

Atividade 1: Pesquisa e apresentação do Texto Científico 1

A survey on classification techniques for opinion mining and sentiment analysis

Disciplina: Prática de Laboratório de Pesquisa (TC Parte 1)
Profa Ana Maria Martins Carvalho Msc – 1º Sem/2024
Nome do Aluno (a): Arthur Fernandes Miranda Borges de Morais

Nome do texto científico: Artigo.

Nome dos autores: Fatemeh Hemmatian, Mohammad Karim Sohrabi.

Ano de Publicação: 2017.

Nome do Periódico: A survey on classification techniques for opinion mining and sentiment analysis.

Qualis: A1.

OBJETIVOS

1 - OBJETIVO GERAL

Realizar uma revisão sistemática de mineração de opiniões e análise de sentimento para classificar os métodos disponíveis e comparar suas vantagens e desvantagens.

2 - OBJETIVOS ESPECÍFICOS

Realizar a abordagem geral da mineração de opinião, abordar cada método principal, sua base de funcionamento, pontuar vantagens, desvantagens e características.

Qual é o problema (pergunta a ser respondida com essa pesquisa)?

Como é o processo de mineração de opinião e análise de sentimento, quais são os métodos conhecidos até a data de publicação, como eles funcionam e quais suas vantagens e desvantagens.

Qual a justificativa para fazer essa pesquisa?

Apesar de existirem vários artigos sobre métodos de mineração de opinião, a falta de artigos de revisão sistemática entre eles é um fato. Este artigo se apresenta para suprir esta demanda.

Metodologia

Realizar a revisão dos artigos selecionados, coletar as informações principais sobre eles, apresentar diagramas com o processo da mineração de opinião e montar uma tabela que compara os métodos dos artigos selecionados, pontuando suas características.

Abdul-Mageed M, Diab M, Kübler S (2014) SAMAR: subjectivity and sentiment analysis for arabic social

media. Comput Speech Lang 28(1):20-37

Acampora G, Cosma G (2015) A comparison of fuzzy approaches to E-commerce review rating prediction.

In: 2015 conference of the international fuzzy systems association and the European society for fuzzy

logic and technology (IFSA-EUSFLAT-15). Atlantis Press

Ahmed S, Danti A (2016) Effective sentimental analysis and opinion mining of web reviews using rule based

classifiers. In: Behera H, Mohapatra D (eds) Computational intelligence in data mining—volume 1.

Advances in intelligent systems and computing, vol 410. Springer, New Delhi Alfaro C, Cano-Montero J, Gómez J, Moguerza JM, Ortega F (2016) A multi-stage method for content

classification and opinion mining on weblog comments. Ann Oper Res 236(1):197–213 Anjaria M, Guddeti RMR (2014) A novel sentiment analysis of social networks using supervised learning.

Soc Netw Anal Min 4(1):1–15

Appel O, Chicalana F, Carter J, Fujita H (2016) A hybrid approach to the sentiment analysis problem at the

sentence level. Knowl Based Syst 108:110-124

Arab M, Sohrabi MK (2017) Proposing a new clustering method to detect phishing websites.

Turk J Electr

Eng Comput Sci. https://doi.org/10.3906/elk-1612-279

Archambault D, Greene D, Cunningham P (2013) Twittercrowds: techniques for exploring topic and sentiment

in microblogging data. Preprint. arXiv:1306.3839

Baeza-Yates R, Ribeiro-Neto B (1999) Modern information retrieval, vol 463. ACM Press, New York

Bajpai R, Poria S, Ho D, Cambria E (2017) Developing a concept-level knowledge base for sentiment analysis

in Singlish. Preprint. arXiv:1707.04408

Balahur A, Perea-Ortega JM (2015) Sentiment analysis system adaptation for multilingual processing: the

case of tweets. Inf Process Manag 51(4):547–556

Balahur A, Hermida JM, Montoyo A (2012) Detecting implicit expressions of emotion in text: a comparative

analysis. Decis Support Syst 53(4):742–753

Balazs JA, Velasquez JD (2016) Opinion mining and information fusion: a survey. Inf Fusion 27:95–110

Bastı E, Kuzey C, Delen D (2015) Analyzing initial public offerings' short-term performance using decision

trees and SVMs. Decis Support Syst 73:15–27

Belkin M, Niyogi P, Sindhwani V (2006) Manifold regularization: a geometric framework for learning from

labeled and unlabeled examples. J Mach Learn Res 7:2399–2434

Berger AL, Pietra VJD, Pietra SAD (1996) A maximum entropy approach to natural language processing.

Comput Linguist 22(1):39-71

Bilal M, Israr H, Shahid M, Khan A (2016) Sentiment classification of Roman-Urdu opinions using Naïve

Bayesian, decision tree and KNN classification techniques. J King Saud Univ Comput Inf Sci 28:330–344

Bing L, Chan KC, Ou C (2014) Public sentiment analysis in Twitter data for prediction of a company's

stock price movements. In: IEEE 11th international conference on e-business engineering (ICEBE), pp

232-239

Bisio F, Meda C, Gastaldo P, Zunino R, Cambria E (2017) Concept-level sentiment analysis with SenticNet.

In: Cambria E, Das D, Bandyopadhyay S, Feraco A (eds) A practical guide to sentiment analysis. Socioaffective computing, vol 5. Springer, Cham, pp 173–188

Blei DM, Ng AY, Jordan MI (2003) Latent dirichlet allocation. J Mach Learn Res 3:993–1022 Blitzer J, Dredze M, Pereira F (2007) Biographies, bollywood, boom-boxes and blenders: domain adaptation

for sentiment classification. In: ACL, vol 7, pp 440–447

Blum A, Chawla S (2001) Learning from labeled and unlabeled data using graph mincuts. In: Brodley CE,

Danyluk AP (eds) Proceedings of the eighteenth international conference on machine learning, pp 19–26

Blum A, Mitchell T (1998) Combining labeled and unlabeled data with co-training. In:

Proceedings of the

eleventh annual conference on computational learning theory. ACM, pp 92–100

Boiy E, Moens MF (2009) A machine learning approach to sentiment analysis in multilingual Web texts. Inf

Retr 12(5):526-558

Bollen J, Mao H, Zeng X (2011) Twitter mood predicts the stock market. J Comput Sci 2(1):1–8

Bouadjenek MR, Hacid H, Bouzeghoub M (2016) Social networks and information retrieval, how are they converging? A survey, a taxonomy and an analysis of social information retrieval approaches and platforms.

Inf Syst 56:1–18

Bravo-Marquez F, Frank E, Pfahringer B (2016) Building a Twitter opinion lexicon from automaticallyannotated tweets. Knowl Based Syst 108:65–78

Cai C, Xia B (2015) Convolutional neural networks for multimedia sentiment analysis. In: 4th Springer

conference on natural language processing and Chinese computing, pp 159–167

Cambria E (2013) An introduction to concept-level sentiment analysis. In: MICAI 2013:

Advances in soft

computing and its applications Mexican international conference on artificial intelligence, pp 478–483

Cambria E (2016) Affective computing and sentiment analysis. IEEE Intell Syst 31(2):102–107

Cambria E, Schuller B, Xia Y, Havasi C (2013) New avenues in opinion mining and sentiment analysis. IEEE

Intell Syst 28(2):15-21

Carter D, Inkpen D (2015) Inferring aspect-specific opinion structure in product reviews using co-training. In:

Gelbukh A (ed) Computational linguistics and intelligent text processing. CICLing 2015.

Lecture notes

in computer science, vol 9042. Springer, Cham, pp 225–240

Chao AFY, Yang H (2018) Using Chinese radical parts for sentiment analysis and domain-dependent seed set

extraction. Comput Speech Lang 47:194-213

Chen LS, Liu CH, Chiu HJ (2011) A neural network based approach for sentiment classification in the

blogosphere. J Informetr 5(2):313–322

Chen L, Wang F, Qi L, Liang F (2014) Experiment on sentiment embedded comparison interface. Knowl

Based Syst 64:44-58

Chen T, Xu R, He Y, Xia Y, Wang X (2016) Learning user and product distributed representations using a

sequence model for sentiment analysis. IEEE Comput Intell Mag 11(3):34-44

Chinsha TC, Joseph S (2015) A syntactic approach for aspect based opinion mining. In:

IEEE international

conference on semantic computing (ICSC), pp 24-31

Claypo N, Jaiyen S (2015) Opinion mining for thai restaurant reviews using K-means clustering and MRF

feature selection. In: 7th international conference on knowledge and smart technology (KST), pp 105–108

Cortes C, Vapnik V (1995) Support-vector networks. Mach Learn 20(3):273–297

Cover TM, Thomas JA (2012) Elements of information theory. Wiley, London

Da Silva NFF, Coletta LF, Hruschka ER, Hruschka ER Jr (2016) Using unsupervised information to improve

semi-supervised tweet sentiment classification. Inf Sci 355:348-365

Dang Y, Zhang Y, Chen H (2010) A lexicon-enhanced method for sentiment classification: an experiment on

online product reviews. IEEE Intell Syst 25(4):46-53

Daud A, Khan W, Che D (2017) Urdu language processing: a survey. Artif Intell Rev 47(3):279–311

Dave K, Lawrence S, Pennock DM (2003) Mining the peanut gallery: opinion extraction and semantic classification of product reviews. In: Proceedings of the 12th international ACM conference on World Wide

Web, pp 519-528

De A, Kopparapu SK (2013) Unsupervised clustering technique to harness ideas from an Ideas Portal. In:

International IEEE conference on advances in computing, communications and informatics (ICACCI),

pp 1563-1568

De Fortuny EJ, De Smedt T, Martens D, Daelemans W (2014) Evaluating and understanding text-based stock

price prediction models. Inf Process Manag 50(2):426-441

Di Caro L, Grella M (2013) Sentiment analysis via dependency parsing. Comput Stand Interfaces 35(5):442–

453

Duncan B, Zhang Y (2015) Neural networks for sentiment analysis on Twitter. In: IEEE 14th international

conference on cognitive informatics & cognitive computing (ICCICC), pp 275–278

Duwairi RM, Qarqaz I (2014) Arabic sentiment analysis using supervised classification. In:

International IEEE

conference on future internet of things and cloud (FiCloud), pp 579-583

Ebrahimi M, Suen CY, Ormandjieva O (2016) Detecting predatory conversations in social media by deep

convolutional neural networks. Digit Investig 18:33-49

Farra N, Challita E, Assi RA, Hajj H (2010) Sentence-level and document-level sentiment mining for arabic

texts. In: Proceedings of IEEE international conference on data mining workshops, pp 1114–1119

Feng S, Song K, Wang D, Yu G (2015) A word-emoticon mutual reinforcement ranking model for building

sentiment lexicon from massive collection of microblogs. World Wide Web 18(4):949–967 Fernández-Gavilanes M, Álvarez-López T, Juncal-Martínez J, Costa-Montenegro E, González-Castaño FJ

(2016) Unsupervised method for sentiment analysis in online texts. Expert Syst Appl 58:57–75

Fersini E, Messina E, Pozzi FA (2016) Expressive signals in social media languages to improve polarity

detection. Inf Process Manag 52(1):20–35

Ficamos P, Liu Y, Chen W (2017) A Naive Bayes and maximum entropy approach to sentiment analysis: capturing domain-specific data in Weibo. In: IEEE international conference on big data and smart computing (BigComp), pp 336–339

Gao W, Li S, Xue Y, Wang M, Zhou G (2014) Semi-supervised sentiment classification with self-training

on feature subspaces. In: Su X, He T (eds) Chinese Lexical Semantics. CLSW 2014.

Lecture notes in

computer science, vol 8922. Springer, Cham, pp 231–239

Gao K, Xu H, Wang J (2015) A rule-based approach to emotion cause detection for Chinese micro-blogs.

Expert Syst Appl 42(9):4517–4528

Garcia-Pablos A, Guadros M, Rigau G (2017) W2VLDA: almost unsupervised system for aspect based sentiment analysis. Expert Syst Appl.

https://doi.org/10.1016/j.eswa.2017.08.049

Goel A, Gautam J, Kumar S (2016) Real time sentiment analysis of tweets using Naive Bayes. In: 2nd

international conference on next generation computing technologies (NGCT), pp 257–261 Grefenstette G, Qu Y, Shanahan JG, Evans DA (2004) Coupling niche browsers and affect analysis for an

opinion mining application. In: Proceedings of RIAO '04 Coupling approaches, coupling media and

coupling languages for information retrieval, pp 186–194

Gu X, Gu Y, Wu H (2017) Cascaded convolutional neural networks for aspect-based opinion summary. Neural

Process Lett 46:1-20

Gupta E, Rathee G, Kumar P, Chauhan DS (2015) Mood swing analyser: a dynamic sentiment detection

approach. Proc Natl Acad Sci India Sect A Phys Sci 85(1):149–157

Habernal I, Ptá*cek T, Steinberger J (2015) Supervised sentiment analysis in Czech social media. Inf Process

Manag 51(4):532-546

Hajmohammadi MS, Ibrahim R, Selamat A (2014) Cross-lingual sentiment classification using multiple source

languages in multi-view semi-supervised learning. Eng Appl Artif Intell 36:195–203

Hajmohammadi MS, Ibrahim R, Selamat A (2015) Graph-based semi-supervised learning for cross-lingual

sentiment classification. In: Guyen N, Trawi 'nski B, Kosala R (eds) Intelligent Information and Database

Systems. ACIIDS 2015. Lecture notes in computer science, vol 9011. Springer, Cham, pp 97–106

Hasan KMA, Sabuj MS, Afrin Z (2015) Opinion mining using Naïve Bayes. In: IEEE International WIE

conference on electrical and computer engineering (WIECON-ECE)

Hassan A, Radev D (2010) Identifying text polarity using random walks. In: Proceedings of the 48th annual

meeting of the association for computational linguistics. Association for Computational Linguistics, pp 395–403

Hatzivassiloglou V, McKeown KR (1997) Predicting the semantic orientation of adjectives.

In: Proceedings

of the 35th annual meeting of the association for computational linguistics and eighth conference of

the European chapter of the association for computational linguistics. Association for Computational

Linguistics, pp 174–181

He Y, Zhou D (2011) Self-training from labeled features for sentiment analysis. Inf Process Manag 47(4):606–

616

Hofmann T (1999) Probabilistic latent semantic indexing. In: Proceedings of the 22nd annual international

ACM SIGIR conference on Research and development in information retrieval. ACM, pp 50–57

Hong S, Lee J, Lee JH (2014) Competitive self-training technique for sentiment analysis in mass social media.

In: 15th international symposium on soft computing and intelligent systems (SCIS), 2014 Joint 7th

International Conference on and Advanced Intelligent Systems (ISIS). IEEE, pp 9–12

Huang F, Zhang S, Zhang J, Yu G (2017) Multimodal learning for topic sentiment analysis in microblogging.

Neurocomputing 253:144–153

Hu M, Liu B (2004) Mining and summarizing customer reviews. In: Proceedings of the tenth ACM SIGKDD

international conference on knowledge discovery and data mining. ACM, pp 168–177 losifidis V, Ntutsi E (2017) Large scale sentiment learning with limited labels. In:

Proceedings of the 23rd

ACM SIGKDD international conference on knowledge discovery and data mining, pp 1823–1832

Irsoy O, Cardie C (2014) Opinion mining with deep recurrent neural networks. In: Proceedings of the conference on empirical methods in natural language processing (EMNLP)

Jain A, Jain M (2017) Location based Twitter opinion mining using common-sense information. Glob J Enterp

Inf Syst 9(2):28–32

Jeyapriya A, Selvi K (2015) Extracting aspects and mining opinions in product reviews using supervised

learning algorithm. In: 2015 2nd international conference on electronics and communication systems

(ICECS). IEEE, pp 548-552

Jian Z, Chen X, Wang HS (2010) Sentiment classification using the theory of ANNs. J China Univ Posts

Telecommun 17:58-62

Jiang D, Luo X, Xuan J, Xu Z (2017a) Sentiment computing for the news event based on the social media big

data. IEEE Access 5:2373-2382

Jiang M, Wang J, Lan M, Wu Y (2017b) An effective gated and attention-based neural network model for finegrained financial target-dependent sentiment analysis. In: Springer international conference on knowledge

science, engineering and management, pp 42-54

Jiménez-Zafra SM, Martín-Valdivia MT, Martínez-Cámara E, Ureña-López LA (2015) Combining resources

to improve unsupervised sentiment analysis at aspect-level. J Inf Sci 42:213–229 Jin W, Ho HH, Srihari RK (2009) OpinionMiner: a novel machine learning system for web

opinion mining and

extraction. In: Proceedings of the 15th ACM SIGKDD international conference on knowledge discovery

and data mining, pp 1195-1204

Joachims T (1998) Text categorization with support vector machines: learning with many relevant features.

Springer, Berlin, pp 137–142

Joachims T (2003) Transductive learning via spectral graph partitioning. In: ICML, vol 3, pp 290–297

Kagan V, Stevens A, Subrahmanian VS (2015) Using twitter sentiment to forecast the 2013 pakistani election

and the 2014 indian election. IEEE Intell Syst 1:2-5

Kalchbrenner N, Grefenstette E, Blunsom P (2014) A convolutional neural network for modelling sentences.

In: Proceedings of the 52nd annual meeting of the association for computational linguistics Kanayama H, Nasukawa T (2006) Fully automatic lexicon expansion for domain oriented sentiment analysis.

In: Proceedings of the conference on empirical methods in natural language processing, Association for

Computational Linguistics, pp 355–363

Keshavarz H, Abadeh MS (2017) ALGA: adaptive lexicon learning using genetic algorithm for sentiment

analysis of microblogs. Knowl Based Syst 122:1-16

Keshtkar F, Inkpen D (2013) A bootstrapping method for extracting paraphrases of emotion expressions from

texts. Comput Intell 29(3):417-435

Khan FH, Bashir S, Qamar U (2014) TOM: Twitter opinion mining framework using hybrid classification

scheme. Decis Support Syst 57:245-257

Khan FH, Qamar U, Bashir S (2016) Multi-objective model selection (MOMS)-based semi-supervised framework for sentiment analysis. Cogn Comput 8(4):614–628 Khan FH, Qamar U, Bashir S (2017) Lexicon based semantic detection of sentiments using expected likelihood

estimate smoothed odds ratio. Artif Intell Rev 48(1):113–138

Kisioglu P, Topcu YI (2011) Applying Bayesian belief network approach to customer churn analysis: a case

study on the telecom industry of Turkey. Expert Syst Appl 38(6):7151–7157

Kobayashi N, Inui K, Matsumoto Y (2007) Extracting aspect-evaluation and aspect-of relations in opinion

mining. In: EMNLP-CoNLL, vol 7, pp 1065-1074

Kranjc J, Smailovi´c J, Podpečan V, Grčar M, Žnidaršičc M, Lavračc N (2015) Active learning for sentiment

analysis on data streams: methodology and workflow implementation in the ClowdFlows platform. Inf

Process Manag 51(2):187–203

Kumar S, Morstatter F, Liu H (2014) Twitter data analytics. Springer, Berlin

Lafferty J, McCallum A, Pereira FC (2001) Conditional random fields: probabilistic models for segmenting and

labeling sequence data. In: Proceedings of the eighteenth international conference on machine learning,

pp 282-289

Li G, Liu F (2012) Application of a clustering method on sentiment analysis. J Inf Sci 38(2):127–139

Li G, Liu F (2014) Sentiment analysis based on clustering: a framework in improving accuracy and recognizing

neutral opinions. Appl Intell 40(3):441-452

Li G, Chang K, Hoi SC (2012) Multiview semi-supervised learning with consensus. IEEE Trans Knowl Data

Eng 24(11):2040-2051

Li S, Zhou L, Li Y (2015) Improving aspect extraction by augmenting a frequency-based method with webbased similarity measures. Inf Process Manag 51(1):58–67

Li Q, Jin Z, Wang C, Zeng DD (2016) Mining opinion summarizations using convolutional neural networks

in Chinese microblogging systems. Knowl Based Syst 107:289–300

Li Q, Guo X, Bai X (2017) Weekdays or weekends: exploring the impacts of microblog posting patterns on

gratification and addiction. Inf Manag 54(5):613–624

Liao C, Feng C, Yang S, Huang H (2016) A hybrid method of domain lexicon construction for opinion targets

extraction using syntax and semantics. J Comput Sci Technol 31:595–603

Liu B (2007) Web data mining: exploring hyperlinks, contents, and usage data. Springer, Berlin

Liu B (2012) Sentiment analysis and opinion mining. Synthesis lectures on human language technologies.

Morgan & Calypool Publishers, pp 1–167.

https://doi.org/10.2200/S00416ED1V01Y201204HLT016

Liu B (2015) Sentiment analysis: mining opinions, sentiments, and emotions. Cambridge University Press,

Cambridge

Liu B, Zhang L (2012) A Survey of Opinion Mining and Sentiment Analysis. In: Aggarwal C., Zhai C. (eds)

Mining text data. Springer, Boston, MA, pp 415–463

Liu J, Seneff S, Zue V (2012) Harvesting and summarizing user-generated content for advanced speech-based

HCI. IEEE J Sel Top Signal Process 6(8):982–992

Liu S, Li F, Li F, Cheng X, Shen H (2013a) Adaptive co-training SVM for sentiment classification on tweets.

In: Proceedings of the 22nd ACM international conference on conference on information & knowledge

management. ACM, pp 2079–2088

Liu S, Zhu W, Xu N, Li F, Cheng XQ, Liu Y, Wang Y (2013b) Co-training and visualizing sentiment evolvement

for tweet events. In: Proceedings of the 22nd international conference on World Wide Web companion.

International World Wide Web Conferences Steering Committee, pp 105–106

Lo SL, Cambria E, Chiong R, Cornforth D (2017) Multilingual sentiment analysis: from formal to informal

and scarce resource languages. Artif Intell Rev 48(4):499–527

Lu TJ (2015) Semi-supervised microblog sentiment analysis using social relation and text similarity. In: 2015

international conference on big data and smart computing (BigComp). IEEE, pp 194–201 Luo W, Zhuang F, Zhao W, He Q, Shi Z (2015) QPLSA: utilizing quad-tuples for aspect identification and

rating. Inf Process Manag 51(1):25-41

Lv Y, Liu J, Chen H, Mi J, Liu M, Zheng Q (2017) Opinioned post detection in Sina Weibo.

IEEE Access

5:7263-7271

Ma B, Zhang N, Liu G, Li L, Yuan H (2015) Semantic search for public opinions on urban affairs: a probabilistic

topic modeling-based approach. Inf Process Manag 52:430

Ma H, Jia M, Zhang D, Lin X (2017) Combining tag correlation and user social relation for microblog

recommendation. Inf Sci 385-386:325-337

Majumder N, Poria S, Gelbukh A, Cambria E (2017) Deep learning-based document modeling for personality

detection from text. IEEE Intell Syst 32(2):74-79

Manek AS, Shenoy PD, Mohan MC, Venougopal KR (2017) Aspect term extraction for sentiment analysis

in large movie reviews using Gini Index feature selection method and SVM classifier. World Wide Web

20(2):135-154

Marcheggiani D, Täckström O, Esuli A, Sebastiani F (2014) Hierarchical multi-label conditional random fields

for aspect-oriented opinion mining. In: de Rijke M et al (eds) Advances in information retrieval. ECIR

2014. Lecture notes in computer science, vol 8416. Springer, Cham, pp 273–285 Marrese-Taylor E, Velásquez JD, Bravo-Marquez F (2014) A novel deterministic approach for aspect-based

opinion mining in tourism products reviews. Expert Syst Appl 41(17):7764–7775

Medhat W, Hassan A, Korashy H (2014) Sentiment analysis algorithms and applications: a survey. Ain Shams

Eng J 5(4):1093–1113

Mele I (2013) Web usage mining for enhancing search-result delivery and helping users to find interesting

web content. In: Proceedings of the sixth ACM international conference on Web search and data mining.

ACM, pp 765-770

Mesnil G, Mikolov T, Ranzato MA, Bengio Y (2015) Ensemble of generative and discriminative techniques

for sentiment analysis of movie reviews. Preprint. arXiv:1412.5335

Mihalcea R, Banea C, Wiebe JM (2007) Learning multilingual subjective language via cross-lingual projections. In: Proceedings of the Association for Computational Linguistics (ACL 2007), Prague

Mohammad SM, Zhu X, Kiritchenko S, Martin J (2015) Sentiment, emotion, purpose, and style in electoral

tweets. Inf Process Manag 51(4):480-499

Molina-González MD, Martínez-Cámara E, Martín-Valdivia MT, Urena-López LA (2014) Cross-domain sentiment analysis using Spanish opinionated words. In: Métais E, Roche M,

Teisseire M (eds) Natural

language processing and information systems. NLDB 2014. Lecture notes in computer science, vol

8455. Springer, Cham, pp 214–219

Molina-González MD, Martínez-Cámara E, Martín-Valdivia MT, Ureña-López LA (2015) A Spanish semantic

orientation approach to domain adaptation for polarity classification. Inf Process Manag 51(4):520–531

Moraes R, Valiati JF, Neto WPG (2013) Document-level sentiment classification: an empirical comparison

between SVM and ANN. Expert Syst Appl 40(2):621–633

Moreo A, Romero M, Castro JL, Zurita JM (2012) Lexicon-based comments-oriented news sentiment analyzer

system. Expert Syst Appl 39(10):9166–9180

Mudinas A, Zhang D, Levene M (2012) Combining lexicon and learning based approaches for concept-level

sentiment analysis. In: Proceedings of the first international workshop on issues of sentiment discovery

and opinion mining

Muhammad A, Wiratunga M, Lothian R (2016) Contextual sentiment analysis for social media genres. Knowl

Based Syst 108:92-101

Mukherjee A, Liu B (2012) Aspect extraction through semi-supervised modeling. In:

Proceedings of the 50th

annual meeting of the association for computational linguistics: long papers—volume 1.

Association for

Computational Linguistics, pp 339–348

Mullen T, Collier N (2004) Sentiment analysis using support vector machines with diverse information sources.

In: EMNLP, vol 4, pp 412-418

Nofer M, Hinz O (2015) Using Twitter to predict the stock market. Bus Inf Syst Eng

57(4):229–242

Olson DL, Delen D (2008) Advanced data mining techniques. Springer, Berlin

Pandarachalil R, Sendhilkumar S, Mahalakshmi GS (2015) Twitter sentiment analysis for large-scale data: an

unsupervised approach. Cogn Comput 7(2):254–262

Pandey AC, Rajpoot DS, Saraswat M (2017) Twitter sentiment analysis using hybrid cuckoo search method.

Inf Process Manag 53(4):764-779

Pang B, Lee L (2004) A sentimental education: sentiment analysis using subjectivity summarization based on

minimum cuts. In: Proceedings of the 42nd annual meeting on Association for Computational Linguistics.

Association for Computational Linguistics

Pang B, Lee L, Vaithyanathan S (2002) Thumbs up? Sentiment classification using machine learning techniques. In: Proceedings of the ACL-02 conference on empirical methods in natural language processing,

vol 10, pp 79–86

Parveen H, Pandey S (2016) Sentiment analysis on Twitter data-set using Naive Bayes algorithm. In: 2nd international conference on applied and theoretical computing and communication technology (iCATccT),

pp 416-419

Penalver-Martinez I, Garcia-Sanchez F, Valencia-Garcia R, Rodriguez-Garcia MA, Moreno V, Fraga A,

Sanchez-Cervantes JL (2014) Feature-based opinion mining through ontologies. Expert Syst Appl

41(13):5995-6008

Peng H, Cambria E, Hussain A (2017) A review of sentiment analysis research in Chinese language. Cogn

Comput 9(4):423-435

Petz G, Karpowicz M, Fürschuß H, Auinger A, Střríteský V, Holzinger A (2015)

Computational approaches

for mining user's opinions on the Web 2.0. Inf Process Manag 51(4):510-519

Pham D, Le A (2017) Learning multiple layers of knowledge representation for aspect based sentiment analysis.

Data Knowl Eng. https://doi.org/10.1016/j.datak.2017.06.001

Phu VN, Dat ND, Tran VTN, Chau VTN, Nguyen TA (2017) Fuzzy C-means for english sentiment classification in a distributed system. Appl Intell 46(3):717–738

Ponomareva N (2014) Graph-based approaches for semi-supervised and cross-domain sentiment analysis.

PhD Thesis, University of Wolverhampton

Poria S, Gelbukh A, Hussain A, Howard N, Das D, Bandyopadhyay S (2013) Enhanced SenticNet with

affective labels for concept-based opinion mining. IEEE Intell Syt 28(2):31-38

Poria S, Cambria E, Winterstein G, Huang GB (2014) Sentic patterns: dependency-based rules for concept-level

sentiment analysis. Knowl Based Syst 69:45-63

Poria A, Cambria E, Gelbukh A (2016) Aspect extraction for opinion mining with a deep convolutional neural

network. Knowl Based Syst 108:42-49

Poria S, Peng H, Hussan A, Howard N, Cambria E (2017) Ensemble application of convolutional neural

networks and multiple kernel learning for multimodal sentiment analysis. Neurocomputing 261:217–

230

Qazi A, Syed KBS, Raj RG, Cambria E, Tahir M, Alghazzawi D (2016) A concept-level approach to the

analysis of online review helpfulness. Comput Hum Behav 58:75-81

Qiu G, Liu B, Bu J, Chen C (2011) Opinion word expansion and target extraction through double propagation.

Comput Linguist 37(1):9–27

Quinlan JR (1986) Induction of decision trees. Mach Learn 1(1):81–106

Rabiner LR (1989) A tutorial on hidden Markov models and selected applications in speech recognition. Proc

IEEE 77(2):257-286

Ramadhani RA, Indirani F, Nugrahadi DT (2016) Comparison of Naive Bayes smoothing methods for Twitter

sentiment analysis. In: International conference on advanced computer science and information systems

(ICACSIS), pp 287–292

Rana TA, Cheah Y (2016) Aspect extraction in sentiment analysis: comparative analysis and survey. Artif

Intell Rev 46(4):459-483

Rao Y, Lei J, Wenyin L, Li Q, Chen M (2014) Building emotional dictionary for sentiment analysis of online

news. World Wide Web 17(4):723-742

Rathan M, Hulipalled VR, Venugopal KR, Patnaik LM (2017) Consumer insight mining: aspect based Twitter

opinion mining of mobile phone reviews. Appl Soft Comput.

https://doi.org/10.1016/j.asoc.2017.07.056

Ravi K, Ravi V (2015) A survey on opinion mining and sentiment analysis: Tasks, approaches and applications.

Knowl Based Syst 89:14-46

Ren F, Kang X (2013) Employing hierarchical Bayesian networks in simple and complex emotion topic

analysis. Comput Speech Lang 27(4):943–968

Riaz S, Fatima M, Kamran M, Nasir MW (2017) Opinion mining on large scale data using sentiment analysis

and k-means clustering. Clust Comput 20:1–16

Rout JK, Dalima A, Choo KR, Bakshi S, Jena SK (2017) Revisiting semi-supervised learning for online

deceptive review detection. IEEE Access 5:1319–1327

Saif H, He Y, Fernandez M, Alani H (2016) Contextual semantics for sentiment analysis of Twitter. Inf Process

Manag 52(1):5-19

Saleh MR, Martín-Valdivia MT, Montejo-Ráez A, Ureña-López LA (2011) Experiments with SVM to classify

opinions in different domains. Expert Syst Appl 38(12):14799–14804

Scholer F, Kelly D, Carterette B (2016) Information retrieval evaluation using test collections. Inf Retr J

19(3):225-229

Severyn A, Moschitti A, Uryupina O, Plank B, Filippova K (2016) Multi-lingual opinion mining on youtube.

Inf Process Manag 52(1):46–60

Shah RR, Yu Y, Verma A, Tang S, Shaik AD, Zimmermann R (2016) Leveraging multimodal information for

event summarization and concept-level sentiment analysis. Knowl Based Syst 108:102-109

Sharma R, Nigam S, Jain R (2014) Opinion mining of movie reviews at document level. Preprint.

arXiv:1408.3829

Shi B, Chang K (2008) Generating a concept hierarchy for sentiment analysis. In: IEEE international conference

on systems, man and cybernetics, SMC 2008. IEEE, pp 312–317

Sierra B, Lazkano E, Jauregi E, Irigoien I (2009) Histogram distance-based bayesian network structure learning:

a supervised classification specific approach. Decis Support Syst 48(1):180–190 Sindhwani V, Melville P (2008) Document-word co-regularization for semi-supervised sentiment analysis. In:

8th IEEE international conference on data mining, pp 1025–1030

Singh J, Gupta V (2017) A systematic review of text stemming techniques. Artif Intell Rev 48(2):157–217

Sisodia DS, Verma S (2012) Web usage pattern analysis through web logs: a review. In: 2012 international

joint conference on computer science and software engineering (JCSSE). IEEE, pp 49–53 Sohrabi MK (2018) A gossip-based information fusion protocol for distributed frequent itemset mining. Enterp

Inf Syst. https://doi.org/10.1080/17517575.2017.1405286

Sohrabi MK, Akbari S (2016) A comprehensive study on the effects of using data mining techniques to predict

tie strength. Comput Hum Behav 60:534-541

Sohrabi MK, Azgomi H (2017a) Parallel set similarity join on big data based on locality-sensitive hashing.

Sci Comput Program 145:1–12

Sohrabi MK, Azgomi H (2017b) TSGV: a table-like structure based greedy method for materialized view

selection in data warehouse. Turk J Electr Eng Comput Sci 25(4):3175–3187

Sohrabi MK, Barforoush AA (2012) Efficient colossal pattern mining in high dimensional datasets. Knowl

Based Syst 33:41-52

Sohrabi MK, Barforoush AA (2013) Parallel frequent itemset mining using systolic arrays.

Knowl Based Syst

37:462-471

Sohrabi MK, Ghods V (2014) Top-down vertical itemset mining. In: Proceedings of the SPIE 9443 sixth

international conference on graphic and image processing

Sohrabi MK, Ghods V (2015) Top- materialized view selection for a data warehouse using frequent itemset

mining. In: Proceedings of the ICACTE conference, Berlin, Germany

Sohrabi MK, Ghods V (2016) CUSE: a novel cube-based approach for sequential pattern mining. In: Proceedings of the IEEE international symposium on computational business intelligence, Olten, Switzerland

Sohrabi MK, Karimi F (2018) Feature selection approach to detect spam in the Facebook social network. Arab

J Sci Eng. https://doi.org/10.1007/s13369-017-2855-x

Sohrabi MK, Marzooni HH (2016) Association rule mining using new FP-linked list algorithm.

J Adv Comput

Res 7(01):23-34

Sohrabi MK, Roshani R (2017) Frequent itemset mining using cellular learning automata.

Comput Hum Behav

68:244-253

Sohrabi MK, Tajik A (2017) Multi-objective feature selection for warfarin dose prediction.

Comput Biol Chem

69:126-133

Speriosu M, Sudan N, Upadhyay S, Baldridge J (2011) Twitter polarity classification with label propagation

over lexical links and the follower graph. In: Proceedings of the first workshop on unsupervised learning

in NLP. Association for Computational Linguistics, pp 53–63

Subrahmanian VS, Reforgiato D (2008) AVA: adjective-verb-adverb combinations for sentiment analysis.

IEEE Intell Syst 23(4):43-50

Subramanya A, Bilmes J (2011) Semi-supervised learning with measure propagation. J Mach Learn Res

12:3311-3370

Sun J, Wang G, Cheng X, Fu Y (2015) Mining affective text to improve social media item recommendation.

Inf Process Manag 51(4):444–457

Sun S, Luo C, Chen J (2017) A review of natural language processing techniques for opinion mining systems.

Inf Fusion 36:10-25

Taboada M, Brooke J, Tofiloski M, Voll K, Stede M (2011) Lexicon-based methods for sentiment analysis.

Comput Linguist 37(2):267-307

Talukdar PP, Crammer K (2009) New regularized algorithms for transductive learning. In:

Buntine W, Grobelnik M, Mladeni'c D, Shawe-Taylor J (eds) Machine learning and knowledge discovery in databases.

ECML PKDD 2009. Lecture notes in computer science, vol 5782. Springer, Berlin, pp 442–457

Tang D, Qin B, Liu T, Yang Y (2015) User modeling with neural network for review rating prediction.

In: Proceedings of IJCAI, pp 1340–1346

Tang H, Tan S, Cheng X (2009) A survey on sentiment detection of reviews. Expert Syst Appl 36(7):10760–

10773

Tripathy A, Agrawal A, Rath SK (2016) Classification of sentiment reviews using n-gram machine learning

approach. Expert Syst Appl 57:117-126

Titov I, McDonald R (2008) Modeling online reviews with multi-grain topic models. In: Proceedings of the

17th international conference on World Wide Web, pp 111–120

Tsagkalidou K, Koutsonikola V, Vakali A, Kafetsios K (2011) Emotional aware clustering on micro-blogging

sources. In: D'Mello S, Graesser A, Schuller B, Martin JC (eds) Affective computing and intelligent

interaction. ACII 2011. Lecture notes in computer science, vol 6974. Springer, Berlin, pp 387–396

Tsai AC, Wu C, Tsai RT, Hsu JY (2013) Building a concept-level sentiment dictionary based on commonsense

knowledge. IEEE Intell Syt 28(2):22-30

Tsakalidis A, Papadopoulos S, Cristea AI, Kompatsiaris Y (2015) Predicting elections for multiple countries

using Twitter and polls. IEEE Intell Syst 30(2):10-17

Turney P (2002) 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 ACL'02,

Association for Computational Linguistics, pp 417–424

Unankard S, Li X, Sharaf M, Zhong J, Li X (2014) Predicting elections from social networks based on subevent detection and sentiment analysis. In: Web information systems engineering—WISE 2014. Springer,

Berlin, pp 1–16

Vakali A, Kafetsios K (2012) Emotion aware clustering analysis as a tool for Web 2.0 communities detection:

implications for curriculum development. In: World Wide Web Conference. WWW Velásquez JD (2013) Combining eye-tracking technologies with web usage mining for identifying Website

Keyobjects. Eng Appl Artif Intell 26(5):1469-1478

Vilares D, Alonso MA, Gómez-Rodríguez C (2017) Supervised sentiment analysis in multilingual environments. Inf Process Manag 53(3):595–607

Vinodhini G, Chandrasekaran RM (2016) A comparative performance evaluation of neural network based

approach for sentiment classification of online reviews. J King Saud Univ Comput Inf Sci 28(1):2–12

Vuli'c I, De Smet W, Tang J, Moens MF (2015) Probabilistic topic modeling in multilingual settings: an

overview of its methodology and applications. Inf Process Manag 51(1):111–147

Wan X (2011) Bilingual co-training for sentiment classification of Chinese product reviews.

Comput Linguist

37(3):587-616

Wang G, Zhang Z, Sun J, Yang S, Larson CA (2015a) POS-RS: a random subspace method for sentiment

classification based on part-of-speech analysis. Inf Process Manag 51(4):458–479

Wang J, Cong G, Zhao XW, Li X (2015b) Mining user intents in twitter: a semi-supervised approach to

inferring intent categories for tweets. In: Twentyninth AAAI conference on artificial intelligence

Wang J, Xue Y, Li S, Zhou G (2015c) Leveraging interactive knowledge and unlabeled data in gender classification with co-training. In: Liu A, Ishikawa Y, Qian T, Nutanong S, Cheema M (eds) Database Systems

for Advanced Applications. DASFAA 2015. Lecture notes in computer science, vol 9052. Springer,

Cham, pp 246-251

Wang G, Zheng D, Yang S (2017a) FCE-SVM: a new cluster based ensemble method for opinion mining from

social media. Inf Syst e-Bus Manag 15:1–22

Wang W, Tan G, Wang H (2017b) Cross-domain comparison of algorithm performance in extracting aspectbased opinions from Chinese online reviews. Int J Mach Learn Cybern 8(3):1053–1070

Wehrmann J, Becker W, Cagnini HE, Barros RC (2017) A character-based convolutional neural network for

language-agnostic Twitter sentiment analysis. In: IEEE international joint conference on neural networks

(IJCNN), pp 2384-2391

Wen S, Wan X (2014) Emotion classification in microblog texts using class sequential rules.

In: Twentyeighth

AAAI conference on artificial intelligence

Wilson T, Wiebe J, Hoffmann P (2005) Recognizing contextual polarity in phrase level sentiment analysis. In:

Proceedings of HLT/EMNLP-05

Wu Y, Zhang Q, Huang X, Wu L (2009) Phrase dependency parsing for opinion mining. In:

Proceedings of

the 2009 conference on empirical methods in natural language processing: volume 3.

Association for

Computational Linguistics, pp 1533–1541

Wu F, Song Y, Huang Y (2016) Microblog sentiment classification with heterogeneous sentiment knowledge.

Inf Sci 373:149-164

Xia R, Zong C, Li S (2011) Ensemble of feature sets and classification algorithms for sentiment classification.

Inf Sci 181(6):1138-1152

Xia Y, Cambria E, Hussain A (2015) AspNet: aspect extraction by bootstrapping generalization and propagation

using an aspect network. Cogn Comput 7(2):241–253

Xia R, Xu F, Yu J, Qi Y, Cambria E (2016) Polarity shift detection, elimination and ensemble: a three-stage

model for document-level sentiment analysis. Inf Process Manag 52(1):36-45

Xing FZ, Cambria E, Welsch RE (2018) Natural language based financial forecasting: a survey. Artif Intell

Rev. https://doi.org/10.1007/s10462-017-9588-9

Xu L, Lin J, Wang L, Yin C, Wang J (2017) Deep convolutional neural network based approach for aspect-based

sentiment analysis. Adv Sci Technol Lett 143:199–204

Yan X, Huang T (2015) Tibetan sentence sentiment analysis based on the maximum entropy model. In:

10th international conference on broadband and wireless computing, communication and applications

(BWCCA), pp 594-597

Yan Z, Jiang X, Pedryc W (2017) Fusing and mining opinions for reputation generation. Inf Fusion 36:172–184

Yang B, Cardie C (2014) Context-aware learning for sentence-level sentiment analysis with posterior regularization. In: ACL, no 1, pp 325–335

Yin PY, Guo YM (2013) Optimization of multi-criteria website structure based on enhanced tabu search and

web usage mining. Appl Math Comput 219(24):11082-11095

Yu J, Zha ZJ, Wang M, Chua TS (2011) Aspect ranking: identifying important product aspects from online

consumer reviews. In: Proceedings of the 49th annual meeting of the association for computational

linguistics: human language technologies, vol 1, pp 1496–1505

Zhang X, Gong W, Kawamura Y (2004) Customer behavior pattern discovering with web mining. In: Yu JX,

Lin X, Lu H, Zhang Y (eds) Advanced web technologies and applications. APWeb, Lecture notes in

computer science, vol 3007. Springer, Berlin, pp 844-853

Zhou F, Jiao JR, Yang XJ, Lei B (2017) Augmenting feature model through customer preference mining by

hybrid sentiment analysis. Expert Syst Appl 89:306–317

Zhuang L, Jing F, Zhu XY (2006) Movie review mining and summarization. In: Proceedings of the 15th ACM

international conference on information and knowledge management, pp 43-50

Zimmermann M, Ntoutsi E, Spiliopoulou M (2016) Extracting opinionated (sub) features from a stream of product reviews using accumulated novelty and internal re-organization. Inf Sci

329:876-899

Zimmermann M, Ntoutsi E, Spiliopoulou M (2014) A semi-supervised self-adaptive classifier over opinionated

streams. In: 2014 IEEE international conference on data mining workshop (ICDMW). IEEE, pp 425–432