josef Valvoda, Ryan Cotterell, and Brian DuSell . Training Neural Networks as Recognizers of Formal Languages . In <i>Proc. ICLR</i> . 2025.	
	Juan Luis Gastaldi, John Terilla, Luca Malagutti, Brian DuSell , Tim Vieira, and Ryan Cotterell. The Foundations of Tokenization: Statistical and Computational Concerns . In <i>Proc. ICLR</i> . 2025.	
	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 *Proc. EMNLP*. 2022.

Brian DuSell and David Chiang. Learning Hierarchical Structures with Differentiable Nondeterministic Stacks. In *Proc. ICLR*. 2022.
Spotlight paper (awarded to 5% of submitted papers).

Brian DuSell and David Chiang. Learning Context-Free Languages with Nondeterministic Stack RNNs. In *Proc. CoNLL*. 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	
RESEARCH POSITIONS	• “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	
	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 Amazon Web Services Team: Amazon Translate Manager: Georgiana Dinu Mentors: Xing Niu and Greg Hanneman	Jun to Sep 2020
	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.	Sep 2011 to May 2013
TEACHING EXPERIENCE	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.	Spring 2022
	Teaching Assistant CSE 40657/60657: Natural Language Processing University of Notre Dame Department of Computer Science and Engineering Instructor: David Chiang	Fall 2018
	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.	Spring 2017
	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.	Fall 2016
	Teaching Assistant CSE 30331: Data Structures University of Notre Dame Department of Computer Science and Engineering Instructors: Paul Brenner and Raul Santelices	Fall 2012
	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 .	Spring and Fall 2012
MENTORING	<ul style="list-style-type: none"> Octave Arevian, ETHZ master's thesis project 	Sep 2024 to Mar 2025

PROFESSIONAL SERVICE	<ul style="list-style-type: none"> • Area Chair: EMNLP 2025, ACL 2025 • Reviewer: ICML 2025, ICLR 2025, ACL 2024, ICML 2024, EMNLP 2023, NeurIPS 2023 (top reviewer), ACL 2023, EMNLP 2022, EMNLP 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.