

Bibliography

- Abadi, Martín, Agarwal, Ashish, Barham, Paul, Brevdo, Eugene, Chen, Zhifeng, Citro, Craig, Corrado, Greg S., Davis, Andy, Dean, Jeffrey, Devin, Matthieu, Ghemawat, Sanjay, Goodfellow, Ian, Harp, Andrew, Irving, Geoffrey, Isard, Michael, Jia, Yangqing, Jozefowicz, Rafal, Kaiser, Lukasz, Kudlur, Manjunath, Levenberg, Josh, Mané, Dandelion, Monga, Rajat, Moore, Sherry, Murray, Derek, Olah, Chris, Schuster, Mike, Shlens, Jonathon, Steiner, Benoit, Sutskever, Ilya, Talwar, Kunal, Tucker, Paul, Vanhoucke, Vincent, Vasudevan, Vijay, Viégas, Fernanda, Vinyals, Oriol, Warden, Pete, Wattenberg, Martin, Wicke, Martin, Yu, Yuan, and Zheng, Xiaoqiang. 2015. *TensorFlow: Large-Scale Machine Learning on Heterogeneous Systems*. Software available from tensorflow.org.
- Adamic, Lada A, and Adar, Eytan. 2003. Friends and neighbors on the web. *Social networks*, **25**(3), 211–230.
- Afsar Minhas, Fayyaz ul Amir, Geiss, Brian J, and Ben-Hur, Asa. 2014. PAIRpred: Partner-specific prediction of interacting residues from sequence and structure. *Proteins: Structure, Function, and Bioinformatics*, **82**(7), 1142–1155.
- Aggarwal, Charu C. 2018. Neural networks and deep learning. *Springer*, **10**, 978–3.
- Allamanis, Miltiadis, Brockschmidt, Marc, and Khademi, Mahmoud. 2017. Learning to represent programs with graphs. *arXiv preprint arXiv:1711.00740*.
- Andersen, Reid, Chung, Fan, and Lang, Kevin. 2006. Local graph partitioning using pagerank vectors. Pages 475–486 of: *2006 47th Annual IEEE Symposium on Foundations of Computer Science (FOCS'06)*. IEEE.
- Atwood, James, and Towsley, Don. 2016. Diffusion-convolutional neural networks. Pages 1993–2001 of: *Advances in neural information processing systems*.
- Babai, László. 2016. Graph isomorphism in quasipolynomial time. Pages 684–697 of: *Proceedings of the forty-eighth annual ACM symposium on Theory of Computing*.
- Bahdanau, Dzmitry, Cho, Kyunghyun, and Bengio, Yoshua. 2014. Neural machine translation by jointly learning to align and translate. *arXiv preprint arXiv:1409.0473*.
- Bai, Song, Zhang, Feihu, and Torr, Philip HS. 2019. Hypergraph convolution and hypergraph attention. *arXiv preprint arXiv:1901.08150*.
- Banarescu, Laura, Bonial, Claire, Cai, Shu, Georgescu, Madalina, Griffitt, Kira, Hermjakob, Ulf, Knight, Kevin, Koehn, Philipp, Palmer, Martha, and Schneider, Nathan. 2013. Abstract meaning representation for sembanking. Pages 178–186

- of: *Proceedings of the 7th Linguistic Annotation Workshop and Interoperability with Discourse*.
- Bastings, Joost, Titov, Ivan, Aziz, Wilker, Marcheggiani, Diego, and Sima'an, Khalil. 2017. Graph convolutional encoders for syntax-aware neural machine translation. *arXiv preprint arXiv:1704.04675*.
- Battaglia, Peter, Pascanu, Razvan, Lai, Matthew, Rezende, Danilo Jimenez, et al. 2016. Interaction networks for learning about objects, relations and physics. Pages 4502–4510 of: *Advances in neural information processing systems*.
- Battaglia, Peter W, Hamrick, Jessica B, Bapst, Victor, Sanchez-Gonzalez, Alvaro, Zambaldi, Vinicius, Malinowski, Mateusz, Tacchetti, Andrea, Raposo, David, Santoro, Adam, Faulkner, Ryan, et al. 2018. Relational inductive biases, deep learning, and graph networks. *arXiv preprint arXiv:1806.01261*.
- Baytas, Inci M, Xiao, Cao, Wang, Fei, Jain, Anil K, and Zhou, Jiayu. 2018. Heterogeneous Hyper-Network Embedding. Pages 875–880 of: *2018 IEEE International Conference on Data Mining (ICDM)*. IEEE.
- Beck, Daniel, Haffari, Gholamreza, and Cohn, Trevor. 2018. Graph-to-Sequence Learning using Gated Graph Neural Networks. Pages 273–283 of: *Proceedings of the 56th Annual Meeting of the Association for Computational Linguistics (Volume 1: Long Papers)*.
- Belkin, Mikhail, and Niyogi, Partha. 2003. Laplacian eigenmaps for dimensionality reduction and data representation. *Neural computation*, **15**(6), 1373–1396.
- Berg, Rianne van den, Kipf, Thomas N, and Welling, Max. 2017. Graph convolutional matrix completion. *arXiv preprint arXiv:1706.02263*.
- Berlusconi, Giulia, Calderoni, Francesco, Parolini, Nicola, Verani, Marco, and Piccardi, Carlo. 2016. Link prediction in criminal networks: A tool for criminal intelligence analysis. *PloS one*, **11**(4), e0154244.
- Bishop, Christopher M. 2006. *Pattern recognition and machine learning*. springer.
- Bonacich, Phillip. 1972. Factoring and weighting approaches to status scores and clique identification. *Journal of mathematical sociology*, **2**(1), 113–120.
- Bonacich, Phillip. 2007. Some unique properties of eigenvector centrality. *Social networks*, **29**(4), 555–564.
- Bonchev, Danail. 1991. *Chemical graph theory: introduction and fundamentals*. Vol. 1. CRC Press.
- Bondy, John Adrian, et al. *Graph theory with applications*. Vol. 290.
- Borgatti, Stephen P, Mehra, Ajay, Brass, Daniel J, and Labianca, Giuseppe. 2009. Network analysis in the social sciences. *science*, **323**(5916), 892–895.
- Bourigault, Simon, Lagnier, Cedric, Lamprier, Sylvain, Denoyer, Ludovic, and Gallinari, Patrick. 2014. Learning social network embeddings for predicting information diffusion. Pages 393–402 of: *Proceedings of the 7th ACM international conference on Web search and data mining*.
- Boyd, Stephen, Boyd, Stephen P, and Vandenberghe, Lieven. 2004. *Convex optimization*. Cambridge university press.
- Bracewell, Ronald Newbold. *The Fourier transform and its applications*. Vol. 31999.
- Bruna, Joan, Zaremba, Wojciech, Szlam, Arthur, and LeCun, Yann. 2013. Spectral networks and locally connected networks on graphs. *arXiv preprint arXiv:1312.6203*.

- Cai, Hongyun, Zheng, Vincent W, and Chang, Kevin Chen-Chuan. 2018. A comprehensive survey of graph embedding: Problems, techniques, and applications. *IEEE Transactions on Knowledge and Data Engineering*, **30**(9), 1616–1637.
- Cai, Jin-Yi, Fürer, Martin, and Immerman, Neil. 1992. An optimal lower bound on the number of variables for graph identification. *Combinatorica*, **12**(4), 389–410.
- Cao, Shaosheng, Lu, Wei, and Xu, Qionghai. 2015. Grarep: Learning graph representations with global structural information. Pages 891–900 of: *Proceedings of the 24th ACM international conference on information and knowledge management*.
- Cao, Shaosheng, Lu, Wei, and Xu, Qionghai. 2016. Deep neural networks for learning graph representations. In: *Thirtieth AAAI conference on artificial intelligence*.
- Cao, Yu, Fang, Meng, and Tao, Dacheng. 2019. BAG: Bi-directional Attention Entity Graph Convolutional Network for Multi-hop Reasoning Question Answering. Pages 357–362 of: *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)*.
- Carlini, Nicholas, and Wagner, David. 2017. Towards evaluating the robustness of neural networks. Pages 39–57 of: *2017 IEEE Symposium on Security and Privacy (SP)*. IEEE.
- Cartwright, Dorwin, and Harary, Frank. 1956. Structural balance: a generalization of Heider's theory. *Psychological review*, **63**(5), 277.
- Cauchy, Augustin. Méthode générale pour la résolution des systèmes d'équations simultanées.
- Chami, Ines, Ying, Zhitao, Ré, Christopher, and Leskovec, Jure. 2019. Hyperbolic graph convolutional neural networks. Pages 4868–4879 of: *Advances in neural information processing systems*.
- Chan, T-H Hubert, and Liang, Zhibin. 2019. Generalizing the hypergraph Laplacian via a diffusion process with mediators. *Theoretical Computer Science*.
- Chan, T-H Hubert, Louis, Anand, Tang, Zhihao Gavin, and Zhang, Chenzi. 2018. Spectral properties of hypergraph Laplacian and approximation algorithms. *Journal of the ACM (JACM)*, **65**(3), 15.
- Chang, Shiyu, Han, Wei, Tang, Jiliang, Qi, Guo-Jun, Aggarwal, Charu C, and Huang, Thomas S. 2015. Heterogeneous network embedding via deep architectures. Pages 119–128 of: *Proceedings of the 21th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*.
- Chaudhary, Anshika, Mittal, Himangi, and Arora, Anuja. 2019. Anomaly Detection Using Graph Neural Networks. Pages 346–350 of: *2019 International Conference on Machine Learning, Big Data, Cloud and Parallel Computing (COMITCon)*. IEEE.
- Chen, Jianfei, Zhu, Jun, and Song, Le. 2018a. Stochastic Training of Graph Convolutional Networks with Variance Reduction. Pages 941–949 of: *International Conference on Machine Learning*.
- Chen, Jie, Ma, Tengfei, and Xiao, Cao. 2018b. Fastgcn: fast learning with graph convolutional networks via importance sampling. *arXiv preprint arXiv:1801.10247*.
- Chen, Tianshui, Yu, Weihao, Chen, Riquan, and Lin, Liang. 2019a. Knowledge-embedded routing network for scene graph generation. Pages 6163–6171 of: *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*.

- Chen, Ting, and Sun, Yizhou. 2017. Task-guided and path-augmented heterogeneous network embedding for author identification. Pages 295–304 of: *Proceedings of the Tenth ACM International Conference on Web Search and Data Mining*.
- Chen, Xia, Yu, Guoxian, Wang, Jun, Domeniconi, Carlotta, Li, Zhao, and Zhang, Xi-angliang. 2019b. ActiveHNE: Active Heterogeneous Network Embedding. *arXiv preprint arXiv:1905.05659*.
- Chen, Zhao-Min, Wei, Xiu-Shen, Wang, Peng, and Guo, Yanwen. 2019c. Multi-Label Image Recognition with Graph Convolutional Networks. Pages 5177–5186 of: *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*.
- Chen, Zhengdao, Li, Xiang, and Bruna, Joan. 2017. Supervised community detection with line graph neural networks. *arXiv preprint arXiv:1705.08415*.
- Cheng, Kewei, Li, Jundong, and Liu, Huan. 2017. Unsupervised feature selection in signed social networks. Pages 777–786 of: *Proceedings of the 23rd ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*.
- Chiang, Wei-Lin, Liu, Xuanqing, Si, Si, Li, Yang, Bengio, Samy, and Hsieh, Cho-Jui. 2019. Cluster-gcn: An efficient algorithm for training deep and large graph convolutional networks. Pages 257–266 of: *Proceedings of the 25th ACM SIGKDD International Conference on Knowledge Discovery & Data Mining*.
- Cho, Kyunghyun, Van Merriënboer, Bart, Gulcehre, Caglar, Bahdanau, Dzmitry, Bougares, Fethi, Schwenk, Holger, and Bengio, Yoshua. 2014a. Learning phrase representations using RNN encoder-decoder for statistical machine translation. *arXiv preprint arXiv:1406.1078*.
- Cho, Minsu, Sun, Jian, Duchenne, Olivier, and Ponce, Jean. 2014b. Finding matches in a haystack: A max-pooling strategy for graph matching in the presence of outliers. Pages 2083–2090 of: *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*.
- Choi, Edward, Xu, Zhen, Li, Yujia, Dusenberry, Michael, Flores, Gerardo, Xue, Emily, and Dai, Andrew. 2020. Learning the Graphical Structure of Electronic Health Records with Graph Convolutional Transformer. Pages 606–613 of: *Proceedings of the AAAI Conference on Artificial Intelligence*, vol. 34.
- Chung, Fan RK, and Graham, Fan Chung. 1997. *Spectral graph theory*. American Mathematical Soc.
- Cohen, Marco Damonte Shay B. 2019. Structural Neural Encoders for AMR-to-text Generation. Pages 3649–3658 of: *Proceedings of NAACL-HLT*.
- Cui, Peng, Wang, Xiao, Pei, Jian, and Zhu, Wenwu. 2018. A survey on network embedding. *IEEE Transactions on Knowledge and Data Engineering*, **31**(5), 833–852.
- Cygan, Marek, Pilipczuk, Marcin, Pilipczuk, Michał, and Woitaszczyk, Jakub Onufry. 2012. Sitting closer to friends than enemies, revisited. Pages 296–307 of: *International Symposium on Mathematical Foundations of Computer Science*. Springer.
- Dahl, George, Ranzato, Marc’Aurelio, Mohamed, Abdel-rahman, and Hinton, Geoffrey E. 2010. Phone recognition with the mean-covariance restricted Boltzmann machine. Pages 469–477 of: *Advances in neural information processing systems*.
- Dai, Hanjun, Li, Hui, Tian, Tian, Huang, Xin, Wang, Lin, Zhu, Jun, and Song, Le. 2018. Adversarial Attack on Graph Structured Data. In: *Proceedings of the 35th International Conference on Machine Learning, PMLR*, vol. 80.

- De Cao, Nicola, and Kipf, Thomas. 2018. MolGAN: An implicit generative model for small molecular graphs. *arXiv preprint arXiv:1805.11973*.
- De Cao, Nicola, Aziz, Wilker, and Titov, Ivan. 2019. Question Answering by Reasoning Across Documents with Graph Convolutional Networks. Pages 2306–2317 of: *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)*.
- Deerwester, Scott, Dumais, Susan T, Furnas, George W, Landauer, Thomas K, and Harshman, Richard. 1990. Indexing by latent semantic analysis. *Journal of the American society for information science*, **41**(6), 391–407.
- Defferrard, Michaël, Bresson, Xavier, and Vandergheynst, Pierre. 2016. Convolutional neural networks on graphs with fast localized spectral filtering. Pages 3844–3852 of: *Advances in neural information processing systems*.
- Deng, Li, and Liu, Yang. 2018. *Deep learning in natural language processing*. Springer.
- Deng, Li, Seltzer, Michael L, Yu, Dong, Acero, Alex, Mohamed, Abdel-rahman, and Hinton, Geoff. 2010. Binary coding of speech spectrograms using a deep auto-encoder. In: *Eleventh Annual Conference of the International Speech Communication Association*.
- Derr, Tyler, Ma, Yao, and Tang, Jiliang. 2018. Signed graph convolutional networks. Pages 929–934 of: *2018 IEEE International Conference on Data Mining (ICDM)*. IEEE.
- Devlin, Jacob, Chang, Ming-Wei, Lee, Kenton, and Toutanova, Kristina. 2018. Bert: Pre-training of deep bidirectional transformers for language understanding. *arXiv preprint arXiv:1810.04805*.
- Dhillon, Inderjit S, Guan, Yuqiang, and Kulis, Brian. 2007. Weighted graph cuts without eigenvectors a multilevel approach. *IEEE transactions on pattern analysis and machine intelligence*, **29**(11), 1944–1957.
- Di Martino, Adriana, Yan, Chao-Gan, Li, Qingyang, Denio, Erin, Castellanos, Francisco X, Alaerts, Kaat, Anderson, Jeffrey S, Assaf, Michal, Bookheimer, Susan Y, Dapretto, Mirella, et al. 2014. The autism brain imaging data exchange: towards a large-scale evaluation of the intrinsic brain architecture in autism. *Molecular psychiatry*, **19**(6), 659–667.
- Dong, Yuxiao, Chawla, Nitesh V, and Swami, Ananthram. 2017. metapath2vec: Scalable representation learning for heterogeneous networks. Pages 135–144 of: *Proceedings of the 23rd ACM SIGKDD international conference on knowledge discovery and data mining*. ACM.
- Duchi, John, Hazan, Elad, and Singer, Yoram. 2011. Adaptive subgradient methods for online learning and stochastic optimization. *Journal of Machine Learning Research*, **12**(Jul), 2121–2159.
- Duvenaud, David K, Maclaurin, Dougal, Iparraguirre, Jorge, Bombarell, Rafael, Hirzel, Timothy, Aspuru-Guzik, Alán, and Adams, Ryan P. 2015. Convolutional networks on graphs for learning molecular fingerprints. Pages 2224–2232 of: *Advances in neural information processing systems*.
- Entezari, Negin, Al-Sayouri, Saba A, Darvishzadeh, Amirali, and Papalexakis, Evangelos E. 2020. All You Need Is Low (Rank) Defending Against Adversarial Attacks on Graphs. Pages 169–177 of: *Proceedings of the 13th International Conference on Web Search and Data Mining*.

- Fan, Wenqi, Ma, Yao, Li, Qing, He, Yuan, Zhao, Eric, Tang, Jiliang, and Yin, Dawei. 2019. Graph Neural Networks for Social Recommendation. Pages 417–426 of: *The World Wide Web Conference*. ACM.
- Feller, William. 1957. An introduction to probability theory and its applications. *aitp*.
- Feng, Fuli, He, Xiangnan, Tang, Jie, and Chua, Tat-Seng. 2019a. Graph adversarial training: Dynamically regularizing based on graph structure. *IEEE Transactions on Knowledge and Data Engineering*.
- Feng, Yifan, You, Haoxuan, Zhang, Zizhao, Ji, Rongrong, and Gao, Yue. 2019b. Hyper-graph neural networks. Pages 3558–3565 of: *Proceedings of the AAAI Conference on Artificial Intelligence*, vol. 33.
- Fernandes, Patrick, Allamanis, Miltiadis, and Brockschmidt, Marc. 2018. Structured neural summarization. *arXiv preprint arXiv:1811.01824*.
- Fey, Matthias, and Lenssen, Jan E. 2019. Fast Graph Representation Learning with PyTorch Geometric. In: *ICLR Workshop on Representation Learning on Graphs and Manifolds*.
- Finn, Chelsea, Abbeel, Pieter, and Levine, Sergey. 2017. Model-agnostic meta-learning for fast adaptation of deep networks. Pages 1126–1135 of: *Proceedings of the 34th International Conference on Machine Learning-Volume 70*. JMLR. org.
- Fouss, Francois, Pirotte, Alain, Renders, Jean-Michel, and Saerens, Marco. 2007. Random-walk computation of similarities between nodes of a graph with application to collaborative recommendation. *IEEE Transactions on knowledge and data engineering*, **19**(3), 355–369.
- Fout, Alex, Byrd, Jonathon, Shariat, Basir, and Ben-Hur, Asa. 2017. Protein interface prediction using graph convolutional networks. Pages 6530–6539 of: *Advances in Neural Information Processing Systems*.
- Frobenius, Georg, Frobenius, Ferdinand Georg, Frobenius, Ferdinand Georg, Frobenius, Ferdinand Georg, and Mathematician, Germany. 1912. Über Matrizen aus nicht negativen Elementen.
- Fu, Tsu-Jui, Li, Peng-Hsuan, and Ma, Wei-Yun. 2019. GraphRel: Modeling text as relational graphs for joint entity and relation extraction. Pages 1409–1418 of: *Proceedings of the 57th Annual Meeting of the Association for Computational Linguistics*.
- Gao, Hongyang, and Ji, Shuiwang. 2019. Graph U-Nets. Pages 2083–2092 of: Chaudhuri, Kamalika, and Salakhutdinov, Ruslan (eds), *Proceedings of the 36th International Conference on Machine Learning, ICML 2019, 9-15 June 2019, Long Beach, California, USA*. Proceedings of Machine Learning Research, vol. 97. PMLR.
- Gao, Hongyang, Wang, Zhengyang, and Ji, Shuiwang. 2018a. Large-scale learnable graph convolutional networks. Pages 1416–1424 of: *Proceedings of the 24th ACM SIGKDD International Conference on Knowledge Discovery & Data Mining*.
- Gao, Hongyang, Wang, Zhengyang, and Ji, Shuiwang. 2020. Kronecker Attention Networks. Pages 229–237 of: *Proceedings of the 26th ACM SIGKDD International Conference on Knowledge Discovery & Data Mining*.
- Gao, Ming, Chen, Leihui, He, Xiangnan, and Zhou, Aoying. 2018b. Bine: Bipartite network embedding. Pages 715–724 of: *The 41st International ACM SIGIR Conference on Research & Development in Information Retrieval*.
- Garey, Michael R, and Johnson, David S. *Computers and intractability*. Vol. 174.

- Gidaris, Spyros, and Komodakis, Nikos. 2019. Generating classification weights with gnn denoising autoencoders for few-shot learning. Pages 21–30 of: *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*.
- Gilmer, Justin, Schoenholz, Samuel S., Riley, Patrick F., Vinyals, Oriol, and Dahl, George E. 2017. Neural Message Passing for Quantum Chemistry. Pages 1263–1272 of: Precup, Doina, and Teh, Yee Whye (eds), *Proceedings of the 34th International Conference on Machine Learning, ICML 2017, Sydney, NSW, Australia, 6-11 August 2017*. Proceedings of Machine Learning Research, vol. 70. PMLR.
- Goldberg, David, Nichols, David, Oki, Brian M, and Terry, Douglas. 1992. Using collaborative filtering to weave an information tapestry. *Communications of the ACM*, **35**(12), 61–70.
- Goldberg, Ken, Roeder, Theresa, Gupta, Dhruv, and Perkins, Chris. 2001. Eigentaste: A constant time collaborative filtering algorithm. *information retrieval*, **4**(2), 133–151.
- Goldberg, Yoav. 2016. A primer on neural network models for natural language processing. *Journal of Artificial Intelligence Research*, **57**, 345–420.
- Goodfellow, Ian, Pouget-Abadie, Jean, Mirza, Mehdi, Xu, Bing, Warde-Farley, David, Ozair, Sherjil, Courville, Aaron, and Bengio, Yoshua. 2014a. Generative adversarial nets. Pages 2672–2680 of: *Advances in neural information processing systems*.
- Goodfellow, Ian, Bengio, Yoshua, and Courville, Aaron. 2016. *Deep learning*.
- Goodfellow, Ian J, Shlens, Jonathon, and Szegedy, Christian. 2014b. Explaining and harnessing adversarial examples. *arXiv preprint arXiv:1412.6572*.
- Goyal, Palash, and Ferrara, Emilio. 2018. Graph embedding techniques, applications, and performance: A survey. *Knowledge-Based Systems*, **151**, 78–94.
- Grover, Aditya, and Leskovec, Jure. 2016. node2vec: Scalable feature learning for networks. Pages 855–864 of: *Proceedings of the 22nd ACM SIGKDD international conference on Knowledge discovery and data mining*. ACM.
- Gu, Quanquan, and Han, Jiawei. 2011. Towards feature selection in network. Pages 1175–1184 of: *Proceedings of the 20th ACM international conference on Information and knowledge management*.
- Gu, Yupeng, Sun, Yizhou, Li, Yanen, and Yang, Yang. 2018. Rare: Social rank regulated large-scale network embedding. Pages 359–368 of: *Proceedings of the 2018 World Wide Web Conference*.
- Guo, Zhijiang, Zhang, Yan, and Lu, Wei. 2019. Attention Guided Graph Convolutional Networks for Relation Extraction. *arXiv preprint arXiv:1906.07510*.
- Gutmann, Michael U, and Hyvärinen, Aapo. 2012. Noise-contrastive estimation of unnormalized statistical models, with applications to natural image statistics. *Journal of Machine Learning Research*, **13**(Feb), 307–361.
- Hagberg, Aric, Swart, Pieter, and S Chult, Daniel. 2008. *Exploring network structure, dynamics, and function using NetworkX*. Tech. rept. Los Alamos National Lab.(LANL), Los Alamos, NM (United States).
- Hamaguchi, Takuo, Oiwa, Hidekazu, Shimbo, Masashi, and Matsumoto, Yuji. 2017. Knowledge transfer for out-of-knowledge-base entities: a graph neural network approach. Pages 1802–1808 of: *Proceedings of the 26th International Joint Conference on Artificial Intelligence*. AAAI Press.

- Hamilton, Will, Ying, Zhitao, and Leskovec, Jure. 2017a. Inductive representation learning on large graphs. Pages 1024–1034 of: *Advances in Neural Information Processing Systems*.
- Hamilton, William L, Ying, Rex, and Leskovec, Jure. 2017b. Representation learning on graphs: Methods and applications. *arXiv preprint arXiv:1709.05584*.
- Han, Jiangfan, Luo, Ping, and Wang, Xiaogang. 2019. Deep self-learning from noisy labels. Pages 5138–5147 of: *Proceedings of the IEEE International Conference on Computer Vision*.
- Han, Jiawei, Pei, Jian, and Kamber, Micheline. 2011. *Data mining: concepts and techniques*. Elsevier.
- He, Chaoyang, Xie, Tian, Rong, Yu, Huang, Wenbing, Li, Yanfang, Huang, Junzhou, Ren, Xiang, and Shahabi, Cyrus. 2019. Bipartite Graph Neural Networks for Efficient Node Representation Learning. *arXiv preprint arXiv:1906.11994*.
- He, Kaiming, Zhang, Xiangyu, Ren, Shaoqing, and Sun, Jian. 2016. Deep residual learning for image recognition. Pages 770–778 of: *Proceedings of the IEEE conference on computer vision and pattern recognition*.
- Heider, Fritz. 1946. Attitudes and cognitive organization. *The Journal of psychology*, **21**(1), 107–112.
- Hochreiter, Sepp, and Schmidhuber, Jürgen. 1997. Long short-term memory. *Neural computation*, **9**(8), 1735–1780.
- Hoffman, Kenneth, and Kunze, Ray. Linear algebra. 1971. *Englewood Cliffs, New Jersey*.
- Hu, Weihua, Liu, Bowen, Gomes, Joseph, Zitnik, Marinka, Liang, Percy, Pande, Vijay, and Leskovec, Jure. 2019. Pre-training graph neural networks. *arXiv preprint arXiv:1905.12265*.
- Hu, Ziniu, Dong, Yuxiao, Wang, Kuansan, Chang, Kai-Wei, and Sun, Yizhou. 2020. GPT-GNN: Generative Pre-Training of Graph Neural Networks. *arXiv preprint arXiv:2006.15437*.
- Huang, Qiang, Xia, Tingyu, Sun, Huiyan, Yamada, Makoto, and Chang, Yi. 2020. Unsupervised Nonlinear Feature Selection from High-Dimensional Signed Networks. Pages 4182–4189 of: *AAAI*.
- Huang, Wenbing, Zhang, Tong, Rong, Yu, and Huang, Junzhou. 2018. Adaptive sampling towards fast graph representation learning. Pages 4558–4567 of: *Advances in Neural Information Processing Systems*.
- Ioffe, Sergey, and Szegedy, Christian. 2015. Batch normalization: Accelerating deep network training by reducing internal covariate shift. *arXiv preprint arXiv:1502.03167*.
- Jeong, Dasaem, Kwon, Taegyun, Kim, Yoojin, and Nam, Juhan. 2019. Graph neural network for music score data and modeling expressive piano performance. Pages 3060–3070 of: *International Conference on Machine Learning*.
- Jiang, Jianwen, Wei, Yuxuan, Feng, Yifan, Cao, Jingxuan, and Gao, Yue. 2019. Dynamic Hypergraph Neural Networks. Pages 2635–2641 of: *IJCAI*.
- Jin, Hongwei, and Zhang, Xinhua. Latent adversarial training of graph convolution networks.
- Jin, Wei, Li, Yaxin, Xu, Han, Wang, Yiqi, and Tang, Jiliang. 2020a. Adversarial Attacks and Defenses on Graphs: A Review and Empirical Study. *arXiv preprint arXiv:2003.00653*.

- Jin, Wei, Ma, Yao, Liu, Xiaorui, Tang, Xianfeng, Wang, Suhang, and Tang, Jiliang. 2020b. Graph Structure Learning for Robust Graph Neural Networks. *arXiv preprint arXiv:2005.10203*.
- Jin, Wei, Derr, Tyler, Liu, Haochen, Wang, Yiqi, Wang, Suhang, Liu, Zitao, and Tang, Jiliang. 2020c. Self-supervised Learning on Graphs: Deep Insights and New Direction. *arXiv preprint arXiv:2006.10141*.
- Jin, Wengong, Barzilay, Regina, and Jaakkola, Tommi. 2018. Junction tree variational autoencoder for molecular graph generation. *arXiv preprint arXiv:1802.04364*.
- Joshi, Chaitanya K, Laurent, Thomas, and Bresson, Xavier. 2019. An efficient graph convolutional network technique for the travelling salesman problem. *arXiv preprint arXiv:1906.01227*.
- Joyce, James M. 2011. *Kullback-Leibler Divergence*.
- Jurafsky, Daniel, and Martin, James H. *Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition*.
- Kamath, Uday, Liu, John, and Whitaker, James. 2019. *Deep learning for nlp and speech recognition*. Vol. 84. Springer.
- Kampffmeyer, Michael, Chen, Yinbo, Liang, Xiaodan, Wang, Hao, Zhang, Yujia, and Xing, Eric P. 2019. Rethinking knowledge graph propagation for zero-shot learning. Pages 11487–11496 of: *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*.
- Kana, Rajesh K, Uddin, Lucina Q, Kenet, Tal, Chugani, Diane, and Müller, Ralph-Axel. 2014. Brain connectivity in autism. *Frontiers in Human Neuroscience*, **8**, 349.
- Karypis, George, and Kumar, Vipin. 1998. A fast and high quality multilevel scheme for partitioning irregular graphs. *SIAM Journal on scientific Computing*, **20**(1), 359–392.
- Khademi, Mahmoud, and Schulte, Oliver. 2020. Deep Generative Probabilistic Graph Neural Networks for Scene Graph Generation. Pages 11237–11245 of: *AAAI*.
- Khalil, Elias, Dai, Hanjun, Zhang, Yuyu, Dilkina, Bistra, and Song, Le. 2017. Learning combinatorial optimization algorithms over graphs. Pages 6348–6358 of: *Advances in Neural Information Processing Systems*.
- Kingma, Diederik P, and Ba, Jimmy. 2014. Adam: A method for stochastic optimization. *arXiv preprint arXiv:1412.6980*.
- Kingma, Diederik P, and Welling, Max. 2013. Auto-encoding variational bayes. *arXiv preprint arXiv:1312.6114*.
- Kipf, Thomas, Fetaya, Ethan, Wang, Kuan-Chieh, Welling, Max, and Zemel, Richard. 2018. Neural relational inference for interacting systems. *arXiv preprint arXiv:1802.04687*.
- Kipf, Thomas N, and Welling, Max. 2016a. Semi-supervised classification with graph convolutional networks. *arXiv preprint arXiv:1609.02907*.
- Kipf, Thomas N, and Welling, Max. 2016b. Variational graph auto-encoders. *arXiv preprint arXiv:1611.07308*.
- Koren, Yehuda, Bell, Robert, and Volinsky, Chris. 2009. Matrix factorization techniques for recommender systems. *Computer*, **42**(8), 30–37.
- Krizhevsky, Alex, Sutskever, Ilya, and Hinton, Geoffrey E. 2012. Imagenet classification with deep convolutional neural networks. Pages 1097–1105 of: *Advances in neural information processing systems*.

- Kuhn, Michael, Letunic, Ivica, Jensen, Lars Juhl, and Bork, Peer. 2016. The SIDER database of drugs and side effects. *Nucleic acids research*, **44**(D1), D1075–D1079.
- Kunegis, Jérôme, Lommatzsch, Andreas, and Bauckhage, Christian. 2009. The slashdot zoo: mining a social network with negative edges. Pages 741–750 of: *Proceedings of the 18th international conference on World wide web*. ACM.
- Lai, Yi-An, Hsu, Chin-Chi, Chen, Wen Hao, Yeh, Mi-Yen, and Lin, Shou-De. 2017. Prune: Preserving proximity and global ranking for network embedding. Pages 5257–5266 of: *Advances in neural information processing systems*.
- Le Cun, Yann, and Fogelman-Soulié, Françoise. 1987. Modèles connexionnistes de l'apprentissage. *Intellectica*, **2**(1), 114–143.
- Lee, John Boaz, Rossi, Ryan, and Kong, Xiangnan. 2018. Graph classification using structural attention. Pages 1666–1674 of: *Proceedings of the 24th ACM SIGKDD International Conference on Knowledge Discovery & Data Mining*.
- Lee, Junhyun, Lee, Inyeop, and Kang, Jaewoo. 2019. Self-Attention Graph Pooling. Pages 3734–3743 of: Chaudhuri, Kamalika, and Salakhutdinov, Ruslan (eds), *Proceedings of the 36th International Conference on Machine Learning, ICML 2019, 9-15 June 2019, Long Beach, California, USA*. Proceedings of Machine Learning Research, vol. 97. PMLR.
- Lee, Kenton, He, Luheng, Lewis, Mike, and Zettlemoyer, Luke. 2017. End-to-end neural coreference resolution. *arXiv preprint arXiv:1707.07045*.
- Leskovec, Jure, and Krevl, Andrej. 2014. *SNAP Datasets: Stanford Large Network Dataset Collection*.
- Leskovec, Jure, and Sosič, Rok. 2016. SNAP: A General-Purpose Network Analysis and Graph-Mining Library. *ACM Transactions on Intelligent Systems and Technology (TIST)*, **8**(1), 1.
- Leskovec, Jure, Huttenlocher, Daniel, and Kleinberg, Jon. 2010a. Predicting positive and negative links in online social networks. Pages 641–650 of: *Proceedings of the 19th international conference on World wide web*. ACM.
- Leskovec, Jure, Huttenlocher, Daniel, and Kleinberg, Jon. 2010b. Signed networks in social media. Pages 1361–1370 of: *Proceedings of the SIGCHI conference on human factors in computing systems*. ACM.
- Li, Chang, and Goldwasser, Dan. 2019. Encoding Social Information with Graph Convolutional Networks for Political Perspective Detection in News Media. Pages 2594–2604 of: *Proceedings of the 57th Annual Meeting of the Association for Computational Linguistics*.
- Li, Chaolong, Cui, Zhen, Zheng, Wenming, Xu, Chunyan, and Yang, Jian. 2018a. Spatio-temporal graph convolution for skeleton based action recognition. In: *Thirty-Second AAAI Conference on Artificial Intelligence*.
- Li, Chunyan, Liu, Hongju, Hu, Qian, Que, Jinlong, and Yao, Junfeng. 2019a. A novel computational model for predicting microRNA–disease associations based on heterogeneous graph convolutional networks. *Cells*, **8**(9), 977.
- Li, Jundong, Hu, Xia, Jian, Ling, and Liu, Huan. 2016. Toward time-evolving feature selection on dynamic networks. Pages 1003–1008 of: *2016 IEEE 16th International Conference on Data Mining (ICDM)*. IEEE.

- Li, Jundong, Dani, Harsh, Hu, Xia, Tang, Jiliang, Chang, Yi, and Liu, Huan. 2017a. Attributed network embedding for learning in a dynamic environment. Pages 387–396 of: *Proceedings of the 2017 ACM on Conference on Information and Knowledge Management*. ACM.
- Li, Jundong, Cheng, Kewei, Wang, Suhang, Morstatter, Fred, Trevino, Robert P, Tang, Jiliang, and Liu, Huan. 2017b. Feature selection: A data perspective. *ACM Computing Surveys (CSUR)*, **50**(6), 1–45.
- Li, Jundong, Guo, Ruocheng, Liu, Chenghao, and Liu, Huan. 2019b. Adaptive unsupervised feature selection on attributed networks. Pages 92–100 of: *Proceedings of the 25th ACM SIGKDD International Conference on Knowledge Discovery & Data Mining*.
- Li, Maosen, Chen, Siheng, Chen, Xu, Zhang, Ya, Wang, Yanfeng, and Tian, Qi. 2019c. Actional-Structural Graph Convolutional Networks for Skeleton-based Action Recognition. Pages 3595–3603 of: *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*.
- Li, Qimai, Han, Zhichao, and Wu, Xiao-Ming. 2018b. Deeper Insights Into Graph Convolutional Networks for Semi-Supervised Learning. Pages 3538–3545 of: McIlraith, Sheila A., and Weinberger, Kilian Q. (eds), *Proceedings of the Thirty-Second AAAI Conference on Artificial Intelligence (AAAI-18), the 30th innovative Applications of Artificial Intelligence (IAAI-18), and the 8th AAAI Symposium on Educational Advances in Artificial Intelligence (EAAI-18), New Orleans, Louisiana, USA, February 2-7, 2018*. AAAI Press.
- Li, Ruoyu, Wang, Sheng, Zhu, Feiyun, and Huang, Junzhou. 2018c. Adaptive graph convolutional neural networks. In: *Thirty-Second AAAI Conference on Artificial Intelligence*.
- Li, Yaxin, Jin, Wei, Xu, Han, and Tang, Jiliang. 2020a. DeepRobust: A PyTorch Library for Adversarial Attacks and Defenses. *arXiv preprint arXiv:2005.06149*.
- Li, Ye, Sha, Chaofeng, Huang, Xin, and Zhang, Yanchun. 2018d. Community detection in attributed graphs: An embedding approach. In: *Thirty-Second AAAI Conference on Artificial Intelligence*.
- Li, Yu, Tian, Yuan, Zhang, Jiawei, and Chang, Yi. 2020b. Learning Signed Network Embedding via Graph Attention. In: *Proceedings of the Thirty-Fourth AAAI Conference on Artificial Intelligence*.
- Li, Yujia, Tarlow, Daniel, Brockschmidt, Marc, and Zemel, Richard. 2015. Gated graph sequence neural networks. *arXiv preprint arXiv:1511.05493*.
- Li, Zhuwen, Chen, Qifeng, and Koltun, Vladlen. 2018e. Combinatorial optimization with graph convolutional networks and guided tree search. Pages 539–548 of: *Advances in Neural Information Processing Systems*.
- Liang, Xiaodan, Shen, Xiaohui, Feng, Jiashi, Lin, Liang, and Yan, Shuicheng. 2016. Semantic object parsing with graph lstm. Pages 125–143 of: *European Conference on Computer Vision*. Springer.
- Liao, Renjie, Li, Yujia, Song, Yang, Wang, Shenlong, Hamilton, Will, Duvenaud, David K, Urtasun, Raquel, and Zemel, Richard. 2019. Efficient graph generation with graph recurrent attention networks. Pages 4255–4265 of: *Advances in Neural Information Processing Systems*.
- Lin, Yankai, Liu, Zhiyuan, Sun, Maosong, Liu, Yang, and Zhu, Xuan. 2015. Learning

- entity and relation embeddings for knowledge graph completion. In: *Twenty-ninth AAAI conference on artificial intelligence*.
- Ling, Huan, Gao, Jun, Kar, Amlan, Chen, Wenzheng, and Fidler, Sanja. 2019. Fast interactive object annotation with curve-gcn. Pages 5257–5266 of: *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*.
- Liu, Huan, and Motoda, Hiroshi. 2007. *Computational methods of feature selection*. CRC Press.
- Liu, Huan, and Motoda, Hiroshi. 2012. *Feature selection for knowledge discovery and data mining*. Vol. 454. Springer Science & Business Media.
- Liu, Ke, Sun, Xiangyan, Jia, Lei, Ma, Jun, Xing, Haoming, Wu, Junqiu, Gao, Hua, Sun, Yax, Boulnois, Florian, and Fan, Jie. 2018a. Chemi-net: a graph convolutional network for accurate drug property prediction. *arXiv preprint arXiv:1803.06236*.
- Liu, Qi, Nickel, Maximilian, and Kiela, Douwe. 2019a. Hyperbolic graph neural networks. Pages 8230–8241 of: *Advances in Neural Information Processing Systems*.
- Liu, Zhiwei, Dou, Yingdong, Yu, Philip S, Deng, Yutong, and Peng, Hao. 2020. Alleviating the Inconsistency Problem of Applying Graph Neural Network to Fraud Detection. *arXiv preprint arXiv:2005.00625*.
- Liu, Ziqi, Chen, Chaochao, Yang, Xinxing, Zhou, Jun, Li, Xiaolong, and Song, Le. 2018b. Heterogeneous graph neural networks for malicious account detection. Pages 2077–2085 of: *Proceedings of the 27th ACM International Conference on Information and Knowledge Management*.
- Liu, Ziqi, Chen, Chaochao, Li, Longfei, Zhou, Jun, Li, Xiaolong, Song, Le, and Qi, Yuan. 2019b. Geniepath: Graph neural networks with adaptive receptive paths. Pages 4424–4431 of: *Proceedings of the AAAI Conference on Artificial Intelligence*, vol. 33.
- Ma, Lingxiao, Yang, Zhi, Miao, Youshan, Xue, Jilong, Wu, Ming, Zhou, Lidong, and Dai, Yafei. 2018a. Towards efficient large-scale graph neural network computing. *arXiv preprint arXiv:1810.08403*.
- Ma, Lingxiao, Yang, Zhi, Miao, Youshan, Xue, Jilong, Wu, Ming, Zhou, Lidong, and Dai, Yafei. 2019a. Neugraph: parallel deep neural network computation on large graphs. Pages 443–458 of: *2019 {USENIX} Annual Technical Conference ({USENIX}{ATC} 19)*.
- Ma, Tengfei, Chen, Jie, and Xiao, Cao. 2018b. Constrained generation of semantically valid graphs via regularizing variational autoencoders. Pages 7113–7124 of: *Advances in Neural Information Processing Systems*.
- Ma, Tengfei, Xiao, Cao, Zhou, Jiayu, and Wang, Fei. 2018c. Drug similarity integration through attentive multi-view graph auto-encoders. *arXiv preprint arXiv:1804.10850*.
- Ma, Yao, Wang, Suhang, Ren, ZhaoChun, Yin, Dawei, and Tang, Jiliang. 2017. Preserving local and global information for network embedding. *arXiv preprint arXiv:1710.07266*.
- Ma, Yao, Ren, Zhaochun, Jiang, Ziheng, Tang, Jiliang, and Yin, Dawei. 2018d. Multi-dimensional network embedding with hierarchical structure. Pages 387–395 of: *Proceedings of the Eleventh ACM International Conference on Web Search and Data Mining*.

- Ma, Yao, Wang, Suhang, Aggarwal, Charu C., and Tang, Jiliang. 2019b. Graph Convolutional Networks with EigenPooling. Pages 723–731 of: Teredesai, Ankur, Kumar, Vipin, Li, Ying, Rosales, Rómer, Terzi, Evimaria, and Karypis, George (eds), *Proceedings of the 25th ACM SIGKDD International Conference on Knowledge Discovery & Data Mining, KDD 2019, Anchorage, AK, USA, August 4-8, 2019*. ACM.
- Ma, Yao, Wang, Suhang, Aggarwal, Chara C, Yin, Dawei, and Tang, Jiliang. 2019c. Multi-dimensional Graph Convolutional Networks. Pages 657–665 of: *Proceedings of the 2019 SIAM International Conference on Data Mining*. SIAM.
- Ma, Yao, Wang, Suhang, Derr, Tyler, Wu, Lingfei, and Tang, Jiliang. 2020a. *Attacking Graph Convolutional Networks via Rewiring*.
- Ma, Yao, Guo, Ziyi, Ren, Zhaocun, Tang, Jiliang, and Yin, Dawei. 2020b. Streaming graph neural networks. Pages 719–728 of: *Proceedings of the 43rd International ACM SIGIR Conference on Research and Development in Information Retrieval*.
- Maas, Andrew L, Hannun, Awni Y, and Ng, Andrew Y. 2013. Rectifier nonlinearities improve neural network acoustic models. In: *in ICML Workshop on Deep Learning for Audio, Speech and Language Processing*. Citeseer.
- Marcheggiani, Diego, and Titov, Ivan. 2017. Encoding Sentences with Graph Convolutional Networks for Semantic Role Labeling. Pages 1506–1515 of: *Proceedings of the 2017 Conference on Empirical Methods in Natural Language Processing*.
- Marcheggiani, Diego, Bastings, Joost, and Titov, Ivan. 2018. Exploiting Semantics in Neural Machine Translation with Graph Convolutional Networks. Pages 486–492 of: *Proceedings of the 2018 Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies, Volume 2 (Short Papers)*.
- McCulloch, Warren S, and Pitts, Walter. 1943. A logical calculus of the ideas immanent in nervous activity. *The bulletin of mathematical biophysics*, 5(4), 115–133.
- Menon, Aditya Krishna, and Elkan, Charles. 2011. Link prediction via matrix factorization. Pages 437–452 of: *Joint european conference on machine learning and knowledge discovery in databases*. Springer.
- Mikolov, Tomas, Sutskever, Ilya, Chen, Kai, Corrado, Greg S, and Dean, Jeff. 2013. Distributed representations of words and phrases and their compositionality. Pages 3111–3119 of: *Advances in neural information processing systems*.
- Mishra, Pushkar, Del Tredici, Marco, Yannakoudakis, Helen, and Shutova, Ekaterina. 2019. Abusive Language Detection with Graph Convolutional Networks. Pages 2145–2150 of: *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)*.
- Miwa, Makoto, and Bansal, Mohit. 2016. End-to-end relation extraction using lstms on sequences and tree structures. *arXiv preprint arXiv:1601.00770*.
- Monti, Federico, Bronstein, Michael, and Bresson, Xavier. 2017. Geometric matrix completion with recurrent multi-graph neural networks. Pages 3697–3707 of: *Advances in Neural Information Processing Systems*.
- Monti, Federico, Frasca, Fabrizio, Eynard, Davide, Mannion, Damon, and Bronstein, Michael M. 2019. Fake news detection on social media using geometric deep learning. *arXiv preprint arXiv:1902.06673*.

- Morin, Frederic, and Bengio, Yoshua. 2005. Hierarchical probabilistic neural network language model. Pages 246–252 of: *Aistats*, vol. 5. Citeseer.
- Morris, Christopher, Ritzert, Martin, Fey, Matthias, Hamilton, William L, Lenssen, Jan Eric, Rattan, Gaurav, and Grohe, Martin. 2019. Weisfeiler and leman go neural: Higher-order graph neural networks. Pages 4602–4609 of: *Proceedings of the AAAI Conference on Artificial Intelligence*, vol. 33.
- Nastase, Vivi, Mihalcea, Rada, and Radev, Dragomir R. 2015. A survey of graphs in natural language processing. *Natural Language Engineering*, **21**(5), 665–698.
- Nathani, Deepak, Chauhan, Jatin, Sharma, Charu, and Kaul, Manohar. 2019. Learning Attention-based Embeddings for Relation Prediction in Knowledge Graphs. Pages 4710–4723 of: *Proceedings of the 57th Annual Meeting of the Association for Computational Linguistics*.
- Neville, Jennifer, and Jensen, David. Iterative classification in relational data.
- Newman, Mark. 2018. *Networks: An Introduction*. Oxford university press.
- Newman, Mark EJ. 2006. Modularity and community structure in networks. *Proceedings of the national academy of sciences*, **103**(23), 8577–8582.
- Ng, Andrew, et al. Sparse autoencoder.
- Ng, Andrew Y, Jordan, Michael I, and Weiss, Yair. 2002. On spectral clustering: Analysis and an algorithm. Pages 849–856 of: *Advances in neural information processing systems*.
- Nguyen, Giang Hoang, Lee, John Boaz, Rossi, Ryan A, Ahmed, Nesreen K, Koh, Eun-yeon, and Kim, Sungchul. 2018. Continuous-time dynamic network embeddings. Pages 969–976 of: *Companion Proceedings of the The Web Conference 2018*.
- Nguyen, Thin, Le, Hang, and Venkatesh, Svetha. 2019. GraphDTA: prediction of drug–target binding affinity using graph convolutional networks. *BioRxiv*, 684662.
- Nickel, Maximilian, Murphy, Kevin, Tresp, Volker, and Gabrilovich, Evgeniy. 2015. A review of relational machine learning for knowledge graphs. *Proceedings of the IEEE*, **104**(1), 11–33.
- Niepert, Mathias, Ahmed, Mohamed, and Kutzkov, Konstantin. 2016. Learning convolutional neural networks for graphs. Pages 2014–2023 of: *International conference on machine learning*.
- Norcliffe-Brown, Will, Vafeias, Stathis, and Parisot, Sarah. 2018. Learning conditioned graph structures for interpretable visual question answering. Pages 8334–8343 of: *Advances in Neural Information Processing Systems*.
- Nwankpa, Chigozie, Ijomah, Winifred, Gachagan, Anthony, and Marshall, Stephen. 2018. Activation functions: Comparison of trends in practice and research for deep learning. *arXiv preprint arXiv:1811.03378*.
- Olshausen, Bruno A, and Field, David J. 1997. Sparse coding with an overcomplete basis set: A strategy employed by V1? *Vision research*, **37**(23), 3311–3325.
- Oono, Kenta, and Suzuki, Taiji. 2020. Graph Neural Networks Exponentially Lose Expressive Power for Node Classification. In: *International Conference on Learning Representations*.
- Ou, Mingdong, Cui, Peng, Pei, Jian, Zhang, Ziwei, and Zhu, Wenwu. 2016. Asymmetric transitivity preserving graph embedding. Pages 1105–1114 of: *Proceedings of the 22nd ACM SIGKDD international conference on Knowledge discovery and data mining*.
- Owen, Art B. 2013. *Monte Carlo theory, methods and examples*.

- Pan, Shirui, Hu, Ruiqi, Long, Guodong, Jiang, Jing, Yao, Lina, and Zhang, Chengqi. 2018. Adversarially regularized graph autoencoder for graph embedding. *arXiv preprint arXiv:1802.04407*.
- Pareja, Aldo, Domeniconi, Giacomo, Chen, Jie, Ma, Tengfei, Suzumura, Toyotaro, Kanezashi, Hiroki, Kaler, Tim, and Leisersen, Charles E. 2019. Evolvegcnn: Evolving graph convolutional networks for dynamic graphs. *arXiv preprint arXiv:1902.10191*.
- Parisot, Sarah, Ktena, Sofia Ira, Ferrante, Enzo, Lee, Matthew, Guerrero, Ricardo, Glocker, Ben, and Rueckert, Daniel. 2018. Disease prediction using graph convolutional networks: Application to Autism Spectrum Disorder and Alzheimers disease. *Medical image analysis*, **48**, 117–130.
- Park, Namyong, Kan, Andrey, Dong, Xin Luna, Zhao, Tong, and Faloutsos, Christos. 2019. Estimating node importance in knowledge graphs using graph neural networks. Pages 596–606 of: *Proceedings of the 25th ACM SIGKDD International Conference on Knowledge Discovery & Data Mining*.
- Paszke, Adam, Gross, Sam, Chintala, Soumith, Chanan, Gregory, Yang, Edward, DeVito, Zachary, Lin, Zeming, Desmaison, Alban, Antiga, Luca, and Lerer, Adam. 2017. Automatic differentiation in PyTorch.
- Peixoto, Tiago P. 2014. The graph-tool python library. *figshare*.
- Peng, Zhen, Dong, Yixiang, Luo, Minnan, Wu, Xiao-Ming, and Zheng, Qinghua. 2020. Self-Supervised Graph Representation Learning via Global Context Prediction. *arXiv preprint arXiv:2003.01604*.
- Perozzi, Bryan, Al-Rfou, Rami, and Skiena, Steven. 2014. Deepwalk: Online learning of social representations. Pages 701–710 of: *Proceedings of the 20th ACM SIGKDD international conference on Knowledge discovery and data mining*. ACM.
- Perraudin, Nathanaël, Paratte, Johan, Shuman, David, Martin, Lionel, Kalofolias, Vasilis, Vandergheynst, Pierre, and Hammond, David K. 2014. GSPBOX: A toolbox for signal processing on graphs. *arXiv preprint arXiv:1408.5781*.
- Perron, Oskar. 1907. Zur theorie der matrices. *Mathematische Annalen*, **64**(2), 248–263.
- Peters, Matthew E, Neumann, Mark, Iyyer, Mohit, Gardner, Matt, Clark, Christopher, Lee, Kenton, and Zettlemoyer, Luke. 2018. Deep contextualized word representations. *arXiv preprint arXiv:1802.05365*.
- Pillai, S Unnikrishna, Suel, Torsten, and Cha, Seunghun. 2005. The Perron-Frobenius theorem: some of its applications. *IEEE Signal Processing Magazine*, **22**(2), 62–75.
- Qi, Yanlin, Li, Qi, Karimian, Hamed, and Liu, Di. 2019. A hybrid model for spatiotemporal forecasting of PM2.5 based on graph convolutional neural network and long short-term memory. *Science of the Total Environment*, **664**, 1–10.
- Qiu, Jiezhong, Tang, Jian, Ma, Hao, Dong, Yuxiao, Wang, Kuansan, and Tang, Jie. 2018a. Deepinf: Social influence prediction with deep learning. Pages 2110–2119 of: *Proceedings of the 24th ACM SIGKDD International Conference on Knowledge Discovery & Data Mining*.
- Qiu, Jiezhong, Dong, Yuxiao, Ma, Hao, Li, Jian, Wang, Kuansan, and Tang, Jie. 2018b. Network embedding as matrix factorization: Unifying deepwalk, line, pte, and

- node2vec. Pages 459–467 of: *Proceedings of the Eleventh ACM International Conference on Web Search and Data Mining*. ACM.
- Radford, Alec, Wu, Jeff, Child, Rewon, Luan, David, Amodei, Dario, and Sutskever, Ilya. 2019. Language Models are Unsupervised Multitask Learners.
- Ren, Kui, Zheng, Tianhang, Qin, Zhan, and Liu, Xue. 2020. Adversarial attacks and defenses in deep learning. *Engineering*.
- Resnick, Paul, and Varian, Hal R. 1997. Recommender systems. *Communications of the ACM*, **40**(3), 56–58.
- Ribeiro, Leonardo FR, Saverese, Pedro HP, and Figueiredo, Daniel R. 2017. struc2vec: Learning node representations from structural identity. Pages 385–394 of: *Proceedings of the 23rd ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*. ACM.
- Rong, Yu, Huang, Wenbing, Xu, Tingyang, and Huang, Junzhou. 2019. Dropedge: Towards deep graph convolutional networks on node classification. In: *International Conference on Learning Representations*.
- Rong, Yu, Huang, Wenbing, Xu, Tingyang, and Huang, Junzhou. 2020. DropEdge: Towards Deep Graph Convolutional Networks on Node Classification. In: *International Conference on Learning Representations*.
- Rosenblatt, Frank. 1958. The perceptron: a probabilistic model for information storage and organization in the brain. *Psychological review*, **65**(6), 386.
- Rossi, Ryan A., and Ahmed, Nesreen K. 2015. The Network Data Repository with Interactive Graph Analytics and Visualization. In: *Proceedings of the Twenty-Ninth AAAI Conference on Artificial Intelligence*.
- Rossi, Ryan A, Ahmed, Nesreen K, Koh, Eunye, Kim, Sungchul, Rao, Anup, and Yadkori, Yasin Abbasi. 2018. HONE: higher-order network embeddings. *arXiv preprint arXiv:1801.09303*.
- Roweis, Sam T, and Saul, Lawrence K. 2000. Nonlinear dimensionality reduction by locally linear embedding. *science*, **290**(5500), 2323–2326.
- Rumelhart, David E, Hinton, Geoffrey E, and Williams, Ronald J. 1986. Learning representations by back-propagating errors. *nature*, **323**(6088), 533–536.
- Rusek, Krzysztof, Suárez-Varela, José, Mestres, Albert, Barlet-Ros, Pere, and Cabellos-Aparicio, Albert. 2019. Unveiling the potential of Graph Neural Networks for network modeling and optimization in SDN. Pages 140–151 of: *Proceedings of the 2019 ACM Symposium on SDN Research*.
- Sahu, Sunil Kumar, Christopoulou, Fenia, Miwa, Makoto, and Ananiadou, Sophia. 2019. Inter-sentence Relation Extraction with Document-level Graph Convolutional Neural Network. *arXiv preprint arXiv:1906.04684*.
- Sailer, Lee Douglas. 1978. Structural equivalence: Meaning and definition, computation and application. *Social Networks*, **1**(1), 73–90.
- Salvador, Stan, and Chan, Philip. 2007. Toward accurate dynamic time warping in linear time and space. *Intelligent Data Analysis*, **11**(5), 561–580.
- Sankar, Aravind, Wu, Yanhong, Gou, Liang, Zhang, Wei, and Yang, Hao. 2018. Dynamic graph representation learning via self-attention networks. *arXiv preprint arXiv:1812.09430*.
- Scarselli, Franco, Yong, Sweah Liang, Gori, Marco, Hagenbuchner, Markus, Tsoi, Ah Chung, and Maggini, Marco. 2005. Graph neural networks for ranking web

- pages. Pages 666–672 of: *Proceedings of the 2005 IEEE/WIC/ACM International Conference on Web Intelligence*. IEEE Computer Society.
- Scarselli, Franco, Gori, Marco, Tsoi, Ah Chung, Hagenbuchner, Markus, and Monfardini, Gabriele. 2008. The graph neural network model. *IEEE Transactions on Neural Networks*, **20**(1), 61–80.
- Schlichtkrull, Michael, Kipf, Thomas N, Bloem, Peter, Van Den Berg, Rianne, Titov, Ivan, and Welling, Max. 2018. Modeling relational data with graph convolutional networks. Pages 593–607 of: *European Semantic Web Conference*. Springer.
- Seide, Frank, Li, Gang, and Yu, Dong. 2011. Conversational speech transcription using context-dependent deep neural networks. In: *Twelfth annual conference of the international speech communication association*.
- Sen, Prithviraj, Namata, Galileo, Bilgic, Mustafa, Getoor, Lise, Galligher, Brian, and Eliassi-Rad, Tina. 2008. Collective classification in network data. *AI magazine*, **29**(3), 93–93.
- Shang, Chao, Tang, Yun, Huang, Jing, Bi, Jinbo, He, Xiaodong, and Zhou, Bowen. 2019a. End-to-end structure-aware convolutional networks for knowledge base completion. Pages 3060–3067 of: *Proceedings of the AAAI Conference on Artificial Intelligence*, vol. 33.
- Shang, Junyuan, Xiao, Cao, Ma, Tengfei, Li, Hongyan, and Sun, Jimeng. 2019b. Gamenet: Graph augmented memory networks for recommending medication combination. Pages 1126–1133 of: *Proceedings of the AAAI Conference on Artificial Intelligence*, vol. 33.
- Shang, Junyuan, Ma, Tengfei, Xiao, Cao, and Sun, Jimeng. 2019c. Pre-training of graph augmented transformers for medication recommendation. *arXiv preprint arXiv:1906.00346*.
- Shchur, Oleksandr, and Günnemann, Stephan. 2019. Overlapping community detection with graph neural networks. *arXiv preprint arXiv:1909.12201*.
- Shi, Chuan, Hu, Binbin, Zhao, Wayne Xin, and Philip, S Yu. 2018a. Heterogeneous information network embedding for recommendation. *IEEE Transactions on Knowledge and Data Engineering*, **31**(2), 357–370.
- Shi, Jianbo, and Malik, Jitendra. 2000. Normalized cuts and image segmentation. *IEEE Transactions on pattern analysis and machine intelligence*, **22**(8), 888–905.
- Shi, Lei, Zhang, Yifan, Cheng, Jian, and Lu, Hanqing. 2019a. Skeleton-Based Action Recognition with Directed Graph Neural Networks. Pages 7912–7921 of: *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*.
- Shi, Lei, Zhang, Yifan, Cheng, Jian, and Lu, Hanqing. 2019b. Two-stream adaptive graph convolutional networks for skeleton-based action recognition. Pages 12026–12035 of: *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*.
- Shi, Yu, Han, Fangqiu, He, Xinwei, He, Xinran, Yang, Carl, Luo, Jie, and Han, Jiawei. 2018b. mvn2vec: Preservation and collaboration in multi-view network embedding. *arXiv preprint arXiv:1801.06597*.
- Shuman, David I, Narang, Sunil K, Frossard, Pascal, Ortega, Antonio, and Vandergheynst, Pierre. 2013. The emerging field of signal processing on graphs: Extending high-dimensional data analysis to networks and other irregular domains. *IEEE signal processing magazine*, **30**(3), 83–98.

- Si, Chenyang, Jing, Ya, Wang, Wei, Wang, Liang, and Tan, Tieniu. 2018. Skeleton-based action recognition with spatial reasoning and temporal stack learning. Pages 103–118 of: *Proceedings of the European Conference on Computer Vision (ECCV)*.
- Si, Chenyang, Chen, Wentao, Wang, Wei, Wang, Liang, and Tan, Tieniu. 2019. An attention enhanced graph convolutional lstm network for skeleton-based action recognition. Pages 1227–1236 of: *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*.
- Simonovsky, Martin, and Komodakis, Nikos. 2017. Dynamic edge-conditioned filters in convolutional neural networks on graphs. Pages 3693–3702 of: *Proceedings of the IEEE conference on computer vision and pattern recognition*.
- Simonovsky, Martin, and Komodakis, Nikos. 2018. Graphvae: Towards generation of small graphs using variational autoencoders. Pages 412–422 of: *International Conference on Artificial Neural Networks*. Springer.
- Simonyan, Karen, and Zisserman, Andrew. 2014. Very deep convolutional networks for large-scale image recognition. *arXiv preprint arXiv:1409.1556*.
- Song, Linfeng, Peng, Xiaochang, Zhang, Yue, Wang, Zhiguo, and Gildea, Daniel. 2017. Amr-to-text generation with synchronous node replacement grammar. *arXiv preprint arXiv:1702.00500*.
- Song, Linfeng, Wang, Zhiguo, Yu, Mo, Zhang, Yue, Florian, Radu, and Gildea, Daniel. 2018a. Exploring graph-structured passage representation for multi-hop reading comprehension with graph neural networks. *arXiv preprint arXiv:1809.02040*.
- Song, Linfeng, Zhang, Yue, Wang, Zhiguo, and Gildea, Daniel. 2018b. A graph-to-sequence model for AMR-to-text generation. *arXiv preprint arXiv:1805.02473*.
- Song, Linfeng, Zhang, Yue, Wang, Zhiguo, and Gildea, Daniel. 2018c. N-ary relation extraction using graph state lstm. *arXiv preprint arXiv:1808.09101*.
- Srivastava, Nitish, Hinton, Geoffrey, Krizhevsky, Alex, Sutskever, Ilya, and Salakhutdinov, Ruslan. 2014. Dropout: a simple way to prevent neural networks from overfitting. *The journal of machine learning research*, **15**(1), 1929–1958.
- Sun, Changzhi, Gong, Yeyun, Wu, Yuanbin, Gong, Ming, Jiang, Daxin, Lan, Man, Sun, Shiliang, and Duan, Nan. 2019a. Joint type inference on entities and relations via graph convolutional networks. Pages 1361–1370 of: *Proceedings of the 57th Annual Meeting of the Association for Computational Linguistics*.
- Sun, Fan-Yun, Hoffmann, Jordan, and Tang, Jian. 2019b. InfoGraph: Unsupervised and Semi-supervised Graph-Level Representation Learning via Mutual Information Maximization. *arXiv preprint arXiv:1908.01000*.
- Sun, Ke, Lin, Zhouchen, and Zhu, Zhanxing. 2019c. Multi-Stage Self-Supervised Learning for Graph Convolutional Networks on Graphs with Few Labels. *arXiv preprint arXiv:1902.11038*.
- Sundararajan, Mukund, Taly, Ankur, and Yan, Qiqi. 2017. Axiomatic attribution for deep networks. Pages 3319–3328 of: *Proceedings of the 34th International Conference on Machine Learning-Volume 70*. JMLR. org.
- Sutskever, I, Vinyals, O, and Le, QV. 2014. Sequence to sequence learning with neural networks. *Advances in NIPS*.
- Sutton, Richard S, McAllester, David A, Singh, Satinder P, and Mansour, Yishay. 2000. Policy gradient methods for reinforcement learning with function approximation. Pages 1057–1063 of: *Advances in neural information processing systems*.

- Szegedy, Christian, Vanhoucke, Vincent, Ioffe, Sergey, Shlens, Jon, and Wojna, Zbigniew. 2016. Rethinking the inception architecture for computer vision. Pages 2818–2826 of: *Proceedings of the IEEE conference on computer vision and pattern recognition*.
- Tai, Kai Sheng, Socher, Richard, and Manning, Christopher D. 2015. Improved semantic representations from tree-structured long short-term memory networks. *arXiv preprint arXiv:1503.00075*.
- Tan, Pang-Ning, Steinbach, Michael, and Kumar, Vipin. 2016. *Introduction to data mining*. Pearson Education India.
- Tang, Jian, Qu, Meng, Wang, Mingzhe, Zhang, Ming, Yan, Jun, and Mei, Qiaozhu. 2015. Line: Large-scale information network embedding. Pages 1067–1077 of: *Proceedings of the 24th international conference on world wide web*. International World Wide Web Conferences Steering Committee.
- Tang, Jiliang, and Liu, Huan. 2012a. Feature selection with linked data in social media. Pages 118–128 of: *Proceedings of the 2012 SIAM International Conference on Data Mining*. SIAM.
- Tang, Jiliang, and Liu, Huan. 2012b. Unsupervised feature selection for linked social media data. Pages 904–912 of: *Proceedings of the 18th ACM SIGKDD international conference on Knowledge discovery and data mining*.
- Tang, Jiliang, Gao, Huiji, Hu, Xia, and Liu, Huan. 2013a. Exploiting homophily effect for trust prediction. Pages 53–62 of: *Proceedings of the sixth ACM international conference on Web search and data mining*.
- Tang, Jiliang, Hu, Xia, Gao, Huiji, and Liu, Huan. 2013b. Unsupervised feature selection for multi-view data in social media. Pages 270–278 of: *Proceedings of the 2013 SIAM International Conference on Data Mining*. SIAM.
- Tang, Jiliang, Alelyani, Salem, and Liu, Huan. 2014a. Feature selection for classification: A review. *Data classification: Algorithms and applications*, 37.
- Tang, Jiliang, Hu, Xia, and Liu, Huan. 2014b. Is distrust the negation of trust? the value of distrust in social media. Pages 148–157 of: *Proceedings of the 25th ACM conference on Hypertext and social media*.
- Tang, Jiliang, Aggarwal, Charu, and Liu, Huan. 2016a. Node classification in signed social networks. Pages 54–62 of: *Proceedings of the 2016 SIAM international conference on data mining*. SIAM.
- Tang, Jiliang, Chang, Yi, Aggarwal, Charu, and Liu, Huan. 2016b. A survey of signed network mining in social media. *ACM Computing Surveys (CSUR)*, **49**(3), 1–37.
- Tang, Lei, and Liu, Huan. 2009. Relational learning via latent social dimensions. Pages 817–826 of: *Proceedings of the 15th ACM SIGKDD international conference on Knowledge discovery and data mining*. ACM.
- Tang, Xianfeng, Li, Yandong, Sun, Yiwei, Yao, Huaxiu, Mitra, Prasenjit, and Wang, Suhang. 2019. Robust graph neural network against poisoning attacks via transfer learning. *arXiv preprint arXiv:1908.07558*.
- Tang, Xianfeng, Yao, Huaxiu, Sun, Yiwei, Wang, Yiqi, Tang, Jiliang, Aggarwal, Charu, Mitra, Prasenjit, and Wang, Suhang. 2020. Graph Convolutional Networks against Degree-Related Biases. *CIKM*.
- Tenenbaum, Joshua B, De Silva, Vin, and Langford, John C. 2000. A global geometric framework for nonlinear dimensionality reduction. *science*, **290**(5500), 2319–2323.

- Teney, Damien, Liu, Lingqiao, and van den Hengel, Anton. 2017. Graph-structured representations for visual question answering. Pages 1–9 of: *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*.
- Trinajstić, Nenad. 2018. *Chemical graph theory*. Routledge.
- Tu, Ke, Cui, Peng, Wang, Xiao, Wang, Fei, and Zhu, Wenwu. 2018. Structural deep embedding for hyper-networks. In: *Thirty-Second AAAI Conference on Artificial Intelligence*.
- Tu, Ming, Wang, Guangtao, Huang, Jing, Tang, Yun, He, Xiaodong, and Zhou, Bowen. 2019. Multi-hop Reading Comprehension across Multiple Documents by Reasoning over Heterogeneous Graphs. Pages 2704–2713 of: *Proceedings of the 57th Annual Meeting of the Association for Computational Linguistics*.
- Vashishth, Shikhar, Sanyal, Soumya, Nitin, Vikram, and Talukdar, Partha. 2019. Composition-based multi-relational graph convolutional networks. *arXiv preprint arXiv:1911.03082*.
- Vaswani, Ashish, Shazeer, Noam, Parmar, Niki, Uszkoreit, Jakob, Jones, Llion, Gomez, Aidan N, Kaiser, Łukasz, and Polosukhin, Illia. 2017. Attention is all you need. Pages 5998–6008 of: *Advances in neural information processing systems*.
- Veličković, Petar, Cucurull, Guillem, Casanova, Arantxa, Romero, Adriana, Lio, Pietro, and Bengio, Yoshua. 2017. Graph attention networks. *arXiv preprint arXiv:1710.10903*.
- Velickovic, Petar, Fedus, William, Hamilton, William L, Liò, Pietro, Bengio, Yoshua, and Hjelm, R Devon. 2019. Deep Graph Infomax. In: *ICLR (Poster)*.
- Vinyals, Oriol, and Le, Quoc. 2015. A neural conversational model. *arXiv preprint arXiv:1506.05869*.
- Vosoughi, Soroush, Roy, Deb, and Aral, Sinan. 2018. The spread of true and false news online. *Science*, **359**(6380), 1146–1151.
- Wang, Daixin, Cui, Peng, and Zhu, Wenwu. 2016. Structural deep network embedding. Pages 1225–1234 of: *Proceedings of the 22nd ACM SIGKDD international conference on Knowledge discovery and data mining*. ACM.
- Wang, Fei, Li, Tao, Wang, Xin, Zhu, Shenghuo, and Ding, Chris. 2011. Community discovery using nonnegative matrix factorization. *Data Mining and Knowledge Discovery*, **22**(3), 493–521.
- Wang, Hao, Xu, Tong, Liu, Qi, Lian, Defu, Chen, Enhong, Du, Dongfang, Wu, Han, and Su, Wen. 2019a. MCNE: An End-to-End Framework for Learning Multiple Conditional Network Representations of Social Network. *arXiv preprint arXiv:1905.11013*.
- Wang, Hongwei, Wang, Jia, Wang, Jialin, Zhao, Miao, Zhang, Weinan, Zhang, Fuzheng, Xie, Xing, and Guo, Minyi. 2018a. Graphgan: Graph representation learning with generative adversarial nets. In: *Thirty-Second AAAI Conference on Artificial Intelligence*.
- Wang, Hongwei, Zhang, Fuzheng, Zhang, Mengdi, Leskovec, Jure, Zhao, Miao, Li, Wenjie, and Wang, Zhongyuan. 2019b. Knowledge-aware graph neural networks with label smoothness regularization for recommender systems. Pages 968–977 of: *Proceedings of the 25th ACM SIGKDD International Conference on Knowledge Discovery & Data Mining*.

- Wang, Hongwei, Zhao, Miao, Xie, Xing, Li, Wenjie, and Guo, Minyi. 2019c. Knowledge graph convolutional networks for recommender systems. Pages 3307–3313 of: *The World Wide Web Conference*. ACM.
- Wang, Jianyu, Wen, Rui, Wu, Chunming, Huang, Yu, and Xion, Jian. 2019d. Fdgars: Fraudster detection via graph convolutional networks in online app review system. Pages 310–316 of: *Companion Proceedings of The 2019 World Wide Web Conference*.
- Wang, Minjie, Yu, Lingfan, Zheng, Da, Gan, Quan, Gai, Yu, Ye, Zihao, Li, Mufei, Zhou, Jinjing, Huang, Qi, Ma, Chao, et al. 2019e. Deep graph library: Towards efficient and scalable deep learning on graphs. *arXiv preprint arXiv:1909.01315*.
- Wang, Peifeng, Han, Jialong, Li, Chenliang, and Pan, Rong. 2019f. Logic attention based neighborhood aggregation for inductive knowledge graph embedding. Pages 7152–7159 of: *Proceedings of the AAAI Conference on Artificial Intelligence*, vol. 33.
- Wang, Suhang, Aggarwal, Charu, Tang, Jiliang, and Liu, Huan. 2017a. Attributed signed network embedding. Pages 137–146 of: *Proceedings of the 2017 ACM on Conference on Information and Knowledge Management*.
- Wang, Suhang, Tang, Jiliang, Aggarwal, Charu, Chang, Yi, and Liu, Huan. 2017b. Signed network embedding in social media. Pages 327–335 of: *Proceedings of the 2017 SIAM international conference on data mining*. SIAM.
- Wang, Xiang, He, Xiangnan, Cao, Yixin, Liu, Meng, and Chua, Tat-Seng. 2019g. KGAT: Knowledge Graph Attention Network for Recommendation. *arXiv preprint arXiv:1905.07854*.
- Wang, Xiang, He, Xiangnan, Wang, Meng, Feng, Fuli, and Chua, Tat-Seng. 2019h. Neural graph collaborative filtering. Pages 165–174 of: *Proceedings of the 42nd international ACM SIGIR conference on Research and development in Information Retrieval*.
- Wang, Xiao, Cui, Peng, Wang, Jing, Pei, Jian, Zhu, Wenwu, and Yang, Shiqiang. 2017c. Community preserving network embedding. In: *Thirty-first AAAI conference on artificial intelligence*.
- Wang, Xiao, Ji, Houye, Shi, Chuan, Wang, Bai, Ye, Yanfang, Cui, Peng, and Yu, Philip S. 2019i. Heterogeneous graph attention network. Pages 2022–2032 of: *The World Wide Web Conference*.
- Wang, Xiaolong, Ye, Yufei, and Gupta, Abhinav. 2018b. Zero-shot recognition via semantic embeddings and knowledge graphs. Pages 6857–6866 of: *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*.
- Wang, Xiaoyang, Ma, Yao, Wang, Yiqi, Jin, Wei, Wang, Xin, Tang, Jiliang, Jia, Caiyan, and Yu, Jian. 2020a. Traffic Flow Prediction via Spatial Temporal Graph Neural Network. Pages 1082–1092 of: *Proceedings of The Web Conference 2020*.
- Wang, Xuhong, Du, Ying, Cui, Ping, and Yang, Yupu. 2020b. OCGNN: One-class Classification with Graph Neural Networks. *arXiv preprint arXiv:2002.09594*.
- Wang, Yaping, Jiao, Pengfei, Wang, Wenjun, Lu, Chunyu, Liu, Hongtao, and Wang, Bo. 2019j. Bipartite network embedding via effective integration of explicit and implicit relations. Pages 435–451 of: *International Conference on Database Systems for Advanced Applications*. Springer.
- Wang, Yue, Sun, Yongbin, Liu, Ziwei, Sarma, Sanjay E, Bronstein, Michael M, and

- Solomon, Justin M. 2019k. Dynamic graph cnn for learning on point clouds. *ACM Transactions on Graphics (TOG)*, **38**(5), 1–12.
- Wang, Zhichun, Lv, Qingsong, Lan, Xiaohan, and Zhang, Yu. 2018c. Cross-lingual knowledge graph alignment via graph convolutional networks. Pages 349–357 of: *Proceedings of the 2018 Conference on Empirical Methods in Natural Language Processing*.
- Watkins, Christopher JCH, and Dayan, Peter. 1992. Q-learning. *Machine learning*, **8**(3-4), 279–292.
- Weber, Mark, Domeniconi, Giacomo, Chen, Jie, Weidele, Daniel Karl I, Bellei, Claudio, Robinson, Tom, and Leiserson, Charles E. 2019. Anti-money laundering in bitcoin: Experimenting with graph convolutional networks for financial forensics. *arXiv preprint arXiv:1908.02591*.
- Wei, Xiaokai, Xie, Sihong, and Yu, Philip S. 2015. Efficient partial order preserving unsupervised feature selection on networks. Pages 82–90 of: *Proceedings of the 2015 SIAM International Conference on Data Mining*. SIAM.
- Wei, Xiaokai, Cao, Bokai, and Philip, S Yu. 2016. Unsupervised feature selection on networks: a generative view. In: *Thirtieth AAAI Conference on Artificial Intelligence*.
- Weisfeiler, B, and Leman, A. The reduction of a graph to canonical form and the algebr which appears therein.
- Welbl, Johannes, Stenetorp, Pontus, and Riedel, Sebastian. 2018. Constructing datasets for multi-hop reading comprehension across documents. *Transactions of the Association for Computational Linguistics*, **6**, 287–302.
- Wen, Yu-Hui, Gao, Lin, Fu, Hongbo, Zhang, Fang-Lue, and Xia, Shihong. 2019. Graph CNNs with motif and variable temporal block for skeleton-based action recognition. Pages 8989–8996 of: *Proceedings of the AAAI Conference on Artificial Intelligence*, vol. 33.
- Werbos, Paul John. 1994. *The roots of backpropagation: from ordered derivatives to neural networks and political forecasting*. Vol. 1. John Wiley & Sons.
- Werling, Donna M, and Geschwind, Daniel H. 2013. Sex differences in autism spectrum disorders. *Current opinion in neurology*, **26**(2), 146.
- Widder, David Vernon, and Hirschman, Isidore Isaac. 2015. *Convolution Transform*. Vol. 2153. Princeton University Press.
- Wu, Huijun, Wang, Chen, Tyshtetskiy, Yuriy, Docherty, Andrew, Lu, Kai, and Zhu, Liming. 2019. Adversarial Examples for Graph Data: Deep Insights into Attack and Defense. Pages 4816–4823 of: Kraus, Sarit (ed), *Proceedings of the Twenty-Eighth International Joint Conference on Artificial Intelligence, IJCAI 2019, Macao, China, August 10-16, 2019*. ijcai.org.
- Wu, Zonghan, Pan, Shirui, Chen, Fengwen, Long, Guodong, Zhang, Chengqi, and Philip, S Yu. 2020. A comprehensive survey on graph neural networks. *IEEE Transactions on Neural Networks and Learning Systems*.
- Xu, Bingbing, Shen, Huawei, Cao, Qi, Qiu, Yunqi, and Cheng, Xueqi. 2019a. Graph Wavelet Neural Network. *arXiv preprint arXiv:1904.07785*.
- Xu, Han, Ma, Yao, Liu, Haochen, Deb, Debayan, Liu, Hui, Tang, Jiliang, and Jain, Anil. 2019b. Adversarial attacks and defenses in images, graphs and text: A review. *arXiv preprint arXiv:1909.08072*.

- Xu, Jian. 2017. Representing Big Data as Networks: New Methods and Insights. *arXiv preprint arXiv:1712.09648*.
- Xu, Kaidi, Chen, Hongge, Liu, Sijia, Chen, Pin-Yu, Weng, Tsui-Wei, Hong, Mingyi, and Lin, Xue. 2019c. Topology Attack and Defense for Graph Neural Networks: An Optimization Perspective. Pages 3961–3967 of: Kraus, Sarit (ed), *Proceedings of the Twenty-Eighth International Joint Conference on Artificial Intelligence, IJCAI 2019, Macao, China, August 10-16, 2019*. ijcai.org.
- Xu, Keyulu, Li, Chengtao, Tian, Yonglong, Sonobe, Tomohiro, Kawarabayashi, Ken-ichi, and Jegelka, Stefanie. 2018a. Representation Learning on Graphs with Jumping Knowledge Networks. Pages 5449–5458 of: Dy, Jennifer G., and Krause, Andreas (eds), *Proceedings of the 35th International Conference on Machine Learning, ICML 2018, Stockholmsmässan, Stockholm, Sweden, July 10-15, 2018*. Proceedings of Machine Learning Research, vol. 80. PMLR.
- Xu, Keyulu, Hu, Weihua, Leskovec, Jure, and Jegelka, Stefanie. 2019d. How Powerful are Graph Neural Networks? In: *7th International Conference on Learning Representations, ICLR 2019, New Orleans, LA, USA, May 6-9, 2019*. OpenReview.net.
- Xu, Kun, Wu, Lingfei, Wang, Zhiguo, Feng, Yansong, Witbrock, Michael, and Sheinin, Vadim. 2018b. Graph2seq: Graph to sequence learning with attention-based neural networks. *arXiv preprint arXiv:1804.00823*.
- Xu, Kun, Wang, Liwei, Yu, Mo, Feng, Yansong, Song, Yan, Wang, Zhiguo, and Yu, Dong. 2019e. Cross-lingual Knowledge Graph Alignment via Graph Matching Neural Network. *arXiv preprint arXiv:1905.11605*.
- Xuan, Ping, Pan, Shuxiang, Zhang, Tiangang, Liu, Yong, and Sun, Hao. 2019. Graph convolutional network and convolutional neural network based method for predicting lncRNA-disease associations. *Cells*, **8**(9), 1012.
- Yadati, Naganand, Nimishakavi, Madhav, Yadav, Prateek, Nitin, Vikram, Louis, Anand, and Talukdar, Partha. 2019. HyperGCN: A New Method For Training Graph Convolutional Networks on Hypergraphs. Pages 1509–1520 of: *Advances in Neural Information Processing Systems*.
- Yan, Sijie, Xiong, Yuanjun, and Lin, Dahua. 2018. Spatial temporal graph convolutional networks for skeleton-based action recognition. In: *Thirty-Second AAAI Conference on Artificial Intelligence*.
- Yanardag, Pinar, and Vishwanathan, SVN. 2015. Deep graph kernels. Pages 1365–1374 of: *Proceedings of the 21th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*.
- Yang, Bishan, Yih, Wen-tau, He, Xiaodong, Gao, Jianfeng, and Deng, Li. 2014. Learning multi-relational semantics using neural-embedding models. *arXiv preprint arXiv:1411.4072*.
- Yang, Jaewon, and Leskovec, Jure. 2015. Defining and evaluating network communities based on ground-truth. *Knowledge and Information Systems*, **42**(1), 181–213.
- Yang, Xu, Tang, Kaihua, Zhang, Hanwang, and Cai, Jianfei. 2019. Auto-encoding scene graphs for image captioning. Pages 10685–10694 of: *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*.
- Yao, Liang, Mao, Chengsheng, and Luo, Yuan. 2019. Graph convolutional networks for text classification. Pages 7370–7377 of: *Proceedings of the AAAI Conference on Artificial Intelligence*, vol. 33.

- Ying, Rex, He, Ruining, Chen, Kaifeng, Eksombatchai, Pong, Hamilton, William L, and Leskovec, Jure. 2018a. Graph convolutional neural networks for web-scale recommender systems. Pages 974–983 of: *Proceedings of the 24th ACM SIGKDD International Conference on Knowledge Discovery & Data Mining*.
- Ying, Rex, He, Ruining, Chen, Kaifeng, Eksombatchai, Pong, Hamilton, William L, and Leskovec, Jure. 2018b. Graph convolutional neural networks for web-scale recommender systems. Pages 974–983 of: *Proceedings of the 24th ACM SIGKDD International Conference on Knowledge Discovery & Data Mining*. ACM.
- Ying, Zhitao, You, Jiaxuan, Morris, Christopher, Ren, Xiang, Hamilton, Will, and Leskovec, Jure. 2018c. Hierarchical graph representation learning with differentiable pooling. Pages 4800–4810 of: *Advances in Neural Information Processing Systems*.
- Ying, Zhitao, Bourgeois, Dylan, You, Jiaxuan, Zitnik, Marinka, and Leskovec, Jure. 2019. Gnnexplainer: Generating explanations for graph neural networks. Pages 9244–9255 of: *Advances in neural information processing systems*.
- You, Jiaxuan, Liu, Bowen, Ying, Zhitao, Pande, Vijay, and Leskovec, Jure. 2018a. Graph convolutional policy network for goal-directed molecular graph generation. Pages 6410–6421 of: *Advances in neural information processing systems*.
- You, Jiaxuan, Ying, Rex, Ren, Xiang, Hamilton, William L, and Leskovec, Jure. 2018b. Graphrnn: Generating realistic graphs with deep auto-regressive models. *arXiv preprint arXiv:1802.08773*.
- You, Yuning, Chen, Tianlong, Wang, Zhangyang, and Shen, Yang. 2020. When Does Self-Supervision Help Graph Convolutional Networks? *arXiv preprint arXiv:2006.09136*.
- Yu, Bing, Yin, Haoteng, and Zhu, Zhanxing. 2017. Spatio-temporal graph convolutional networks: A deep learning framework for traffic forecasting. *arXiv preprint arXiv:1709.04875*.
- Yu, Dong, and Deng, Li. 2016. *AUTOMATIC SPEECH RECOGNITION*. Springer.
- Yuan, Hao, and Ji, Shuiwang. 2019. StructPool: Structured graph pooling via conditional random fields. In: *International Conference on Learning Representations*.
- Yuan, Hao, Tang, Jiliang, Hu, Xia, and Ji, Shuiwang. 2020. XGNN: Towards Model-Level Explanations of Graph Neural Networks. *arXiv preprint arXiv:2006.02587*.
- Yuan, Shuhan, Wu, Xintao, and Xiang, Yang. 2017. SNE: signed network embedding. Pages 183–195 of: *Pacific-Asia conference on knowledge discovery and data mining*. Springer.
- Yuan, Xiaoyong, He, Pan, Zhu, Qile, and Li, Xiaolin. 2019. Adversarial examples: Attacks and defenses for deep learning. *IEEE transactions on neural networks and learning systems*, **30**(9), 2805–2824.
- Zeiler, Matthew D. 2012. ADADELTA: an adaptive learning rate method. *arXiv preprint arXiv:1212.5701*.
- Zeng, Hanqing, Zhou, Hongkuan, Srivastava, Ajitesh, Kannan, Rajgopal, and Prasanna, Viktor. 2019. Graphsaint: Graph sampling based inductive learning method. *arXiv preprint arXiv:1907.04931*.
- Zhang, Chuxu, Song, Dongjin, Huang, Chao, Swami, Ananthram, and Chawla, Nitesh V. 2019a. Heterogeneous graph neural network. Pages 793–803 of: *Proceedings of the 25th ACM SIGKDD International Conference on Knowledge Discovery & Data Mining*.

- Zhang, Fanjin, Liu, Xiao, Tang, Jie, Dong, Yuxiao, Yao, Peiran, Zhang, Jie, Gu, Xiaotao, Wang, Yan, Shao, Bin, Li, Rui, et al. 2019b. Oag: Toward linking large-scale heterogeneous entity graphs. Pages 2585–2595 of: *Proceedings of the 25th ACM SIGKDD International Conference on Knowledge Discovery & Data Mining*.
- Zhang, Guo, He, Hao, and Katabi, Dina. 2019c. Circuit-GNN: Graph neural networks for distributed circuit design. Pages 7364–7373 of: *International Conference on Machine Learning*.
- Zhang, Jiani, Shi, Xingjian, Xie, Junyuan, Ma, Hao, King, Irwin, and Yeung, Dit-Yan. 2018a. Gaan: Gated attention networks for learning on large and spatiotemporal graphs. *arXiv preprint arXiv:1803.07294*.
- Zhang, Ningyu, Deng, Shumin, Sun, Zhanlin, Wang, Guanying, Chen, Xi, Zhang, Wei, and Chen, Huajun. 2019d. Long-tail Relation Extraction via Knowledge Graph Embeddings and Graph Convolution Networks. *arXiv preprint arXiv:1903.01306*.
- Zhang, Wei Emma, Sheng, Quan Z, Alhazmi, Ahoud, and Li, Chenliang. 2020. Adversarial attacks on deep-learning models in natural language processing: A survey. *ACM Transactions on Intelligent Systems and Technology (TIST)*, **11**(3), 1–41.
- Zhang, Yizhou, Xiong, Yun, Kong, Xiangnan, Li, Shanshan, Mi, Jinhong, and Zhu, Yangyong. 2018b. Deep collective classification in heterogeneous information networks. Pages 399–408 of: *Proceedings of the 2018 World Wide Web Conference*.
- Zhang, Yuhao, Qi, Peng, and Manning, Christopher D. 2018c. Graph Convolution over Pruned Dependency Trees Improves Relation Extraction. Pages 2205–2215 of: *Proceedings of the 2018 Conference on Empirical Methods in Natural Language Processing*.
- Zhao, Lingxiao, and Akoglu, Leman. 2019. PairNorm: Tackling Oversmoothing in GNNs. *arXiv preprint arXiv:1909.12223*.
- Zhou, Jie, Cui, Ganqu, Zhang, Zhengyan, Yang, Cheng, Liu, Zhiyuan, Wang, Lifeng, Li, Changcheng, and Sun, Maosong. 2018a. Graph neural networks: A review of methods and applications. *arXiv preprint arXiv:1812.08434*.
- Zhou, Lekui, Yang, Yang, Ren, Xiang, Wu, Fei, and Zhuang, Yueting. 2018b. Dynamic network embedding by modeling triadic closure process. In: *Thirty-Second AAAI Conference on Artificial Intelligence*.
- Zhou, Yaqin, Liu, Shangqing, Siow, Jingkai, Du, Xiaoning, and Liu, Yang. 2019. Devign: Effective vulnerability identification by learning comprehensive program semantics via graph neural networks. Pages 10197–10207 of: *Advances in Neural Information Processing Systems*.
- Zhu, Dingyuan, Zhang, Ziwei, Cui, Peng, and Zhu, Wenwu. 2019a. Robust graph convolutional networks against adversarial attacks. Pages 1399–1407 of: *Proceedings of the 25th ACM SIGKDD International Conference on Knowledge Discovery & Data Mining*.
- Zhu, Hao, Lin, Yankai, Liu, Zhiyuan, Fu, Jie, Chua, Tat-seng, and Sun, Maosong. 2019b. Graph Neural Networks with Generated Parameters for Relation Extraction. *arXiv preprint arXiv:1902.00756*.
- Zhu, Rong, Zhao, Kun, Yang, Hongxia, Lin, Wei, Zhou, Chang, Ai, Baole, Li, Yong, and Zhou, Jingren. 2019c. Aligraph: A comprehensive graph neural network platform. *arXiv preprint arXiv:1902.08730*.

- Zhu, Shenghuo, Yu, Kai, Chi, Yun, and Gong, Yihong. 2007. Combining content and link for classification using matrix factorization. Pages 487–494 of: *Proceedings of the 30th annual international ACM SIGIR conference on Research and development in information retrieval*.
- Zhu, Xiaojin, Ghahramani, Zoubin, and Lafferty, John D. 2003. Semi-supervised learning using gaussian fields and harmonic functions. Pages 912–919 of: *Proceedings of the 20th International conference on Machine learning (ICML-03)*.
- Zitnik, Marinka, Agrawal, Monica, and Leskovec, Jure. 2018. Modeling polypharmacy side effects with graph convolutional networks. *Bioinformatics*, **34**(13), i457–i466.
- Zügner, Daniel, and Günnemann, Stephan. 2019. Adversarial attacks on graph neural networks via meta learning. *arXiv preprint arXiv:1902.08412*.
- Zügner, Daniel, Akbarnejad, Amir, and Günnemann, Stephan. 2018. Adversarial attacks on neural networks for graph data. Pages 2847–2856 of: *Proceedings of the 24th ACM SIGKDD International Conference on Knowledge Discovery & Data Mining*.