RESEARCH ARTICLE OPEN

A Comprehensive State of Art Techniques Machine Learning Models on Recommendation Systems

Mr. Ilea Mihail Ovidiu

Lecturer, Department of Medical Biosciences,'Gr.T.Popa' University of Medicine and Pharmacy-Romania

ABSTRACT

Recommender systems (RS) utilize various technique to recommend the service/product for an attentive client. Currently, RS utilize machine learning (ML) modules in the artificial intelligence (AI) field. Alternatively, choosing a proper ML technique for RS is a difficult process and selection of this ML technique performs a major part that affect the efficiency of RS. The scientist and experts worked on RS that have lesser amount of data regarding the current method. Additionally, the implemented RS utilize ML method that are often undergoes difficulty that should be resolved. In this study, a complete review has been taken that analysis several methods present in the RS and recognizes various problems.

Keywords: Recommendation scheme, Machine Learning, Artificial Intelligence, e-commerce, Intelligent models

I. INTRODUCTION

Currently, huge amount of digital data is created and several clients have visit to the internet faces substantial challenges of data overload that delayed fast accessing of attracted things on the Internet. Several data retrieval modules such as DevilFinder, Google, and so on have solved this problem, however customization and prioritization (a module perform maps present content to the attracted client and favored) of data aren't accessible. It has increased the need of RS are raising. The RS are assumed as data filtering modules that handle the problem of data overload [1] by the extraction of significant data fragment from huge number of dynamic generated information is depending upon the user preference, interest/nature of the thing. The RS have the ability to predict certain client would select a product or not depending upon user's detail. The RS would be beneficial for customers and service providers. They reduce the cost for transaction by choosing and identifying precuts in an online shopping architecture. It is guaranteed that the RS results in improved problem-solving procedure. In e-commerce system, RS enhances the revenue, hence it is effective using selling several products. For methodological collections, RS supports clients by allowing them to search. Hence, the need of utilizing an efficient and accurate RS in a scheme would provide relevant and reliant recommendation for the clients that could not be excessive.

RS is called as a problem-solving approach for clients in complex data platform. In the factor of e-commerce, the RS is determined by a device that could help clients when seeking for the record of data related to their preference and interest. They can help and record the social procedure by other recommendations to make choice in adequate individual detail/knowledge of another things. The RS handles the problem of data overload when the client normally encounters via providing special content, personalized and services recommendation. Recently, various methods to utilize succeeding method includes content based, hybrid filtering and collaborative. The ML module is utilized in RS for providing improved suggestion to the clients. However, the ML area doesn't contain an appropriate classification module for its methods because of huge amount of techniques present in the survey. Therefore, it isn't easy for selecting a ML method, which is suitable to RS. The lack of complete literature on ML approaches on RS inspires for performing this research. Hence, a complete literature is generated that analyses several methods occurs in the RS and recognizes several problems.

II. EXISTING MACHINE LEARNING BASED RECOMMENDER SYSTEMS

The CACF GA method, a RS is presented [2]. The CACF GA provides a position concerned with advertisement by selecting the clients and communication context. To develop a context aware RS, distinct contexts are determined and accordingly, the concept of context equivalence is utilized on a cooperative filtering procedure. The best similarity values between the contexts are distributed by GA. A prototype module is established and collected inputs such as current visiting, time and specific needs (i.e. movies, hotel) from the clients. The attained MAE of introduced technique is lesser the conventional methods. Additionally, it is authenticated by a dataset with

sparse rating that makes the problems of sparsity. The concept of ST initiates the set of living things [3]. The PSO is a Meta heuristic technique that utilize population based searching method. The persons in the set are defined as particle and group of local guidelines are utilized for all particles [4]. The ACO is biological inspired technique in which the ants create a network of router that connects the food source and nest [5]. Various RS is depending upon SI methods are deliberated.

In [6], TARS is presented for using ACO to provide neighbor suggestions by similarity. The ACO gives suggestion using an efficient decision that generates and a number of neighbors are utilized for predicting rate. Additionally, the active pheromone updating feature determines the client's approval as a recommender that is useful for eliminating the cold start challenge for current clients. The TARS handles sparsity challenge by incorporating the comparison measure utilized for computing similarity between 2 clients with another metrics so called assurance in partner profile in the creation of focused trust graph to each client. The continuous updating of trust level between the client results in accurate suggestion. Relating to traditional methods by a standard dataset, the TARS performs another approach based on recall, F -measure, and precision. Nadi et al. [7] utilizes ACO with FL for suggesting similar URL to the consumers with equal perceptions. The directional pattern of the customer is used to accurate and interrelated forecast using position of appropriate class. Additionally, the distance among 2 customers is defined by fuzzy set that is sequentially utilized to fuzzy ant-based clustering. The pheromone level of each cluster is calculated and upgraded by the suggestion created to the present customers. The upgraded pheromone level is utilized to the product recommendation in forthcoming years for novel clients and therefore cold start problem is simply decreased. However, it is inappropriate for the conditions that requires appropriate resolution due to sparse user item matrix.

Hsu et al. [8] proposed a personalized and accessible module to recommend the subordinate learning in Facebook using ABC technique. This technique suggests research material depending upon complex level, "likes" to a certain sequence content and so on. The ABC technique is equivalent for random food seeking function of bees where the achieved nectar amount of each food source is assumed by fitness value. Research with optimum matching query and individual adored with various research are recommended for fitness value and computational time of ABC technique with randomized search method was made should be optimum. Ujjin and Bentley [97] utilized PSO to develop client profile for successive identifying the similarity of dynamic client with another. To handle information containing sparse variables, PSO is utilized. The recommendation for movies is provided to the current customer by the opinion from another clients. The outcomes of PSO based RS is made to be effective compared to GA and Pearson method. [10] utilize ACO for constructing cloud based context aware RS so called Omni suggest for selecting places. They utilize HITS technique for eliminating sparsity problems and cold start using suggestion venue to the clients by selecting prior clients and parallel calculation. The issue of scalability is solved using cloud based framework.

III. CONCLUSION

Currently, RS utilize ML modules in the AI field. Alternatively, choosing a proper ML technique for RS is a difficult process and selection of this ML technique performs a major part that affect the efficiency of RS. The scientist and experts worked on RS that have lesser amount of data regarding the current method. Additionally, the implemented RS utilize ML method that are often undergoes difficulty that should be resolved. In this study, a complete review has been taken that analysis several methods present in the RS and recognizes various problems.

REFERENCES

[1] M. Y. H. Al-Shamri, and K. K. Bharadwaj, “Fuzzy-genetic approach to recommender systems based on a novel hybrid user model,” *Expert systems with applications* 35, no. 3, 2008, pp. 3861399.

[2] F. Hernandez, E. Gaudioso, “Evaluation of recommender systems: a new approach,” *Expert Systems with Applications* 35, 2008, pp. 790–804.

[3] J. Kennedy, R. Eberhart, and Y. Shi, *Swarm Intelligence*, 1st Ed. San Mateo, CA: Morgan Kaufmann, 2001.pp. 611–616.

[4] Z. Winklerová, “Maturity of the Particle Swarm as a Metric for Measuring the Particle Swarm Intelligence,” In *Swarm Intelligence*, Springer Berlin Heidelberg, 2012.pp. 348- 349.

[5] Y. J. Gong, R. T. Xu, J. Zhang, and O. Liu, “A clustering-based adaptive parameter control method for continuous ant colony optimization,” in *Proceedings of IEEE International Conference on Systems, Man, and Cybernetics*,2009, pp. 1827–1832.

[6] P. Bedi and R. Sharma, "Trust based recommender system using ant colony for trust computation," *Expert Systems with Applications*, vol. 39, no. 1, pp. 1183-1190, 2012.

[7] S. Nadi, M. Saraee, A. Bagheri, and M. D. Jazi, "FARS: Fuzzy ant based recommender system for web users," *International Journal of Computer Science* 8, no. 1, 2011, pp. 203209

[8] C. C. Hsu, H. C.Chen, K. K. Huang, and Y. M. Huang, "A personalized auxiliary material recommendation system based on learning style on Facebook applying an artificial bee colony algorithm," *Computers& Mathematics with Applications*64, no. 5, 2012, pp. 15061513.

[9] S. Ujjin, & P.J. Bentley, "Particle Swarm Optimization recommender system," In *Proceedings of the IEEE Swarm Intelligence Symposium*, 2003, pp. 124–131.

[10] O. Khalid, M. Khan, S. Khan, and A. Zomaya,"OmniSuggest: A Ubiquitous Cloud based Context Aware Recommendation System for Mobile Social Networks," *IEEE Transactions on Services Computing* 2013, pp. 1-1.

[11] Alzubi, O. A. (2015, September). Performance evaluation of AG block turbo codes over fading channels using BPSK. In Proceedings of the The International Conference on Engineering & MIS 2015 (pp. 1-6).

[12] Kavitha, M., & Palani, S. (2014). Hierarchical classifier for soft and hard exudates detection of retinal fundus images. Journal of Intelligent & Fuzzy Systems, 27(5), 2511-2528.

[13] Anuradha, M., Jayasankar, T., Prakash, N. B., Sikkandar, M. Y., Hemalakshmi, G. R., Bharatiraja, C., & Britto, A. S. F. (2021). IoT enabled cancer prediction system to enhance the authentication and security using cloud computing. Microprocessors and Microsystems, 80, 103301.

[14] S. Namasudra, S. Dhamodharavadhani, and R. Rathipriya, "Nonlinear neural network based forecasting model for predicting COVID-19 cases", Neural Processing Letters, 2021. DOI: 10.1007/s11063-021-10495-w

[15] Elhoseny, M., & Shankar, K. (2019). Reliable data transmission model for mobile ad hoc network using signcryption technique. IEEE Transactions on Reliability, 69(3), 1077-1086.

[16] Mukherjee, R., Kundu, A., Mukherjee, I., Gupta, D., Tiwari, P., Khanna, A., & Shorfuzzaman, M. (2021). IoT-cloud based healthcare model for COVID-19 detection: an enhanced k-Nearest Neighbour classifier based approach. Computing, 1-21.

[17] Li, L., Sun, L., Xue, Y., Li, S., Huang, X., & Mansour, R. F. (2021). Fuzzy Multilevel Image Thresholding Based on Improved Coyote Optimization Algorithm. IEEE Access, 9, 33595-33607.

[18] Alzubi, O. A. A deep learning-based frechet and dirichlet model for intrusion detection in IWSN. Journal of Intelligent & Fuzzy Systems, (Preprint), 1-11.

[19] Kavitha, M., & Palani, S. (2014). Blood vessel, optical disk and damage area-based features for diabetic detection from retinal images. Arabian Journal for Science and Engineering, 39(10), 7059-7071.

[20] Sangeetha J., Jayasankar T. (2019) Emotion Speech Recognition Based on Adaptive Fractional Deep Belief Network and Reinforcement Learning. In: Mallick P., Balas V., Bhoi A., Zobaa A. (eds) Cognitive Informatics and Soft Computing. Advances in Intelligent Systems and Computing, vol 768. Springer, Singapore. https://doi.org/10.1007/978-981-13-0617-4_16

[21] P. Pavithran, S. Mathew, S. Namasudra and P. Lorenz, "A novel cryptosystem based on DNA cryptography and randomly generated Mealy machine", Computers & Security, vol. 104, 2021. DOI: https://doi.org/10.1016/j.cose.2020.102160

[22] Le, DN., Parvathy, V.S., Gupta, D. et al. IoT enabled depthwise separable convolution neural network with deep support vector machine for COVID-19 diagnosis and classification. Int. J. Mach. Learn. & Cyber. (2021). https://doi.org/10.1007/s13042-020-01248-7

[23] Sekaran, R., Goddumarri, S. N., Kallam, S., Ramachandran, M., Patan, R., & Gupta, D. (2021). 5G Integrated Spectrum Selection and Spectrum Access using AI-based Frame work for IoT based Sensor Networks. Computer Networks, 186, 107649.

[24] Zhang, Y. H., Li, Z., Zeng, T., Chen, L., Li, H., Gamarra, M., ... & Cai, Y. D. (2021). Investigating gene methylation

signatures for fetal intolerance prediction. Plos one, 16(4), e0250032.

[25] Alzubi, J. A. (2021). Blockchain-based Lamport Merkle Digital Signature: Authentication tool in IoT healthcare. Computer Communications, 170, 200-208.

[26] Kavitha, M., & Palani, S. (2012). Retinal blood vessel segmentation algorithm for diabetic retinopathy and abnormality classification by supervised machine learning. Int. J. Neural Netw. Appl, 5(1), 47-53.

[27] S. Kumari, R. J. Yadav, S. Namasudra, and C. H. Hsu, "Intelligent deception techniques against adversarial attack on industrial system", International Journal of Intelligent Systems, vol. 36, no. 5, pp. 2412-2437, 2021. DOI: 10.1002/int.22384

[28] 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, 69(4), 1398-1423.

[29] Chavhan, S., Gupta, D., Nagaraju, C., Rammohan, A., Khanna, A., & Rodrigues, J. J. (2021). An Efficient Context-Aware Vehicle Incidents Route Service Management for Intelligent Transport System. IEEE Systems Journal.

[30] Mansour, R. F., El Amraoui, A., Nouaouri, I., Díaz, V. G., Gupta, D., & Kumar, S. (2021). Artificial Intelligence and Internet of Things Enabled Disease Diagnosis Model for Smart Healthcare Systems. IEEE Access, 9, 45137-45146.

[31] Alzubi, O. A. (2016). An empirical study of irregular ag block turbo codes over fading channels. arXiv preprint arXiv:1604.00564.

[32] Kavitha, M., & Palani, D. S. (2012). A New Fast Curvelet Transform with Morphological Operations based method for Extraction of Retinal blood vessels using Graphical User Interface‖. International Journal of Scientific & Engineering Research, 3(6).

[33] Ramesh, S., Yaashuwanth, C., Prathibanandhi, K., Basha, A. R., & Jayasankar, T. (2021). An optimized deep neural network based DoS attack detection in wireless video sensor network. Journal of Ambient Intelligence and Humanized Computing, 1-14.

[34] Jayanthi, J., Jayasankar, T., Krishnaraj, N., Prakash, N. B., Sagai Francis Britto, A., & Vinoth Kumar, K. (2021). An Intelligent Particle Swarm Optimization with Convolutional Neural Network for Diabetic Retinopathy Classification Model. Journal of Medical Imaging and Health Informatics, 11(3), 803-809.

[35] S. Kumari and S. Namasudra, "System reliability evaluation using budget constrained real d-MC search", Computer Communications, vol. 171, 2021. DOI: https://doi.org/10.1016/j.comcom.2021.02.004

[36] Shankar, K., Perumal, E. A novel hand-crafted with deep learning features based fusion model for COVID-19 diagnosis and classification using chest X-ray images. Complex Intell. Syst. (2020). https://doi.org/10.1007/s40747-020-00216-6

[37] Kavitha, M., & Palani, S. (2020). A comprehensive analysis for retinal image classification methods using real-time database. International Journal of Business Information Systems, 34(2), 229-252.

[38] Nair, L. R., Subramaniam, K., PrasannaVenkatesan, G. K. D., Baskar, P. S., & Jayasankar, T. (2020). Essentiality for bridging the gap between low and semantic level features in image retrieval systems: an overview. Journal of Ambient Intelligence and Humanized Computing, 1-13.

[39] S. Namasudra, "Fast and secure data accessing by using DNA computing for the cloud environment", IEEE Transactions on Services Computing, 2020. DOI: 10.1109/TSC.2020.3046471

[40] Shankar, K., 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, 133, 210-216.

[41] Abukharis, S., Alzubi, J. A., Alzubi, O. A., Alamri, S., & O'Farrell, T. (2016). Packet error rate performance of IEEE802. 11g under bluetooth interface. arXiv preprint arXiv:1602.05556.

[42] Mansour, R. F., & Aljehane, N. O. (2021). An optimal segmentation with deep learning based inception network model for intracranial hemorrhage diagnosis. Neural Computing and Applications, 1-13.

[43] Alzubi, J. A. (2020). Bipolar fully recurrent deep structured neural learning based attack detection for securing industrial sensor networks. Transactions

on Emerging Telecommunications Technologies, e4069.

[44] Kavitha, M., Lavanya, G., & Janani, J. (2018). Enhanced SVM classifier for breast cancer diagnosis. International Journal of Engineering Technologies and Management Research, 5(3), 67-74.

[45] Parvathy, P., Subramaniam, K., Venkatesan, G. P., Karthikaikumar, P., Varghese, J., & Jayasankar, T. (2020). Development of hand gesture recognition system using machine learning. Journal of Ambient Intelligence and Humanized Computing, 1-8.

[46] S. Namasudra, "Data access control in the cloud computing environment for bioinformatics", International Journal of Applied Research in Bioinformatics (IJARB), vol. 11, no. 1, pp. 40-50, 2021. DOI: 10.4018/IJARB.2021010105

[47] K. Shankar, Y. Zhang, Y. Liu, L. Wu and C. Chen, "Hyperparameter Tuning Deep Learning for Diabetic Retinopathy Fundus Image Classification," in IEEE Access, vol. 8, pp. 118164-118173, 2020, doi: 10.1109/ACCESS.2020.3005152.

[48] Mansour, R. F., & Abdelrahim, E. M. (2019). An evolutionary computing enriched RS attack resilient medical image steganography model for telemedicine applications. Multidimensional Systems and Signal Processing, 30(2), 791-814.

[49] Alzubi, O. A., Alzubi, J. A., Dorgham, O., & Alsayyed, M. (2020). Cryptosystem design based on Hermitian curves for IoT security. The Journal of Supercomputing, 76(11), 8566-8589.

[50] Kavitha, M., & Palani, S. (2015). Hierarchical Classifier For Microaneurysm Detection. International Journal of Applied Engineering Research, 10(1), 1449-1458.

[51] Anuradha, M., Ganesan, V., Oliver, S., Jayasankar, T., & Gopi, R. (2020). Hybrid firefly with differential evolution algorithm for multi agent system using clustering based personalization. Journal of Ambient Intelligence and Humanized Computing, 1-10.

[52] Hnatiuc, M., Geman, O., Avram, A. G., Gupta, D., & Shankar, K. (2021). Human Signature Identification Using IoT Technology and Gait Recognition. Electronics, 10(7), 852.

[53] Miled, A. B., Dhaouadi, R., & Mansour, R. F. (2020). Knowledge Deduction and Reuse Application to the Products' Design Process. International Journal of Software Engineering and Knowledge Engineering, 30(02), 217-237.

[54] S. Namasudra, R. Chakraborty, A. Majumder and N. R. Moparthi, "Securing multimedia by using DNA based encryption in the cloud computing environment", ACM Transactions on Multimedia Computing, Communications, and Applications, vol. 16, no. 3s, 2020. DOI: https://doi.org/10.1145/3392665

[55] Pustokhina, I. V., Pustokhin, D. A., Kumar Pareek, P., Gupta, D., Khanna, A., & Shankar, K. (2021). Energy-efficient cluster-based unmanned aerial vehicle networks with deep learning-based scene classification model. International Journal of Communication Systems, e4786.

[56] Sholiyi, A., Alzubi, J. A., Alzubi, O. A., Almomani, O., & O'Farrell, T. (2016). Near capacity irregular turbo code. arXiv preprint arXiv:1604.01358.

[57] Muthumayil, K., Buvana, M., & Jayasankar, T. (2021). Energy Utilization using Artificial Bee Colony Algorithm for Network Life Time Enhancement of Homogeneous WSNs. International Journal of Modern Agriculture, 10(2), 1649-1656.

[58] S. Namasudra, R. Chakraborty, S. Kadry, G. Manogaran and B. S. Rawal, "FAST: Fast accessing scheme for data transmission in cloud computing", Peer-to-Peer Networking and Applications, 2020. DOI: 10.1007/s12083-020-00959-6

[59] Shankar, K., & Elhoseny, M. (2019). Trust Based Cluster Head Election of Secure Message Transmission in MANET Using Multi Secure Protocol with TDES. J. UCS, 25(10), 1221-1239.

[60] Chen, T. M., Blasco, J., Alzubi, J. A., & Alzubi O. A. (2014). Intrusion detection. IET, 1(1), 1-9.

[61] Kavitha, M., Syedakbar, S., Meenal, T., Kumar, R. S., & Stonier, A. A. (2021, February). Enhanced Algorithm for Bio Metric Based Secret Data Hiding. In IOP Conference Series: Materials Science and Engineering (Vol. 1055, No. 1, p. 012126). IOP Publishing.

[62] Punarselvam, E., Sikkandar, M. Y., Bakouri, M., Prakash, N. B., Jayasankar, T., & Sudhakar, S. (2020). Different loading condition and angle measurement of human lumbar spine MRI image using ANSYS. Journal of Ambient Intelligence and Humanized Computing, 1-14.

[63] S. Namasudra, "An improved attribute-based encryption technique towards the data security in cloud

computing", Concurrency and Computation: Practice and Exercise, vol. 31, no. 3, 2019. DOI: 10.1002/cpe.4364

[64] Shankar, K., Lakshmanaprabu, 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.

[65] Alrabea, A., Alzubi, O. A., & Alzubi, J. A. (2019). A task-based model for minimizing energy consumption in WSNs. Energy Systems, 1-18.

[66] KAVITHA, M., GANESH, R., & RAJKUMAR, A. FACILITIES NAVIGATION ANDPATIENT MONITORING SYSTEM USING IBEACON TECHNOLOGY.

[67] Kumar, K. V., Jayasankar, T., Eswaramoorthy, V., & Nivedhitha, V. (2020). SDARP: Security based Data Aware Routing Protocol for ad hoc sensor networks. International Journal of Intelligent Networks, 1, 36-42.

[68] S. Namasudra and P. Roy, "Time saving protocol for data accessing in cloud computing", IET Communications, vol. 11, no. 10, pp. 1558-1565, 2017.

[69] 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.

[70] Mansour, R. F. (2017). Evolutionary computing enriched ridge regression model for craniofacial reconstruction. Multimedia Tools and Applications, 1-18.

[71] Mansour, R. F. (2015). Using adaptive mutation to accelerate the convergence of immune algorithms for prediction of 3D molecular structure. International Journal of Computers and Applications, 37(3-4), 127-133.

[72] Shankar, K., Elhoseny, M., Kumar, R. S., Lakshmanaprabu, S. K., & Yuan, X. (2020). Secret image sharing scheme with encrypted shadow images using optimal homomorphic encryption technique. Journal of Ambient Intelligence and Humanized Computing, 11(5), 1821-1833.