

REFERENCES

- [1] Abadi, M., Agarwal, A., Barham, P., Brevdo, E., Chen, Z., Citro, C., Corrado, G. S., Davis, A., Dean, J., Devin, M., Ghemawat, S., Goodfellow, I., Harp, A., Irving, G., Isard, M., Jia, Y., Jozefowicz, R., Kaiser, L., Kudlur, M., Levenberg, J., Mané, D., Monga, R., Moore, S., Murray, D., Olah, C., Schuster, M., Shlens, J., Steiner, B., Sutskever, I., Talwar, K., Tucker, P., Vanhoucke, V., Vasudevan, V., Viégas, F., Vinyals, O., Warden, P., Wattenberg, M., Wicke, M., Yu, Y., and Zheng, X. TensorFlow: Large-scale machine learning on heterogeneous systems, 2015. Software available from tensorflow.org.
- [2] Bai, X. Text classification based on lstm and attention. In 2018 Thirteenth International Conference on Digital Information Management (ICDIM) (2018), IEEE, pp. 29–32.
- [3] Bird, S., Klein, E., and Loper, E. Natural language processing with Python: analyzing text with the natural language toolkit. " O'Reilly Media, Inc.", 2009.
- [4] Carneiro, T., Da Nóbrega, R. V. M., Nepomuceno, T., Bian, G.-B., De Albuquerque, V. H. C., and Reboucas Filho, P. P. Performance analysis of google colaboratory as a tool for accelerating deep learning applications. IEEE Access 6 (2018), 61677–61685.
- [5] Chen, T., and Guestrin, C. Xgboost: A scalable tree boosting system. In Proceedings of the 22nd acm sigkdd international conference on knowledge discovery and data mining (2016), pp. 785–794.
- [6] Chollet, F., et al. Keras. <https://keras.io>, 2015.
- [7] Choudhari, P., and Dhari, S. V. Sentiment analysis and machine learning based sentiment classification: A review. International Journal of Advanced Research in Computer Science 8, 3 (2017).
- [8] Collins, E., Rozanov, N., and Zhang, B. Evolutionary data measures: Understanding the difficulty of text classification tasks. arXiv preprint arXiv:1811.01910 (2018).
- [9] Cortes, C., and Vapnik, V. Support-vector networks. Machine learning 20, 3 (1995), 273–297.
- [10] CrowdFlower. Economic news article tone, <https://data.world/crowdflower/economic-news-article-tone>. Dec 2015.
- [11] Fushiki, T. Estimation of prediction error by using k-fold cross-validation. Statistics and Computing 21, 2 (2011), 137–146.
- [12] Han, J., and Moraga, C. The influence of the sigmoid function parameters on the speed of backpropagation learning. In International Workshop on Artificial Neural Networks (1995), Springer, pp. 195–201.
- [13] Hinton, G. E., and Salakhutdinov, R. R. Replicated softmax: an undirected topic model. In Advances in neural information processing systems (2009), pp. 1607–1614.
- [14] Hochreiter, S., and Schmidhuber, J. Long short-term memory. Neural computation 9, 8 (1997), 1735–1780.
- [15] Honnibal, M., and Montani, I. spaCy 2: Natural language understanding with Bloom embeddings, convolutional neural networks and incremental parsing. To appear, 2017.

- [16] Jones, K. S. Natural language processing: a historical review. University of Cambridge (2001), 2–10.
- [17] Joulin, A., Grave, E., Bojanowski, P., and Mikolov, T. Bag of tricks for efficient text classification. arXiv preprint arXiv:1607.01759 (2016).
- [18] Kanan, T., Sadaqa, O., Aldajeh, A., Alshwabka, H., AlZu'bi, S., Elbes, M., Hawashin, B., Alia, M. A., et al. A review of natural language processing and machine learning tools used to analyze arabic social media. In 2019 IEEE Jordan International Joint Conference on Electrical Engineering and Information Technology (JEEIT) (2019), IEEE, pp. 622–628.
- [19] Khedr, A. E., Yaseen, N., et al. Predicting stock market behavior using data mining technique and news sentiment analysis. International Journal of Intelligent Systems and Applications 9, 7 (2017), 22.
- [20] Kleinbaum, D. G., Dietz, K., Gail, M., Klein, M., and Klein, M. Logistic regression. Springer, 2002.
- [21] LeCun, Y., Bengio, Y., and Hinton, G. Deep learning. Nature 521(7553) (2015), 436–444.
- [22] LeCun, Y., Boser, B., Denker, J. S., Henderson, D., Howard, R., Hubbard, W., and Jackel, L. Backpropagation applied to handwritten zip code recognition. Neural computation 1 (1989), 541–551.
- [23] Liu, G., and Guo, J. Bidirectional lstm with attention mechanism and convolutional layer for text classification. Neurocomputing 337 (2019), 325–338.
- [24] Lu, Y., Rao, Y., Yang, J., and Yin, J. Incorporating lexicons into lstm for sentiment classification. In 2018 International joint conference on neural networks (IJCNN) (2018), IEEE, pp. 1–7.
- [25] McHugh, M. L. Interrater reliability: the kappa statistic. Biochemia medica: Biochemia medica 22, 3 (2012), 276–282.
- [26] Monika, R., Deivalakshmi, S., and Janet, B. Sentiment analysis of us airlines tweets using lstm/rnn. In 2019 IEEE 9th International Conference on Advanced Computing (IACC) (2019), IEEE, pp. 92–95.
- [27] Nair, V., and Hinton, G. E. Rectified linear units improve restricted Boltzmann machines. In Proceedings of the 27th international conference on machine learning (ICML-10) (2010), pp. 807–814.
- [28] Oliphant, T. E. A guide to NumPy, vol. 1. Trelgol Publishing USA, 2006.
- [29] Otter, D. W., Medina, J. R., and Kalita, J. K. A survey of the usages of deep learning for natural language processing. IEEE Transactions on Neural Networks and Learning Systems (2020).
- [30] pandas development team, T. pandas-dev/pandas: Pandas, Feb 2020.
- [31] Pedregosa, F., Varoquaux, G., Gramfort, A., Michel, V., Thirion, B., Grisel, O., Blondel, M., Prettenhofer, P., Weiss, R., Dubourg, V., Vanderplas, J., Passos, A., Cournapeau, D., Brucher, M., Perrot, M., and Duchesnay, E. Scikit-learn: Machine learning in Python. Journal of Machine Learning Research 12 (2011), 2825–2830.
- [32] Pennington, J., Socher, R., and Manning, C. D. Glove: Global vectors for word representation. In Empirical Methods in Natural Language Processing (EMNLP) (2014), pp. 1532–1543.
- [33] Ramos, J., et al. Using tf-idf to determine word relevance in document queries. In Proceedings of the first instructional conference on machine learning (2003), vol. 242, Piscataway, NJ, pp. 133–142.

- [34] Schmidhuber, J. Deep learning in neural networks: An overview. *Neural networks* 61 (2015), 85–117.
- [35] Schuster, M., and Paliwal, K. K. Bidirectional recurrent neural networks. *IEEE transactions on Signal Processing* 45, 11 (1997), 2673–2681.
- [36] Shamal, A. J., Pemathilake, R. G. H., Karunathilake, S. P., and Ganegoda, G. U. Sentiment analysis using token2vec and lstms: User review analyzing module. In *2018 18th International Conference on Advances in ICT for Emerging Regions (ICTer)* (2018), IEEE, pp. 48–53.
- [37] Socher, R., Huang, E. H., Pennin, J., Manning, C. D., and Ng, A. Y. Dynamic pooling and unfolding recursive autoencoders for paraphrase detection. In *Advances in neural information processing systems* (2011), pp. 801–809.
- [38] Sohangir, S., Wang, D., Pomeranets, A., and Khoshgoftaar, T. M. Big data: Deep learning for financial sentiment analysis. *Journal of Big Data* 5, 1 (2018), 3.
- [39] Turney, P. D. Thumbs up or thumbs down?: semantic orientation applied to unsupervised classification of reviews. In *Proceedings of the 40th annual meeting on association for computational linguistics* (2002), Association for Computational Linguistics, pp. 417–424.
- [40] Xu, S. Bayesian naïve bayes classifiers to text classification. *Journal of Information Science* 44, 1 (2018), 48–59.
- [41] Young, T., Hazarika, D., Poria, S., and Cambria, E. Recent trends in deep learning based natural language processing. *IEEE Computational intelligence magazine* 13, 3 (2018), 55–75