

# Evaluation of Feature Selection Techniques in Opinion Mining- A Survey

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## ABSTRACT

Opinion Mining (OM) is the combination of Information Retrieval and computational linguistic strategies managing reviews in a document. It goals to resolve problems related to reviews of products, politics in newsgroup posts, and evaluate websites. The characteristic of feature selection used for OM applications decreases the data dimensionality and get rid of irrelevant features. This paper evaluates a feature selection for OM the usage of Latent Semantic Analysis (LSA) and Laplacian Score (LS) to classify evaluations. Experiments were undertaken with naïve Bayes and Adaboost classifiers and the outcomes have been thus compared to judge the various feature selection methods. Propose extracting words and deciding on words based totally on the importance the usage of tf-idf with semantic primarily based characteristic choice. A feature set is reduced via the use of the brand new semantic primarily based method to recall a man or woman's predictive capability on words and to select features. Experiments had been undertaken with naïve Bayes and Ada raise classifiers and the consequences have been in comparison to choose the characteristic selection strategies. Outcomes prove that the brand new semantic characteristic based choice progressed classifier's performance.

## I. INTRODUCTION

Within the broadest phrases, opinion mining is the technological know-how of the usage of text analysis to understand the drivers in the back of the public sentiment. All text is inherently minable. As such, even as social media can be an apparent supply of cutting-edge opinion, reviews, name center transcripts, net pages, online boards, and survey responses can all show similarly useful [1]. Many techniques exist to determine a writer's view of topics from natural language textual information. A few forms of system gaining knowledge of are used with varying effectiveness [2]. There are special techniques to summarize customer reviews like Information Retrieval, data mining, textual content class, and textual content summarization. Previous to the sector huge internet customers requested critiques of the circle of relatives/buddies to purchase products [3]. Many methods were utilized in OM, the maximum not unusual being lexicon-based and system getting to know. In lexicon, easy text representation is a bag-of-words approach. Opinion lexicons are sources associating with sentiment orientation and phrases. It considers files as a group of words without thinking about members of the family among person phrases. Fantastic opinion phrases are used on this approach to express favoured states at the same time as negative opinion words specific undesired states [4]. Contemporary OM techniques are divided into attribute-driven techniques and sentiment-driven methods. The fundamental concept is to apply characteristic or sentiment keyword to locate opinion applicants with the aid of making use of positive opinion patterns to extract sentiment expressions, thereby filtering the false opinion applicants [5]. OM and sentiment evaluation locate utility in online remark sites and are also used as sub-thing technology in advice structures. OM with sentiment analysis produces less negative comments and greater positive remarks [6]. OM helps

perceive troubles through listening, than by asking, ensuring a correct mirrored image of truth. OM generation has incredible scope for practical packages [7].

Sentiment evaluation retrieves evaluations of certain products/capabilities classifying them as suggested or not that is positive/negative. The sentiment of a selected product in an overview is seldom explicitly positive/negative; however, humans have a combined opinion of assorted features, each positive/negative [8]. Sentiment evaluation extracts, classifies, is familiar with and determines reviews expressed in numerous contents. It attempts to identify opinion / sentiment towards an item. It makes use of NLP and computational techniques to automate extraction / category of sentiment from unstructured text [9]. with more than one reviews to be had for one product and a considerable increase in internet customers, it's miles crucial to expanding a system that collects, builds, analyses, and classifies feedback or an evaluation posted on-line [10]. Sentiment evaluation researchers face NLP's unresolved problems: co reference decision, anaphora resolution, negation dealing with, named-entity recognition, and word-feel disambiguation. OM is a very limited NLP trouble, as the gadget desires to understand the high-quality/poor sentiments of a sentence, and goal entities/topics [11]. There are four feature categories utilized in sentiment analysis semantic feature, syntactic characteristic, link base feature, and stylistic feature [13]. Sentiment detection unearths polarity (fantastic, negative, or neutral) of textual content. Texts are single sentences or quick texts from one supply ("sentence-based") such as twitter files. Consequently, comparisons of social media tracking equipment discover their sentiment detection talents [14]. Subjectivity / objectivity category is an undertaking addressed with sentiment evaluation. Textual content pieces may also/won't include

useful critiques/feedback. Subjective sentences are applicable texts, and objective sentences are irrelevant texts. So it should type out sentences beneficial for us. Subjective sentences are those with records for sentiment evaluation [15].

## **II. LITERATURE SURVEY**

A new syntactic based method which focuses on OM component degree used for syntactic dependency, mixture score of opinion words, senti-wordnet, and element table for OM. The works were carried out on restaurant reviews. The restaurant reviews dataset turned into collected from the web and manually tagged [16]. a new technique to OM changed into proposed via cho et al., (2010) where the authors used map lessen feature as an opinion reading and clustering tool with rating-based total weight and attempted to make OM less difficult due to fixing in map-reduce. The new technique analyzed file's results with OM quicker than using modern techniques and made merchandise that met user's requirements who desired to apply OM results [17]. The jeyapriya & selvi (2015) proposed system is based on phrase-degree to have a look at consumer evaluations. Phrase-stage OM is also known as component-based OM used to extract an item's most vital elements and is expecting orientation of a factor from item critiques[58]. The projected system carried out factor extraction the use of common item set mining in consumer product opinions and mining evaluations as to whether it became superb/terrible [18]. Characterize OM landscape by presenting a faceted taxonomy of different OM factors. The authors survey literature and area these in appropriate places in the new model. The authors suggested a preferred cause workflow from any OM engine. The authors subsequently speculated on precise demanding situations in OM panorama [19]. The methods of the authors permit credibility evaluation and result conversion the use of the impact of the opinion holders on the internet and their personal data, which are analysis-consequences of Linguistic Inquiry and Word Matter (LIWC), consisting of their historical past information and tendency [20].

Through reviews clients evaluated numerous net website indexes quantitatively. To improve mining consequences accuracy the authors used the Mutual Reinforcement Method (MRA) [21]. An OM application over a dataset extracted from the web comprising evaluations with net slang, abbreviations and kind errors became described [22]. A web-based evaluate summarization gadget, to routinely extract maximum representative expressions and client reviews in critiques on numerous product features turned into developed [23]. An agent targeted crawling framework to retrieve topic and genre-related web files become proposed [24]. Individuals, organizations and government should without difficulty recognize the general opinion of a product, agency or public coverage [25]. The dedication of particularities deducing their impact on text pre-processing and OM algorithms[59]. The effectiveness of various algorithms becomes evaluated to determine their applicability to numerous social media channels [26]. A machine's features designed for the

behaviour evaluation of e-trade customers described enabled person identification and the client behaviour extraction to interact with net website customers [27]. An OM framework that extracted reviews and perspectives of clients/clients and analyzed them to offer concrete marketplace waft with established statistical records was verified [28]. A brand new method that used finer granularity clustering for critiques extraction and clustering for calculating their sentiment orientation of evaluations turned into delivered [29].

A tag-subject matter version for blog mining primarily based on the writer-topic model and latent dirichlet allocation turned into presented via tsai (2011). Tag-subject matter model decided most in all likelihood tags/phrases for a subject in blog posts[57]. The version became effectively applied / evaluated on actual-world weblog information [30]. A feature selector's variety regarding their efficiency in improving classifier's overall performance for sentiment evaluation turned into evaluated via isabella et al., this has a look at uses film reviews for sentiment analysis [31].

All feature reduction techniques improved classifier performance as validated by way of alsaffar & omar (2014). Support Vector Machine (SVM) method ensured the highest accuracy in feature selection to classify malay sentiment in comparison to other type procedures like most important component evaluation (PCA) and chi square. SVM recorded 87% experimental accuracy in characteristic choice [32]. A perception into numerous techniques proposed in feature-based OM changed into given by way of ganeshbhai & shah (2015) who discussed boundaries of present day work and destiny direction in feature based OM [33]. An improved feature extraction/refinement technique titled from which extracted accurate features from evaluating facts by the usage of grammatical residences and characteristic phrases semantic traits refining capabilities using recognizing and merging similar ones changed into proposed [34]. The experiments discovered mild type accuracy improvement in combining two or three characteristic selection methods [35]. A brand new technique to contextualize and enrich huge semantic knowledge bases for OM focusing on internet intelligence platforms and high-throughput large facts programs[56] turned into supplied [36]. A new approach for semantic features selection and representation to be described by using consumer via appropriate verbal descriptions the usage of herbal language ideas become proposed [37]. A complete observe on bow representation choices consisting of vocabulary length, forestall phrase elimination, weighting scheme, spatial facts, characteristic selection, and visual bi-gram changed into carried out [38]. Utility and assessment of 3 category strategies over a textual content corpus composed of reviews of commercial merchandise to stumble on critiques approximately them become targeted [39]. A two-stage characteristic choice algorithm depending on a feature choice technique and latent semantic indexing turned into proposed [40]. A web OM set of rules primarily based on sentiment phrase category vector changed into presented. The algorithm through sentiment phrase class strategies compared similarity

among file vectors mined the document's subject matter, and additionally judged the record's topic attributes [41].

a comparative om datasets performance on bagging, dagging, random subspace, and adaboost ensemble strategies with five unique classifiers and 6 exclusive records representation schemes change [42]. A theme detection technique for accepted area independent subjectivity detection that classifies sentences with binary feature: opinionated or non-opinionated become developed [43]. Opinion detection and company subsystem already integrated into larger query-answering machines become provided [45]. Present works on OM and sentiment type of client feedback and opinions on-line [46]. An OM framework that extracts critiques and views of purchasers/clients and analyzes them to provide concrete market drift with tested statistical facts became proved [47]. A method to offset this trouble in the go-domain sentiment type proposed created a sentiment touchy distributional glossary the usage of labeled facts for source domain names and unlabelled facts for source/goal domains [48]. Use of semantic body-based analyzer FrameNet is proposed[55]. This was achieved by applying semantic facts as a characteristic for a gadget mastering-primarily based classifier and the usage of semantic analysis in a bootstrapping technique for the creation of a sentiment lexicon for classifier use [49]. The principle subtask of opinion summarization was proposed. Opinion summarization addresses the determination of sentiment, mind-set or opinion expressed by using an author in natural language regarding a selected characteristic [50]. How syntactic dependency family members primarily based features can be used to improve opinion mining overall performance became explored with the aid[54]. The usage of a dependency relation triples transformation they may be transformed to "composite again-off capabilities" which generalize better than normal lexicalized dependency relation features [51].

OM on Thai restaurant evaluations the usage of k-means clustering and Markov Random Field (MRF) feature selection is proposed[53]. Began with textual content pre-processing to break evaluations into words and cast off stop words, observed by way of text transformation to create keywords and generate input vectors [52]. An OM extraction set of rules to collectively discover major opinion mining elements proposed. Automatically built kernels to combine closely related phrases to new phrases from word degree to word degree based on dependency family members, the authors ensured opinion expressions accuracy and polarity based on: fuzzy measurements, opinion degree intensifiers, and opinion styles [60]. Six novel feature choice strategies that authors specially devised for ordinal classification have been provided. Which are examined on two statistics sets of product assessment facts against three methods from literature, the use of two learning algorithms from a SV regression culture [61]. A brand new metric integrating correlation and reliability statistics between characteristic and class from Multiple Correspondence Analysis (MCA) to attain features for feature selection are proposed [62].

### III. CONCLUSION

This paper proposes a semantic-based feature selection for OM in which the sentiment conveyed in a review is focussed on. Sentiment is classified as high-positive/negative with the aid of extracting / classifying capabilities from reviews. Film evaluations opinion is analyzed / categorized as high positive/negative. Features are extracted from critiques the usage of inverse document frequency and evaluation's categorized using naïve Bayes, Adaboost, and FLRC classifier. Results display that naïve Bayes achieves the satisfactory type. Similarly, research-based totally on supervised mastering has to be undertaken to improve category.

### REFERENCES

- [1]. Manickam, P., Shankar, K., Perumal, E., Ilayaraja, M., & Kumar, K. S. (2019). Secure data transmission through reliable vehicles in VANET using optimal lightweight cryptography. In *Cybersecurity and secure information systems* (pp. 193-204). Springer, Cham.
- [2]. K.Dhanasekaran , P.Anandan, A.Manju "A Computational Approach of Highly Secure Hash Algorithm For Color Image Steganography Using Edge Detection And Honey Encryption Algorithm" *International Journal of Engineering & Technology*, 7 PP. 239-242, 2018.
- [3]. Shankar, K. (2017). Prediction of most risk factors in hepatitis disease using apriori algorithm. *Research Journal of Pharmaceutical Biological and Chemical Sciences*, 8(5), 477-484.
- [4]. Chi-Hua Chen, "A Cell Probe-based Method for Vehicle Speed Estimation," *IEICE Transactions on Fundamentals of Electronics, Communications and Computer Sciences*, vol. E103-A, no. 1, pp. 265-267, January 2020.
- [5]. Dhanapal, R & Visalakshi, P 2016, Real Time Health Care Monitoring System for Driver Community Using Adhoc Sensor Network", *Journal of Medical Imaging and Health Informatics*, ISSN 2156-7018, vol. 6, no. 3, pp. 811-815.
- [6]. Shankar, K., Lakshmanaprabu, S. K., Gupta, D., Khanna, A., & de Albuquerque, V. H. C. (2020). Adaptive optimal multi key based encryption for digital image security. *Concurrency and Computation: Practice and Experience*, 32(4), e5122.
- [7]. "Distributed Security Model for Remote Healthcare (DSM-RH) Services in Internet of Things Environment" Cyril Mathew, R. Dhanapal, P. Visalakshi, K. G. Parthiban, S. Karthik, *Journal of Medical Imaging and Health Informatics*, Volume 10, Number 1, January 2020, pp. 185-193(9).
- [8]. Chi-Hua Chen, Fangying Song, Feng-Jang Hwang, Ling Wu, "A Probability Density Function Generator Based on Neural Networks," *Physica A: Statistical*



- Mechanics and its Applications*, vol. 541, Article ID 123344, March 2020.
- [9]. “Hybrid Dragonfly Optimization-Based Artificial Neural Network for the Recognition of Epilepsy” R. Dhanapal K. G. Parthiban, S. Vijayachitra, *International Journal of Computational Intelligence Systems*, Volume 12, Issue 2, 2019, Pages 1261 - 1269.
- [10]. Mingyang Pan, Yisai Liu, Jiayi Cao, Yu Li, Chao Li, Chi-Hua Chen, “Visual Recognition Based on Deep Learning for Navigation Mark Classification,” *IEEE Access*, vol. 8, pp. 32767-32775, February 2020.
- [11]. “A Cost-Aware Method for Tasks Allocation on the Internet of Things by Grouping the Submitted Tasks” R. Dhanapal, T. Akila, S. Hussain, D. Mavaluru - *Journal of Internet Technology*, Volume 20 (2019) No.7, Pages 2055-2062.
- [12]. Shankar, K., Lakshmanprabu, S. K., Khanna, A., Tanwar, S., Rodrigues, J. J., & Roy, N. R. (2019). Alzheimer detection using Group Grey Wolf Optimization based features with convolutional classifier. *Computers & Electrical Engineering*, 77, 230-243.
- [13]. “Real Time Health Care Monitoring System for Driver Community Using Adhoc Sensor Network” Dhanapal, R.; Visalakshi, P. *Journal of Medical Imaging and Health Informatics*, Volume 6, Number 3, June 2016, pp. 811-815(5).
- [14]. Ling Wu, Qishan Zhang, Chi-Hua Chen, Kun Guo, Deqin Wang, “Deep Learning Techniques for Community Detection in Social Networks,” *IEEE Access*, vol. 8, pp. 96016-96026, May 2020.
- [15]. “A Sector Based Energy Efficient Adaptive Routing Protocol for Large Scale MANET” R. Dhanapal, P. Visalakshi - *Research Journal of Applied Sciences, Engineering and Technology*, volume 9(7): pages 478-484, 2015.
- [16]. Chin-Ling Chen, Tsai-Tung Yang, Yong-Yuan Deng, Chi-Hua Chen, “A Secure IoT Medical Information Sharing and Emergency Notification System Based on Non-repudiation Mechanism,” *Transactions on Emerging Telecommunications Technologies*, Accepted Manuscript.
- [17]. Dhanapal, R & Visalakshi, P 2016, “Optimizing Trust Based Secure Routing for Unified Efficient Resource Sharing for Large Scale MANET-TSRRS”, *Asian Journal of Information Technology*, ISSN :1682-3915, vol. 15, no. 19, pp. 3756-3762.
- [18]. Hsu-Yang Kung, Chi-Hua Chen, Mei-Hsien Lin, Tai-Yang Wu, “Design of Seamless Handoff Control Based on Vehicular Streaming Communications,” *Journal of Internet Technology*, vol. 20, no. 7, pp. 2083-2097, December 2019.
- [19]. Dhanapal, R & Visalakshi, P 2015, “Efficient Clustering Protocol on Ant-Bee agent for Large Scale Manet”, *International Journal of Applied Engineering Research*, ISSN 0973-4562, vol. 10, no. 52, pp. 349-361.
- [20]. Shankar, K., Zhang, Y., Liu, Y., Wu, L., & Chen, C. H. (2020). Hyperparameter Tuning Deep Learning for Diabetic Retinopathy Fundus Image Classification. *IEEE Access*.
- [21]. R. Meera, P. Anandan “A Review On Automatic Detection of Brain Tumor Using Computer Aided Diagnosis System Through MRI” *The Energy Green, Intelligent in Computing & Communication Technologies in Journal of Energy Web and Information Technologies*, Vol5, Issue20, 2018.
- [22]. Shankar, K., & Elhoseny, M. (2019). Trust Based Cluster Head Election of Secure Message Transmission in MANET Using Multi Secure Protocol with TDES. *Journal of Universal Computer Science*, 25(10), 1221-1239.
- [23]. G. Keethana, P. Anandan “A Survey on Security Issues and Challenges in Mobile Ad-hoc Network” *The Energy Green, Intelligent in Computing & Communication Technologies in Journal of Energy Web and Information Technologies*, Vol5, Issue20, 2018.
- [24]. K. Vijayalakshmi, P. Anandan “A Multi Objective Tabu Particle Swarm Optimization for Effective Cluster Head Selection in WSN” *Cluster Computing*, Vol. 22, Issue5, 12275–12282, 2019.
- [25]. Chi-Hua Chen, “An Arrival Time Prediction Method for Bus System,” *IEEE Internet of Things Journal*, vol. 5, no. 5, pp. 4231-4232, October 2018.
- [26]. B. Senthilraja, P. Anandan, A. Manju “The Survey to Implement Recent Reversible Watermarking Techniques In Medical Images And Other Applications” *Journal of Advanced Research in Dynamical & Control Systems*, Vol.10-Special Issue 03, May 2018.
- [27]. Elhoseny, M., Shankar, K., & Uthayakumar, J. (2019). Intelligent diagnostic prediction and classification system for chronic kidney disease. *Scientific reports*, 9(1), 1-14.
- [28]. P. Vinayagam, P. Anandan “A Review on Pixel Performance in CMOS Image Sensors” *Journal of Advanced Research in Dynamical & Control Systems*, 05-Special Issue, July 2017.
- [29]. Elhoseny, M., Bian, G. B., Lakshmanprabu, S. K., Shankar, K., Singh, A. K., & Wu, W. (2019). Effective features to classify ovarian cancer data in internet of medical things. *Computer Networks*, 159, 147-156.
- [30]. P. Anandan, N. Mohankumar, V. Saranya “Characterization of Flicker noise in Dual Material Gate Silicon Nanowire Transistors” *Journal of Nanoelectronics and Optoelectronics*, 12, 72–75 (2017) (Impact Factor 0.369)
- [31]. Elhoseny, M., & Shankar, K. (2020). Energy efficient optimal routing for communication in VANETs via clustering model. In *Emerging Technologies for Connected Internet of Vehicles and Intelligent*

- Transportation System Networks (pp. 1-14). Springer, Cham.
- [32]. N.Mohankumar, A.Mohanbabu, S.Baskaran, P.Anandan, N.Anbuselvan and P.Bharathivikkriraman “Modeling of Sheet Carrier Density, DC and Transconductance of Novel InxAl1-XN/GaN-Based HEMT Structures” *Advanced Materials Research* Vol. 1105 (2015) pp 99-104.
- [33]. J.Sangeetha,T.Jayasankar,“ A Novel Whispered Speaker Identification System Based on Extreme Learning Machine”, *International Journal of Speech Technology*, Springer,(2018) ,21 (1), pp.157–165.
- [34]. G.S.S.S.S.V.Krishna Mohan and Komanapalli Venkata Lakshmi Narayana, “Auto Tuning Smith-Predictive Control of Delayed Processes Based on Model Reference Adaptive Controller”, *Jour of Adv Research in Dynamical & Control Systems*,Vol. 12, 04-Special Issue, p.p.1224-1230, 2020.
- [35]. Mohanty, S. N., Lydia, E. L., Elhoseny, M., Al Otaibi, M. M. G., & Shankar, K. (2020). Deep learning with LSTM based distributed data mining model for energy efficient wireless sensor networks. *Physical Communication*, 101097.
- [36]. Uthayakumar, J., Elhoseny, M., & Shankar, K. (2020). Highly Reliable and Low-Complexity Image Compression Scheme Using Neighborhood Correlation Sequence Algorithm in WSN. *IEEE Transactions on Reliability*.
- [37]. GSSSSV.Krishna Mohan and Yarravarapu Srinivasa Rao, “An efficient design of finite impulse response — Fractional-order differentiator using shuffled frog leaping algorithm heuristic”, *International Journal of Wavelets, Multiresolution and Information Processing*, World Scientific Publishing Company, Vol. 17, No. 2 March 2019.
- [38]. Lydia, E. L., Raj, J. S., PandiSelvam, R., Elhoseny, M., & Shankar, K. (2019). Application of discrete transforms with selective coefficients for blind image watermarking. *Transactions on Emerging Telecommunications Technologies*, e3771.
- [39]. G.S.S.S.S.V. Krishna Mohan & Yarravarapu Srinivasa Rao: “Optimal Order of the Differentiator Selection in Noise Removal of ECG Signals”, *International Journal of Recent Technology and Engineering (IJRTE)*,Volume-7, Issue-6, 260-267, March 2019.
- [40]. Sivaram, A. M., Lydia, E. L., Pustokhina, I. V., Pustokhin, D. A., Elhoseny, M., Joshi, G. P., & Shankar, K. (2020). An Optimal Least Square Support Vector Machine Based Earnings Prediction of Blockchain Financial Products. *IEEE Access*.
- [41]. GSSSSV.Krishna Mohan and Yarravarapu Srinivasa Rao, “An efficient design of fractional order differentiator using hybrid Shuffled frog leaping algorithm for handling noisy electrocardiograms”, *International Journal of Computers and Applications*,Feb 2019.
- [42]. Elhoseny, M., Selim, M. M., & Shankar, K. (2020). Optimal Deep Learning based Convolution Neural Network for digital forensics Face Sketch Synthesis in internet of things (IoT). *International Journal of Machine Learning and Cybernetics*, 1-12.
- [43]. GSSSSV.Krishna Mohan and K.Venkata Lakshmi Narayana, “Design Of A Fractional Order PID For A Three Tank System”, *International Journal of Applied Engineering Research*, Volume 10, Number 2 (2015) pp. 3133-3148, Research India Publications, April 2015.
- [44]. Chi-Hua Chen, Feng-Jang Hwang, Hsu-Yang Kung, “Travel Time Prediction System Based on Data Clustering for Waste Collection Vehicles,” *IEICE Transactions on Information and Systems*, vol. E102-D, no. 7, pp.1374-1383, July 2019.
- [45]. D.V.L.N.Sastry, B.Anil Kumar, P. Kameswara Rao, G.S.S.S.S.V.Krishna Mohan “Tuning Of Fractional Order PID Controller For Interacting Systems By Different Methods”, *i--manager’s Journal on Instrumentation & Control Engineering* Vol.2 No.2 May July 2014.
- [46]. A,Venkata Naga Vamsi, G.S.S.S.S.V.Krishna Mohan, S.S.S.Srikanth, “Simplified Thermocouple Interface For Hot Only Or Cold Only Measurement With Linearization Circuit”, (*IJERA*) *International Journal of Engineering Research and Applications*, Vol. 2, Issue5, September- October 2012, pp.1663-1667.
- [47]. Lakshmanaprabu, S. K., Shankar, K., Ilayaraja, M., Nasir, A. W., Vijayakumar, V., &Chilamkurti, N. (2019). Random forest for big data classification in the internet of things using optimal features. *International journal of machine learning and cybernetics*, 10(10), 2609-2618.
- [48]. D.V.L.N.Sastry, G.S.S.S.S.V.Krishna Mohan, M.S.R.Naidu, N.Mohana Rao, “An Implementation of different non-linear PID controllers on a single tank level control using Matlab”, (*IJCA*) *International Journal of Computer Applications* (0975 – 8887) Volume 54– No.1, September 2012.
- [49]. Mohanty, S. N., Ramya, K. C., Rani, S. S., Gupta, D., Shankar, K., Lakshmanaprabu, S. K., & Khanna, A. (2020). An efficient Lightweight integrated Blockchain (ELIB) model for IoT security and privacy. *Future Generation Computer Systems*, 102, 1027-1037.
- [50]. N. Krishnaraj, Mohamed Elhoseny, E. Laxmi Lydia, K. Shankar, Omar ALDabbas , “An Efficient RADIX TRIE based Semantic-Visual Indexing Model for Large-Scale Image Retrieval in Cloud Environment, *Software: Practice and Experience*, Wiley , 2020
- [51]. Kathiresan, S., Sait, A. R. W., Gupta, D., Lakshmanaprabu, S. K., Khanna, A., & Pandey, H. M. (2020). Automated detection and classification of fundus diabetic retinopathy images using synergic deep learning model. *Pattern Recognition Letters*.
- [52]. Dr.N.Krishnaraj, Kiranmai Bellam, “Improved Distributed Frameworks to Incorporate Big Data

- through Deep Learning”, Journal of Advanced Research in Dynamical & Control Systems, Vol. 12, 03-Special Issue, 2020.pp:332-338
- [53]. Sankhwar, S., Gupta, D., Ramya, K. C., Rani, S. S., Shankar, K., & Lakshmanaprabu, S. K. (2020). Improved grey wolf optimization-based feature subset selection with fuzzy neural classifier for financial crisis prediction. *Soft Computing*, 24(1), 101-110.
- [54]. N.Krishnaraj, Mohamed Elhoseny, M.Thenmozhi, Mahmoud M.Selim , K.Shankar , “Deep Learning Model for real- time image compression in Internet of Underwater Things(IoUT)”, *Journal of Real-time Image Processing* ,2019
- [55]. Pustokhina, I. V., Pustokhin, D. A., Gupta, D., Khanna, A., Shankar, K., & Nguyen, G. N. (2020). An Effective Training Scheme for Deep Neural Network in Edge Computing Enabled Internet of Medical Things (IoMT) Systems. *IEEE Access*, 8, 107112-107123.
- [56]. N.Krishnaraj, M.G.Kavitha, T.Jayasankar, K.Vinoth Kumar , “A Glove based approach to recognize Indian Sign Languages”, *International Journal of Recent Technology and Engineering (IJRTE) Volume-7, Issue-6, March 2019*, pp.1419-1425.
- [57]. Raj, R. J. S., Shobana, S. J., Pustokhina, I. V., Pustokhin, D. A., Gupta, D., & Shankar, K. (2020). Optimal Feature Selection-Based Medical Image Classification Using Deep Learning Model in Internet of Medical Things. *IEEE Access*, 8, 58006-58017.
- [58]. Dr.N.Krishnaraj ,Dr P Kiran Kumar, Mr K Subash Bhagahavn , “Conceptual Semantic Model for Web Document Clustering Using Term Frequency”, *EAI Endorsed Transactions on Energy Web and Information Technologies*, Volume 5, Issue 20,2018,pp.1-4.
- [59]. Pustokhina, I. V., Pustokhin, D. A., Rodrigues, J. J., Gupta, D., Khanna, A., Shankar, K., & Joshi, G. P. (2020). Automatic Vehicle License Plate Recognition using Optimal K-Means with Convolutional Neural Network for Intelligent Transportation Systems. *IEEE Access*.
- [60]. N. Krishnaraj, P. Ezhilarasu, X Z Gao ,”Hybrid Soft Computing Approach for Prediction of Cancer in Colon Using Microarray Gene Data” , *Current Signal Transduction Therapy* Vol.11 (2),pp71-75,June 2016.
- [61]. N. Krishnaraj, P. Ezhilarasu, S.Karthik , Manoj Prabhakar.J, ”Enhancing Security in Mobile Devices through Multimodal biometrics” , *Middle-East Journal of Scientific Research* 23 (8) ,pp. 1598-1603,Jun 2016.
- [62]. Krishnaraj,N.,Ezhilarasu,p., Dharun, V.S.,” Smart Phone Application For Automatic Public Transportation Though Providing Intelligent Bus Status Information To The Users” *International Journal of Applied Engineering Research (IJAER)*, Vol 59, pp.163-167, Jun -2015.