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RESEARCH ARTICLE

Good debt or bad debt: Detecting semantic orientations in economic texts

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Abstract

The use of robo-readers to analyze news texts is an emerging technology trend in computational finance. Recent research has developed sophisticated financial polarity lexicons for investigating how financial sentiments relate to future company performance. However, based on experience from fields that commonly analyze sentiment, it is well known that the overall semantic orientation of a sentence may differ from that of individual words. This article investigates how semantic orientations can be better detected in financial and economic news by accommodating the overall phrase-structure information and domain-specific use of language. Our three main contributions are the following: (a) a human-annotated finance phrase bank that can be used for training and evaluating alternative models; (b) a technique to enhance financial lexicons with attributes that help to identify expected direction of events that affect sentiment; and (c) a linearized phrase-structure model for detecting contextual semantic orientations in economic texts. The relevance of the newly added lexicon features and the benefit of using the proposed learning algorithm are demonstrated in a comparative study against general sentiment models as well as the popular word frequency models used in recent financial studies. The proposed framework is parsimonious and avoids the explosion in feature space caused by the use of conventional n-gram features.

References

Antweiler, W., & Frank, M. (2004). Is all that talk just noise? The information content of Internet stock message boards. *Journal of Finance*, **59**(3), 1259–1294.

Web of Science® | Google Scholar

Balahur, A., Kozareva, Z., & Montoyo, A. (2009). *Determining the polarity and source of opinions expressed in political debates. CICLing '09 Proceedings of the 10th International Conference on Computational Linguistics and Intelligent Text Processing* (pp. 468–480). Berlin, Germany: Springer-Verlag.

Google Scholar

Barber, B., & Odean, T. (2008). All that glitters: The effect of attention and news on the buying behavior of individual and institutional investors. *Review of Financial Studies*, **21**, 758–818.

Web of Science® | Google Scholar

Bollen, J., Gonçalves, B., Ruan, G., & Mao, H. (2011). Happiness is assortative in online social networks. *Artificial Life*, **17**(2), 237–251.

PubMed | Web of Science® | Google Scholar

Chomsky, N. (1957). *Syntactic structures*. The Hague, The Netherlands: Mouton & Co.

Google Scholar

Das, S., & Chen, M. (2007). Yahoo! for Amazon: Sentiment extraction from small talk on the web. *Management Science*, **53**(9), 1375–1388.

Web of Science® | Google Scholar

Davis, A., Piger, J., & Sedor, L. (2012). Beyond the numbers: Measuring the information content of earnings press release language. *Contemporary Accounting Research*, **29**(3), 845–868.

Web of Science® | Google Scholar

Demers, E., & Vega, C. (2008). Soft information in earnings announcements: News or noise? SSRN Working Paper.

Google Scholar

Dzielinski, M., Rieger, M., & Talpsepp, T. 2011. Volatility asymmetry, news, and private investors. In G. Mitra & L. Mitra (Eds.), *The Handbook of news analytics in finance*. Hoboken, NJ: John Wiley & Sons.

Google Scholar

Engelberg, J. (2008). Costly information processing: Evidence from earnings announcements. AFA 2009 San Francisco Meetings Paper. Retrieved from http://ssrn.com/abstract=1107998.

Google Scholar

Finn, R. (1970). A note on estimating the reliability of categorical data. *Educational and Psychological Measurement*, **30**, 71–76.

Web of Science® | Google Scholar

Gabrilovich, E., & Markovitch, S. (2010). Wikipedia-based semantic interpretation for natural language processing. *Journal of Artificial Intelligence Research*, **34**, 443–498.

Web of Science® | Google Scholar

Hatzivassiloglou, V., & McKeown, K. (1997). Predicting the semantic orientation of adjectives. In Proceedings of the 35th Annual Meeting of the Association for Computational Linguistics (ACL-97) (pp. 174–181). Madrid, Spain.

Google Scholar

Hsu, C.-W, & Lin, C.-J. (2002). A comparison of methods for multiclass support vector machines. *IEEE Transactions on Neural Networks*, **13**(2), 415–425.

PubMed Google Scholar

Li, F. (2009). The information content of the forward-looking statements in corporate filings: A naïve Bayesian machine learning approach. Working paper.

Google Scholar

Loughran, T., & McDonald, B. (2011). When is a liability not a liability? Textual analysis, dictionaries and 10-Ks. *Journal of Finance*, **66**(1), 35–66.

Web of Science® Google Scholar

Maks, I., & Vossen, P. (2010). Annotation scheme and gold standard for Dutch subjective adjectives. In Proceedings of the 7th Conference on International Language Resources and Evaluation (LREC-10). European Language Resources Association (ELRA). Malta.

Google Scholar

Malo, P., Siitari, P., & Sinha, A. (2013). Automated query learning with Wikipedia and genetic programming. *Artificial Intelligence*, **194**, 86–110.

Web of Science® Google Scholar

Malo, P., Sinha, A., Wallenius, J., & Korhonen, P. (2011). Concept-based document classification using Wikipedia and value function. *Journal of the American Society for Information Science and Technology*, **62**(12), 2496–2511.

Web of Science® Google Scholar

Manning, C., & Schütze, H. (2003). *Foundations of Statistical Natural Language Processing*. Cambridge, MA: MIT Press.

Google Scholar

Mishne, G. (2005). Experiments with mood classificiation in Blog posts. In Proceedings of the 1st Workshop on Stylistic Analysis of Text for Information Access at SIGIR 2005. Salvador, Brazil: ACM.

Google Scholar

Mishne, G., & de Rijke, M. (2006). Capturing global mood levels using Blog posts. In Proceedings of the AAAI Spring Symposium on Computational Approaches to Analysing Weblogs (pp. 145–152). Palo Alto, CA: AAAI Press.

Google Scholar

Mitra, L., & Mitra, G. (2010). Applications of news analytics in finance: A review. Middlesex, United Kingdom: OptiRisk Systems. Retrieved from http://optirisk-systems.com/papers/Opt0014.pdf.

Google Scholar

Mitra, L., & Mitra, G. (2011). *The handbook of news analysis in finance*. Hoboken, NJ: John Wiley & Sons.

Google Scholar

Mitra, L., Mitra, G., & diBartolomeo, D. (2009). Equity portfolio risk (volatility) estimation using market information and sentiment. *Quantitative Finance*, **9**(8), 887–895.

Web of Science® Google Scholar

Mitrovic, M., Paltoglou, G., & Tadic, B. (2011). Networks and emotion-driven user communities at popular blogs. *The European Physical Journal B*, **77**(4), 597–609.

CAS Web of Science® Google Scholar

Moilanen, K., & Pulman, S. (2007, September). Sentiment composition. In Proceedings of the Recent Advances in Natural Language Processing International Conference (RANLP 2007) (pp. 378–382). Borovets, Bulgaria: ACL.

Google Scholar

Moilanen, K., Pulman, S., & Zhang, Y. (2010, August). Packed feelings and ordered sentiments: Sentiment parsing with quasi-compositional polarity sequencing and compression. In Proceedings of the 1st Workshop on Computational Approaches to Subjectivity and Sentiment Analysis (WASSA 2010) at the 19th European Conference on Artificial Intelligence (ECAI 2010) (pp. 36–43). Lisbon, Portugal: IOS Press.

Google Scholar

O'Hare, N., Davy, M., Bermingham, A., Ferguson, P., Sheridan, P., Gurrin, C., & Smeaton, A.F. (2009). Topic-dependent sentiment analysis of financial blogs. In Proceedings of the 1st International CIKM Workshop on Topic-Sentiment Analysis for Mass Opinion (pp. 9–16). Hong Kong, China: ACM.

Google Scholar

Pang, B., Lee, L., & Vaithyanathan, S. (2002, July). Thumbs up? Sentiment classificiation using machine learning techniques. In Conference on Empirical Methods in Natural Language Processing (EMNLP 2002) (pp. 79–86). Philadelphia, PA.

Google Scholar

Polanyi, L., & Zaenen, A. (2004). Contextual valence shifters. In working notes of the AAAI Spring Symposium on Exploring Attitude and Affect in Text: Theories and Applications (pp. 106–111). Dordrecht, The Netherlands: Springer.

Google Scholar

Riloff, E., & Wiebe, J. 2003. Learning extraction patterns for subjective expressions. In Proceedings of the Conference on Empirical Methods in Natural Language Processing (EMNLP-2003) (pp. 105–112). Sapporo, Japan: ACL.

Google Scholar

Robinson, W. (1957). The statistical measurement of agreement. *American Sociological Review*, **22**, 17–25.

Web of Science® Google Scholar

Shrout, P., & Fleiss, J. (1979). Intraclass correlation: Uses in assessing rater reliability. *Psychological Bulletin*, **86**, 420–428.

CAS PubMed Web of Science® Google Scholar

Stone, P., Dunphy, D., Smith, M., & Ogilvie, D. (1966). *The general inquirer: A computer approach to content analysis*. Cambridge, MA: MIT Press.

Google Scholar

Tetlock, P. (2007). Giving content to investor sentiment: The role of media in the stock market. *Journal of Finance*, **62**, 1139–1168.

Web of Science® Google Scholar

Tetlock, P., Saar-Tsechansky, M., & Macskassy, S. (2008). More than words: Quantifying language to measure firms' fundamentals. *Journal of Finance*, **63**, 1437–1467.

Web of Science® Google Scholar

Thelwall, M., Buckley, K., & Paltoglou, G. (2012). Sentiment strength detection for the social Web. *Journal of the American Society for Information Science and Technology*, **63**(1), 163–173.

Web of Science® Google Scholar

Thelwall, M., Buckley, K., Paltoglou, G., & Kappas, A. (2010). Sentiment strength detection in short informal text. *Journal of the American Society for Information Science and Technology*, **61**(12), 2544–2558.

Web of Science® Google Scholar

Wiebe, J., Wilson, T., & Cardie, C. (2005). Annotating expressions of opinions and emotions in language. *Language Resources and Evaluation*, **39**, 165–210.

Web of Science® | Google Scholar

Wilson, T. (2008). *Fine-grained subjectivity analysis (Unpublished doctoral dissertation)*. University of Pittsburgh, Pittsburgh, PA.

Google Scholar

Wilson, T., Wiebe, J., & Hoffman, P. (2009). Recognizing contextual polarity: An exploration of features for phrase-level sentiment analysis. *Computational Linguistics*, **35**(3), 399–433.

Web of Science® | Google Scholar

Young, L., & Soroka, S. (2012). Affective news: The automated coding of sentiment in political texts. *Political Communication*, **29**, 205–231.

Web of Science® | Google Scholar

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