Big Data and Computing Visions

www.bidacv.com

Big. Data. Comp. Vis. Vol. 1, No. 1 (2021) 1–6.

Paper Type: Original Article

Academic Progress Monitoring Through Neural Network

Ramri Shukla[1,*], Bardia Khalilian[2], Sara Partouvi[3]

[1]Department of Computer Science and Engineering, Amity University, Sector 125, Noida, Uttar Pradesh, India; ramrishukla@gmail.com.
[2] Department of Management and International Business (MIB), University of Auckland, New Zealand.
[3] School of Management & Marketing, Taylor’s University, Malaysia.

Citation:

Shukla, R., Khalilian, B., Partouvi, S. (2021). Academic progress monitoring through neural network. *Big data and computing visions, 1* (1), 1-6.

Received: 06/12/2020 Reviewed: 25/01/2021 Revised: 11/02/2021 Accept: 22/03/2021

Abstract

To lessen the impact of a low student success rate, it's critical to be able to identify students who are in danger of failing early on, so that more targeted remedial intervention may be implemented. Private colleges use a variety of techniques, including increased tuition, expanded laboratory access, and the formation of learning communities. The prompt identification of students in danger of failing a given programme is important to both the students and the institutions with which they are registered, as seen by the debate presented below. Students are classified using artificial neural networks and random forests in this article. A private higher education provider provided a dataset of 2000 students. Artificial neural networks were found to provide the best performing model, with an accuracy of 83.24% percent.

Keywords: Education, Neural network, Monitroing.

1 | Introduction

Over the last decades, the higher education industry has seen various changes, the most notable of which is an increase in the number of schools from which perspective students can pick when considering furthering their studies. Along with the development in public universities, the private higher education sector has grown significantly. Institutions that have been founded and sponsored by the state through the Department of Higher Education and Training are known as public higher education providers (DHET). Private education providers, on the other hand, are owned by private companies or people. While both public and private universities may offer the same qualifications, there is a significant difference in their funding models: public institutions receive government money, whilst private institutions do not and must raise their own funds [1]. The enhancement of science and technology leads to make the life more comfortable than older days. The emerging technologies like software engineering [1] and [2], energy management [3], [4], [5], wireless sensor network [6]-[14], face recognition [15], neural network [16], routing [16] and [17], cloud computing [18], distributive environment [19], mixed environment [20] bellman algorithm [21], programming language [22], neutrosophic shortest path [23], [24], [25], optimal path [26], multi-objective optimal

Corresponding Author: ramrishukla@gmail.com
10.22105/bdcv.2021.142228

path [27], transportation problem [28], [29], [30], uncertainty problem [31]-[36] , fuzzy shortest path [37] and [38], powershell [39], answer note [40], making the products more intelligent and self-healing based. The smart city and [41] applications like smart water[42], [43], [44], smart agriculture [45] smart grid and [41], smart parking [46], smart resource management, etc. are based on IoT [47], [48], [49] and IoE technologies. This study aims to improve the pass rates of students at a private academic institution by constructing a machine learning-based categorization model that can detect students who are at danger of failing a programme. The following algorithms are utilised to generate the classification model: Logic Regression, eXtremeGBoost, Artificial Neural Networks, SVM, Naive Bayes, and Random Forests. The following is a breakdown of the paper's structure: Section 2 contains a literature review, while Sections 3 and 4 provide the methodology, experimental data, and discussions, respectively. Section 5 concludes with a summary of the findings and recommendations for future research.

It is frequently used as a gauge for the performance of institutions [2]. Poor success rates can have a major impact on institutes of higher learning, whether they are government or privately supported, because most are tuition dependent [3]. Furthermore, some people consider a low success rate to be a measure of the quality of education provided by a particular educational institution [4].

2 | Literature Review

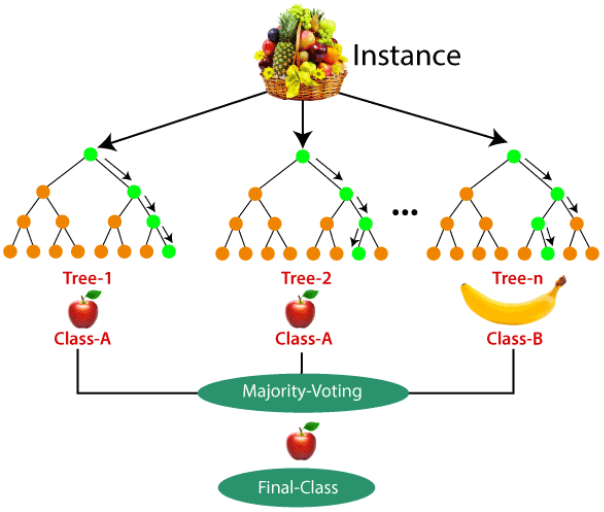
Predicting student performance is critical for assisting at-risk students and ensuring their retention while also improving the university's ranking and reputation. In essence, a heavy emphasis is being made on determining which children are candidates for low academic performance and what circumstances contributed to this, to take early measures to assist the students. The researchers used the students' 'O' level grades (final high school results) and their first three semesters' marks to predict their performance in a study done by [7]. Using Random Forest, they were able to achieve a 96.2 percent accuracy. A decision tree model was created using data from 2,970 first-year university students in another study conducted in Portugal by [8] to estimate the pupils most likely to drop out of university. The academic performance variable was validated as a key determining factor, according to the findings of their investigation. [9] used a multiple regression technique to predict student progress by analysing data from students' profiles. According to reports, a student's achievement is influenced by his or her mother's educational degree.

Random Forest outperformed other classifiers, according to their findings. Variables like midterm grades, lab test grades, seminar performance, assignment, and attendance were used in another study by [10] to create a decision trees model to predict students' academic achievement. They discovered that economic status, family, and relational support all had a significant impact on a student's exam performance. The writers of [15] conducted research to predict pupils' final grades. Students' first-year grades, class attendance, parent income, and the daily distance a student commutes to college were all included in their dataset. They used the ID3 algorithm to accomplish this. C4.5, ID3, and CART decision tree algorithms were used on engineering students' data in another study [16] to predict their success on the final test. They gathered information on variables such as branch, sex, high school grade, father's educational level, and family size. Decision trees were able to successfully identify pupils who were likely to fail based on the accuracy values achieved in their studies. Random forests, support vector machines, decision trees, nave Bayes, K-nearest neighbour, and logistic regression were used as classification methods in the study. They discovered that the top performing algorithm was random forest, which had a 96.2 percent accuracy rate.

2.1 | Random Forests

Classification is a significant aspect of machine learning; we want to know what class (a.k.a. group) an observation belongs to. The capacity to correctly classify observations is particularly useful for a variety of business applications, such as predicting whether a specific user would purchase a product or predicting whether a given loan will fail. Classification algorithms in data science include logistic

regression, support vector machines, naive Bayes classifiers, and decision trees. The random forest classifier, on the other hand, is near the top of the classifier hierarchy (there is also the random forest regressor but that is a topic for another day). We'll look at how fundamental decision tree's function, how individual decision trees are joined to form a random forest, and why random forests are so good at what



they do in this post.

Figure.1 Random Forest algorithm

2.2 | Artificial Neural Network

The Artificial Neural Network Tutorial explains the fundamentals and advanced ideas of artificial neural networks. Our Artificial Neural Network course is designed for both beginners and experts. The term "artificial neural network" refers to a sub-field of artificial intelligence influenced by biology and fashioned after the brain. A computational network based on biological neural networks that construct the structure of the human brain is known as an artificial neural network. Artificial neural networks, like human brains, have neurons that are coupled to each other in various layers of the networks. Nodes are the name for these neurons. The artificial neural network lesson includes all you need to know about artificial neural networks. ANNs, adaptive resonance theory, Korhonen self-organizing map, building blocks, unsupervised learning, Genetic algorithm, and other topics will be covered in this lesson.

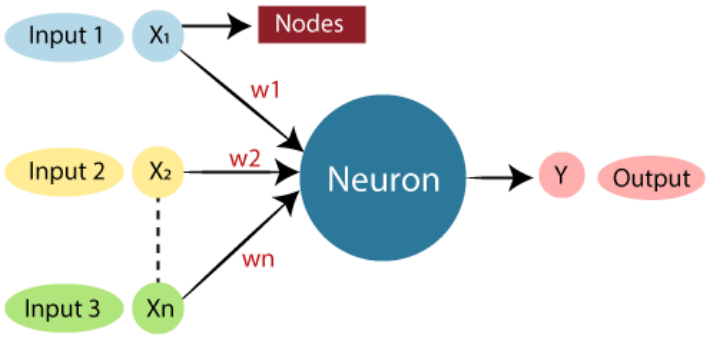


Figure 2. Artificial Neural network

3 | Proposed Work

The acquired raw data was scaled and normalised before being utilised to construct a predictive model. Missing values and outliers are also examined in the raw data. Outliers were excluded from the dataset in this study due to the small number of them. The mean values were used to fill in missing data. Data cleansing was also carried out to minimise typographical errors and duplicate records. The process of

lowering the number of input variables by removing noise from the dataset is referred to as feature selection [31]. Random forest was used to choose features in this study.

Factors	ANN	RF
Accuracy	0.841	0.745
Sensitivity	0.608	0.487
F-Measure	0.712	0.665
Precision	0.684	0.708

ANN has a better performance than the RF model, it was selected for further fine-tuning to improve its predictive performance.

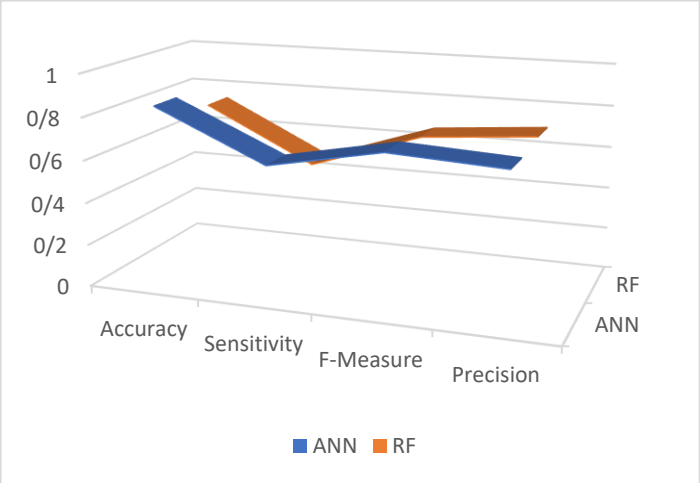


Figure 3. ROC Curve

4 | Conclusion

In this study, it was discovered that utilising a machine learning-based prediction model to identify students at risk of low performance could be a viable option for a private tertiary education school. This study developed two models based on well-known machine learning algorithms for this aim. The highest performing model for the provided dataset was an ANN with three hidden layers with relu as the activation function. Data from various domains of the higher education value chain, such as the psychosocial domain, cognitive domain, institutional domain, personality domain, and demographic domain, should be used to make a more accurate assessment of a student's academic achievement.

References

[1] Ande, V. K., & Mohapatra, H. (2015). SSO mechanism in distributed environment. *International journal of innovations & advancement in computer science*, 4(6), 133-136. https://www.academia.edu/download/38572672/SSO.pdf

[2] Kumar, R., Jha, S., & Singh, R. (2020). A different approach for solving the shortest path problem under mixed fuzzy environment. *International journal of fuzzy system applications (IJFSA)*, *9*(2), 132-161.

[3] Broumi, S., Dey, A., Talea, M., Bakali, A., Smarandache, F., Nagarajan, D., ... & Kumar, R. (2019). Shortest path problem using Bellman algorithm under neutrosophic environment. *Complex & intelligent systems*, *5*(4), 409-416. https://doi.org/10.1007/s40747-019-0101-8

[4] Mohapatra, H. (2000). *C programming: practice cpp.* Kindle Ebook.

[5] Masuti, M., & Mohapatra, H. (2015). Human centric software engineering. *International journal of innovations & advancement in computer science*, *4*(7).

[6] Mohapatra, H., & Rath, A. K. (2020). *Fundamentals of software engineering: designed to provide an insight into the software engineering concepts*. BPB Publications.

[7] Mohapatra, H., Debnath, S., & Rath, A. K. (2019). Energy management in wireless sensor network through EB-LEACH. *International journal of research and analytical reviews (IJRAR)*, 56-61.

[8] Mohapatra, H., Debnath, S., Rath, A. K., Landge, P. B., Gayen, S., & Kumar, R. (2020). An efficient energy saving scheme through sorting technique for wireless sensor network. *International journal of emerging trends in engineering research*, *8*(8), 4278-4286.

[9] Mohapatra, H., Rath, A. K., Landge, P. B., Bhise, D. H. I. R. A. J., Panda, S., & Gayen, S. A. (2020). A comparative analysis of clustering protocols of wireless sensor network. *International journal of mechanical and production engineering research and development (IJMPERD) ISSN (P)*, *10*(3), 8371-8386.

[10] Mohapatra, H., & Rath, A. K. (2019). Fault tolerance through energy balanced cluster formation (EBCF) in WSN. *Smart innovations in communication and computational sciences* (pp. 313-321). Springer, Singapore. https://doi.org/10.1007/978-981-13-2414-7_29

[11] Mohapatra, H., & Rath, A. K. (2019). Fault tolerance in WSN through PE-LEACH protocol. *IET wireless sensor systems*, *9*(6), 358-365.

[12] Mohapatra, H., & Rath, A. K. (2021). Fault tolerance in WSN through uniform load distribution function. *International journal of sensors wireless communications and control*, *11*(4), 385-394. https://doi.org/10.2174/2210327910999200525164954

[13] Mohapatra, H., & Rath, A. K. (2019). Fault-tolerant mechanism for wireless sensor network. *IET wireless sensor systems*, *10*(1), 23-30.

[14] Mohapatra, H., & Rath, A. K. (2020). Survey on fault tolerance-based clustering evolution in WSN. *IET networks*, *9*(4), 145-155.

[15] Mohapatra, H., Rath, A. K., Lenka, R. K., Nayak, R. K., & Tripathy, R. (2021). Topological localization approach for efficient energy management of WSN. *Evolutionary intelligence*, 1-11. https://doi.org/10.1007/s12065-021-00611-z

[16] Mohapatra, H., Rath, S., Panda, S., & Kumar, R. (2020). Handling of man-in-the-middle attack in wsn through intrusion detection system. *International journal of emerging trends in engineering research*, *8*(5), 1503-1510.

[17] Mohapatra, H. (2021). *Designing of fault tolerant models for wireless sensor network* (Ph. D Dissertation, Veer Surendra Sai University of Technology). Retrieved from http://hdl.handle.net/10603/333160

[18] Nirgude, V., Mahapatra, H., & Shivarkar, S. (2017). Face recognition system using principal component analysis & linear discriminant analysis method simultaneously with 3d morphable model and neural network BPNN method. *Global journal of advanced engineering technologies and sciences*, *4*(1), 1-6.

[19] Mohapatra, H. (2009). HCR by using neural network (Master's thesis, M. Tech_s Desertion, Govt. College of Engineering and Technology, Bhubaneswar).

[20] Mohapatra, H., & Rath, A. K. (2021). A fault tolerant routing scheme for advanced metering infrastructure: an approach towards smart grid. *Cluster computing*, *24*, 2193–2211. https://doi.org/10.1007/s10586-021-03255-x

[21] Panda, M., Pradhan, P., Mohapatra, H., & Barpanda, N. K. (2019). Fault tolerant routing in heterogeneous environment. *International journal of scientific & technology research*, *8*(8), 1009-1013.

[22] Parida, R., Rath, K., Mohapatra, H. (2021). Binary self-adaptive salp swarm optimization based dynamic load balancing in cloud computing: load balancing in cloud computing. *International journal of information technology and web engineering (IJITWE)*. In press

[23] Kumar, R., Dey, A., Broumi, S., & Smarandache, F. (2020). A study of neutrosophic shortest path problem. *Neutrosophic graph theory and algorithms* (pp. 148-179). IGI Global.

[24] Kumar, R., Edalatpanah, S. A., Jha, S., & Singh, R. (2019). A novel approach to solve gaussian valued neutrosophic shortest path problems. *International journal of engineering and advanced technology*, *8*(3), 347–353.

[25] Kumar, R., Edaltpanah, S. A., Jha, S., Broumi, S., & Dey, A. (2018). Neutrosophic shortest path problem. *Neutrosophic sets and systems*, *23*, 5–15.

[26] Kumar, R., Edalatpanah, S. A., & Mohapatra, H. (2020). Note on "optimal path selection approach for fuzzy reliable shortest path problem". *Journal of intelligent & fuzzy systems*, *39*(5), 7653-7656. DOI: 10.3233/JIFS-200923

[27] Kumar, R., Edalatpanah, S. A., Jha, S., Broumi, S., Singh, R., & Dey, A. (2019). A multi objective programming approach to solve integer valued neutrosophic shortest path problems. *Neutrosophic sets and systems*, *24*, 134-149.

[28] Kumar, R., Edalatpanah, S. A., Jha, S., & Singh, R. (2019). A pythagorean fuzzy approach to the transportation problem. *Complex & intelligent systems*, *5*(2), 255-263. https://doi.org/10.1007/s40747-019-0108-1

[29] Pratihar, J., Kumar, R., Dey, A., & Broumi, S. (2020). Transportation problem in neutrosophic environment. *Neutrosophic graph theory and algorithms* (pp. 180-212). IGI Global.

[30] Pratihar, J., Kumar, R., Edalatpanah, S. A., & Dey, A. (2021). Modified Vogel's approximation method for transportation problem under uncertain environment. *Complex & intelligent systems*, *7*(1), 29-40. https://doi.org/10.1007/s40747-020-00153-4

[31] Gayen, S., Jha, S., Singh, M., & Kumar, R. (2019). On a generalized notion of anti-fuzzy subgroup and some characterizations. *International journal of engineering and advanced technology*, *8*(3), 385-390.

[32] Gayen, S., Smarandache, F., Jha, S., & Kumar, R. (2020). Interval-valued neutrosophic subgroup based on interval-valued triple t-norm. *Neutrosophic sets in decision analysis and operations research* (pp. 215-243). IGI Global.

[33] Gayen, S., Smarandache, F., Jha, S., & Kumar, R. (2020). Introduction to interval-valued neutrosophic subring. *Neutrosophic sets and systems*, *36*.

[34] Gayen, S., Smarandache, F., Jha, S., Singh, M. K., Broumi, S., & Kumar, R. (2020). Introduction to plithogenic hypersoft subgroup. *Neutrosophic sets and systems*, *33*, 208–233.

[35] Gayen, S., Smarandache, F., Jha, S., Singh, M. K., Broumi, S., & Kumar, R. (2020). Introduction to plithogenic subgroup. *Neutrosophic graph theory and algorithms* (pp. 213-259). IGI Global.

[36] Gayen, S., Smarandache, F., Jha, S., Singh, M. K., Broumi, S., & Kumar, R. (2020). Soft subring theory under interval-valued neutrosophic environment. *Neutrosophic sets and systems*, *36*.

[37] Kumar, R., Edalatpanah, S. A., Jha, S., Gayen, S., & Singh, R. (2019). Shortest path problems using fuzzy weighted arc length. *International journal of innovative technology and exploring engineering*, *8*(6), 724-731.

[38] Kumar, R., Jha, S., & Singh, R. (2017). Shortest path problem in network with type-2 triangular fuzzy arc length. *Journal of applied research on industrial engineering*, *4*(1), 1-7. DOI: 10.22105/jarie.2017.48858

[39] Mohapatra, H., Panda, S., Rath, A., Edalatpanah, S., & Kumar, R. (2020). A tutorial on powershell pipeline and its loopholes. *International journal of emerging trends in engineering research*, *8*(4), 975-982.

[40] Kumar, R., Edalatpanah, S. A., Gayen, S., & Broum, S. (2021). Answer note "a novel method for solving the fully neutrosophic linear programming problems: suggested modifications". *Neutrosophic sets and systems*, *39*(1), 12.

[41] Panda, H., Mohapatra, H., & Rath, A. K. (2020). WSN-based water channelization: an approach of smart water. *Smart cities—opportunities and challenges*, *58*, 157-166. https://doi.org/10.1007/978-981-15-2545-2_15

[42] Mohapatra, H., Rath, A. K. (2020). *IoT-based smart water'* (Control, Robotics & Sensors, 2020), 'IoT Technologies in Smart Cities: From sensors to big data, security and trust', Chap. 3, pp. 63-82, DOI: 10.1049/PBCE128E_ch3.

[43] Mohapatra, H., & Rath, A. K. (2020, October). Nub less sensor based smart water tap for preventing water loss at public stand posts. *2020 IEEE microwave theory and techniques in wireless communications (MTTW)* (Vol. 1, pp. 145-150). IEEE.

[44] Rout, S. S., Mohapatra, H., Nayak, R. K., Tripathy, R., Bhise, D., Patil, S. P., & Rath, A. K. (2020). Smart water solution for monitoring of water usage based on weather condition. *International journal*, *8*(9).

[45] Mohapatra, H., & Rath, A. K. (2021). IoE based framework for smart agriculture. *Journal of ambient intelligence and humanized computing*, 1-18. https://doi.org/10.1007/s12652-021-02908-4

[46] Mohapatra, H., & Rath, A. K. (2021). An IoT based efficient multi-objective real-time smart parking system. *International journal of sensor networks*, *37*(4), 219-232.

[47] Mohapatra, H., & Rath, A. K. (2019). Detection and avoidance of water loss through municipality taps in India by using smart taps and ICT. *IET wireless sensor systems*, *9*(6), 447-457.

[48] Mohapatra, H. (2020). Offline drone instrumentalized ambulance for emergency situations. *IAES international journal of robotics and automation*, *9*(4), 251-255.