Machine Learning Based Recommendation System: A Review

Shreya Sharda and Dr. Gurpreet S Josan
Department of Computer Science, Punjabi University Patiala, Punjab, India

The digital era has created an extreme choice paradigm with an explosion of endless content. A user who is just starting on the platform or looking for a creature can be lost in this ocean. Therefore, it is necessary to design a system that can guide users as per their interest. To overcome this problem, the Recommendation System (RS) came into existence. RS is a tool used to recommend items as per users interests. The benefits of the RS cannot be exaggerated, given the potential impact to improve many of the problems associated with widespread use and over-selection in many web applications. In recent years, Machine learning (ML) shows great interest in different research areas, such as computer vision and Natural Language Processing (NLP), not only because of its stellar performance but also because of its attractive feature of demonstrating learning from scratch. The effect of ML techniques can be seen while applying these techniques to the prediction and recommender system. This paper presented a comprehensive survey on recommendation techniques used in conjunction with the ML approach in many domains. This work aims to find the shortcoming of available RS for different fields and the areas that require more effort to attain higher accuracy.

Keywords: Recommendation system, machine learning schemes, neural network, support vector machine, K-NN, deep NN.

1. INTRODUCTION

Recommended System (RS) is a software tool that provides suggestions for items related to the user's interest [Feuerbach J., et al. 2017]. These systems can be seen everywhere: movies [Aamir M., et al. 2015], music [Mukherjee R., et al. 2013], tourism [Colomo-Palacios R., et al. 2017], and news [Bomhardt C., 2004], and product recommendation systems [Von Reischach F., et al. 2009]. For websites including Google, Amazon, Netflix, YouTube, and many more, this system becomes an essential element. The two major types of variation commonly observed in the working of RSs is illustrated in Fig. 1. When the RS system gives recommendations based on the similarity between the contents that were browsed by the user it is referred to as content based recommendation (refer Fig. 1(a)). However, when the recommendation is based on the similarity that exists between the interests of different users, it is referred as Collaborative RS (refer Fig1(b)). For instance, the newspaper industry has undergone a profound transformation over the last decade and in this modern era, people can access various online news sources through websites provided by traditional newspaper companies, or digital news sites such as Google and Yahoo [Newman N., et al. 2019].

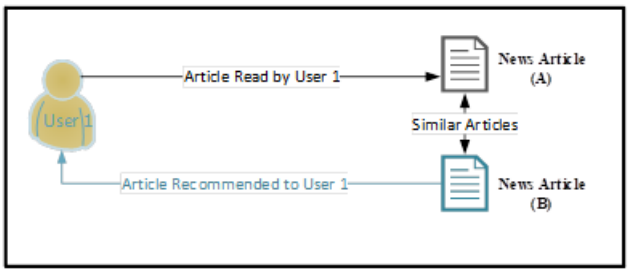

Fig. 1(a) Content Based RSs.

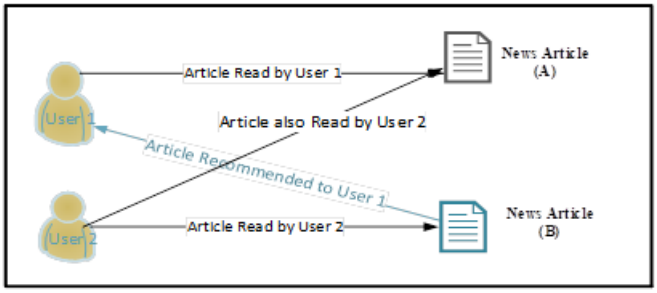

Fig. 1(b) Collaborative RS.

In addition to the above, the updated or new information related to reading any news is provided by the newspaper firm on a real-time basis that helps increase the news publication speed. The accessibility of available online news portals has led to improved user knowledge via various platforms. Hefty information is available on the web [Jannach D., and Hegelich K., 2009]. Therefore, updating news up to date and tracking readers' interest is challenging for the engineers. RS is a tool designed to help users to extract valuable information as per users interest. Such systems aim to filter the data as per the users choice, and in addition to this, the part of users about items or objects has also been recorded by the RS. Significant advancement has been made in RS technology in recent decades. RS can be used in multiple areas, including movies, shopping sites, hotels, tourism, research articles, and so forth [Beel J., et al. 2016]. The recommendation represents another area of application where several techniques can be applied to design an efficient RS. There have been several reported cases in which RS was used to deliver recommendation features on trendy sites. RS is divided into collaborating, content Based (CB) RS, and hybrid RS. The selection of a particular RS has been performed based on the data type to be recommended [Park D.H., et al. 2012].

The last few decades have witnessed Machine Learning (ML) enormously successful in many application areas, such as computer vision and speech recognition [Covington P., et al. 2016]. In recent years, ML has transformed the structure of RS dramatically and brings more opportunities to improve RS's performance. Recent developments in ML-based RS have received significant attention, overcoming traditional models' barriers and achieving high recommendation quality. ML algorithms can effectively capture nonlinear and insignificant user-material relationships and provide a codification of more complex abstracts, such as presenting information at higher levels. Also, it obtains complex connections within data from widely available sources of information, such as contextual and visual information [Dai H., et al. 2016].

The organization of the paper is as follows: Section 2 represents the detailed description of machine learning. Section 3 describes the state of the art of the existing work. Section 4 describes the comparative analysis of existing work in terms of performance parameters. Section 5 represents the conclusion of the proposed work. The major contributions of this review article are as follows;

(1) We focus on finding out the researchers' problem and providing their possible future solution with the advantages of existing recommendation modules.
(2) Our survey provides a challenging face that affects the personalized recommendation model in existing work regardless of the research field and regardless of user expertise.

2. MACHINE LEARNING (ML)

When a system aims to train for a specific set of the target, it is called Artificial Intelligence (AI) to classify the categorized data value. There are different ways of learning a machine based on learning behavior, and there is the categorization of AI. ML is a sub-branch of AI in which the system is trained based on statistical methods. The data distribution architecture produces

many types of learning mechanisms. There are 14 types of learning mechanisms, out of which four types of learning behavior are discussed as follows:

(1) Supervised: It is the type of learning in which the system is trained and classified using the same data set.

(2) Semi-Supervised: In this type of learning, a partition in the entire set of the ratio 70-30% is applied. In some cases, the distribution mechanism is observed to be 80-20%.

(3) Un-supervised: In this type of learning, the test data may or may not be similar to the training data.

(4) Reinforcement Learning: In this learning mechanism, the system retrains itself based on the new accurate classified entries.

Other learning mechanisms are self-supervised learning, multi-instance learning, inductive learning, deductive inference, transductive learning, multi-task learning, active learning, online learning, transfer learning, ensemble learning [Bertens P., et al. 2018]. ML allows users to analyze a massive amount of data. While it usually produces faster and more accurate results for identifying beneficial opportunities or dangerous risks, it may also require additional time and resources to prepare it properly. Combining machine learning with artificial intelligence and cognitive technologies can make it even more efficient when processing large amounts of information. ML approaches can be categorized into supervised and unsupervised learning approaches [Thangavel S.K., et al. 2017]. The supervised approach is again categorized into two subsections: (i) Classification and (ii) regression. Unsupervised learning is sub-divided into clustering approaches.

3. RELATED WORK

This section discussed the research articles presented by several researchers to design recommendation Systems using ML techniques and used in different fields like news, movie reviews, hotel reviews, and many more. [Mai et al. 2009] have presented an NN-based CF approach for an e-commerce RS system. The CF-based NN RS design is useful to improve the minority problem of the co-filtering algorithm and create more effective and more accurate recommended outcomes. The analysis and discussion of this algorithm are based on the following aspects: algorithm design considerations; procedure, implementation of the algorithm; and its characteristic analysis. The researchers have proved that sparsity has been resolved using the proposed technique and provides useful and highly accurate results. [Paradarami et al. 2017] have presented a deep NN-based RS that provides facilities to the business user combinations. The advantage of using the NN approach is to minimize the slog along with misclassification error. The hybrid RS algorithm, in addition to the NN technique, outperformed compared to the collaborative Filtering approach. [Lian et al. 2017] have presented a cross-domain RS known by CCCFNet using CF and CB filtering in combination. Initially, the factorization method has been applied to bond CF and CB filtering together. The performance has been evaluated using databases, namely Douban and Movie Lens 20M. These include information regarding movies, music, books, and activities. The model performed better compared to a number of baseline methods. [Ma Yajun & Lin Sheng 2018] proposed an LDA-LR personalized news recommendation method, which uses the LDA theme model to train the theme distribution of each news, then calculates the user similarity based on the topic, and then combines the LR logistic regression model to filter, and obtains the final news recommendation list. The experiment proves that this recommendation method has increased the accuracy and coverage compared with the existing news recommendation system. [Castillo et al. 2019] analyzed the emergence of multiple definitions of what is a fair ranking and different approaches to providing transparency in search. The different definitions and various methods may be used to address other manifestations of bias and discrimination. In this work, the author evaluates each practice and should first consider the problem it is trying to address. The major limitation is that in this work, approaches may not involve some of the elements we

Table I: COMPARATIVE ANALYSIS OF EXISTING WORK BASED ON ML-TECHNIQUES

Reference	**Technique Used**	**System Designed For**	**Dataset**	**Performance parameters**
[Xu et al. 2006]	SVM	TV program	http://www.ontvjapan.com/program/	Precision (85.3%) and accuracy (92.5 %), prediction accuracy (65%)
[Wang et al. 2014]	K-means Clustering	Movie Review	Movie lens	High recommendation precision
[Kothari and Patel 2015]	SVM	Hotel Review	Collected manually from online sources	Hit ratio (0.90) and Mean Reciprocal Rank (0.22)
[Wang et al. 2016]	PSO and SVM	Movie	MovieLens 1M	Classification accuracy (75.5%), MAE (0.99)
[Yesodha et al. 2018]	SVM	Product Review	Flipkart	MSE (0.006905), and Squared correlation coefficient (0.003844)
[Liu et al. 2010]	BAYESIAN	Personalized news	Data has been collected for one year dated from 1-7-2007 to 30-6-2008	Scaled visits per day, click per day have been examined concerning the number of days.
[K. Wohiduzzaman and S. Ismai 2018]	Hierarchical Clustering	Bangle News	pipelike or Google news portal	The clustering approach performed better to find unique words
[Lau et al. 2011]	Nave Bayes and Logistic regression	News	Dataset is created in collaboration with Pulse that is a local startup providing a news reading application for mobile devices	0.79 F score has been observed.
[Adnan et al. 2014	Fuzzy Logic	News	Data has been crawled from bdnews24.com	Maximum accuracy of up to 91% has been attained for politics news.
[Shirude et al. 2018]	Decision Tree	Library	Dataset is created including, User Profiles, Library Resources, and ACM CCS 2012 as ontology.	Precision (85%), Recall (78%), F1 (81.34%), Coverage (), and accuracy (76.90%).
[Sattar et al. 2017]	Nave Bayes	Movie Reviews	Movie Lens 100K Ratings , and Film Trust (FT)	MAE

have seen in the DM/ML literature on fairness and transparency, adapted to ranking problems, and combined with possibly wholly new methods that will be IR-specific.

[Samaneh et al. 2020] proposed a framework for ranking online news websites from different viewpoints. The ranking of news websites is useful information, which can benefit many news-related tasks such as news retrieval and news recommendation. The order of news websites is obtained in the proposed framework by calculating three measures introduced in the paper and based on user-generated content. Each proposed measure is concerned with news websites' performance from a particular viewpoint, including the completeness of news reports, the diversity of events being covered by the website, and its speed. The use of user-generated content in this

framework, as a partly-unbiased, real-time, and low-cost content on the web, distinguishes the proposed news website ranking framework from the literature. The results obtained for three prominent news websites, BBC, CNN, NYTimes, show that the BBC has the best performance in terms of news completeness and speed, and NYTimes has the best diversity compared to the other two websites.

Table II: COMPARATIVE ANALYSIS OF EXISTING WORK BASED ON DEEP LEARNING-TECHNIQUES

Reference	**Technique Used**	**System Designed For**	**Dataset**	**Performance parameters**
[Kongsakun and Fung 2012]	DT, association rule with ANN	Students Interest	About 3550 student's records have been collected from the last five academic years in different streams.	Mean Square Error (0.028)
[Baskota, and Ng 2018]	SVM with KNN	Graduate School	Collected data manually from a number of universities and named as "Grad Sch."	Precision (0.612), recall (0.626), F-measure (0.615) and accuracy (0.616)
[Da'u et al. 2020]	CNN	Restaurant and laptop domain Reviews	SemEval2014	F-score (88.43%), root (RMSE) and Mean Absolute Error (MAE)
[Nassar et al. 2020]	Deep learning	Hotel Reviews	TripAdvisor	Precision, recall and F measure (0.9295), MAE (0.7552), MAP (0.4643), MRR (0.766)
[Park et al. 2017]	Deep learning	News search	NAVER News dataset	Recall (0.55) session MRR (0.14)
[Zhu et al. 2019]	CNN and R-NN	News interest as per click	The address has been used as a real-time dataset.	80.18% of accuracy has been examined with 82.32% of F score.
[Adeniyi et al. 2016]	KNN	News	Web mining includes proxy server, web server and data gathered from the clicks of web client	Euclidean distance from the other User or Neighbor to user
[Gabriel De Souza et al. 2019]	Recurrent Neural Network (RNN)	News	Globo.com (G1) dataset, and mart Media Adressa	Accuracy has been analyzed as per hit rate.
[Oh et al. 2014]	Deep Neural Network (DNN)	News	http://kecidev.kaist.ac.kr/.	Time (61.8s) and accuracy (75.2%)

3.1 RESEARCH GAPS

It has been observed that Hindi news RS are usually topic modelling and as such only top news is retrieved in the recommendation list and as such users interest remains unsatisfied. The latest survey conducted by Venkatesan and Sabari reflects that there exists a ratio of 40:60 between for users who believe in the recommendation, to those who do not believe in the recommendation suggested to them [Venkatesan and Sabari, 2020]. The above literature review led to a generalized understanding that the traditional collaborative RSs have their instinct limitations that are not limited to data sparsity, data privacy and computational scalability. The gap analysis focusses on

precise blending of the existing machine learning approaches to overcome the challenges of precise prediction and ranking. This considerable gap need to be minimized with a highly accurate and personalized design of RSs.

4. RESULTS AND ANALYSIS

This article presents the orientation of work concerning Support Vector Machine (SVM) and a brief description of SVM is as follows. SVM is a binary class classifier that uses different kernel functions to segregate the data vector against the associated target labels. In general, three kernels are utilized as follows:

(1) Linear Kernel: Follows a linear model for the separation of data labels. Linear Kernel uses $ax + b = 0$ where$a$ and$b$ are arbitrary constants.

(2) Polynomial Kernel: Follows a polynomial type segregation mechanism, which might be quadratic or nth order polynomial. The general equation for polynomial type kernel is $(ax + b)^n$

(3) RBF Kernel: RBF Kernel represents the Radial Basis Function, which co-relates neural network propagation and architecture.

The segregation of kernels is presented in Fig. 2(a), (b), and (c).

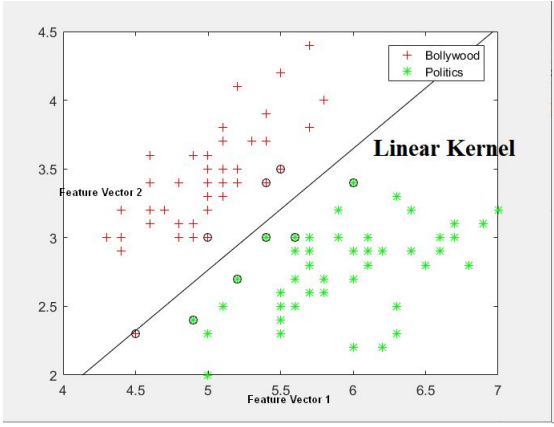

Fig. 2(a) Linear Kernel

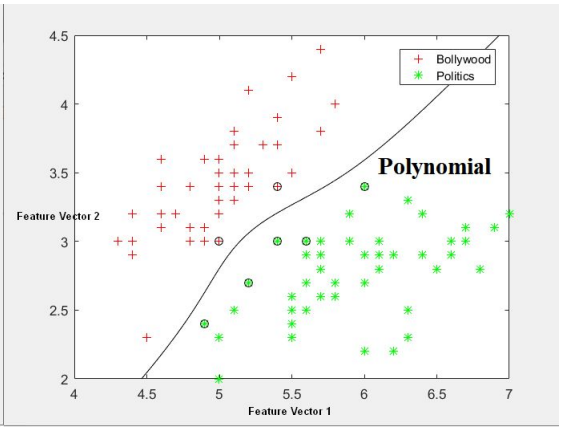

Fig. 2(b) Polynomial Kernel

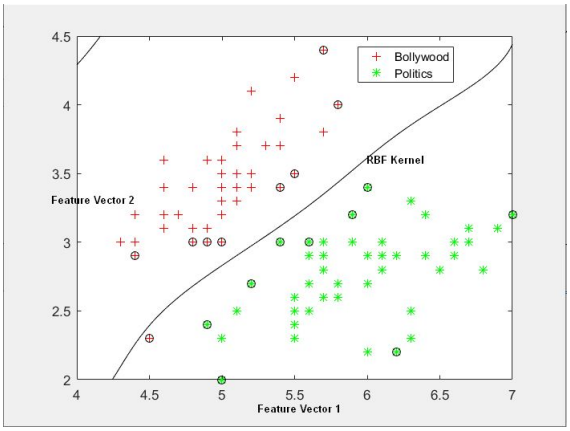

Fig. 2(c) RBF Kernel

To design an RS for any of the domains, the following parameters are needed to be evaluated.

(1) Mean Absolute Error (MAE)

$$MAE = \frac{1}{N}\Sigma_{u,i}|Pr_{ui} - pr_{ui}| \tag{1}$$

Where N signifies the size of test data, pr' is the overall predicted rating for user *'u'* and item *'I'*, and Prui is the actual overall rating.

(2) Precision

$$Precision = \frac{1}{number\ of\ users}\Sigma_u \frac{R_i}{Recommended\ items\ in\ top\ k} \tag{2}$$

R_i is Relevant and number of recommended items in top k

(3) Recall

$$Recall = \frac{1}{Number\ of\ users}\Sigma u \frac{R_i}{Relevant\ data\ or\ items} \tag{3}$$

(4) Mean Average Precision (MAP)

$$MAP = \frac{\Sigma_{n=1}^{k} Precision(k) \times Rel(k)}{min|N_{Relevant\ Items}|} \tag{4}$$

Where $Precision(k)$ is Precision up to the cutoff and Rel is the function that represents 1 for relevant information and 0 for irrelevant.

(5) Mean Reciprocal Rank (MRR)

$$MRR = \frac{1}{Number\ of\ users}\Sigma_u \frac{1}{rank_{1st\ relevant\ item}} \tag{5}$$

(6) Accuracy

$$Accuracy = \frac{The\ number\ of\ correctly\ classified\ Samples}{Total\ Number\ of\ Samples} \tag{6}$$

(7) RMSE

$$RMSE = \sqrt{\frac{\Sigma_{u,i}\varepsilon T(pr_{ui} - Pr_{ui})}{|T|}} \tag{7}$$

Where T is Testing Test, Normally, for an accurate recommendation system, the value of RMSE is required as much smaller as we can.

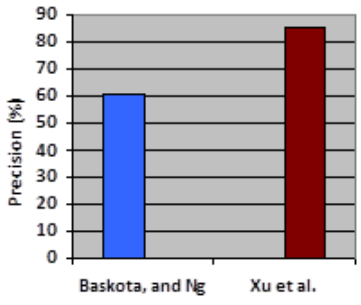

Fig 3. Comparison of Precision

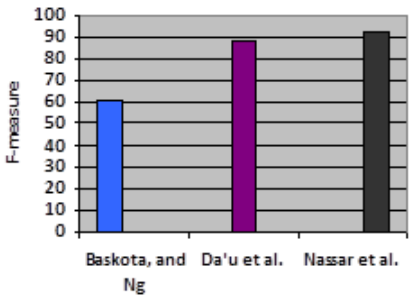

Fig 4. Comparison of F-measure

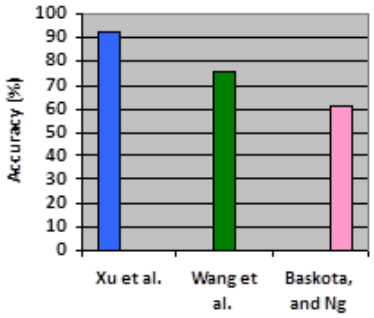

Fig. 5. Comparison of Accuracy

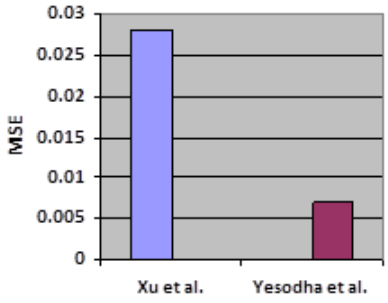

Fig. 6. Comparison of MSE

Fig. 3 represents the comparison of precision values analyzed by researchers Xu et al. (2006) and Baskota, and Ng (2018). Both researchers have design RS using SVM for TV programs, SVM with KNN for the graduate student. The precision analyzed using SVM with the KNN algorithm is lower compared to the simple SVM approach. This might be due to the absence of pre-processing and feature reduction approaches provided by Xu et al. (2006). About 39.38% of improvements have been shown by Xu et al. (2006). Fig. 4 represents the comparison of the F-measure observed by three authors as shown by the blue, the violet, and the gray color, respectively. From the graph, it is seen that Nassar et al. has led the highest F-measure. F-measure is the term evaluated to determine the relationship between precision and recall. Using deep learning Neural Network highest F-measure has been recorded. The improvement using deep learning against CNN, SVM, and KNN has been observed as 51.14% and 5.11%, respectively.

The confusion matrix shown in Table III illustrates the accuracy comparison of the existing studies. It is observed that using the polynomial kernel function in SVM results in the highest classification accuracy, followed by two current studies of Wang et al. and Baskota and Ng.

Table III: Confusion Matrix analysis for accuracies of the existing studies

Existing Studies	**Xu et al.**	**Wang et al.**	**Baskota and Ng**
Xu et al.	92.5%	0	0
Wang et al.	0	75.5%	0
Baskota and Ng	0	0	61.6%
Techniques	Polynomial kernel SVM	PSO and SVM	SVM and KNN

5. CONCLUSION

In the present era the internet has been overloaded with enormous amount of data that is tremendously increasing in both number and volume. Thus, a RS is required that can shorten the search list with respect to individuals interest list to save valuable time and efforts. This paper presents a comprehensive survey of the research works conducted on ML-based RSs. We here discussed the ML technique and highlighted many articles that have took advantage of the ML approach to recommend items as per the user's interest. Every year there are a large number of new techniques and emerging models came into existence. The article helps readers and provides a comprehensive understanding to highlight the most notable developments of RS using the ML technique. It is concluded that there still exits significant scope of research to overcome the challenges faced by RSs in terms of scalability and data security. However, very little research has been conducted involving Hindi language. In addition to this the present work demonstrates that SVM classifier has been the better method to offer highly accurate online or offline recommendations in Hindi language.

REFERENCES

AAMIR, M. AND BHUSRY, F. E. 2005. Recommendation system: state of the art approach. In *International Journal of Computer Applications, 120.*

ADENIYI, D.A.WEI, Z. AND YONGQUAN, Y. 2016. Automated web usage data mining and recommendation system using K-Nearest Neighbor (KNN) classification method. *Applied Computing and Informatics 12, 90-108.*

ADNAN, M.N.M. CHOWDURY, M.R. TAZ, I. AHMED, T. AND RAHMAN, R.M. 2014. Content based news recommendation system based on fuzzy logic. In *2014 International Conference on Informatics, Electronics & Vision (ICIEV), 1-6. IEEE.*

BASKOTA, A. AND NG, Y.K. 2018. A Graduate School Recommendation System Using the Multi-Class Support Vector Machine and KNN Approaches. In *In 2018 IEEE International Conference on Information Reuse and Integration (IRI), 277-284. IEEE.*

BEEL, J. GIPP, B. LANGER, S. AND BREITINGER, C. 2016. paper recommender systems: a literature survey. In *International Journal on Digital Libraries 17, 305-338.*

BERTENS, P. GUITART, A. CHEN, P.P. AND PERIEZ, . 2018. A machine-learning item recommendation system for video games. In *In 2018 IEEE Conference on Computational Intelligence and Games (CIG), 1-4. IEEE.*

BOMHARDT, C. 2004. Newsrec, a svm-driven personal recommendation system for news websites. In *In IEEE/WIC/ACM International Conference on Web Intelligence (WI'04), 545-548. IEEE.*

CASTILLO, C.2019. Fairness and transparency in ranking. In *In ACM SIGIR Forum 52, 64-71. New York, NY, USA: ACM.*

COLOMO-PALACIOS, R. GARCA-PEALVO, F.J. STANTCHEV, V. AND MISRA, S. 2017. Towards a social and context-aware mobile recommendation system for tourism. In *Pervasive and Mobile Computing 38, 505-515.*

COVINGTON, P. ADAMS, J. AND SARGIN, E. 2016. Deep neural networks for youtube recommendations. In *In Proceedings of the 10th ACM conference on recommender systems, 191-198.*

DAI, H. WANG, Y. TRIVEDI, R. AND SONG, L. 2016. Deep coevolutionary network: Embedding user and item features for recommendation. In *arXiv preprint arXiv:1609.03675.*

DA'U, A. SALIM, N. RABIU, I. AND OSMAN, A. 2020. Recommendation system exploiting aspect-based opinion mining with deep learning method. In *Information Sciences 512, 1279-1292.*

FEUERBACH, J. LOEPP, B. AND ZIEGLER, J. 2017. Enhancing an Interactive Recommendation System with Review-based Information Filtering. In *In IntRS@ RecSys, 2-9.*

GABRIEL DE SOUZA, P.M. JANNACH, D. AND DA CUNHA, A.M. 2019. Contextual hybrid session-based news recommendation with recurrent neural networks. *IEEE Access 7, 169185-169203.*

JANNACH, D. AND HEGELICH, K. 2009. A case study on the effectiveness of recommendations in the mobile internet. In *In Proceedings of the third ACM conference on Recommender systems, 205-208.*

KARIMI, S. SHAKERY, A. AND VERMA, R. 2020. Online news media website ranking using user-generated content. In *PJournal of Information Science, 0165551519894928.*

KONGSAKUN, K. AND FUNG, C.C. 2012. Neural network modeling for an intelligent recommendation system supporting srm for universities in thailand. In *WSEAS transactions on Computers 11, 34-44.*

KOTHARI, A.A. AND PATEL, W.D. 2015. A novel approach towards context based recommendations using support vector machine methodology. In *Procedia Computer Science 57, 1171-1178.*

LAU, C.W. 2011. News Recommendation System Using Logistic Regression and Naive Bayes Classifiers.

LIAN, J. ZHANG, F. XIE, X. AND SUN, G. 2017. CCCFNet: a content-boosted collaborative filtering neural network for cross domain recommender systems. In *In Proceedings of the 26th international conference on World Wide Web companion, 817-818.*

LIU, J. DOLAN, P. AND PEDERSEN, E.R. 2010. Personalized news recommendation based on click behavior. In *Proceedings of the 15th international conference on Intelligent user interfaces, 31-40.*

MAI, J. FAN, Y. AND SHEN, Y. 2009. A neural networks-based clustering collaborative filtering algorithm in e-commerce recommendation system. In *In 2009 International Conference on Web Information Systems and Mining, 616-619. IEEE.*

MUKHERJEE, R. SAJJA, N. AND SEN, S. 2003. A movie recommendation systeman application of voting theory in user modeling. In *User Modeling and User-Adapted Interaction 13, 5-33.*

NASSAR, N. JAFAR, A. AND RAHHAL, Y. 2020. A novel deep multi-criteria collaborative filtering model for recommendation system. In *Knowledge-Based Systems 187, 104811.*

NEWMAN, N. FLETCHER, R. KALOGEROPOULOS, A. AND NIELSEN, R. 2019. Reuters Institute digital news report 2019. In *Reuters Institute for the Study of Journalism.*

OH, K.J. LEE, W.J. LIM, C.G. AND CHOI, H.J. 2014. Personalized news recommendation using classified keywords to capture user preference. In *16th International Conference on Advanced Communication Technology, 1283-1287. IEEE.*

PARADARAMI, T.K. BASTIAN, N.D. AND WIGHTMAN, J.L. 2017. A hybrid recommender system using artificial neural networks. In *Expert Systems with Applications 83, 300-313.*

PARK, D.H. KIM, H.K. CHOI, I.Y. AND KIM, J.K. 2012. A literature review and classification of recommender systems research. In *Expert systems with applications 39, 10059-10072.*

PARK, K. LEE, J. AND CHOI, J. 2017. Deep neural networks for news recommendations. In *In Proceedings of the 2017 ACM on Conference on Information and Knowledge Management, 2255-2258.*

SATTAR, A. GHAZANFAR, M.A. AND IQBAL, M. 2017. Building accurate and practical recommender system algorithms using machine learning classifier and collaborative filtering. In *Arabian Journal for Science and Engineering, 42, 3229-3247.*

SHIRUDE, S.B. AND KOLHE, S.R. 2018. Classification of Library Resources in Recommender System Using Machine Learning Techniques. In *In Annual Convention of the Computer Society of India, 661-673. Springer, Singapore.*

THANGAVEL, S.K. BKARATKI, P.D. AND SANKAR, A. 2017. Student placement analyzer: A recommendation system using machine learning. In *In 2017 4th International Conference on Advanced Computing and Communication Systems (ICACCS), 1-5. IEEE.*

VENKATESAN, R. AND SABARI, A. 2020. Issues in various recommender system in e-commerceA survey. In *Journal of Critical Reviews, 7(7), 604-608.*

VON REISCHACH, F. GUINARD, D. MICHAHELLES, F. AND FLEISCH, E. 2009. A mobile product recommendation system interacting with tagged products. In *In 2009 IEEE international conference on pervasive computing and communications, 1-6. IEEE.*

WANG, X. LUO, F. QIAN, Y. AND RANZI, G. 2016. A personalized electronic movie recommendation system based on support vector machine and improved particle swarm optimization. In *PloS one 11, e0165868.*

WANG, Z. YU, X. FENG, N. AND WANG, Z. 2014. An improved collaborative movie recommendation system using computational intelligence. In *Journal of Visual Languages & Computing 25, 667-675.*

WOHIDUZZAMAN, K. AND ISMAIL, S. 2018. Recommendation System for Bangla News Article with Anaphora Resolution. In *2018 4th International Conference on Electrical Engineering and Information & Communication Technology (iCEEiCT), 467-472. IEEE.*

XU, J.A. AND ARAKI, K. 2006. A SVM-based personal recommendation system for TV programs. In *In 2006 12th International Multi-Media Modelling Conference, 4-pp. IEEE.*

YAJUN, M. AND SHENG, L. 2018. Application of LDA-LR in Personalized News Recommendation System. In *In 2018 IEEE 9th International Conference on Software Engineering and Service Science (ICSESS), 279-282. IEEE.*

ZHU, Q. ZHOU, X. SONG, Z.TAN, J.AND GUO, L. 2019. Dan: Deep attention neural network for news recommendation. In *Proceedings of the AAAI Conference on Artificial Intelligence 33, 5973-5980.*

Ms Shreya Sharda is a Research Scholar, who has enrolled for PhD degree in Punjabi University, Patiala. She had completed her masters degree in Computer Application (MCA) from Punjab Technical University, Kapurthala, in 2015. She expertises in PHP during her Master's Program. During the course, she has observed that despite hindi being the main language of India, there's a very less work done to bring it forth practically in this field. Therefore, she has focussed her PhD research towards filling the existing research gaps in the field of hindi language, more specifically in the field of hindi news recommendation. The presented paper is a part of the research work which is focusing towards the designing and deployment of a highly customised hindi news recommendation system.

Dr Gurpreet Singh Josan has completed M. Tech. Computer Science and Engineering from Punjabi University Patiala in Dec 2001, and Ph.D. also from Faculty of Engineering, Punjabi University Patiala in 2009. His research area is Natural Language Processing and Machine Translation. He has more than ten years of teaching and research experience at Yadawindra College of Engineering and Technology, Talwandi Sabo, Dept of IT, Rayat and Bahra Institute of Engg. and Biotechnology, Mohali and currently at DCS, Pun-jabi University Patiala. He is a member of editorial board of International Journal of Computer Applications, New York, USA and also guest editor of International Journal of Translation for their special issue on Machine Translation among Indian Languages' ' published in June 2011. He authored one book and 41 research papers which were pub-lished in various journals and conferences of national and international repute. He also received state award from Government of Punjab in August 2011 for his contributions in research and promotion of Punjabi Language through computers