

## REVIEW

## REVIEW ON SENTIMENT ANALYSIS A LEARNERS' OPINION

Jayakumar Sadhasivam<sup>1\*</sup>, Ramesh Babu Kalivaradhan<sup>2</sup><sup>1</sup>*School of Information Technology and Engineering, VIT University, Vellore – 632014, TN, INDIA*<sup>2</sup>*School of Computer Sciences and Engineering<sup>2</sup>, VIT University, Vellore – 632014, TN, INDIA*

## ABSTRACT

With the booming growth of learning in the 21st century and it is keep expanding it is branches towards many fields. Many researchers expressed their ideas in education data mining filed using opinion mining also called as Sentiment Analysis (SA). Education data mining is used to analyze the learner, instructor and provide the better way to the learners. Sentiment analysis uses Natural Language Processing (NLP) text analysis and computational linguistics to detect and extract our emotions, opinions, attitude and content extracted from individuals using text mining techniques. In this survey paper, deep focused on sentiment analysis in the field of education and learning. The ultimate aim of this paper is to represent the current Sentiment Analysis (SA) classification, models, algorithm, and applications.

## INTRODUCTION

Over a decade, learning is revolutionized using information and communication technologies. Learning platform and web2.0 technologies improved the way of learning and teaching. By increasing the use of the Internet for learning, discussion forums and learning related activities, a huge amount of unstructured data from the learners. In this digital era, learner's discussion forum, comments, and reviews are very important for the instructor. It made difficult to Instructors to understand the learner's mindset and feedback. The amount of data is huge to analyze. Such data can be analyzed using different mining techniques. Focusing on data and text mining techniques to enhance learner's ability is emphasized. Information is related to user feedbacks, discussion forum content, comments and reviews are utilized to the analysis.

In this survey paper, we are discussing research articles related to sentiment analysis in the educational/learning domain. Survey revealed many researchers used the different type of sentimental models and algorithms, but most of the researchers focused on Naive Bayes (NB) and Support Vector Machine (SVM) algorithm. Weka[1] tools are the most common tool used by researchers for analyzing the sentimental analysis.

SA uses the NLP, Text Analysis and Computational Linguistics to extract emotions and feeling from the raw data. SA is an example where a combination of knowledge from engineering, statistics and linguistics is essential for providing accurate analysis. Researchers got attention on SA due to its potential application in information retrieval, discussion forum, blogs, reviews by helping them to retrieve the user opinions from their content.

An essential task in opinion minion is to categorize the polarity of a given content in the document, sentence, or feature or aspect level – whether the given content opinion is a document, a sentence or an entity feature/aspect to be positive, negative, or neutral[2]. Advanced, "beyond polarity" sentiment classification looks, for instance, at emotional states such as "angry," "sad," and "happy"[2]. Sentiment polarity in certain contexts needs in order to predict it from the user-generated text data. Information data can be divided into two categories: facts and opinions. Facts are the objective expression of their entities, events and their properties. Perspectives are typically subjective expressions that portray individuals' sentiments, examinations or emotions toward entities, events and their properties.

With respect to educational domain, SA is included in applying the automatic content analysis process for the purpose of removing the unrelated words and gathering the words related to sentiment from the user opinions and also indicate the variety of sentiment conveyed in education domain like learning website, blogs, discussion forums and review sites. Instructor or educational website administrator tracks the user opinions to find the difficulties of learning from the educational platform. It helps to improve the educational strategies and provide the benefits to the instructor. SA plays an important role in developing a better learning platform and provide to the learner in a better way and also a new user to enroll in their learning platform.

As an emerging area, millions of students and learners enrolling and signup for the new course in MOOC platform (Coursera, edX, Udacity etc..). Currently, most of the university offer the course, lecture notes, video lecture, assignment and text via Learning Management System (LMS). Learning platform is growing each and every day and providing newer and better opportunities for students to learn via the Internet and other Information and Communication Technology. In the educational domain, it is necessary in order to the course provider or instructor to provide the communication between each and every user via discussion board, chat rooms or comments to provide their opinions and evaluate their work. The fundamental need of LMS is to provide the learners requirement very effectively. LMS crucial task is to get

## KEY WORDS

Sentiment Analysis (SA),  
learning, Data Mining,  
Natural Language  
Processing (NLP),  
Education

Received: 18 May 2017  
Accepted: 28 July 2017  
Published: 20 Sept 2017

\*Corresponding Author  
jayakumars@vit.ac.in

the user opinions via survey or comments to know, whether they are providing the user needs efficiently as possible. This survey assists in LMS administrator to track the learner need and rectify their problem immediately or in the upcoming update.

This paper is organized into various sections. Section 2 with literature review, Section 3 with Data Source for Sentiment Analysis in Education Domain, Section 4 for Sentiment Analysis Table summary of the review and finally Section 5 concludes the survey.

## LITERATURE REVIEW

At the early stage of sentiment analysis is processed based on the thumbs up and thumbs down. Peter D. Turney[3] used this method to find out the sentiment analysis in Epinions websites, now acquired by eBay.

Opinion mining is the primary part of Sentiment Analysis. The analysis content is from the review, blog, discussion forum, comments etc. The analysis is used to identify the sentiment classification in the content is generally based on positive and negative. A content has a positive semantic orientation when it has good associations (e.g. "subtle nuances") and a negative semantic orientation when it has bad associations (e.g., "very cavalier")[3][4]. Sentiment classification findings which achieve to conclude whether a text is objective or subjective, or whether a subjective text holds positive or negative sentiments[5]. Sentiment classification uses different types of machine learning and natural language processing approach. There are many supervised and unsupervised techniques available for sentiment classification. Support Vector Machine (SVM) and Naive Bayes(NB) are supervised learning techniques. K-means clustering is used for unsupervised learning techniques. Tony Mullen and Nigel Collier[6] used the SVM to find out the sentiment Analysis in the Internet Movie Database using the Hybrid Support Vector Machine with combine unigram-style feature based SVM.

Vishal A. Kharde and S.S. Sonawane[7] used the Naive Bayes techniques and much more to find out the sentiment analysis in the twitter tweets unstructured data. Sentiment Analysis can be better predicted from the minimum words in the real-time environment using the twitter social media. It helps to identify the group of tweets related to a specific domain using the tags. M. Di Capua, E. Di Nardo, and A. Petrosino[8] proposed an architecture to identify the e-learning tags in the twitter data to identify the SA using machine learning components. As e-learning become the emerging platform in the educational domain, researchers focused their research towards the e-learning and sentimental analysis. D. Song, H. Lin, and Z. Yang[9] proposed opinions and adopting automatic opinion mining to recognize the sentiment of opinions from the web pages on which users are considering or relating their personal opinions and evaluation of the services. Understanding this process of emotional and reaction of a student is complicated in the learning environment. H. H. Binali, C. Wu, and V. Potdar[10] used the conceptual emotion detection and analysis in the system for education domain using the sentimental analysis techniques in education blogs and reviews.

As we are located in the online world, everything is accessed and purchased via online, the online market with trillions of markets share worldwide. D. Tayal and S. Komaragiri[11] proposed their sentimental analysis review towards the blog or microblog, they expressed an idea how a post may change the product sales up and down and to predict the stock market performance. A sample data of 520 movie reviews are used to analyze the opinion mining, the movies are based on particular genres like blog posting, discussion threads, user reviews and critical review. The analysis is tremendously engrossed on the document, sentence length, part-of-speech(POS) distribution, vocabulary, aspects of movies discussed, star ratings used and multimedia content in the reviews. This study identifies the positive and negative on different genres[12]. Baojun Ma[13] proposed their sentimental analysis using the clustering techniques based on the online review. Researchers used the vector space modeling(VSM) k-means clustering algorithm to perform the sentimental analysis to identify the positive and negative review of Movie and Travel website online reviews as a dataset. SA now ahead forward towards analyzing the sentimental in the video, audio, and visual clips. Previously opinion mining analysis is carried out in the textual content. Moisé's H. R. Pereira and his team[14] used the facial recognition techniques to identify the sentimental analysis in the news video. They compute attributes, such as visual potency of recognized feelings and emotions, field sizes of users, voicing probability, sound loudness, speech fundamental frequencies and the sentiment outcomes (polarities) from text sentences in the closed caption[14]. A dataset of 520 videos from Brazilian and American TV newscasts used for SA. After the SA approach, they identified that an accuracy of up to 84% in the sentiments (tension levels) classification task, thus demonstrating its high potential to take advantage of media analysts in several applications, especially, in the journalistic domain[14].

In the current digital world, everyone deals with the problem of email spam threads, affecting millions of users per day. Enaitz Ezpeleta[15] and his team developed a spam classifier using the Bayesian spam filtering classifier. That can improve the spam filtering classifier adding the polarity message. SA utilized to detect the spam emails and they achieved the level of 99.21% accuracy in spam classification. Currently,

social media are median or as a tool used by industry to attract the customer. The industry is watching their social media carefully to know their current updates by their consumer. A single tweet or Facebook post, can affect the industry or company in the larger manner. Social media provides all the content public access and share with other users. It assists industry into gain or loses the market based on the user post. Wu He[16] used the social media tweets to analyze the competitive pizza industry in china. They used unstructured data from the Facebook post, and Twitter tweets of Pizza Hut, Domino's and Papa John's Pizza. This social media tweet is utilized to get the market and e-market decision in china about the pizza industry. Analyzing the content always gives some unpredictable things, that helps the industry for their growth, SA is proposed and analyzed in different categories. We found unbelievable information and answer from the public forums and discussion threads. Yahoo Answer constitutes one of the community-driven questions and answers forum. Onur Kucuktunc[17] proposed a way to analyze the yahoo answers and extracted the user information via sentimental analysis. They used the yahoo answers to identify the user's best answers and sentiment based answers in each domain. The authors[18] introduced a particular structured framework that takes an advantage of existing MOOCs data to provide a learning style for MOOC user. By recognizing and understanding the learning styles, one can utilize certain procedures and approaches to enhance the rate and nature of learning.

## DATA SOURCE

### Websites and blogs

With an increasing using of Internet, learning websites and blogs are mostly utilized to express the user opinions, feeling, recommendation etc. towards anything. Blogs and microblogs are used commonly to express the daily events happening towards the learners. Learning is expressing their feeling, emotions, opinions as positive and negative in a different way publicly. These feelings, emotions, and opinions are utilized to analyze the learner's perspective towards a particular course or subject. Dan Song, Hongfei Lin, Zhihao Yang[9] analyzed 446 learning review articles in Chinese language using SVM. H. H. Binali, C. Wu, and V. Potdar[10] analyzed e-learning corpus of students weekly online review for a semester towards a course. Z. Kechaou, M. Ben Ammar, A. M. Alimi and M. Ammar[19] gathered data from 5 different e-learning blogs reviews and Moodle forum data to analyze 1000 positive and 1000 negative text emotions of the user to classify the sentimental classification model. F. Tian, H. Liang, L. Li, and Q. Zheng[20], analyzed 9957 data corpus from Xi'an Jiaotong University community services. The researchers manually labeled the content into three emotions types, positive, negative and neutral in the Chinese language.

### Discussion forums

Recent trends are to discuss anything in the discussion forums, previously it was only used as a question and answer forum for the user, but nowadays the discussion forums are used for anything to discuss privately and publicly. Discussion forum affects the learners in a different way to show their opinion. Reviews, recommendations etc. Alaa El-Halees[21] extracted discussion forum data of 22MB contains 4957 discussion posts of five courses in the Arabic language.

### Feedback systems

Each and every organization, company and institution use feedback system get the user opinions, comments, and reviews as a known user or anonymously. These feedbacks are used in a variety of ways to analyze the data and improve the institutions, company or organizations. P. Šaloun, M. Hružík, and I. Zelinka[22] used the student's feedback using adaptive web system XAPOS to get the data from the e-shop and e-learning domain in Slavic and Czech language. N. Altrabsheh, M. M. Gaber and M. Cocea[23] used the student feedback system via clickers, mobile phones, clicker applications and social media data for their analysis.

## Summary of the Review

**Table 1:** Study of sentiment analysis in the learning domain

S.no	Studies	Language	Mining Technique	Description	Data Source
1.	Dan Song, Hongfei Lin and Zhihao Yang (2007)[9]	Chinese	Support Vector Machines	Learning system identifies the drawback from the user opinion on the course materials, teachers feedback reviews and comments.	Review dataset of 446 articles (7,324 sentences) are chosen from the different learning domain.
2.	Haji H. BINALI, Chen WU, Vidyasagar POTDAR (2009) [10]	English	Naïve Bayes	Appraisal theory, corpus sentence and statistical schema matching are used to identify the emotions in the student submitted weekly review[10].	Student posted weekly online review for a semester for a course
3.	Alaa El-Halees (2011) [21]	Arabic	Naive Bayes	Student submit their review about the course, it used to measure the course performance and compare with one or more course in each lecture or semester.	4,957 discussion posts which contain 22 MB. 167 Posts, 5017 statements, Total No. of words 27456.
4.	Zied Kechaou, Mohamed Ben	English	Naïve Bayes and Support	Reviews are gathered from a multitude of e-learning blogs and	E-learning review of 1000 positive and 1000 negative

	Ammar, Adel.M Alimi (2011)[19]		Vector Machine	an analysis to study the nature and the structure of web discussion forums and learning blogs turns out to be a significant endeavor[19].	corpus[19].
5.	A. Nisha Jebaseeli, Dr. E. Kirubakaran (2012) [24]	English	Naïve Bayes	Analysis of the M-learning system using Naive Bayes algorithm and compared with K-nearest neighbor and random forest data mining algorithm.	100 reviews are selected in each category of positive, negative and neutral from online android market place.
6.	Feng Tian, Huijun Liang, Longzhuang Li, Qinghua Zheng (2012)[20]	Chinese	Support Vector Machine and Naïve Bayes	Interactive Chinese Texts is used for text classification later combined with syntax feature sets, two sets of new features, frequency based features and interaction related features, which are different from the traditional feature set. Feature set is performing better than SVM[20].	Data collected from student community service includes 9957 turns manually labeled with three emotion types, positive, negative and neutral[20].
7.	P. Šaloun, M. Hružík, I. Zelinka (2013) [22]	Slavic and Czech	Support Vector Machine	Analysis of user feedback in the Slavic and Czech language text content based on business and education environment. The contents are automated for computer processing to check the positive and negative sentiment from the text.	Data collected from Student's feedback using adaptive web system XAPOS.
8.	Nabeela Altrabsheh, Mohamed Medhat Gaber, Mihaela Cocea (2013)[23]	English	Naive Bayes and Support Vector Machines	Student Response Systems used to collect the feedback for lecturer via social media using clickers and mobiles.	Data source from clickers, Mobile Phones (Clicker Applications, SMS), Social Media.
9.	Gang Wang, Jianshan Sun, Jian Ma, Kaiquan Xu, Jibao Gu (2014) [25]	English	Naive Bayes and Support Vector Machine	Performance comparative assessment for ensemble methods (Bagging, Boosting, and Random Subspace) based on five base learners' algorithm such as Naive Bayes(NB), Maximum Entropy, Decision Tree, K Nearest Neighbor, and Support Vector Machine(SVM)[26]. Ten public SA datasets were investigated to confirm the effectiveness of ensemble learning. To increase the functionality of individual base learners for sentiment classification[25].	Dataset from MPQA, Movie review, Two web forums, NTCIR Opinion, Product review and Chinese review. Total of 1200.
10.	Balaji Jagtap, Virendrakumar Dhotre (2014)[27]	English	Support Vector Machine	Teacher feedback system automates the student's feedback for a particular teacher to provide positive and negative, the analysis performed on different domains. On applying advanced feature selection method with the hybrid approach of sentiment classification. Hybrid approach works well with complex data.	Data is collected from student in unstructured format
11.	Miaomiao Wen, Diyi Yang, Carolyn Penstein Rose (2014)[28]	English	Sentiment Polarity Analysis	MOOC forums are used to identify the trending opinions towards the course. To observe the students, drop out and each day forum post. Methods used - Course-level Sentiment Analysis: Collective Sentiment Analysis, User-level Sentiment Analysis: Survival Analysis.	Dataset from three courses from coursera
12.	Lorenzo A. Rossi, Omprakash Gnawali (2014)[29]	English, French, Spanish and Chinese	Support Vector Machine	Analysis of four coursera courses discussion threads. To Analyze the forum activities, different languages, interaction among other users, study groups, assignment and lectures[29].	Discussion forums of 60 Coursera (99,624 threads, 739,093 posts and comments), downloaded between August 2013 and April 2014[29].
13.	P.Bharathisindhu, S. Selva Brunda (2014)[30]	English	Naive Bayes and Support Vector Machine	Identifying the sentimental analysis in E-portal based on the user interest or area, information extracted from subjective information, recognizing opinion-oriented questions and summarization.	Data collection of 100 users review from the website Functionspace.org.

14.	Aysu Ezen-Can, Kristy Elizabeth Boyer, Shaun Kellogg, Sherry Booth (2015)[31]	English	Bayesian Information Criterion (Bic)	An unsupervised dialogue act classification framework with MOOC modeling approaches, with the primary goal of gaining insights about the structure of forum posts in an MOOC[31].	Data collected within an 8-week MOOC for Educators (MOOC-Ed) titled Planning for the Digital Learning Transition in K-12 Schools[31].
15.	V. Kagklis, A. Karatrantou, M. Tantoula, C. T. Panagiotakopoulos, and V. S. Verykios (2015)[32]	Greek	Dictionary-Based Sentiment Classification.	Post graduate students online course forum used to analyze the Sentiment, text mining and Social Network Analysis(SNA) techniques from the data. To analyze the course performance and interaction among students. Sentiment analysis is used in different levels such as sentence, document, and corpus level[33].	Data set consists of the forum activity of 64 students. 12% of women and 88% of Men. A total of 371 messages were posted. 89 out of 371 were starting posts, while the rest 282 of them were replies. 198 messages were posted by the students and the rest were posted by tutors
16	Devendra Singh Chaptol, Eunhee Rhim, Jihie Kim (2015)[34]	English	Sentiwordnet	Coursera Forum posts are used for sentimental analysis to find out the student attrition and study effectiveness using neural network modelling.	Data source from Coursera forum over 3 million students active click logs and over 5000 forum posts are used for research work[34].
17	S. Priyanka, M. Sivakumar (2015)[35]	English	Support Vector Machine	Facebook comments are used for social data analysis based on context adaptive system[35].	KONECT (Koblenz Network Collection) students' textual feedback: SVM Algorithm used (with three types of kernel). A dataset of 1036 instances of teaching and learning related feedback was used, which was analyzed and categorized by 3 experts[35].
18	T. Zarra, R. Chiheb, R. Faizi, and A. El Afia (2016)[36]	English	Latent Semantic Analysis, Singular Value Decomposition	To identify the students' opinions about educational issues that are problematic	62505 Stackoverflow comments

### CONCLUSION

The most recent decade has seen tangible advances in the areas of Natural Language Processing(NLP) and Semantic Analysis(SA) or Opinion Mining. Intellectual developments and its expanded computational power have achieved applications that distinguish subjects and sentiments in correspondences, consequently group of unstructured data information in enterprise settings. This paper reviews the methods applied to various problems in education and learning and it also portrayed the need for the sentiment analysis in the field of education and learning. Most of the researchers used Naïve Bayes and Support Vector Machine algorithm for their research work because of its accuracy and ease of implementation. Furthermore, reviewers used data sources focusing not only on the English language, but also on their native language for sentimental analysis. The future work will suggest a comprehensive model and a case study on the impact of various models in a real-time scenario.

**CONFLICT OF INTEREST**  
NONE

**ACKNOWLEDGEMENTS**  
NONE

**FINANCIAL DISCLOSURE**  
NONE

### REFERENCES

[1] Hall M, Frank E, Holmes G, Pfahringer B, Reutemann P, Witten IH. [2009] The WEKA data mining software,"SIGKDD Explor. Newsl. 11(1): 10.	[5] Abbasi A, Chen H, Salem A.[2008] Sentiment analysis in multiple languages: Feature selection for opinion classification in Web forums,ACM Trans. Inf. Syst. ..., 26(3): 1-34.
[2] Sentiment Analysis,"wikipedia.org. [Online]. Available: <a href="https://en.wikipedia.org/wiki/Sentiment_analysis">https://en.wikipedia.org/wiki/Sentiment_analysis</a> .	[6] Mullen T, Collier N.[2004] Sentiment Analysis using Support Vector Machines with Diverse Information Sources,"Proc. 2004 Conf. Empir. Methods Nat. Lang. Process. (EMNLP 2004), pp. 412-418.
[3] Turney PD.[2002] Thumbs up or thumbs down? Semantic Orientation applied to Unsupervised Classification of Reviews, Proc. 40th Annu. Meet. Assoc. Comput. Linguist., 417-424.	[7] Kharde VA, Sonawane SS.[2016] Sentiment Analysis of Twitter Data: A Survey of Techniques, Int J Comput. Appl., 139(11): 975-8887.
[4] Matt Kiser, Introduction to Sentiment Analysis Algorithms, algorithmia.com, 20-Jan-2017. [Online]. Available: <a href="https://blog.algorithmia.com/introduction-sentiment-analysis-algorithms/">https://blog.algorithmia.com/introduction-sentiment-analysis-algorithms/</a> .	

- [8] Di Capua M, Di Nardo E, Petrosino A. [2007] An Architecture for Sentiment Analysis in Twitter, 214–221.
- [9] Song D, Lin H, Yang Z. [2007] Opinion mining in e-learning system, Proc. - 2007 IFIP Int. Conf Netw Parallel Comput Work. NPC 2007, pp. 788–792.
- [10] Binali HH, Wu C, Potdar V. [2009] A new significant area: Emotion detection in E-learning using opinion mining techniques, 2009 3rd IEEE Int. Conf. Digit. Ecosyst. Technol. DEST '09, pp. 259–264.
- [11] Tayal D, Komaragiri S. [2009] Comparative analysis of the impact of blogging and micro-blogging on market performance, Int J Comput Sci Eng. 1( 3): 176–182.
- [12] Na JC, Thet TT, Khoo CSG. [2010] Comparing sentiment expression in movie reviews from four online genres, Online Inf Rev, 34: 317–338
- [13] Ma B, Yuan H, Wu Y. [2015] Exploring Performance of Clustering Methods on Document Sentiment Analysis, Pereira MHR, Pádua FLC, Pereira ACM, Benevenuto F, Dalip DH. [2016] Fusing audio, textual, and visual features for sentiment analysis of news videos, Proc. 10th Int. Conf. Web Soc. Media, ICWSM 2016, no. Icwsm, pp. 659–662.
- [15] Ezepeleta E, Zurutuza U. [2016] Does sentiment analysis help in bayesian spam filtering?.
- [16] He W, Zha S, Li L. [2013] Social media competitive analysis and text mining: A case study in the pizza industry, 33: 464–472.
- [17] Kucuktunc O, Weber I, Cambazoglu BB. [2012] A Large-Categories and Subject Descriptors, 633–642.
- [18] Sadhasivam J, Babu R. [2017] MOOC : A FRAMEWORK FOR LEARNERS USING LEARNING STYLE, Int. Educ. Res. J. 3(2): 21–24.
- [19] Kechaou Z, Ben Ammar M, Alimi AM, Ammar M, Improving e-learning with sentiment analysis of users' opinions, IEEE Glob. Eng. Educ. Conf. EDUCON [2011], 1032–1038.
- [20] Tian F, Liang H, Li L, Zheng Q. [2012] Sentiment classification in turn-level interactive Chinese texts of e-learning applications, Proc. 12th IEEE Int Conf Adv Learn Technol. ICALT 2012, pp. 480–484.
- [21] El-Halees A. [2011] Mining Feature-opinion in Educational Data for Course Improvement, Int J New Comput. Archit. Their Appl. 1(4): 1076.
- [22] Šaloun P, Hružík M, Zelinka I. [2013] Sentiment analysis - E-bussines and E-learning common issue, ICETA 2013 - 11th IEEE Int. Conf. Emerg. eLearning Technol. Appl Proc, 339–343.
- [23] Altrabsheh N, Gaber MM, Cocea M. [2013] SA-E: Sentiment analysis for education, Front. Artif. Intell. Appl., 255: 353–362
- [24] Jebaseeli AN. [2012] M-Learning Sentiment Analysis with Data Mining Techniques, Int J Comput Sci. 3(8): 45–48.
- [25] Wang G, Sun J, Ma J, Xu K, Gu J. [2014] Sentiment classification: The contribution of ensemble learning, Decis. Support Syst., 57(1): 77–93
- [26] Wang G, Zhang Z, Sun J, Yang S, Larson CA. [2015] POS-RS: A Random Subspace method for sentiment classification based on part-of-speech analysis, Inf. Process. Manag. 51(4): 458–479
- [27] Jagtap B, Dhotre V. [2014] SVM and HMM Based Hybrid Approach of Sentiment Analysis for Teacher Feedback Assessment, Ijetts. Org, 3( 3): 229–232.
- [28] Wen M, Yang D, Rosé C. [2014] Sentiment Analysis in MOOC Discussion Forums: What does it tell us?, Proc. Educ. Data Min., no. Edm, 1–8
- [29] Rossi LA. and Gnawali O . [2014] Language independent analysis and classification of discussion threads in Coursera MOOC forums, in Information Reuse and Integration (IRI), 2014 IEEE 15th International Conference on, 2014, pp. 654–661.
- [30] P. Bharathisindhu and Brunda SS. [2014] Identifying E-Learner's Opinion Using Automated Sentiment Analysis in E-Learning, IJRETI International J Res Eng Technol. 3( 1): 2319–2322
- [31] Ezen-Can A, Boyer KE, Kellogg S, Booth S. [2015] Unsupervised modeling for understanding MOOC discussion forums, Proc. Fifth Int. Conf. Learn. Anal. Knowl. - LAK '15, pp. 146–150,
- [32] Kagklis V, Karatrantou A, Tantoula M, Panagiotakopoulos CT, Verykios VS. [2015] A Learning Analytics Methodology for Detecting Sentiment in Student Fora: A Case Study in Distance Education., Eur. J. Open, Distance E-Learning, 18(2): 74–94
- [33] Agathangelou P, Katakis I, Kokkoras F, Ntonas K. [2014] Mining Domain-Specific Dictionaries of Opinion Words, in Web Information Systems Engineering – WISE 2014: 15th International Conference, Thessaloniki, Greece, October 12–14, 2014, Proceedings, Part I, B. Benatallah, A. Bestavros, Y. Manolopoulos, A. Vakali, and Y. Zhang, Eds. Cham: Springer International Publishing, 2014, pp. 47–62.
- [34] Chaplot DS, Rhim E, Kim J. [2015] Predicting student attrition in MOOCs using sentiment analysis and neural networks, Work. 17th Int. Conf. Artif Intell Educ AIED-WS, 1432: 7–12.
- [35] Priyanka S, Sivakumar M. [2015] Big Data Processing in Sentiment and Opinion Mining for Detecting Student Depression in E-Learning Using Rich Facebook Dataset Collection, 5(4): 1208–1216.
- [36] Zarra T, Chiheb R, Faizi R, El Afia A. [2016] Using Textual Similarity and Sentiment Analysis in Discussions Forums to Enhance Learning.pdf, 10(1): 191–200