

Steven Bethard

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University of Arizona

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RESEARCH INTERESTS

Natural language processing and machine learning theory and applications, including modeling the language of time and timelines, normalizing text to medical and geospatial ontologies, and information extraction models for clinical applications.

CHRONOLOGY OF EDUCATION

2002-08 – 2007-12 Ph.D. Computer Science and Cognitive Science, University of Colorado
Dissertation: “Finding Event, Temporal and Causal Structure in Text:
A Machine Learning Approach.” Advisor: James H. Martin
1998-08 – 2002-05 B.S., B.A. Computer Science, Mathematics, Linguistics, University of Arizona

CHRONOLOGY OF EMPLOYMENT

2020-08 –	Associate Professor	University of Arizona, School of Information
2020-02 –	Courtesy Appointment	University of Arizona, Computer Science
2016-08 –	Courtesy Appointment	University of Arizona, Linguistics
2016-08 –	GIDP Faculty	University of Arizona, Cognitive Science GIDP
2016-08 – 2020-08	Assistant Professor	University of Arizona, School of Information
2013-08 – 2016-08	Assistant Professor	University of Alabama at Birmingham, Department of Computer and Information Sciences
2011-10 – 2015-10	Visiting Professor	KU Leuven, Department of Computer Science
2011-09 – 2013-08	Research Associate	University of Colorado, Institute of Cognitive Science
2010-09 – 2011-08	Postdoctoral Fellow	KU Leuven, Department of Computer Science
2009-06 – 2009-08	Senior Research Scientist	Johns Hopkins University, Human Language Technology Center of Excellence
2009-01 – 2010-08	Postdoctoral Scholar	Stanford University, Department of Computer Science
2008-01 – 2008-12	Research Associate	University of Colorado, Institute of Cognitive Science

HONORS AND AWARDS

2021-04 Teaching Award, University of Arizona School of Information
2016-02 Kevin and Jo Ann Reilly Endowed Award (\$1000), University of Alabama at Birmingham
2009-06 Vannevar Bush Best Paper Award (\$1000), Joint Conference on Digital Libraries
2008-12 Daniel Henkel Service Award, University of Colorado Office of International Education
2002-03 NSF Graduate Research Fellowship Honorable Mention
1998-08 Flinn Scholar
1998-08 National Merit Scholar

SERVICE/OUTREACH

LOCAL/STATE OUTREACH

2015, 2016 Site coordinator, North American Computational Linguistics Olympiad

NATIONAL/INTERNATIONAL SERVICE: COMMITTEES

2020-2022 Vice-Secretary Elect, Special Interest Group on the Lexicon
of the Association for Computational Linguistics (SIGLEX)

2016-2020 Board member (representative of the SemEval section), Special Interest Group on the Lexicon
of the Association for Computational Linguistics (SIGLEX)

NATIONAL/INTERNATIONAL SERVICE: CONFERENCE ORGANIZATION

2021 Area chair, Annual Meeting of the Association for Computational Linguistics (ACL)

2021 Publication Chair, North American Chapter of the Association for Computational Linguistics
(NAACL)

2020 Publication Chair, Annual Meeting of the Association for Computational Linguistics (ACL)

2019 Area chair, Annual Meeting of the Association for Computational Linguistics (ACL)

2019 Area chair, North American Chapter of the Association for Computational Linguistics
(NAACL)

2018 Organizer, Parsing Time Normalizations shared task

2016-2018 Co-Chair, International Workshop on Semantic Evaluation (SemEval)

2016, 2019 Organizer, Clinical Natural Language Processing Workshop (Clinical NLP)

2015-2017 Organizer, Clinical TempEval shared task

2015-2016 Area chair, Annual Meeting of the Association for Computational Linguistics (ACL)

2014 Organizer, Workshop on Computational Approaches to Causality in Language

2013 Publication Chair, Empirical Methods in Natural Language Processing (EMNLP)

2013 Faculty advisor, ACL Student Research Workshop

2012-2013 Organizer, SemEval Spatial Role Labeling Task

2011-2012 Mentor, ACL Student Research Workshop

2011 Organizer, American Medical Informatics Association Virtual Journal Club on Temporal
Reasoning

NATIONAL/INTERNATIONAL SERVICE: GRANT REVIEWING

2021 US National Institutes of Health, Risk, Prevention and Health Behavior

2020 México: Consejo Nacional de Ciencia y Tecnología, Frontier Science

2013, 2015, 2018

US National Science Foundation, Division of Information and Intelligent Systems

2017 Israel Science Foundation (ISF), Individual Research Grants

2017 US National Institutes of Health, Biomedical Library and Informatics

2017 Netherlands Organization for Scientific Research (NWO), Council for the Humanities

2016 Swiss National Science Foundation, Division of Mathematics, Physical and Engineering
Sciences

NATIONAL/INTERNATIONAL SERVICE: JOURNAL REVIEWING

2016-2022 Transactions of the Association for Computational Linguistics

2012-2013, 2015, 2019-2021

Journal of Natural Language Engineering (JNLE)
 2019–2020 Transactions on Audio, Speech and Language Processing
 2014, 2019 Journal of the American Medical Informatics Association (JAMIA)
 2018–2019 Journal of Biomedical Informatics
 2018 PLOS ONE
 2013, 2015 Cognition
 2014 Computational Linguistics (CL)
 2013–2014 Transactions on Asian Language Information Processing (TALIP)
 2011–2013 Journal of Artificial Intelligence Research (JAIR)
 2013 Journal of Language Modeling (JLM)
 2013 Transactions on Information Forensics & Security (TIFS)
 2010–2011 International Journal on Digital Libraries (IJDL)
 2011 Transactions on Computational Biology and Bioinformatics (TCBB)
 2008 Language Resources and Evaluation (LRE)

NATIONAL/INTERNATIONAL SERVICE: CONFERENCE REVIEWING

2021–2022 Association for Computational Linguistics Rolling Review (ARR), Action Editor
 2009, 2011, 2013–2021
 Empirical Methods in Natural Language Processing (EMNLP)
 2018 Machine Learning for Healthcare (MLHC)
 2009, 2011–2014, 2017–2018
 Annual Meeting of the Association for Computational Linguistics (ACL)
 2010, 2012–2013, 2016, 2018
 North American Chapter of the Association for Computational Linguistics (NAACL)
 2017 International Joint Conference on Natural Language Processing (IJCNLP)
 2012, 2016 International Conference on Computational Linguistics (COLING)
 2016 International Joint Conference on Artificial Intelligence (IJCAI)
 2015–2016 International World Wide Web Conference (WWW)
 2012, 2014 European Chapter of the Association for Computational Linguistics (EACL)
 2013 American Medical Informatics Association Annual Symposium (AMIA)
 2010–2013 Joint Conference on Digital Libraries (JCDL)
 2012–2013 Joint Conference on Lexical and Computational Semantics (*SEM)
 2011 Conference on Natural Language Learning (CoNLL)
 2010 International Conference on Language Resources and Evaluation (LREC)
 2007–2008 IEEE International Conference on Semantic Computing (ICSC)

NATIONAL/INTERNATIONAL SERVICE: WORKSHOP REVIEWING

2021 Workshop on Biomedical Language Processing (BioNLP)
 2021 Workshop on Domain Adaptation for NLP (Adapt-NLP)
 2012–2018, 2021–2022
 International Workshop on Semantic Evaluation (SemEval)
 2018–2020 International Workshop on Spatial Language Understanding (SpLU)
 2020 Workshop for Natural Language Processing Open Source Software (NLP-OSS)
 2019 Workshop on Natural Language Processing and Computational Social Science
 2019 Combined Workshop on Spatial Language Understanding (SpLU)
 & Grounded Communication for Robotics (RoboNLP)

- 2017 Workshop on Ethics in Natural Language Processing (EthNLP)
- 2016 Workshop on Cross-Platform Text Mining and Natural Language Processing Interoperability
- 2015 Workshop on Replicability and Reusability in Natural Language Processing (RRNLP)
- 2014 Workshop on Computational Approaches to Causality in Language (CAtoCL)
- 2014 Workshop on Computational Approaches to Code Switching (CodeSwitch)
- 2014 Workshop on Open Infrastructures and Analysis Frameworks for HLT (OIAF4HLT)

DEPARTMENTAL SERVICE

- 2018–2021 Academic Advisor for MS INFO students, University of Arizona School of Information
- 2017–2021 Curriculum committee, University of Arizona School of Information
- 2016–2017, 2018–2021
Graduate committee, University of Arizona School of Information
- 2015–2016 Faculty search committee, U. of Alabama at Birmingham Computer and Info. Sci.
- 2014–2016 Undergrad curriculum committee, U. of Alabama at Birmingham Computer and Info. Sci.
- 2014–2016 Ph.D. qualifying exam committee, U. of Alabama at Birmingham Computer and Info. Sci.
- 2004–2007 Student grants committee, University of Colorado Boulder Institute of Cognitive Science
- 2004 Hiring committee, University of Colorado Boulder Department of Linguistics

COLLEGE-LEVEL SERVICE

- 2019–2021 Computational Social Science Advisory Committee,
University of Arizona College of Social and Behavioral Sciences
- 2012–2013 Curriculum design committee, University of Colorado Boulder social media certificate

UNIVERSITY-LEVEL SERVICE

- 2018–2021 Data Science Resources and Training Steering Committee, University of Arizona
- 2018–2021 Cognitive Science GIDP Executive Committee
- 2007–2008 CU International Leader, University of Colorado Boulder
- 2005–2007 International Peer Mentor, University of Colorado Boulder

PUBLICATIONS/CREATIVE ACTIVITY

CHAPTERS IN SCHOLARLY BOOKS AND MONOGRAPHS

- González López, Samuel, **Steven Bethard**, and Aurelio López-López (June 2014). “[Identifying Weak Sentences in Student Drafts: A Tutoring System](#)”. In: *Methodologies and Intelligent Systems for Technology Enhanced Learning*. Ed. by Tania Di Mascio, Rosella Gennari, Pierpaolo Vitorini, Rosa Vicari, and Fernando de la Prieta. Vol. 292. Advances in Intelligent Systems and Computing, pp. 77–85.
- Bethard, Steven**, Hong Yu, Ashley Thornton, Vasileios Hatzivassiloglou, and Dan Jurafsky (2005). “[Extracting opinion propositions and opinion holders using syntactic and lexical cues](#)”. In: *Computing Attitude and Affect in Text: Theory and Applications*. Ed. by James G. Shanahan, Yan Qu, and Janyce Wiebe, pp. 125–141.

EDITED CONFERENCE PROCEEDINGS

- Naumann, Tristan, **Steven Bethard**, Kirk Roberts, and Anna Rumshisky, eds. (July 2022). “[Proceedings of the 4th Clinical Natural Language Processing Workshop](#)”.
- Toutanova, Kristina, Anna Rumshisky, Luke Zettlemoyer, Dilek Hakkani-Tur, Iz Beltagy, **Steven Bethard**, Ryan Cotterell, Tanmoy Chakraborty, and Yichao Zhou, eds. (June 2021). “[Proceedings of the 2021 Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies](#)”.

- Rumshisky, Anna, Kirk Roberts, **Steven Bethard**, and Tristan Naumann, eds. (Nov. 2020). “[Proceedings of the 3rd Clinical Natural Language Processing Workshop](#)”.
- Rumshisky, Anna, Kirk Roberts, **Steven Bethard**, and Tristan Naumann, eds. (June 2019). “[Proceedings of the 2nd Clinical Natural Language Processing Workshop](#)”.
- Apidianaki, Marianna, Saif M. Mohammad, Jonathan May, Ekaterina Shutova, **Steven Bethard**, and Marine Carpuat, eds. (June 2018). “[Proceedings of The 12th International Workshop on Semantic Evaluation \(SemEval-2018\)](#)”.
- Bethard, Steven**, Marine Carpuat, Marianna Apidianaki, Saif M. Mohammad, Daniel Cer, and David Jurgens, eds. (Aug. 2017). “[Proceedings of the 11th International Workshop on Semantic Evaluation \(SemEval-2017\)](#)”.
- Rumshisky, Anna, Kirk Roberts, **Steven Bethard**, and Tristan Naumann, eds. (Dec. 2016). “[Proceedings of the Clinical Natural Language Processing Workshop \(ClinicalNLP\)](#)”.
- Bethard, Steven**, Marine Carpuat, Daniel Cer, David Jurgens, Preslav Nakov, and Torsten Zesch, eds. (June 2016). “[Proceedings of the 10th International Workshop on Semantic Evaluation \(SemEval-2016\)](#)”.
- Kolomiyets, Oleksandr, Marie-Francine Moens, Martha Palmer, James Pustejovsky, and **Steven Bethard**, eds. (Apr. 2014). “[Proceedings of the EACL 2014 Workshop on Computational Approaches to Causality in Language \(CAtOCL\)](#)”.
- Yarowsky, David, Timothy Baldwin, Anna Korhonen, Karen Livescu, and **Steven Bethard**, eds. (Oct. 2013). “[Proceedings of the 2013 Conference on Empirical Methods in Natural Language Processing](#)”.
- Dey, Anik, Sebastian Krause, Ivelina Nikolova, Eva Vecchi, **Steven Bethard**, Preslav I. Nakov, and Feiyu Xu, eds. (Aug. 2013). “[51st Annual Meeting of the Association for Computational Linguistics Proceedings of the Student Research Workshop](#)”.

REFEREED JOURNAL ARTICLES

- Emerson, Kirk, Elizabeth Baldwin, Tyler A. Scott, Justin R. Pidot, Aaron M. Lien, Faiz Currim, **Steven Bethard**, Sudha Ram, Marc L. Miller, and Laura López-Hoffman (2022). “[Toward NEPA performance: A framework for assessing EIAs](#)”. In: *Environmental Impact Assessment Review* 97, p. 106879.
- Rains, Stephen A, Yotam Shmargad, Kevin Coe, Kate Kenski, and **Steven Bethard** (Aug. 2021). “[Assessing the Russian Troll Efforts to Sow Discord on Twitter during the 2016 U.S. Election](#)”. In: *Human Communication Research* 47.4, pp. 477–486.
- González-López, Samuel, **Steven Bethard**, Francisca Cecilia Encinas Orozco, and Adrián Pastor López-Monroy (2021). “[Consumer Cynicism Identification for Spanish Reviews using a Spanish Transformer Model](#)”. In: *Procesamiento del Lenguaje Natural* 66.0, pp. 111–120.
- Xu, Dongfang, Manoj Gopale, Jiacheng Zhang, Kris Brown, Edmon Begoli, and **Steven Bethard** (July 2020). “[Unified Medical Language System resources improve sieve-based generation and Bidirectional Encoder Representations from Transformers \(BERT\)-based ranking for concept normalization](#)”. In: *Journal of the American Medical Informatics Association*.
- Laparra, Egoitz, **Steven Bethard**, and Timothy A Miller (Apr. 2020). “[Rethinking domain adaptation for machine learning over clinical language](#)”. In: *JAMIA Open*.
- Lin, Chen, **Steven Bethard**, Dmitriy Dligach, Farig Sadeque, Guergana Savova, and Timothy A Miller (Feb. 2020). “[Does BERT need domain adaptation for clinical negation detection?](#)” In: *Journal of the American Medical Informatics Association* 27.4, pp. 584–591.
- López, Samuel González, Aurelio López-López, **Steven Bethard**, and Jesús Miguel García Gorrostieta (2019). “[A Model for Identifying Steps in Undergraduate Thesis Methodology](#)”. In: *Res. Comput. Sci.* 148.5, pp. 17–24.

- Laparra, Egoitz, Dongfang Xu, and **Steven Bethard** (May 2018). “[From Characters to Time Intervals: New Paradigms for Evaluation and Neural Parsing of Time Normalizations](#)”. In: *Transactions of the Association for Computational Linguistics* 6, pp. 343–356.
- Osborne, John D., Matthew B. Neu, Maria I. Danila, Thamar Solorio, and **Steven J. Bethard** (Jan. 2018). “[CUILESS2016: a clinical corpus applying compositional normalization of text mentions](#)”. In: *Journal of Biomedical Semantics* 9.1, p. 2.
- Miller, Timothy, Dmitriy Dligach, **Steven Bethard**, Chen Lin, and Guergana Savova (2017). “[Towards generalizable entity-centric clinical coreference resolution](#)”. In: *Journal of Biomedical Informatics* 69, pp. 251–258.
- Lin, Chen, Dmitriy Dligach, Timothy A Miller, **Steven Bethard**, and Guergana K Savova (Mar. 2016). “[Multilayered temporal modeling for the clinical domain](#)”. In: *Journal of the American Medical Informatics Association* 23.2, pp. 387–395.
- Osborne, John D, Matthew Wyatt, Andrew O Westfall, James Willig, **Steven Bethard**, and Geoff Gordon (Mar. 2016). “[Efficient identification of nationally mandated reportable cancer cases using natural language processing and machine learning](#)”. In: *Journal of the American Medical Informatics Association*.
- Pradhan, Ligaj, Chengcui Zhang, and **Steven Bethard** (2016). “[Extracting Hierarchy of Coherent User-Concerns to Discover Intricate User Behavior from User Reviews](#)”. In: *International Journal of Multimedia Data Engineering and Management (IJMDEM)* 7.4, pp. 63–80.
- Do, Quynh Thi Ngoc, **Steven Bethard**, and Marie-Francine Moens (Nov. 2015). “[Domain Adaptation in Semantic Role Labeling Using a Neural Language Model and Linguistic Resources](#)”. In: *IEEE/ACM Transactions on Audio, Speech, and Language Processing* 23.11, pp. 1812–1823.
- Mulder, Wim De, **Steven Bethard**, and Marie-Francine Moens (Mar. 2015). “[A survey on the application of recurrent neural networks to statistical language modeling](#)”. In: *Computer Speech & Language* 30.1, pp. 61–98.
- Chambers, Nathanael, Taylor Cassidy, Bill McDowell, and **Steven Bethard** (Oct. 2014). “[Dense Event Ordering with a Multi-Pass Architecture](#)”. In: *Transactions of the Association for Computational Linguistics* 2, pp. 273–284.
- Sultan, Md. Arafat, **Steven Bethard**, and Tamara Sumner (May 2014). “[Back to Basics for Monolingual Alignment: Exploiting Word Similarity and Contextual Evidence](#)”. In: *Transactions of the Association for Computational Linguistics* 2, pp. 219–230.
- Styler IV, William F., **Steven Bethard**, Sean Finan, Martha Palmer, Sameer Pradhan, Piet C. de Groen, Brad Erickson, Timothy Miller, Chen Lin, Guergana Savova, and James Pustejovsky (Apr. 2014). “[Temporal Annotation in the Clinical Domain](#)”. In: *Transactions of the Association for Computational Linguistics* 2, pp. 143–154.
- Pathak, Jyotishman, Kent R Bailey, Calvin E Beebe, **Steven Bethard**, David S Carrell, Pei J Chen, Dmitriy Dligach, Cory M Endle, Lacey A Hart, Peter J Haug, Stanley M Huff, Vinod C Kaggal, Dingcheng Li, Hongfang Liu, Kyle Marchant, James Masanz, Timothy Miller, Thomas A Oniki, Martha Palmer, Kevin J Peterson, Susan Rea, Guergana K Savova, Craig R Stancl, Sunghwan Sohn, Harold R Solbrig, Dale B Suesse, Cui Tao, David P Taylor, Les Westberg, Stephen Wu, Ning Zhuo, and Christopher G Chute (Nov. 2013). “[Normalization and standardization of electronic health records for high-throughput phenotyping: the SHARPN consortium](#)”. In: *Journal of the American Medical Informatics Association* 20.e2, e341–e348.
- Dligach, Dmitriy, **Steven Bethard**, Lee Becker, Timothy Miller, and Guergana K. Savova (Oct. 2013). “[Discovering body site and severity modifiers in clinical texts](#)”. In: *Journal of the American Medical Informatics Association*.

- Wetzler, Philipp, **Steven Bethard**, Heather Leary, Kirsten Butcher, Soheil Danesh Bahreini, Jin Zhao, James H. Martin, and Tamara Sumner (Oct. 2013). “[Characterizing and Predicting the Multifaceted Nature of Quality in Educational Web Resources](#)”. In: *ACM Transactions on Interactive Intelligent Systems* 3.3, 15:1–15:25.
- Levin, Michael, Stefan Krawczyk, **Steven Bethard**, and Dan Jurafsky (May 2012). “[Citation-based bootstrapping for large-scale author disambiguation](#)”. In: *Journal of the American Society for Information Science and Technology* 63.5, pp. 1030–1047.
- Bethard, Steven**, Zhiyong Lu, James H. Martin, and Lawrence Hunter (June 2008). “[Semantic Role Labeling for Protein Transport Predicates](#)”. In: *BMC Bioinformatics* 9.1, p. 277.
- Bethard, Steven**, James H. Martin, and Sara Klingenstein (Dec. 2007). “[Finding Temporal Structure in Text: Machine Learning of Syntactic Temporal Relations](#)”. In: *International Journal of Semantic Computing (IJSC)* 1.4, pp. 441–458.

REFEREED CONFERENCE ARTICLES

- Su, Xin, Yiyun Zhao, and **Steven Bethard** (May 2022). “[A Comparison of Strategies for Source-Free Domain Adaptation](#)”. In: *Proceedings of the 60th Annual Meeting of the Association for Computational Linguistics (Volume 1: Long Papers)*. [Acceptance rate 21%], pp. 8352–8367.
- Zhao, Yiyun, Jian Gang Ngui, Lucy Hall Hartley, and **Steven Bethard** (Nov. 2021). “[Do pretrained transformers infer telicity like humans?](#)” In: *Proceedings of the 25th Conference on Computational Natural Language Learning*. [Acceptance rate 23%], pp. 72–81.
- Liang, Zhengzhong, **Steven Bethard**, and Mihai Surdeanu (June 2021). “[Explainable Multi-hop Verbal Reasoning Through Internal Monologue](#)”. In: *Proceedings of the 2021 Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies*. [Acceptance rate 26%], pp. 1225–1250.
- Yadav, Vikas, **Steven Bethard**, and Mihai Surdeanu (June 2021). “[If You Want to Go Far Go Together: Unsupervised Joint Candidate Evidence Retrieval for Multi-hop Question Answering](#)”. In: *Proceedings of the 2021 Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies*. [Acceptance rate 26%], pp. 4571–4581.
- Laparra, Egoitz and **Steven Bethard** (Dec. 2020). “[A Dataset and Evaluation Framework for Complex Geographical Description Parsing](#)”. In: *Proceedings of the 28th International Conference on Computational Linguistics*. [Acceptance rate 35%], pp. 936–948.
- Xu, Dongfang, Zeyu Zhang, and **Steven Bethard** (July 2020). “[A Generate-and-Rank Framework with Semantic Type Regularization for Biomedical Concept Normalization](#)”. In: *Proceedings of the 58th Annual Meeting of the Association for Computational Linguistics*. [Acceptance rate 23%], pp. 8452–8464.
- Yadav, Vikas, **Steven Bethard**, and Mihai Surdeanu (July 2020). “[Having Your Cake and Eating It Too: Training Neural Retrieval for Language Inference without Losing Lexical Match](#)”. In: *Proceedings of the 43rd International ACM SIGIR Conference on Research and Development in Information Retrieval*. SIGIR ’20. [Acceptance rate 26%], pp. 1625–1628.
- Yadav, Vikas, **Steven Bethard**, and Mihai Surdeanu (July 2020). “[Unsupervised Alignment-based Iterative Evidence Retrieval for Multi-hop Question Answering](#)”. In: *Proceedings of the 58th Annual Meeting of the Association for Computational Linguistics*. [Acceptance rate 23%], pp. 4514–4525.
- Zhao, Yiyun and **Steven Bethard** (July 2020). “[How does BERT’s attention change when you fine-tune? An analysis methodology and a case study in negation scope](#)”. In: *Proceedings of the 58th Annual Meeting of the Association for Computational Linguistics*. [Acceptance rate 23%], pp. 4729–4747.

- Yadav, Vikas, **Steven Bethard**, and Mihai Surdeanu (Nov. 2019). “[Quick and \(not so\) Dirty: Unsupervised Selection of Justification Sentences for Multi-hop Question Answering](#)”. In: *Proceedings of the 2019 Conference on Empirical Methods in Natural Language Processing and the 9th International Joint Conference on Natural Language Processing (EMNLP-IJCNLP)*. [Acceptance rate 23%], pp. 2578–2589.
- Sadeque, Farig, Stephen Rains, Yotam Shmargad, Kate Kenski, Kevin Coe, and **Steven Bethard** (June 2019). “[Incivility Detection in Online Comments](#)”. In: *Proceedings of the Eighth Joint Conference on Lexical and Computational Semantics (*SEM 2019)*. [Acceptance rate 33%], pp. 283–291.
- Xu, Dongfang, Egoitz Laparra, and **Steven Bethard** (June 2019). “[Pre-trained Contextualized Character Embeddings Lead to Major Improvements in Time Normalization: a Detailed Analysis](#)”. In: *Proceedings of the Eighth Joint Conference on Lexical and Computational Semantics (*SEM 2019)*. [Acceptance rate 33%], pp. 68–74.
- Yadav, Vikas, **Steven Bethard**, and Mihai Surdeanu (June 2019). “[Alignment over Heterogeneous Embeddings for Question Answering](#)”. In: *Proceedings of the 2019 Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies, Volume 1 (Long and Short Papers)*. [Acceptance rate 26%], pp. 2681–2691.
- Yadav, Vikas and **Steven Bethard** (Aug. 2018). “[A Survey on Recent Advances in Named Entity Recognition from Deep Learning models](#)”. In: *Proceedings of the 27th International Conference on Computational Linguistics*. [Acceptance rate 37%], pp. 2145–2158.
- Yadav, Vikas, Rebecca Sharp, and **Steven Bethard** (June 2018). “[Deep Affix Features Improve Neural Named Entity Recognizers](#)”. In: *Proceedings of the Seventh Joint Conference on Lexical and Computational Semantics*. [Acceptance rate 29%], pp. 167–172.
- Pradhan, Ligaj, Chengcui Zhang, **Steven Bethard**, and Xin Chen (Apr. 2018). “[Embedding User Behavioral Aspect in TF-IDF Like Representation](#)”. In: *2018 IEEE Conference on Multimedia Information Processing and Retrieval (MIPR)*. [Acceptance rate 20%], pp. 262–267.
- Sadeque, Farig, Dongfang Xu, and **Steven Bethard** (Feb. 2018). “[Measuring the Latency of Depression Detection in Social Media](#)”. In: *Proceedings of the Eleventh ACM International Conference on Web Search and Data Mining. WSDM '18*. [Acceptance rate 16%], pp. 495–503.
- Do, Quynh Ngoc Thi, **Steven Bethard**, and Marie-Francine Moens (Nov. 2017). “[Improving Implicit Semantic Role Labeling by Predicting Semantic Frame Arguments](#)”. In: *Proceedings of the Eighth International Joint Conference on Natural Language Processing (Volume 1: Long Papers)*. [Acceptance rate 31%], pp. 90–99.
- Pradhan, Ligaj, Chengcui Zhang, and **Steven Bethard** (Aug. 2017). “[Infusing Latent User-Concerns from User Reviews into Collaborative Filtering](#)”. In: *2017 IEEE International Conference on Information Reuse and Integration (IRI)*. [Acceptance rate 29%], pp. 471–477.
- Dligach, Dmitriy, Timothy Miller, Chen Lin, **Steven Bethard**, and Guergana Savova (Apr. 2017). “[Neural Temporal Relation Extraction](#)”. In: *Proceedings of the 15th Conference of the European Chapter of the Association for Computational Linguistics: Volume 2, Short Papers*. [Acceptance rate 24%], pp. 746–751.
- Viani, Natalia, Timothy A. Miller, Dmitriy Dligach, **Steven Bethard**, Carlo Napolitano, Silvia G. Priori, Riccardo Bellazzi, Lucia Sacchi, and Guergana K. Savova (2017). “[Recurrent Neural Network Architectures for Event Extraction from Italian Medical Reports](#)”. In: *Artificial Intelligence in Medicine: 16th Conference on Artificial Intelligence in Medicine, AIME 2017, Vienna, Austria, June 21-24, 2017, Proceedings*. Ed. by Annette ten Teije, Christian Popow, John H. Holmes, and Lucia Sacchi. [Acceptance rate 39%], pp. 198–202.
- Do, Quynh Ngoc Thi, **Steven Bethard**, and Marie-Francine Moens (Dec. 2016). “[Facing the most difficult case of Semantic Role Labeling: A collaboration of word embeddings and co-training](#)”. In: *Proceedings of COLING 2016, the 26th International Conference on Computational Linguistics: Technical Papers*. [Acceptance rate 32%], pp. 1275–1284.

- Sapkota, Upendra, Thamar Solorio, Manuel Montes, and **Steven Bethard** (Aug. 2016). “[Domain Adaptation for Authorship Attribution: Improved Structural Correspondence Learning](#)”. In: *Proceedings of the 54th Annual Meeting of the Association for Computational Linguistics (Volume 1: Long Papers)*. [Acceptance rate 28%], pp. 2226–2235.
- Pradhan, Ligaj, Chengcui Zhang, and **Steven Bethard** (July 2016). “[Towards Extracting Coherent User Concerns and Their Hierarchical Organization from User Reviews](#)”. In: *2016 IEEE 17th International Conference on Information Reuse and Integration (IRI)*. [Acceptance rate 26%], pp. 582–590.
- Bethard, Steven** and Jonathan Parker (May 2016). “[A Semantically Compositional Annotation Scheme for Time Normalization](#)”. In: *Proceedings of the Tenth International Conference on Language Resources and Evaluation (LREC 2016)*. Ed. by Nicoletta Calzolari (Conference Chair), Khalid Choukri, Thierry Declerck, Marko Grobelnik, Bente Maegaard, Joseph Mariani, Asuncion Moreno, Jan Odijk, and Stelios Piperidis. [Acceptance rate 60%].
- Shrestha, Prasha, Nicolas Rey-Villamizar, Farig Sadeque, Ted Pedersen, **Steven Bethard**, and Thamar Solorio (May 2016). “[Age and Gender Prediction on Health Forum Data](#)”. In: *Proceedings of the Tenth International Conference on Language Resources and Evaluation (LREC 2016)*. Ed. by Nicoletta Calzolari (Conference Chair), Khalid Choukri, Thierry Declerck, Marko Grobelnik, Bente Maegaard, Joseph Mariani, Asuncion Moreno, Jan Odijk, and Stelios Piperidis. [Acceptance rate 60%].
- Do, Quynh Ngoc Thi, **Steven Bethard**, and Marie-Francine Moens (Sept. 2015). “[Adapting Coreference Resolution for Narrative Processing](#)”. In: *Proceedings of the 2015 Conference on Empirical Methods in Natural Language Processing*. [Acceptance rate 24%], pp. 2262–2267.
- Sultan, Md Arafat, **Steven Bethard**, and Tamara Sumner (Sept. 2015). “[Feature-Rich Two-Stage Logistic Regression for Monolingual Alignment](#)”. In: *Proceedings of the 2015 Conference on Empirical Methods in Natural Language Processing*. [Acceptance rate 24%], pp. 949–959.
- Sapkota, Upendra, **Steven Bethard**, Manuel Montes, and Thamar Solorio (June 2015). “[Not All Character N-grams Are Created Equal: A Study in Authorship Attribution](#)”. In: *Proceedings of the 2015 Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies*. [Acceptance rate 26%], pp. 93–102.
- Sultan, Md. Arafat, **Steven Bethard**, and Tamara Sumner (Sept. 2014). “[Towards automatic identification of core concepts in educational resources](#)”. In: *2014 IEEE/ACM Joint Conference on Digital Libraries (JCDL)*. [Acceptance rate 29%], pp. 379–388.
- Sapkota, Upendra, Thamar Solorio, Manuel Montes, **Steven Bethard**, and Paolo Rosso (Aug. 2014). “[Cross-Topic Authorship Attribution: Will Out-Of-Topic Data Help?](#)” In: *Proceedings of COLING 2014, the 25th International Conference on Computational Linguistics: Technical Papers*. [Acceptance rate 32%], pp. 1228–1237.
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- Lin, Chen, Timothy Miller, Alvin Kho, **Steven Bethard**, Dmitriy Dligach, Sameer Pradhan, and Guergana Savova (June 2014). “[Descending-Path Convolution Kernel for Syntactic Structures](#)”. In: *Proceedings of the 52nd Annual Meeting of the Association for Computational Linguistics (Volume 2: Short Papers)*. [Acceptance rate 25%], pp. 81–86.
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SCHOLARLY PRESENTATIONS

COLLOQUIA

- 6 Apr 2018 University of Arizona (CogSci): “Teaching Computers the Language of Time”
- 16 Mar 2018 University of Arizona (MIS): “Parsing the Language of Time”
- 22 Apr 2016 University of Arizona (iSchool): “Parsing the Language of Time”
- 28 Mar 2016 University of Southern Mississippi: “Parsing the Language of Time”
- 3 Mar 2016 University of South Alabama: “Parsing the Language of Time”
- 9 Feb 2016 University of Colorado Boulder: “Parsing the Language of Time”
- 21 Jan 2016 University of California Davis: “Parsing the Language of Time”
- 18 Mar 2015 Northeastern University: “Extracting Timelines from Unstructured Text”
- 20 Feb 2015 Tufts University: “Extracting Timelines from Unstructured Text”
- 9 Jul 2014 i2b2 Academic Users’ Group Annual Meeting: “State of the Art in Timeline Extraction”
- 18 Jun 2012 University of Arizona: “Extracting Timelines from Unstructured Text”
- 7 Mar 2012 Radboud University Nijmegen: “Extracting Timelines from Unstructured Text”
- 3 Feb 2012 University of Chicago: “Extracting Timelines from Unstructured Text”
- 27 Jan 2012 Indiana University: “Extracting Timelines from Unstructured Text”
- 14 Jan 2011 University of Arizona: “Exploring ERP effects of metaphor via crowdsourcing”
- 15 Jul 2008 Johns Hopkins University: “Extracting event structure: building models and corpora”
- 12 Jun 2008 University of Pittsburgh: “Building corpora to support the semantic analysis of text”
- 9 Feb 2007 Western State College: “Meaning from Text: Teaching Computers to Read”
- 26 Feb 2007 University of Texas at Dallas: “Timelines from Text: Research and Resources”
- 6 Apr 2010 Xerox-PARC: “Learning the Temporal Ordering of Textual Events”
- 1 Jun 2010 NSF workshop on Chinese temporal and discourse annotation: “Mechanical Turk and Web Counts: Collecting and Using Distributional Information about Event Durations”

CONFERENCES

- 16 Feb 2019 2019 Annual Meeting of the American Association for the Advancement of Science (AAAS-2019), Machine Learning and Human Language scientific session: “Human Annotation and Machine Learning in Understanding the Language of Time”
- 5 Nov 2016 2016 Conference on Empirical Methods in Natural Language Processing (EMNLP-2016) Workshop on Uphill Battles in Language Processing: “Visualizing the Content of a Children’s Story in a Virtual World: Lessons Learned”
- 16 Jun 2016 10th International Workshop on Semantic Evaluation (SemEval-2016): “SemEval-2016 Task 12: Clinical TempEval”
- 5 Jun 2015 9th International Workshop on Semantic Evaluation (SemEval-2015): “SemEval-2015 Task 6: Clinical TempEval”
- 4 Jun 2015 9th International Workshop on Semantic Evaluation (SemEval-2015): “CUAB: Supervised Learning of Disorders and their Attributes using Relations”

- 29 May 2014 Ninth International Conference on Language Resources and Evaluation (LREC 2014): “ClearTK 2.0: Design Patterns for Machine Learning in UIMA”
- 19 Oct 2013 Conference on Empirical Methods in Natural Language Processing (EMNLP 2013): “A Synchronous Context Free Grammar for Time Normalization”
- 14 Jun 2013 7th International Workshop on Semantic Evaluation (SemEval-2013): “ClearTK-TimeML: A minimalist approach to TempEval 2013”
- 24 May 2012 Eighth International Conference on Language Resources and Evaluation (LREC 2012): “Annotating Story Timelines as Temporal Dependency Structures”
- 6 Jun 2012 NAACL 2010 Workshop on Creating Speech and Language Data with Amazon’s Mechanical Turk: “Crowdsourcing and language studies: the new generation of linguistic data”
- 17 Jun 2009 Joint Conference on Digital Libraries (JCDL 2009): “Automatically characterizing resource quality for educational digital libraries”
- 16 Jun 2009 Joint Conference on Digital Libraries (JCDL 2009): “Topic Model Methods for Automatically Identifying Out-of-Scope Resources”
- 4 Jun 2009 NAACL-HLT 2009 Workshop on Computational Approaches to Linguistic Creativity (CALC-09): “Topic Model Analysis of Metaphor Frequency for Psycholinguistic Stimuli”
- 17 Jun 2008 46th Annual Meeting of the Association for Computational Linguistics: “Learning Semantic Links from a Corpus of Parallel Temporal and Causal Relations”
- 28 May 2008 Sixth International Conference on Language Resources and Evaluation (LREC 2008): “Building a Corpus of Temporal-Causal Structure”
- 17 Sep 2007 First IEEE International Conference on Semantic Computing (ICSC 2007) “Timelines from Text: Identification of Syntactic Temporal Relations”
- 24 Jun 2007 Fourth International Workshop on Semantic Evaluations (SemEval-2007): “CU-TMP: Temporal Relation Classification Using Syntactic and Semantic Features”
- 26 Mar 2007 AAAI Spring Symposium on Machine Reading: “Semantic integration in learning from text”
- 22 Jul 2006 Empirical Methods in Natural Language Processing (EMNLP 2006): “Identification of Event Mentions and their Semantic Class”
- 22 Mar 2004 AAAI Spring Symposium on Exploring Attitude and Affect in Text: “Automatic extraction of opinion propositions and their holders”

AWARDED GRANTS AND CONTRACTS

FEDERAL

- 2016-01 – 2025-05 \$3,500,000 PI: Savova, Bethard US National Institutes of Health, BD2K R01
[Extended Methods and Software Development for Health NLP](#)
 Role: PI
- 2010-09 – 2023-05 \$6,500,000 PI: Savova US National Institutes of Health, NLM, R01
[Temporal Relation Discovery for Clinical Text](#)
 Role: Site PI
- 2018-09 – 2022-08 \$1,500,000 PI: López-Hoffman US National Science Foundation, SBE, SMA
[A Data Science Platform and Mechanisms for Its Sustainability](#)
 Role: Co-PI
- 2021-01 – 2022-12 \$400,000 PI: Crane, Bethard US National Institutes of Health, NLM, R01
[Using natural language processing to determine predictors of healthy diet and physical activity behavior change in ovarian cancer survivors](#)
 Role: PI

2018-09 – 2022-07 \$1,100,000 PI: Miller US National Institutes of Health, NLM, R01
[Automated Domain Adaptation for Clinical Natural Language Processing](#)
 Role: Site PI

2017-12 – 2022-07 \$4,500,000 PI: Surdeanu Defense Advanced Research Projects Agency
[GRASP: Global Reading and Assembly for Semantic, Probabilistic World Models](#)
 Role: Co-PI

2021-03 – 2022-06 \$750,000 PI: RedShred, LLC Air Force
[VADER: Voice Assistant for Data Entry and Recording](#)
 Role: Site PI

2013-03 – 2014-01 \$19,000 PI: Bethard US National Science Foundation, CISE, IIS
[ACL 2013 Student Research Workshop](#)
 Role: Principal Investigator

2012-09 – 2015-11 €1,993,326 PI: Moens EU FP7 ICT FET-Open
[Machine Understanding for Interactive Storytelling](#)
 Role: Co-PI

2007-09 – 2008-09 \$138,213 PI: Martin US National Science Foundation, CISE, IIS
[SGER: Relevance Models for Digital Repository Management](#)
 Role: Senior Personnel

2006-08 – 2006-12 \$10,000 US Department of Homeland Security
Dissertation Grant Award

2003-08 – 2006-08 \$82,800 plus tuition US Department of Homeland Security
Graduate Fellowship

INSTITUTIONAL

2015-11 – 2017-11 \$132,557 PI: Wells University of Alabama Health Services Foundation
[Natural Language Processing to Identify COPD Exacerbations in Real Time](#)
 Role: Co-Investigator

MENTORING

POSTDOCTORAL ADVISOR

John Culnan, School of Information, University of Arizona, 2022
 Egoitz Laparra, School of Information, University of Arizona, 2017-2022
 Cynthia M Kroeger, Nutrition Obesity Research Center, University of Alabama at Birmingham, 2015-2016
 NIH F32 “Research-reporting fidelity within dietary weight-loss supplement literature”

THESIS ADVISOR

Jiacheng Zhang, Ph.D., Information, University of Arizona, expected 2026
 Kadir Bulut Ozler, Ph.D., Information, University of Arizona, expected 2025
 Xin Su, Ph.D., Information, University of Arizona, expected 2025
 Sarah Stueve, Ph.D., Information, University of Arizona, expected 2025
 Zeyu Zhang, Ph.D., Information, University of Arizona, expected 2023
 Yiyun Zhao, Ph.D., Linguistics, University of Arizona, 2022
 Thesis: *How to probe linguistic knowledge and bias*
 Jiacheng Zhang, M.S., Computer Science, University of Arizona, 2021
 Thesis: *General Benefits of Monolingual Pre-training in Transformers*

Dongfang Xu, Ph.D., Information, University of Arizona, 2021

Thesis: *Neural Network Algorithms for Ontology Informed Information Extraction*

Vikas Yadav, Ph.D., Information, University of Arizona, 2020

Thesis: *Evidence Retrieval for Explainable Question Answering*

Farig Sadeque, Ph.D., Information, University of Arizona, 2019

Thesis: *User behavior in social media: engagement, incivility, and depression*

John Osborne, Ph.D., Computer and Information Sciences, U. of Alabama at Birmingham, 2016

Thesis: *Machine Learning of Composite Concepts and the Alleviation of The Content Completeness Problem in Text Mention Normalization*

Uendra Sapkota, Ph.D., Computer and Information Sciences, U. of Alabama at Birmingham, 2015

Thesis: *Domain adaptation for authorship attribution*

THESIS CO-ADVISOR

Rongbing Xie, Ph.D., Public Health, University of Alabama at Birmingham, 2017

Thesis: *Modeling depression treatment strategies for human immunodeficiency virus (HIV) positive patients*

Quynh Thi Ngoc Do, Ph.D., Computer Science, KU Leuven, 2017

Thesis: *Domain adaptation in natural language processing for visualizing a children's story in a virtual world*

Bram Jans, M.S., Computer Science, KU Leuven, 2011

Thesis: *Construction and evaluation of databases of narrative event chains*

Saurabh Shekhar Verma, M.S., Artificial Intelligence, KU Leuven, 2011

Thesis: *Identification and Classification of Temporally Relevant Events in Text*

Carine Yu, M.S., Artificial Intelligence, KU Leuven, 2011

Thesis: *The Bedtime Story Generator*

MEMBER OF THESIS COMMITTEE

Mohammad Abdolhosseini Moghaddam, Ph.D., Hydrology, University of Arizona, 2020

Thesis: *Application and Limitation of Deep Learning Algorithms to Hydrogeology – Data Driven Approaches to Understanding Effective Hydraulic Conductivity, Flux, and Monitoring Network Design*

Gretchen Stahlman, Ph.D., Information, University of Arizona, 2019

Thesis: *Exploring the Long Tail of Astronomy: A Mixed-Methods Approach to Searching for Dark Data*

Md. Arafat Sultan, Ph.D., Computer Science, University of Colorado Boulder, 2016

Thesis: *Short-Text Semantic Similarity: Algorithms and Applications*

Samuel González López, Ph.D., Computer Science, I. N. de Astrofísica, Óptica y Electrónica, Mexico, 2015

Thesis: *Linguistic Analysis of Research Drafts of Undergraduate Students*

Ralph Frank McSweeney IV, M.S., Computer and Information Sciences, U. of Alabama at Birmingham, 2015

Thesis: *Malware Detection through Disassembled Function Analysis*

Ifeyinwa Okoye, Ph.D., Computer Science, University of Colorado Boulder, 2013

Thesis: *Applying the theory of conceptual change to improve students' understanding of science concepts with an educational recommender system*

Oleksandr Kolomiyets, Ph.D., Computer Science, KU Leuven, 2012

Thesis: *Algorithms for Temporal Information Processing of Text and their Applications*

Raquel Mochales Palau, Ph.D., Computer Science, KU Leuven, 2011

Thesis: *Automatic Detection and Classification of Argumentation in a Legal Case*

COURSES TAUGHT

2022-Sp	Instructor	INFO 507: Information Research Methods		15 grad
2021-Fa	Instructor	ISTA 457 / INFO 557: Neural Networks	16 undergrad	30 grad
2021-Sp	Instructor	INFO 507: Information Research Methods		24 grad
2020-Fa	Instructor	ISTA 457 / INFO 557: Neural Networks	10 undergrad	37 grad
2019-Fa	Instructor	ISTA 457 / INFO 557: Neural Networks	9 undergrad	47 grad
2019-Sp	Instructor	LING 439/539: Statistical Natural Language Processing	13 undergrad	31 grad
2018-Fa	Instructor	ISTA 457 / INFO 557: Neural Networks	10 undergrad	21 grad
2018-Sp	Instructor	ISTA 457 / INFO 557: Neural Networks	8 undergrad	26 grad
2017-Sp	Instructor	ISTA 116: Statistical Foundations for the Information Age	64 undergrad	
2016-Fa	Instructor	ISTA 116: Statistical Foundations for the Information Age	59 undergrad	
2016-Sp	Instructor	CS 460/660/760: Artificial Intelligence	12 undergrad	9 grad
2015-Fa	Instructor	CS 201: Introduction to Programming	48 undergrad	
2015-Fa	Instructor	CS 499: Senior Capstone	25 undergrad	
2015-Sp	Instructor	CS 460/660/760: Artificial Intelligence	9 undergrad	19 grad
2014-Fa	Instructor	CS 201: Introduction to Programming	63 undergrad	
2014-Fa	Instructor	CS 499: Senior Capstone	16 undergrad	
2014-Sp	Instructor	CS 460/660/760: Artificial Intelligence	4 undergrad	24 grad
2013-Fa	Instructor	CS 499: Senior Capstone	5 undergrad	
2008-Fa	Instructor	CSCI 3202: Introduction to Artificial Intelligence	57 undergrad	
2002-Sp	Section Leader	CSC 345: Analysis of Discrete Structures	20 undergrad	
2001-Fa	Section Leader	CSC 245: Introduction to Discrete Structures	20 undergrad	
2001-Sp	Section Leader	CSC 335: Object-Oriented Programming and Design	20 undergrad	
2000-Fa	Section Leader	CSC 227: Program Design and Development	20 undergrad	
2000-Sp	Section Leader	CSC 127a: Introduction to Computer Science	20 undergrad	