References

[1] Mohammad Javad Hosseini, Hannaneh Hajishirzi, Oren Etzioni, and Nate Kushman. Learning to solve arithmetic word problems with verb categorization. In *Proceedings of the 2014 Conference on Empirical Methods in Natural Language Processing (EMNLP)*, pages 523–533, 2014.

[2] Nate Kushman, Yoav Artzi, Luke Zettlemoyer, and Regina Barzilay. Learning to automatically solve algebra word problems. In *Proceedings of the 52nd Annual Meeting of the Association for Computational Linguistics (Volume 1: Long Papers)*, volume 1, pages 271–281, 2014.

[3] Bussaba Amnueypornsakul and Suma Bhat. Machine-guided solution to mathematical word problems. In *Proceedings of the 28th Pacific Asia Conference on Language, Information and Computing*, 2014.

[4] Subhro Roy and Dan Roth. Illinois math solver: math reasoning on the web. In *Proceedings of the 2016 Conference of the North American Chapter of the Association for Computational Linguistics: Demonstrations*, pages 52–56, 2016.

[5] Danqing Huang, Shuming Shi, Chin-Yew Lin, and Jian Yin. Learning fine-grained expressions to solve math word problems. In *Proceedings of the 2017 Conference on Empirical Methods in Natural Language Processing*, pages 805–814, 2017.

[6] Minjoon Seo, Hannaneh Hajishirzi, Ali Farhadi, Oren Etzioni, and Clint Malcolm. Solving geometry problems: Combining text and diagram interpretation. In *Proceedings of the 2015 Conference on Empirical Methods in Natural Language Processing*, pages 1466–1476, 2015.

[7] Anton Dries, Angelika Kimmig, Jesse Davis, Vaishak Belle, and Luc De Raedt. Solving probability problems in natural language. In *Proceed-*

ings Twenty-Sixth International Joint Conference on Artificial Intelligence, pages 3981–3987, 2017.

[8] Diunuge B Wijesinghe, Surangika Ranathunga, and Gihan Dias. Computer representation of venn and euler diagrams. *Advances in ICT for Emerging Regions*, pages 100–105, 2016.

[9] Diunuge Buddhika Wijesinghe, Jcs Kadupitiya, Surangika Ranathunga, and Gihan Dias. Automatic assessment of student answers consisting of venn and euler diagrams. In *2017 IEEE 17th International Conference on Advanced Learning Technologies (ICALT)*, pages 243–247. IEEE, 2017.

[10] Donald Ervin Knuth. The art of computer programming volume 4, pre-fascicle 0b. a draft of section 7.1. 2: Boolean evaluation, 2007.

[11] Daniel G Bobrow. Natural language input for a computer problem solving system. 1964.

[12] Anirban Mukherjee and Utpal Garain. A review of methods for automatic understanding of natural language mathematical problems. *Artificial Intelligence Review*, 29(2):93–122, 2008.

[13] Sourav Mandal and Sudip Kumar Naskar. Solving arithmetic mathematical word problems: A review and recent advancements. In *Information Technology and Applied Mathematics*, pages 95–114. Springer, 2019.

[14] Mark Steedman and Jason Baldridge. Combinatory categorial grammar. *Non-Transformational Syntax: Formal and Explicit Models of Grammar*, pages 181–224, 2011.

[15] Takuya Matsuzaki, Hidenao Iwane, Hirokazu Anai, and Noriko H Arai. The most uncreative examinee: A first step toward wide coverage natural language math problem solving. In *AAAI*, pages 1098–1104, 2014.

[16] Takuya Matsuzaki, Takumi Ito, Hidenao Iwane, Hirokazu Anai, and Noriko H Arai. Semantic parsing of pre-university math problems. In *Pro-*

ceedings of the 55th Annual Meeting of the Association for Computational Linguistics (Volume 1: Long Papers), volume 1, pages 2131–2141, 2017.

[17] Shuming Shi, Yuehui Wang, Chin-Yew Lin, Xiaojiang Liu, and Yong Rui. Automatically solving number word problems by semantic parsing and reasoning. In *Proceedings of the 2015 Conference on Empirical Methods in Natural Language Processing*, pages 1132–1142, 2015.

[18] Subhro Roy. *Reasoning about quantities in natural language*. PhD thesis, University of Illinois at Urbana-Champaign, 2017.

[19] Lipu Zhou, Shuaixiang Dai, and Liwei Chen. Learn to solve algebra word problems using quadratic programming. In *Proceedings of the 2015 Conference on Empirical Methods in Natural Language Processing*, pages 817–822, 2015.

[20] Danqing Huang, Shuming Shi, Chin-Yew Lin, Jian Yin, and Wei-Ying Ma. How well do computers solve math word problems? large-scale dataset construction and evaluation. In *Proceedings of the 54th Annual Meeting of the Association for Computational Linguistics (Volume 1: Long Papers)*, volume 1, pages 887–896, 2016.

[21] Shyam Upadhyay and Ming-Wei Chang. Annotating derivations: A new evaluation strategy and dataset for algebra word problems. *arXiv preprint arXiv:1609.07197*, 2016.

[22] Rik Koncel-Kedziorski, Hannaneh Hajishirzi, Ashish Sabharwal, Oren Etzioni, and Siena Dumas Ang. Parsing algebraic word problems into equations. *Transactions of the Association for Computational Linguistics*, 3:585–597, 2015.

[23] Subhro Roy and Dan Roth. Solving general arithmetic word problems. *arXiv preprint arXiv:1608.01413*, 2016.

[24] Subhro Roy and Dan Roth. Unit dependency graph and its application to arithmetic word problem solving. *arXiv preprint arXiv:1612.00969*, 2016.

[25] Arindam Mitra and Chitta Baral. Learning to use formulas to solve simple arithmetic problems. In *Proceedings of the 54th Annual Meeting of the Association for Computational Linguistics (Volume 1: Long Papers)*, volume 1, pages 2144–2153, 2016.

[26] Suleyman Cetintas, Luo Si, Yan Ping Xin, Dake Zhang, and Joo Young Park. Automatic text categorization of mathematical word problems. In *FLAIRS Conference*, 2009.

[27] Pruthwik Mishra, Litton J Kurisinkel, and Dipti Misra Sharma. Arithmetic word problem solver using frame identification. *arXiv preprint arXiv:1808.03028*, 2018.

[28] Chao-Chun Liang, Shih-Hong Tsai, Ting-Yun Chang, Yi-Chung Lin, and Keh-Yih Su. A meaning-based english math word problem solver with understanding, reasoning and explanation. In *Proceedings of COLING 2016, the 26th International Conference on Computational Linguistics: System Demonstrations*, pages 151–155, 2016.

[29] Eugene Charniak. Carps: a program which solves calculus word problems. 1968.

[30] Bruce W Ballard and Alan W Biermann. Programming in natural language:âĂIJnlcâĂİ as a prototype. In *Proceedings of the 1979 annual conference*, pages 228–237. ACM, 1979.

[31] Johan De Kleer. Qualitative and quantitative knowledge in classical mechanics. 1975.

[32] Alan Bundy, George Luger, M Stone, and Robert Welham. Mecho: Year one. In *Proceedings of the 2nd Summer Conference on Artificial Intelligence and Simulation of Behaviour*, pages 94–103. IOS Press, 1976.

[33] Gordon S Novak Jr. Computer understanding of physics problems stated in natural language.(dissertation), also technical report nl-30. 1976.

[34] GE Oberem. Albert: a physics problem solving monitor and coach. In *Proceedings of the first international conference on computer assisted learning (ICCALâĂŹ87). Calgary Alberta, Canada*, pages 179–184, 1987.

[35] Xiaorong Huang. Human oriented proof presentation: A reconstructive approach. 1999.

[36] Kyle Morton and Yanzhen Qu. A novel framework for math word problem solving. *International Journal of Information and Education Technology*, 3(1):88, 2013.

[37] Rik Koncel-Kedziorski, Subhro Roy, Aida Amini, Nate Kushman, and Hannaneh Hajishirzi. Mawps: A math word problem repository. In *Proceedings of the 2016 Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies*, pages 1152–1157, 2016.

[38] Suleyman Cetintas, Luo Si, Yan Ping Xin, Dake Zhang, Joo Young Park, and Ron Tzur. A joint probabilistic classification model of relevant and irrelevant sentences in mathematical word problems. *arXiv preprint arXiv:1411.5732*, 2014.

[39] Xuedong Tian, Ruihan Bai, Fang Yang, Jinyuan Bai, and Xinfu Li. Mathematical expression extraction in text fields of documents based on hmm. *Journal of Computer and Communications*, 5(14):1, 2017.

[40] Oren Etzioni, Michael Cafarella, Doug Downey, Ana-Maria Popescu, Tal Shaked, Stephen Soderland, Daniel S Weld, and Alexander Yates. Unsupervised named-entity extraction from the web: An experimental study. *Artificial intelligence*, 165(1):91–134, 2005.

[41] Sean R. Eddy. Profile hidden markov models. *Bioinformatics (Oxford, England)*, 14(9):755–763, 1998.

[42] Daniel M Bikel, Scott Miller, Richard Schwartz, and Ralph Weischedel. Nymble: a high-performance learning name-finder. *arXiv preprint cmp-lg/9803003*, 1998.

[43] J. Ross Quinlan. Induction of decision trees. *Machine learning*, 1(1):81–106, 1986.

[44] Jagat Narain Kapur. *Maximum-entropy models in science and engineering.* John Wiley & Sons, 1989.

[45] Marti A. Hearst, Susan T Dumais, Edgar Osuna, John Platt, and Bernhard Scholkopf. Support vector machines. *IEEE Intelligent Systems and their applications*, 13(4):18–28, 1998.

[46] John Lafferty, Andrew McCallum, and Fernando CN Pereira. Conditional random fields: Probabilistic models for segmenting and labeling sequence data. 2001.

[47] Jenny Rose Finkel, Trond Grenager, and Christopher Manning. Incorporating non-local information into information extraction systems by gibbs sampling. In *Proceedings of the 43rd annual meeting on association for computational linguistics*, pages 363–370. Association for Computational Linguistics, 2005.

[48] David Nadeau and Satoshi Sekine. A survey of named entity recognition and classification. *Lingvisticae Investigationes*, 30(1):3–26, 2007.

[49] Rahul Sharnagat. Named entity recognition: A literature survey. *Center For Indian Language Technology*, 2014.

[50] Vikas Yadav and Steven Bethard. A survey on recent advances in named entity recognition from deep learning models. In *Proceedings of the 27th International Conference on Computational Linguistics*, pages 2145–2158, 2018.

[51] Jing Li, Aixin Sun, Jianglei Han, and Chenliang Li. A survey on deep learning for named entity recognition. *arXiv preprint arXiv:1812.09449*, 2018.

[52] Wenpeng Yin, Katharina Kann, Mo Yu, and Hinrich Schütze. Comparative study of cnn and rnn for natural language processing. *arXiv preprint arXiv:1702.01923*, 2017.

[53] Zhiheng Huang, Wei Xu, and Kai Yu. Bidirectional lstm-crf models for sequence tagging. *arXiv preprint arXiv:1508.01991*, 2015.

[54] Jason PC Chiu and Eric Nichols. Named entity recognition with bidirectional lstm-cnns. *Transactions of the Association for Computational Linguistics*, 4:357–370, 2016.

[55] Wang Ling, Tiago Luís, Luís Marujo, Ramón Fernandez Astudillo, Silvio Amir, Chris Dyer, Alan W Black, and Isabel Trancoso. Finding function in form: Compositional character models for open vocabulary word representation. *arXiv preprint arXiv:1508.02096*, 2015.

[56] John Venn. I. on the diagrammatic and mechanical representation of propositions and reasonings. *The London, Edinburgh, and Dublin philosophical magazine and journal of science*, 10(59):1–18, 1880.

[57] Aaron Meurer, Christopher P Smith, Mateusz Paprocki, Ondřej Čertík, Sergey B Kirpichev, Matthew Rocklin, AMiT Kumar, Sergiu Ivanov, Jason K Moore, Sartaj Singh, et al. Sympy: symbolic computing in python. *PeerJ Computer Science*, 3:e103, 2017.