

# Review of Sentiment Analysis: A Multilingual Approach

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**Abstract:** Social media is the platform where large amount of sentimental information are present. Sentiment analysis combines the natural language processing for analysing various emotions present in the social media. Natural language processing is a field in machine learning which is used to analyse and understand the given text. It can be used to analyse whether the product review or movie review is positive or negative based on data. The importance of Malayalam is increasing on social media sites and shopping sites which show the scope of this topic. The sentiment analysis is done with the help of sentiment classification. Dividing the tweets based on their polarity i.e. negative, positive and neutral. Here the positive comments are taken into consideration and the negative comments are discarded. This paper study various sentiment analysis works and analyses various approaches used for sentiment analysis of different languages.

**Keywords:** Machine learning, NLP, ANN, Maximum Entropy, Naive bayes

## I. INTRODUCTION

Sentiment analysis is a most research area in Natural Language Processing (NLP). Sentiment analysis is also called as opinion mining. Due to the rapid growth in the social media sentimental contents or emotions expressed in these platforms are increasing day by day. By analysing this content, we can identify the sentiments behind it. Sentiment analysis is used to analyse the reviews, social media and blogs. Polarity detection is mainly used for the sentiment analysis of the social media and blogs. Now a day's these inspire the people to express their emotions publicly. We know Malayalam is a language spoken India predominantly in the state of Kerala. It was designated as classical language in India in 2013. Today most of the people communicate through the regional language and Malayalam is a morphologically rich language so sentiment analyses have some complexities compared to English language. Here we also identify hate speech.

While using these social media where people share their feelings and belief a huge number of comments, post and messages are interchanged between them. This includes peoples from different background which often use hateful speech. These contents become difficult to control. Hate speech detection is used for the analysis of offensive speech used in these platforms. Social media contents are difficult to analyse due to its less reliability and presence of large number of noise content. Using of regional languages make sentiment analysis more difficult to perform. Comments and post are now often seen in these regional languages. For example in the case of Malayalam languages people use aggressive and hate words in comments and post. So the analysis of these becomes more important.

This paper attempts to study and compare the different sentiment analysis work.

## II. LITERATURE SURVEY

In [1] this paper considers the problem of classifying documents not by topic, but by overall sentiment. Naive Bayes is a text classification. It is used to assign to a given document of a class. Maximum entropy is an alternative technique which has proven effective in a number of natural language processing applications. Support vector machines are large margins, rather than probabilistic, classifier in contrast to Naive Bayes and Maximum Entropy represented by vector  $w$ .

In [2] it automatically collects corpus for sentiment analysis and opinion mining purposes. We execute linguistic analysis of the composed quantity and give details exposed phenomena. Using corpus, it build a sentiment classifier that is able to determine positive, negative and neutral statements for documents. Using Twitter API collected corpus of test posts and formed a dataset of three classes. Positive sentiment, negative sentiment and a set of objective text In order to collect a corpus of objective posts, it retrieved text messages from twitter accounts of popular. It acquired 44nwpps to collect a training set of objective texts, because it only exceeds 140 characters. Then it checks the distribution of words frequency in the corpus.

In [3] focused on a specific domain. Here first manually collects the corpus from Malayalam novels, after that pos-tagging (parts-of-speech) of the input. Using extracted patterns scoring of sentence is calculated. SO-PMI-IR formulas classify the inputs in to two classes desirable or not desirable. It appropriately classifies the input four classes: joy, sorrow, anger or neutral. For simplicity and to reduce error corpus creation and pos-tagging is done manually. Accuracy of the paper is 63%.

In paper [4] A computational lexicon plays an significant role in machine translation while it is the lay where all the data about the words of a language is stored for suitable habit. Words are gear of life which is universal in every language. All words in a language are sole having their own purpose and meaning. The syntactic and semantic information about individual words can be encapsulated in a extremely prearranged storehouse known s computational lexicon which is very necessary for Machine Translation. For scheming a computational lexicon, the first and foremost duty is to recognize the head words or root words in the language. The root word identifier planned in this work is a rule based approach which without human intervention removes the inflected part and derives the root words using morphophonemic rules. The system is experienced with 2400 words from a Malayalam corpus to create the linguistic data such as the root form, their inflected forms and grammatical class. The presentation is evaluated using the statistical actions like precision, recall and f-measure. The principles obtained for these actions are more than 90%.

In [5] this paper indicates how it creates two state of art svm classifier. One is used to detect the sentiment of messages such as tweets and sms. It automatically detects the sentiment of a message. That is, determine whether given message is positive, negative, or neutral. It will train a svm on the training data provided. Each tweet was represented as a feature vector made up of the features such as word ngrams, character ngrams, pos, hash tags etc.... The other one is used to detect the sentiment of a term with in a message. It is automatically detecting the sentiment of a message. It automatically detects the sentiments of a term in a message. That is, detect whether a term within a message conveys a positive, negative, or neutral. Same term may express different sentiment in different contexts.

In [6] is a rule based approach for understanding sentiment from Malayalam reviews. In this paper, a sentence level sentiment extraction is used. The sentence level sentiment extraction is helpful in movie websites that user comments. For analyzing sentiments negation rules are used. It will reduce the errors. Here first collects the corpus from movie websites or blogs and newspapers. Using Sandhirules the sentence re divided in to various tokens. Then each word is compared with the pre-annotated list, and then the words are classified into positive, negative or neutral polarity. After this apply negation rule to identify the overall polarity. Accuracy of the paper is 85%.

In [7] proposed a lexical resources based proceed towards to take out sentiments from domain independent Malayalam reviews. The proposed techniques find out the polarity of opinion words in the input text with the help of Hindi Word Net based lexical resource file created. Machine Learning techniques are used for tagging certain special cases. This move toward also gives a improved accuracy of 93.6%.

In [8] Parts Of Speech (POS) Tagging are the duty of conveying to every expression of a text the appropriate POS tag in its background of exterior. The chunking is then course of identifying and conveying different types of phrases in sentences. This paper describes the study of different approaches that are used in tagging and chunking in Malayalam language. Part Of Speech Tagging and chunking are two well-known troubles in Natural Language Processing. A Tagger can be measured a translator that reads sentences from confident language and outputs the matching sequences of part of speech (POS) tags, enchanting into version the background in which each word of the sentence appears. A chunker involves separating sentences into non-overlapping segments on the source of very external analysis. The presented tagger cannot be used for Indian language. The reasons are: the rule based tagger would not work because the arrangement of Indian languages differs greatly from the western languages and the stochastic tagger can be used in a very rough form. Parts' of Speech tagging now is a comparatively established field. Many methods have been explored.

In [9] contribute the customer review classification which is used for analyse the highly instructed number of tweets and its polarity. For this first done the data pre-processing which is remove the repeated words and punctuations. After data pre-processing data set which is improved and has lot of distinct properties. Then feature extraction extract the adjective from the data set by using unigram model. It also discards the preceding and successive words occurring in the sentence. For training and classification use the three supervised techniques first naïve bayes is training classifier classification once the training is complete it provide the sentiment polarity. Then maximum entropy is widely used in natural language processing an example of such model is logistic regression which corresponds to the maximum entropy classifier for independent. Next is support vector machines are supervised learning model with associate learning algorithm that analyse the data used for classification and regression analysis. Given a set of training example each marked as belonging to one or the other two categories. After the training and classification, then used the semantic analysis which is derived from the database word set each terms is associated with each other.

In [10] is a hybrid approach. It is used for extracting the sentiment from Malayalam movie reviews. Maximum entropy model is the hybrid approach is used for tagging and some rules for handling special cases. Such as negation, intensifiers, dilators etc. Maximum entropy classifier is a probabilistic classifier which belongs to the class of

exponential models. It categorizing input without knowing that much knowledge. To fit our training data it selects maximum entropy from all the models. The tagged classes is increased to seven from positive, negative and neutral to new classes such as inverse negative, intensifier, dilator and special. The number of positive and negative words is counted for to find the overall polarity. The accuracy is 93.6%.

In [11] the task is a message level classification of tweets into positive, negative and neutral sentiment. Tweets are very noisy s they need lot of pre-processing. The step of pre-processing is tokenization which make a paragraphs into meaningful words or sentences, then remove non-English tweets, it replace the emotions and remove the numbers. Then it generates a baseline model and the pre-processing steps, then learn the positive, negative and neutral frequencies of unigram, bigrams, and trigrams in the training set. After it feature extraction is working on it, that is, there are total 34 features, it calculate the feature for the whole tweets in the message. And then it divided into tweet based feature and lexicon based features. After the pre-processing and feature extraction, message or tweet will classified into positive, negative or neutral sentiments.

In [12] performs sentiment analysis of user using data mining classifier. Tweets are collected for training and testing. Then data pre-processing, which means that clean up the data, remove the user-id, twitter-id, user-info, special character, duplicate tweets etc are removed. After that classify the tweets into positive, negative and neutral which classification done by using SentiWordNet 3.0.0 dictionary. Which is used to set polarity to each word. If the sentence having zero polarity then it is neutral, more positive word than negative polarity then positive sentence else it is negative. k nearest neighbor classifier is gives a better accuracy .

In [13] sentiment analysis system for Malayalam movie reviews is implemented by using a combined approach of machine learning methods, CRF combined with rule and SVM combined with rules re used separately. They concluded by saying that SVM out performs CRF with an accuracy 91%.

In [14] A practical approach to sentiment analysis of Hindi tweet: in this paper discuss sentiment analysis using Hindi languages. Which is used a unsupervised learning lexicon method for classification. In this paper choose subjective lexicon based approach and which is created by using some methods that are use bilingual dictionary, machine translation and use of wordnet. Here a sentiWordnet is created and each entry of lexicon is categorised into verb, noun, adjective, and adverb. Subjective lexicon based algorithm is proposed which is compared with unigram presence method and positive and negative words are counted.

In [15] is a venture to do aspect based sentiment analysis in Malayalam. The principal issues alive in this domain are there particular improper grained duties in light of only polarity, but not admirable grained duties in light of the condition on which the user is reporting. Still so frequent performances were considered for universal languages like English, it is few for local Malayalam. To create a movie site which subsist if a data base include the full designs of movie? The sentiment words are enter by the user, the system will produce suitable reaction according to the enteritis. Outcome can be displayed in the shape of emotions with emoticons .it subsist of three sections. Supervision consists of brave information of registered users and movie reviews. Supervision can login to the movie site and insert or eliminate particular information. Next, the user login to the movie site enters the review and submits it. The system will produce matching production and display the outcome using emotions and emoticons. The non registered user can visit the movie site and recognize the on the whole review of the movie. The present system can only examine some of the emotion similes. This can be completed by analysing more emotions. Aspect based sentiment analysis helps to get better the value of the feature on which the author is commenting.

In [16] consist of the sentiment analysis of Tamil language. The extraction of sentiment for the Tamil language is done with the help of English language. The multilingual sentiment analysis is divided into two namely machine - translation based method and bilingual -dictionary based method . Here extracting the sentiment of reviews. The Tamil language reviews is converted into the English language with the help of Google translate and then the translated reviews are classified .the classification is done using algorithms and techniques etc.. Sentiment analysis can be done in two ways namely, supervised method and unsupervised method. The supervised method consists of polarity classification using naive Bayes classifier etc... The unsupervised method consists of polarity classification using sentiment lexicon.

In [17] uses the sentiment analysis by the deep learning method. Here tweets are collected and pre-processed. Train state and test state used to train and test the dataset. It uses a tensor flow program for creating the network. The accuracy is regarding 67.45% for train set and for the test set is regarding 52.60%.

In [18] sentiment analysis is a natural language processing. Extracting the sentiments of Malayalam movie review and classify them such as positive, negative and neutral. compared to English language, Malayalam language is rich language so extracting the sentiment of Malayalam language has some complexities. Sentiment analysis has some levels namely, sentence levels sentiment analysis, document level sentiment analysis and aspect level sentiment analysis. The sentiment can be done in three ways like machine learning approach and lexicon based approaches. Here

using the supervised learning machine approach. The review classification is done with some steps Web scrapping of input data, pre-processing (tokenization ,pos tagging), extraction of opinion words, extraction of subjective sentences and review classification. The proposed system gives the accuracy of about 87.5%for sentence levels classification and 90% accuracy for document level classification.

In [19] data pre-processing remove re-tweet ,text cleaning, negation handling etc. then feature extraction use 3 feature classes word n-gram, character n-gram and negative sentiment. In English character n-gram is better. Supervised learning techniques are used for Indonesian language hate speech detection. And 10 fold validations is used for evaluation.

In [20] tweets are directly accessed from the twitter API and then build a sentiment classification. Author evaluates about the people sentiments about a person, product, or a brand. By sharing users opining about particular topic they can understand their sentiment towards it. Here the tweets are collected first which are specified in the form of hash tags by using the twitter API. Authentication is performed by giving in the keys using a library RAAuth. After that certificate downloaded and PIN is generated to access the tweets. Four phases are used, phase I tweets are collected. Phase II the collected tweets are pre-processed. Tokenization and stemming is performed in this phase. In the phase III the pre-processed tweets are compared with a BoW (Bag of Words) which is used for the classification as positive, negative and neutral. In the final phase classified tweets are visualized using histogram and pie charts.

In [21] this paper evaluates the sentiment analysis by using an in build Python library called Text Blob, for the analysis on three platform twitter, Face book and news website. Here the author uses ANN (Artificial Neural Network) for the classification of tweets. This is a much easier and less time consuming manner. ANN is a computational model which is similar to our biological neural network. By using twitter API tweets are collected. To classify the tweet naïve bias algorithm is used. Feed forward neural network is used to split the data into train and test the by applying the min-max approach the accuracy of the system is evaluated. R programming is used to predict and analyse the result. 70-89% accuracy is obtained for a large amount of dataset with very less time consumed.

In [22]Sentiment analysis or opinion mining is a natural language dealing with to discovering the emotions of open outlook from user generated text .sentiment analysis in social media, obtaining great significance today because people use social media platforms to share their perspective and outlook on pertinent subject in the shape of movie reviews, product reviews, political discussions etc. The user generated text accumulated from social media can assist machines to encapsulate and grasp intelligent conclusions in various domains. Sentiment analysis in Malayalam language has a great significance. Malayalam is a small resource language and it does not own a standard corpus or a sentiment lexicon. This work presents a machine learning approach to sentiment analysis in Malayalam language using the CRF and SVM .The learning realize a two levels and the system classify sentences into positive , negative and neutral classes . The work covers design of a huge size explained corpus as a main duty and then followed by teaching a sentence level classifier to execute sentiment analysis.

Paper [23] compares different machine learning and deep learning algorithms. In the data collecting phase the tweets are collected using twitter 140 API. The pre-processing phases have different steps such as removal of noise, tokenization, stemming, removal of punctuation, Bag of Words, removal of words etc... In the feature extraction phase certain features are identified and obtained. Classification is done using the Naive Bayes, Recurrent Neural Networks, Decision Trees, Neural Networks, and Random Forrest. Hybrid model has an accuracy 83.6 % with sensitivity 87.1% and specificity 79.3%.

In [24] mainly tweets are share or express the feeling and opinion about real time events. In this first segmentation, extract the meaningful segments. Which also remove the stop words, tokenization, spelling checking and pos tagging. Then classify the each segments into predefined categories using NER (named entity recognition). Twitter streams are clustering for detect the event. Using the naïve bayes classification which is used for classify as event or non-event. After that sentimental analysis for assign sentiment score by using SentiWordNet to each segment which is used for analyse the nature of twitter. It is used to indicate the tweets polarity. Detect the event and it's polarity and noisy polarity.

In [25] directed the issue of part of speech (pos) tagging of Malayalam tweets. The casual approach of posts or tweets or texts in social media input posture a objection in using general pos tag-set for tagging the test. For the existing work a tag-set was planned that include 17 boorish tags and 9915 tweets were tagged physically for experiment and evaluation. The tagged data were figure out using sequential deep learning methods like recurrent neural network (RNN), gated recurrent units (GRU), long short term memory (LSTM), and bidirectional LSTM (BLSTM). The preparation of the model was executed on the tagged tweets, at word level and character level. The research was prepared using measures like precision, recall, f1-measure, accuracy. During the preparation, it was establish that GRU based deep learning sequential model gave the highest f1 measure of 0.9254; at character level, the BLSTM based deep learning sequential gave the highest f1 measure of 0.8739. Decide the fitting number of hidden states, we diverse it has

4, 16, 32 and 64, and executed teaching for each. It was experiential that the raise in hidden states enhanced the tagger model. This is an original work to perform Malayalam twitter data pos tagging using deep learning sequential model.

Table 2.1 A Summary of Various Works

Year	References	Methodology	Remarks
2012	[3] Mohandas, Neethu , Janardhanan P S Nair , and V . Govindaru	POS tagging	Accuracy of 63%.
2012	[4] Meera Subhash, Wilscy .M and S.A Shanavas	Lexicon based	Precision, recall and f-measure of 90%
2014	[6] Nair , D.S.,Jayan , J.P., Rajeev , R.R.,Sherly,E.	Sentence level sentiment analysis	Accuracy of 85%.
2014	[7] Anagha ,m, Raveena R Kumar, Sreetha K and P C Reghu Raj	Lexicon based	Accuracy of 93.6%.
2015	[10] Anagha ,M., Raveena R Kumar, Sreetha K and P C Reghu Raj	Maximum entropy	Accuracy is 93.6%.
2015	[13] Deepu S.Nair, Jisha P.Jayan, Raheev R.R and Elizabeth Sherly	SVM,CRF	Accuracy 91%.
2017	[18] Ashna M P and Ancy K Sunny	pre-processing- stemming tokenization,	Accuracy: Sentence level-87.5% Document level-90%
2018	[21] Sneha Paliwal, Sunil Kumar Khatri and Mayank Sharma,	ANN, R programming	Accuracy 70-89%
2018	[23] Mohammed H. Abd El-Jawad, Rania Hodhod and Yasser M.k.Omar	Compares deep learning algorithms pre-processing-tokenization, stemming Classification- Naive Bayes, neural network, random forest	Accuracy 83.6 %, sensitivity 87.1% and specificity 79.3%.
2018	[25] Kumar , S.: Kumar , M.A; Soman and K P	Pos tagging Deep learning-(RNN,GRU,LSTM,BLSTM)	f1 measure : GRU-0.9254 BLSTM-0.8739

### III. CONCLUSION

Now a day's information's are being communicated via regional languages like Malayalam, which lead to the potential opportunity of analyzing these contents and identify whether it is acceptable or not. Here in this paper we analyses various sentiment analysis works and compared the accuracy of various approaches. This paper also studies the works in various languages like Malayalam, English, Tamil etc. Based on the study it shows that ANN is much easier than other machine learning algorithms and it is also a less time consuming algorithm. So ANN is suitable for sentiment analysis of multilingual languages.

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### REFERENCES

- [1]. Bo Pang, Lillian Lee and Shivakumar Vaithyanathan "Thumbs Up? Sentiment classification using machine learning techniques," Association for computational linguistics, July 2002
- [2]. Alexander Pak and Patrick Parouvek , " Twitter as a Corpus for Sentiment Analysis and Opinion Mining " , In Proceedings of LREC, 2010
- [3]. Mohandas, Neethu , Janardhanan P S Nair , and V . Govindaru."Domain specific sentence level mood extraction from Malayalam text". Advances in computing and communications (ICACC), 2012 International conference on .IEEE, 2012.
- [4]. Meera Subhash, Wilscy .M and S.A Shanavas, "A Rule Based Approach for Root Word Identification in Malayalam Language", International Journal of Computer Science and Information Technology(IJCSIT) Volume:4 , June 2012
- [5]. Saif M. Mohammad, Svetlana Kiritchenko, and Xiaodan Zhu " NRC-Canada :Building the state – of – the – Art in Sentiment Analysis of Tweets" Second Joint Conference on Lexical and Computational Semantics, Volume 2, June 2013
- [6]. Nair , D.S.,Jayan , J.P., Rajeev , R.R.,Sherly,E. " SentiMa- Sentiment extraction for Malayalam." Advances in computing, Communication and Informatics (ICACCI) 2014 International Conference on IEEE, 2014
- [7]. Anagha ,m, Raveena R Kumar, Sreetha K and P C Reghu Raj, "Lexical Resource Based Hybrid Approach for Cross Domain Sentiment Analysis in Malayalam" ,International Journal of Engineering Science ,Volume:15, December 2014

- [8]. Rinku T S, Merlin Rajan and Varunakshi Bhojane , "Various Approaches Used for Tagging and Chunking in Malayalam " , International Journal of Scientific and Engineering Research, Volume:5 ,may 2014
- [9]. Geetika Gautam and Divakar Yadav , "Sentiment Analysis of Twitter Data Using Machine Learning Approaches and Semantic Analysis " 7<sup>th</sup> International Conference on Contemporary Computing (IC3), 2014
- [10]. Anagha ,M., Raveena R Kumar, Sreetha K and P C Reghu Raj. "A Novel Hybrid Approach on Maximum Entropy Classifier for Sentiment Analysis of Malayalam Movie Reviews" , International Journal of Scientific Research, Volume: 4 June 2015
- [11]. Ayush Dalmia, Manish Gupta, Vasudeva Varma "Twitter Sentiment Analysis The good ,the bad and the neutral" ,Association for Computational Linguistic, June 2015
- [12]. Anurag P.Jain and Mr Vijay D. Katkar "Sentiments Analysis of Twitter Data Using Data Mining" ,International Conference on Information Processing(ICIP) Vishwakarma Institute of Technology, December 2015
- [13]. Deepu S.Nair, Jisha P.Jayan, Raheev R.R and Elizabeth Sherly " Sentiment Analysis of Malayalam Film Review Using Machine Learning Techniques" , International Conference on Advancing in Computing, Communication and Informatics(ICACCI) 2015
- [14]. Sharma, Y. , Mangat, V., and Kaur, "A Practical Approach to Sentiment Analysis of Hindi Tweets" , 1<sup>st</sup> International Conference on Next Generation Computing Technologies(NGCT),2015
- [15]. Ms Anu P C, Ms Heera B M, Ms Lini K U and Ms.Lilly Raffy Cheertha, "Aspect Based Sentiment Analysis In Malayalam" , International Journal of Advances in Engineering And Scientific Research, volume:3, December 2016
- [16]. R. Thilagavathi and Mrs.K. Krishnakumari , M.E.(PhD), "Tamil English Language Sentiment Analysis System" ,International Journal of Engineering Rescesrch and Technology(IJERT) ,volume:4,2016
- [17]. Adyan Marendra Ramadhani and Hong Soon Goo "Twitter Sentiment Analysis Using Deep Learning Methods" , 7<sup>th</sup> International Annual Engineering Seminar(InAES), 2017
- [18]. Ashna M P and Ancy K Sunny , "Lexicon Based Sentiment Analysis System for Malayalam Language" , International Conference on Computing ,Methodologies and Communication (ICCMC) 2017
- [19]. Ika Alfina , Rio Mulia , Mohammad Ivan Fanany and Yudo Ekanata, "Hate Speech Detection in the Indonesian Language: A Data Set and Preliminary Study" , International Conference on Advanced Computer Science and Information System , 2017
- [20]. Prakruthi V , Sindhu D and Dr. S Anubhama Kumar, "Real Time Sentiment Analysis of Twitter Posts" , 3<sup>rd</sup> IEEE International Conference on Computation Systems and Information Technology for Sustainable Solutions 2018
- [21]. Sneh Paliwal, Sunil Kumar Khatri and Mayank Sharma, "Sentiment Analysis and Prediction Using Neural Networks" , Proceedings of the International Conference on Inventive Research in Computing Applications (ICIRCA), 2018
- [22]. M. Rahul ,R.R Rajeev and S.Shine , " Social Media Sentiment Analysis for Malayalam " ,International journal of Computer Sciences and Engineering, Volume:6 2018
- [23]. Mohammed H. Abd El-Jawad, Rania Hodhod and Yasser M.k.Omar , " Sentiment Analysis of Social Media Networks Using Machine Learning". 14<sup>th</sup> International Computer Engineering Conference(ICENCO), 2018
- [24]. Mamta Patil and H K Chavan , "Event Based Sentiment Analysis of Twitter Data" , Second International Conference on Computing Methodologies and Communication(ICCMC) , 2018
- [25]. Kumar , S.: Kumar , M.A; Soman and K P, "Deep Learning Based Part – Of- Speech Tagging for Malayalam Twitter Data (Special Issue : Deep Learning Techniquesx For Natural Language Processing)" , Journal of Intelligent Systems , Walter de Gruyter GmbH, 2018

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