DESIGN OF MACHINE LEARNING

R.V. Mani Sankari[1]

[1]Fatima College, India.

ABSTRACT

This work presents a machine-learning (ML) algorithm for maximum power point tracking (MPPT) of an isolated photovoltaic (PV) system. Due to the dynamic nature of weather conditions, the energy generation of PV systems is non-linear. Since there is no specific method for effectively dealing with the non-linear data, the use of ML methods to operate the PV system at its maximum power point (MPP) is desirable. A strategy based on the decision-tree (DT) regression ML algorithm is proposed in this work to determine the MPP of a PV system. The data were gleaned from the technical specifications of the PV module and were used to train and test the DT. These algorithms predict the maximum power available and the associated voltage of the module for a define amount of irradiance and temperature. The boost converter duty cycle was determined using predicted values. The simulation was carried out for a 10-W solar panel with a short-circuit current of 0.62 A and an open-circuit voltage of 21.50 V at 1000 W/m2 irradiance and a temperature of 25°C. The simulation findings demonstrate that the proposed method compelled the PV panel to work at the MPP predicted by DTs compared to the existing topologies such as β-MPPT, cuckoo search and artifical neural network results. From the proposed algorithm

1. INTRODUCTION

The text provided explores the influence of Internet advancement and the Internet plus strategy on the educational sector, particularly focusing on online examination systems and personalized learning. Here's a rephrased version of the key points:

Revamping Traditional Education: The advent of the Internet and the Internet plus strategy have brought about a significant overhaul in education, notably by transcending conventional learning methods like paper-based exams. This shift has resulted in reduced reliance on manual labor and physical resources in educational processes.

Benefits of Online Exam Systems: The rise of online examination systems has addressed the shortcomings of traditional paper-based exams. These systems offer advantages such as minimized manual efforts, streamlined procedures, and improved accessibility.

Challenges Amidst Big Data Era: Despite the advantages of online education, the sector grapples with the challenge of information overload. There is an abundance of underutilized resources, and existing systems may not effectively harness them. Furthermore, students may struggle to navigate through overwhelming amounts of data.

Emphasis on Fundamental Functions: While certain online exam systems prioritize visual appeal and additional features for profitability, those developed by universities often prioritize essential examination functions tailored to assessing students' recent learning.

Navigating Information Overload: The surplus of data in the era of big data presents hurdles for both users and information service providers. Users may find it difficult to locate pertinent information, while providers face challenges in making their content stand out.

Advancement in Recommendation Systems: Traditional recommendation algorithms like collaborative filtering encounter limitations in handling issues such as sparse data and initial user interactions. Consequently, there is a shift toward employing deep learning-based recommendation systems to enhance accuracy and tackle these challenges effectively.

Customized Learning Experience: Personalization is increasingly gaining importance in education. The paper suggests integrating personalized recommendation algorithms into online examination systems to suggest tailored questions based on students' past performance. This approach aims to boost learning efficiency by offering targeted practice materials.

In essence, the text highlights the transformative impact of technology on education, underscores the hurdles posed by information overload, and underscores the significance of personalized approaches to enrich learning outcomes.

Related work:

Since its inception in 2006 by Hinton et al., deep learning has garnered significant attention and utilization within the scientific community, particularly excelling in fields like image processing and natural language processing. In recent years, its application has expanded extensively [12]. Initially, deep learning was integrated into recommendation algorithms using restricted Boltzmann machines, but the extensive connectivity between neural network layers posed

challenges. Presently, most research in recommendation algorithms revolves around deep learning. [13] introduced a recommendation algorithm based on multilayer neural networks, which was employed in YouTube video recommendations. [14] devised a memory-based collaborative filtering algorithm for neural networks, leveraging user-item interaction relationships and nonlinear combination of neighbouring users through a memory layer to enhance user representation and effectiveness. However, this approach only considers first-order connectivity in the amalgamation of nearby users, neglecting deeper user feature information. To address the sparcity issue encountered in traditional collaborative filtering, a hierarchical Bayesian model based on deep learning has been proposed. This model incorporates specific auxiliary information to represent content details in a neural network, thereby mitigating the limitations of conventional collaborative filtering

2. INTELLIGENT PAPER TEST SYSTEM

This system largely fullfills the design requirements described above (with the exception of support for automated parking machines, which is not included at this time to reduce costs). The subsystems in are briefly described below: (1) Parameter input module It can accept various control conditions input by the user and put various control conditions in the automatic grouping of papers for reasonable and flexible matching, which is an important guarantee of the system's scientificity and flexibility. It is worth mentioning that this module can dynamically reflect the important information of the question bank in the system, such as various assessment points, the amount of questions of various assessment points, and generate question papers accordingly. (2) Automated paper assembling module The core part of the system, its efficiency is closely related to the structure of the question bank. A well designed automatic paper-forming module should be able to interface well with the parameter input module and complete the function of randomly generating examination papers under strict control. The output module of the system can output test papers directly to a printer or to Word for typesetting and printing. It is particularly worth mentioning that the organic System main console eludom tupniretemaraP Automatic test paper module System output module Automatic test module System maintenance module Storage loading module Information statistics module maintenance Test question Item bank maintenance Local loading Remote loading Test paper information Achievement information Figure 3: Main system. 4 Wireless Communications and Mobile Computing combination of the system and MS Word, borrowing Word's powerful typesetting functions and spell checking and grammar checking tools, makes it possible for the user to have a complete and beautiful examination paper in front of him. (3) System output module The system output module can output test papers directly to the printer or to Word for typesetting and printing. It is particularly worth mentioning that the organic combination of the system and MS Word, using Word's powerful typesetting functions and spell checking and grammar checking tools, makes it possible to present the user with a complete and beautiful examination paper [21, 22]. (4) System maintenance module The maintenance module of the system can be divided into two submodules, one for the maintenance of test papers and the other for the maintenance of question banks. The main purpose of the maintenance module is to modify test errors and save them back to the original question bank, which is in line with user habits, as users are generally reluctant to maintain the question bank directly, and there is some assurance of the security of the question bank. The question bank maintenance module can add, delete, and change questions, and it has the ability to add new questions and new question types, so it can adapt to the changing standards of the National Level 4 and 6 examinations. Practice has proven that a dynamic and scalable system is a viable system. (5) Automatic test module This is where the user can conduct an on-machine test of the objective part of the set of test papers (including listening tests). The system here fully simulates the real examination room, e.g., listening can only be listened to once, other test questions can be referred to repeatedly; there is a clock to show the time, etc. (6) Storage and loading module The main purpose of this module is to allow users to use the system for on-board testing and paper maintenance. The web-based version can remotely load teacher-generated test papers for examinations [23]. (7) Information statistics module Here, the user can access a variety of dynamic information about the test papers: the types of questions they contain, the number of questions in each type, the distribution of assessment priorities, the difficulty factor, etc. The user can even perform statistics such as pass rates and merit rates, in the simple result management system provided as an add-on to this module. The flowchart for randomly selected questions is essentially a random selection of questions under a variety of conditions, see Figure 4. The focus is on random selection, and the key is on condition control. Two types of question banks have(4) System maintenance module The maintenance module of the system can be divided into two submodules, one for the maintenance of test papers and the other for the maintenance of question banks. The main purpose of the maintenance module is to modify test errors and save them back to the original question bank, which is in line with user habits, as users are generally reluctant to maintain the question bank directly, and there is some assurance of the security of the question bank. The question bank maintenance module can add, delete, and change questions, and it has the ability to add new questions and new question types, so it can adapt to the changing standards of the National Level 4 and 6

examinations. Practice has proven that a dynamic and scalable system is a viable system. (5) Automatic test module This is where the user can conduct an on-machine test of the objective part of the set of test papers (including listening tests). The system here fully simulates the real examination room, e.g., listening can only be listened to once, other test questions can be referred to repeatedly; there is a clock to show the time, etc. (6) Storage and loading module The main purpose of this module is to allow users to use the system for on-board testing and paper maintenance. The web-based version can remotely load teacher-generated test papers for examinations [23]. (7) Information statistics module Here, the user can access a variety of dynamic information about the test papers: the types of questions they contain, the number of questions in each type, the distribution of assessment priorities, the difficulty factor, etc. The user can even perform statistics such as pass rates and merit rates, in the simple result management system provided as an add-on to this module. The flowchart for randomly selected questions is essentially a random selection of questions under a variety of conditions, see Figure 4. The focus is on random selection, and the key is on condition control. Two types of question banks have been designed: special and general. The dedicated question bank contains a few typical question types already available in the system, such as reading comprehension. One of the difficulties of the system is that the parameter input module should allow the user to control the criteria for new question types. About the interface between the system and Word in the output module, the system queries the registration information on the user's machine to detect whether Word is installed and where it is located and then uses OLE Automation to communicate with it [24, 25]. Start Initial value of counter Count out ? Random questions Is it out of bounds Compliance

3. EXPERIMENT AND DATA

Table 1: Format of data collected. Dataset Data collection format Student error data Student ID, title JD, whether it is wrong Gowalla User ID, location ID, check in Amazon-book User ID, book ID, purchase or not Table 2: Statistical information on the dataset. Dataset Users Items Interactions Density Gowalla 27458 40685 1027424 0.000074 Amazon-book 54231 95478 2948712 0.00059 (1) Gowalla dataset: this dataset is a check-in dataset from the Gowalla website, which records the check-in time and location information of users on the social networking site, including user ID, check-in time, latitude, longitude, and location ID. Users can share their location through check-in. Wireless Communications and Mobile Computing 5 In order to take advantage of the system's on-board testing and paper maintenance capabilities, the system provides a dedicated storage and loading module in addition to text files to hold the papers. This storage can of course be done by storing a single paper in a single file, but this would result in a flood of files and inconvenience to manage, so the system uses a single file to store multiple papers (4) System maintenance module The maintenance module of the system can be divided into two submodules, one for the maintenance of test papers and the other for the maintenance of question banks. The main purpose of the maintenance module is to modify test errors and save them back to the original question bank, which is in line with user habits, as users are generally reluctant to maintain the question bank directly, and there is some assurance of the security of the question bank. The question bank maintenance module can add, delete, and change questions, and it has the ability to add new questions and new question types, so it can adapt to the changing standards of the National Level 4 and 6 examinations. Practice has proven that a dynamic and scalable system is a viable system. (5) Automatic test module This is where the user can conduct an on-machine test of the objective part of the set of test papers (including listening tests). The system here fully simulates the real examination room, e.g., listening can only be listened to once, other test questions can be referred to repeatedly; there is a clock to show the time, etc. (6) Storage and loading module The main purpose of this module is to allow users to use the system for on-board testing and paper maintenance. The web-based version can remotely load teacher-generated test papers for examinations [23]. (7) Information statistics module Here, the user can access a variety of dynamic information about the test papers: the types of questions they contain, the number of questions in each type, the distribution of assessment priorities, the difficulty factor, etc. The user can even perform statistics such as pass rates and merit rates, in the simple result management system provided as an add-on to this module. The flowchart for randomly selected questions is essentially a random selection of questions under a variety of conditions, see Figure 4. The focus is on random selection, and the key is on condition control. Two types of question banks have been designed: special and general. The dedicated question bank contains a few typical question types already available in the system, such as reading comprehension. One of the difficulties of the system is that the parameter input module should allow the user to control the criteria for new question types. About the interface between the system and Word in the output module, the system queries the registration information on the user's machine to detect whether Word is installed and where it is located and then uses OLE Automation to communicate with it [24, 25]. Start Initial value of counter Count out ? Random questions Is it out of bounds Compliance with standards Counter plus 1 N N N Y Y Y Figure 4: Flow chart of randomly selected questions. Table 1: Format of data collected. Dataset Data collection format Student error data Student ID, title JD, whether it is wrong Gowalla User ID,

location ID, check in Amazon-book User ID, book ID, purchase or not Table 2: Statistical information on the dataset. Dataset Users Items Interactions Density Gowalla 27458 40685 1027424 0.000074 Amazon-book 54231 95478 2948712 0.00059 (1) Gowalla dataset: this dataset is a check-in dataset from the Gowalla website, which records the check-in time and location information of users on the social networking site, including user ID, check-in time, latitude, longitude, and location ID. Users can share their location through check-in. Wireless Communications and Mobile Computing 5 In order to take advantage of the system's on-board testing and paper maintenance capabilities, the system provides a dedicated storage and loading module in addition to text files to hold the papers. This storage can of course be done by storing a single paper in a single file, but this would result in a flood of files and inconvenience to manage, so the system uses a single file to store multiple papers   lection. In order to complete the test recommendation function, the first step is to obtain the data. The data can be obtained from the exam system database wrong question record table; you need to collect the student id, question id, whether the question is wrong (0 or 1), and all students' wrong question record data. In this paper, the recommendation data interface is reserved for the recommendation exercise module of the examination system, which can obtain data from the database and call the recommendation algorithm. However, as the system prototype implemented in this paper is still in the testing stage, the data of real students' question records are being collected and a large amount of data cannot be obtained. In order to ensure the accuracy and effectiveness of the recommendation algorithm, two publicly available datasets, Amazon-book and Gowalla, which can be mapped to the database structure of the prototype, were selected for experimentation to verify the effectiveness of the recommendation algorithm. The descriptions of the dataset selection are as follows: (1) These two datasets are publicly available and have been widely used in the study of recommendation algorithms (2) In fact, the recommendation algorithm in this paper focuses on the implementation of the recommendation function and the accuracy of the algorithm's recommendations and is not specific to a particular scenario, as shown in Table 1 The table above shows the format of the data recorded for real student errors in the system and the format of the records for the two datasets. For each dataset, in order to perform the algorithm experiments, data processing needs to be performed first. The two datasets differ in size, sparsity, etc. and the statistics for both are shown in Table 2. 5.2. Comparative Analysis of Results. The model is improved based on NGCF as shown in Figure 5 for the examination evaluation of different students. The user and item embedding is first initialized and an attention mechanism is introduced in the propagation layer. Then, a combination of variable weighted averaging is applied to the interaction information, and after multiple layers of propagation, the embedding is obtained after optimization of each layer. Finally, these embeddings, together with the initial embedding, are connected through a cascade layer. 1.00 0.75 0.50 0.25 0.00 –0.25 –0.50 –0.75 –1.00 012 3456 Figure 5: Assessment of different student examinations. Table 3: Comparison of the results of the four algorithms. Dataset Algorithm name Recall@20 ndcg@20 Gowalla BPRMF 0.1234 0.1475 NCF 0.1324 0.1992 NGCF 0.1427 0.2147 NGCF-Att 0.1424 0.2213 Amazon-book BPRMF 0.0234 0.0257 NCF 0.0541 0.5331 NGCF 0.0321 0.0547 NGCF-Att 0.0257 0.0654 6 Wireless Communications and Mobile Computing In addition, to validate the effectiveness of the algorithmic models, the model NGCF-Att from this paper was compared with the three algorithms BPRMF, NCF, and NGCF. For a fair comparison, all algorithms were optimized using the BPR loss function. The recall@20 and ndcg@20 evaluation metrics for the four algorithms on the Gowalla and Amazon-book datasets are shown in Table 3. The comparison of the results in the above table shows that the other three models based on deep learning are slightly better than the traditional matrix decomposition MF model, which reflects the optimization of the traditional MF to varying degrees. Secondly, the index of NGCF-Att will be slightly higher than that of NCF and NGCF, because it combines the advantages of the two models and introduces an attention mechanism to improve network efficiency. Therefore, we can draw the following conclusions: (1) The research of recommendation algorithm based on deep learning is an important way to improve the performance of recommendation system (2) Inner product has some limitations. Using neural network instead of inner product can capture the complex nonlinear interaction between users and items (3) The attention mechanism assigns different weights to different items of each user, which is more in line with the realistic level of users' preference for different items. Variable weight learning improves the performance of the model and makes it easier to explain   lection. In order to complete the test recommendation function, the first step is to obtain the data. The data can be obtained from the exam system database wrong question record table; you need to collect the student id, question id, whether the question is wrong (0 or 1), and all students' wrong question record data. In this paper, the recommendation data interface is reserved for the recommendation exercise module of the examination system, which can obtain data from the database and call the recommendation algorithm. However, as the system prototype implemented in this paper is still in the testing stage, the data of real students' question records are being collected and a large amount of data cannot be obtained. In order to ensure the accuracy and effectiveness of the recommendation algorithm, two publicly available datasets, Amazon-book and Gowalla, which can be mapped to the database structure of the prototype, were

selected for experimentation to verify the effectiveness of the recommendation algorithm. The descriptions of the dataset selection are as follows: (1) These two datasets are publicly available and have been widely used in the study of recommendation algorithms (2) In fact, the recommendation algorithm in this paper focuses on the implementation of the recommendation function and the accuracy of the algorithm's recommendations and is not specific to a particular scenario, as shown in Table 1 The table above shows the format of the data recorded for real student errors in the system and the format of the records for the two datasets. For each dataset, in order to perform the algorithm experiments, data processing needs to be performed first. The two datasets differ in size, sparsity, etc. and the statistics for both are shown in Table 2. 5.2. Comparative Analysis of Results. The model is improved based on NGCF as shown in Figure 5 for the examination evaluation of different students. The user and item embedding is first initialized and an attention mechanism is introduced in the propagation layer. Then, a combination of variable weighted averaging is applied to the interaction information, and after multiple layers of propagation, the embedding is obtained after optimization of each layer. Finally, these embeddings, together with the initial embedding, are connected through a cascade layer. 1.00 0.75 0.50 0.25 0.00 –0.25 –0.50 –0.75 –1.00 012 3456 Figure 5: Assessment of different student examinations. Table 3: Comparison of the results of the four algorithms. Dataset Algorithm name Recall@20 ndcg@20 Gowalla BPRMF 0.1234 0.1475 NCF 0.1324 0.1992 NGCF 0.1427 0.2147 NGCF-Att 0.1424 0.2213 Amazon-book BPRMF 0.0234 0.0257 NCF 0.0541 0.5331 NGCF 0.0321 0.0547 NGCF-Att 0.0257 0.0654 6 Wireless Communications and Mobile Computing In addition, to validate the effectiveness of the algorithmic models, the model NGCF-Att from this paper was compared with the three algorithms BPRMF, NCF, and NGCF. For a fair comparison, all algorithms were optimized using the BPR loss function. The recall@20 and ndcg@20 evaluation metrics for the four algorithms on the Gowalla and Amazon-book datasets are shown in Table 3. The comparison of the results in the above table shows that the other three models based on deep learning are slightly better than the traditional matrix decomposition MF model, which reflects the optimization of the traditional MF to varying degrees. Secondly, the index of NGCF-Att will be slightly higher than that of NCF and NGCF, because it combines the advantages of the two models and introduces an attention mechanism to improve network efficiency. Therefore, we can draw the following

4. CONCLUSION

At present, the system has been used in different colleges and universities and is widely popular because of its powerful function suitable for English teaching and has strong promotion value. It is believed that the networking of the system will facilitate the use of Intranet for multimedia teaching and paperless examination process of institutions. Data Availability The raw data supporting the conclusions of this article will be made available by the author, without undue reservation. Conflicts of Interest The author declared that he/she has no conflicts of interest regarding this work.

5. REFRENCES

[1] Z. Ghahramani, "Probabilistic machine learning and artificial intelligence," Nature, vol. 521, no. 7553, pp. 452–459, 2015.

[2] J. Wang, Y. Ma, L. Zhang, R. X. Gao, and D. Wu, "Deep learning for smart manufacturing: methods and applications," Journal of Manufacturing Systems, vol. 48, pp. 144–156, 2018.

[3] S. Khan and T. Yairi, "A review on the application of deep learning in system health management," Mechanical Systems and Signal Processing, vol. 107, pp. 241–265, 2018.

[4] K. H. Yu, A. L. Beam, and I. S. Kohane, "Artificial intelligence in healthcare," Nature Biomedical Engineering, vol. 2, no. 10, pp. 719–731, 2018.

[5] R. Cioffi, M. Travaglioni, G. Piscitelli, A. Petrillo, and F. De Felice, "Artificial intelligence and machine learning applications in smart production: progress, trends, and directions," Sustainability, vol. 12, no. 2, p. 492, 2020.

[6] M. S. Mahdavinejad, M. Rezvan, M. Barekatain, P. Adibi, P. Barnaghi, and A. P. Sheth, "Machine learning for Internet of Things data analysis: a survey," Digital Communications and Networks, vol. 4, no. 3, pp. 161–175, 2018.

[7] N. Hoic-Bozic, V. Mornar, and I. Boticki, "A blended learning approach to course design and implementation," IEEE Transactions on Education, vol. 52, no. 1, pp. 19–30, 2009.

[8] J. A. Cruz and D. S. Wishart, "Applications of machine learning in cancer prediction and prognosis," Cancer Informatics, vol. 2, p. 117693510600200, 2006.

[9] L. Wen, L. Gao, and X. Li, "A new deep transfer learning based on sparse auto-encoder for fault diagnosis," IEEE Transactions on systems, man, and cybernetics: systems, vol. 49, no. 1, pp. 136–144, 2019.

[10] L. Buitinck, G. Louppe, M. Blondel et al., "API design for machine learning software: experiences from the scikit-learn project," 2013, http://arxiv.org/abs/1309.0238.

[11] P. D. Sorlie, L. M. Avilés-Santa, S. Wassertheil-Smoller et al., "Design and implementation of the Hispanic community health study/study of Latinos," Annals of Epidemiology, vol. 20, no. 8, pp. 629–641, 2010.

[12] A. Abbasi and H. Chen, "Applying authorship analysis to extremist-group web forum messages," IEEE Intelligent Systems, vol. 20, no. 5, pp. 67–75, 2005.

[13] J. Konečný, H. B. McMahan, D. Ramage, and P. Richtárik, "Federated optimization: distributed machine learning for on-device intelligence," 2016, http://arxiv.org/abs/1610.02527.

[14] N. Mehrabi, F. Morstatter, N. Saxena, K. Lerman, and A. Galstyan, "A survey on bias and fairness in machine learning," ACM Computing Surveys (CSUR), vol. 54, no. 6, pp. 1–35, 2021.

[15] P. Zheng, Z. Sang, R. Y. Zhong et al., "Smart manufacturing systems for Industry 4.0: conceptual framework, scenarios, and future perspectives. Frontiers of," Mechanical Engineering, vol. 13, no. 2, pp. 137–150, 2018.

[16] X. Lin, Y. Rivenson, N. T. Yardimci et al., "All-optical machine learning using diffractive deep neural networks," Science, vol. 361, no. 6406, pp. 1004–1008, 2018.

[17] J. Li, Z. Zhou, J. Wu et al., "Decentralized on-demand energy supply for blockchain in internet of things: a microgrids approach," IEEE Transactions on Computational Social Systems, vol. 6, no. 6, pp. 1395–1406, 2019.

[18] W. Duan, J. Gu, M. Wen, G. Zhang, Y. Ji, and S. Mumtaz, "Emerging technologies for 5G-IoV networks: applications, trends and opportunities," IEEE Network, vol. 34, no. 5, pp. 283–289, 2020.

[19] Z. H. A. N. G. Zheng-wan, W. U. Di, and Z. H. A. N. G. Chunjiong, "Study of cellular traffic prediction based on multichannel sparse LSTM," Computer Science, vol. 48, no. 6, pp. 296–300, 2021. Wireless Communications and Mobile Computing 7

[20] P. An, Z. Wang, and C. Zhang, "Ensemble unsupervised autoencoders and Gaussian mixture model for cyberattack detection," Information Processing & Management, vol. 59, no. 2, article 102844, 2022.

[21] F. M. Abd Algalil and S. P. Zambare, "Effects of temperature on the development of Calliphorid fly of forensic importance Chrysomya megacephala (Fabricius, 1794)," Indian Journal of Applied Research, vol. 5, no. 2, pp. 767–769, 2015.

[22] H. Shi, M. Xu, and R. Li, "Deep learning for household load forecasting—a novel pooling deep RNN," IEEE Transactions on Smart Grid, vol. 9, no. 5, pp. 5271–5280, 2018.

[23] E. Rosten, R. Porter, and T. Drummond, "Faster and better: a machine learning approach to corner detection," IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 32, no. 1, pp. 105–119, 2010.

[24] T. Wuest, D. Weimer, C. Irgens, and K. D. Thoben, "Machine learning in manufacturing: advantages, challenges, and applications," Production & Manufacturing Research, vol. 4, no. 1, pp. 23–45, 2016.

[25] S. B. Kotsiantis, I. D. Zaharakis, and P. E. Pintelas, "Machine learning: a review of classification and combining techniques," Artificial Intelligence Review, vol. 26, no. 3, pp. 159–190, 2006