DAFTAR PUSTAKA

[1] C. A. Conto, S. Akseer, and T. Dreesen, "COVID-19 : Effects of School Closures on Foundational Skills and Promising Practices for Monitoring and Mitigating Learning Loss," 2020.

[2] A. H. Lubis, S. Z. S. Idrus, and S. A. Rashid, "The exposure of MOOC usage in Indonesia," *Int. J. Sci. Technol. Res.*, vol. 9, no. 2, pp. 2716–2720, 2020.

[3] S. S. Kusumawardani and Syukron Abu Ishaq Alfarozi, "Kajian Penggunaan Data Log Mahasiswa untuk Berbagai Permasalahan Analisis Pembelajaran," *J. Nas. Tek. Elektro dan Teknol. Inf.*, vol. 9, no. 4, pp. 365–374, 2020, doi: 10.22146/jnteti.v9i4.779.

[4] Heri Suryaman, Kusnan, and Husni Mubarok, "Profile of Online Learning in Building Engineering Education Study Program During the COVID-19 Pandemic," *IJORER Int. J. Recent Educ. Res.*, vol. 1, no. 2, pp. 63–77, 2020, doi: 10.46245/ijorer.v1i2.42.

[5] V. Sathishkumar, R. Radha, A. Saravanakumar, and K. Mahalakshmi, "E-Learning during Lockdown of Covid-19 Pandemic: A Global Perspective," *Int. J. Control Autom.*, vol. 13, no. June, pp. 1088–1099, 2020.

[6] N. I. Jha, I. Ghergulescu, and A. N. Moldovan, "OULAD MOOC dropout and result prediction using ensemble, deep learning and regression techniques," *CSEDU 2019 - Proc. 11th Int. Conf. Comput. Support. Educ.*, vol. 2, no. Csedu, pp. 154–164, 2019, doi: 10.5220/0007767901540164.

[7] S. Keskin and H. Yurdugül, "Factors Affecting Students' Preferences for Online and Blended Learning: Motivational Vs. Cognitive," *Eur. J. Open, Distance E-Learning*, vol. 22, no. 2, pp. 72–86, 2020, doi: 10.2478/eurodl-2019-0011.

[8] H. Karimi, J. Huang, and T. Derr, "A Deep Model for Predicting Online Course Performance," *Assoc. Adv. Artif. Intell.*, 2020, [Online]. Available: www.aaai.org.

[9] H. Aldowah, H. Al-Samarraie, A. I. Alzahrani, and N. Alalwan, "Factors affecting student dropout in MOOCs: a cause and effect decision-making model," *J. Comput. High. Educ.*, vol. 32, no. 2, pp. 429–454, 2020, doi: 10.1007/s12528-019-09241-y.

[10] M. Hussain, W. Zhu, W. Zhang, and S. M. R. Abidi, "Student Engagement Predictions in an e-Learning System and Their Impact on Student Course Assessment Scores," *Comput. Intell. Neurosci.*, vol. 2018, pp. 1–21, 2018,

doi: 10.1155/2018/6347186.

[11] J. W. Seol, W. Yi, J. Choi, and K. S. Lee, "Causality patterns and machine learning for the extraction of problem-action relations in discharge summaries," *Int. J. Med. Inform.*, vol. 98, pp. 1–12, 2017, doi: 10.1016/j.ijmedinf.2016.10.021.

[12] M. Adnan *et al.*, "Predicting at-risk students at different percentages of course length for early intervention using machine learning models," *IEEE Access*, pp. 7519–7539, 2021, doi: 10.1109/ACCESS.2021.3049446.

[13] G. Casalino, G. Castellano, A. Mannavola, and G. Vessio, "Educational Stream Data Analysis: A Case Study," in *20th IEEE Mediterranean Electrotechnical Conference, MELECON 2020 - Proceedings*, 2020, no. June 2017, pp. 232–237, doi: 10.1109/MELECON48756.2020.9140510.

[14] J. Chen, J. Feng, J. Hu, and X. Sun, "Causal analysis of learning performance based on a bayesian network and mutual information," *Entropy*, vol. 21, no. 11, pp. 1–25, 2019, doi: 10.3390/e21111102.

[15] L. Guan, "A Study on the Application of Bayesian Networks in the English Proficiency Test in Higher Vocational Colleges," in *Proceedings - 2020 International Conference on Computers, Information Processing and Advanced Education, CIPAE 2020*, 2020, pp. 196–198, doi: 10.1109/CIPAE51077.2020.00058.

[16] B. A. Guilhen and S. T. Kofuji, "Modeling of an intelligent system for Education 4.0 using Bayesian networks and active methodologies," in *International Conference on Teaching, Assessment, and Learning for Engineering*, 2020, pp. 229–234, doi: 10.1109/TALE48869.2020.9368363.

[17] Y. Zhang, "On the Causality of Students' Courses by Bayesian Networks," *Proc. - 2019 12th Int. Symp. Comput. Intell. Des. Isc. 2019*, pp. 144–147, 2019, doi: 10.1109/ISCID.2019.10116.

[18] A. Ramirez-Arellano, E. Acosta-Gonzaga, J. Bory-Reyes, and L. M. Hernández-Simón, "Factors affecting student learning performance: A causal model in higher blended education," *J. Comput. Assist. Learn.*, vol. 34, no. 6, pp. 807–815, 2018, doi: 10.1111/jcal.12289.

[19] N. Shiratori, "Modeling Dropout Behavior Patterns Using Bayesian Networks in Small-Scale Private University," *Proc. - 2017 6th IIAI Int. Congr. Adv. Appl. Informatics, IIAI-AAI 2017*, pp. 170–173, 2017, doi: 10.1109/IIAI-AAI.2017.178.

[20] M. Baranyi, K. Gal, R. Molontay, and M. Szabo, "Modeling students' academic performance using Bayesian networks," in *ICETA 2019 - 17th*

IEEE International Conference on Emerging eLearning Technologies and Applications, Proceedings, 2019, pp. 42–49, doi: 10.1109/ICETA48886.2019.9040067.

[21] M. Windarti, "Prediksi Masa Studi Mahasiswa Menggunakan Kombinasi Algoritma Bayesian Network Dan K-Nearest Neighbors," 2016.

[22] P. Ramazi, M. Kunegel-Lion, R. Greiner, and M. A. Lewis, "Exploiting the full potential of Bayesian networks in predictive ecology," *Methods Ecol. Evol.*, vol. 12, no. 1, pp. 135–149, 2021, doi: 10.1111/2041-210X.13509.

[23] T. G. Pratama, "Seleksi Fitur Berbasis Wrapper Untuk Klasifikasi ASD Pada AQ-Screening Method," 2020.

[24] L. Rahman, N. A. Setiawan, and A. E. Permanasari, "Penerapan Metode Ensemble Dan Seleksi Fitur Untuk Meningkatkan Kinerja Prediksi Prestasi Akademik Mahasiswa," 2018.

[25] V. Shanmugarajeshwari and R. Lawrance, "Analysis of students' performance evaluation using classification techniques," *2016 Int. Conf. Comput. Technol. Intell. Data Eng. ICCTIDE 2016*, pp. 1–7, 2016, doi: 10.1109/ICCTIDE.2016.7725375.

[26] A. M. Nazif, A. A. Hesham Sedky, and O. M. Badawy, "MOOC's Student Results Classification by Comparing PNN and other Classifiers with Features Selection," in *21st International Arab Conference on Information Technology (ACIT)*, 2021, no. 21, pp. 1–9, doi: 10.1109/acit50332.2020.9300123.

[27] M. Hlosta, Z. Zdrahal, and J. Zendulka, "Are we meeting a deadline? classification goal achievement in time in the presence of imbalanced data," *Knowledge-Based Syst.*, vol. 160, no. June, pp. 278–295, 2018, doi: 10.1016/j.knosys.2018.07.021.

[28] S. Poudyal, M. Nagahi, M. Nagahisarchoghaei, and G. Ghanbari, "Machine Learning Techniques for Determining Students' Academic Performance: A Sustainable Development Case for Engineering Education," pp. 920–924, 2021, doi: 10.1109/dasa51403.2020.9317178.

[29] H. Waheed, S. U. Hassan, N. R. Aljohani, J. Hardman, S. Alelyani, and R. Nawaz, "Predicting academic performance of students from VLE big data using deep learning models," *Comput. Human Behav.*, vol. 104, 2020, doi: 10.1016/j.chb.2019.106189.

[30] M. Hlosta, Z. Zdrahal, and J. Zendulka, "Ouroboros: Early identification of at-risk students without models based on legacy data," in *ACM International Conference Proceeding Series*, 2017, pp. 6–15, doi:

10.1145/3027385.3027449.

[31] N. Japkowicz and S. Stephen, “The class imbalance problem A systematic study fulltext.pdf,” *Intell. Data Anal.*, vol. 6, no. 5, pp. 429–449, 2002.

[32] E. Mulyani, I. Hidayah, and S. Fauziati, “PREDIKSI SISWA DROPOUT PADA MASSIVE OPEN ONLINE,” 2020.

[33] W. Dwi Yuniarti, E. Winarko, and A. Musdholifah, “Data mining for student assessment in e-leaming: A survey,” *2020 5th Int. Conf. Informatics Comput. ICIC 2020*, 2020, doi: 10.1109/ICIC50835.2020.9288533.

[34] Z. D. Bozorgi, I. Teinemaa, M. Dumas, M. La Rosa, and A. Polyvyanyy, “Process Mining Meets Causal Machine Learning: Discovering Causal Rules from Event Logs,” in *International Conference on Process Mining (ICPM)*, 2020, no. 2, pp. 129–136, doi: 10.1109/icpm49681.2020.00028.

[35] A. Picciano, “Beyond Student Perceptions: Issues of Interaction, Presence, and Performance in An Online Course,” *J. Asynchronous Learn. Networks*, vol. 6, no. 1, pp. 21–40, 2002.

[36] Y. Lee and J. Choi, “A review of *online* course dropout research: Implications for practice and future research,” *Educ. Technol. Res. Dev.*, vol. 59, no. 5, pp. 593–618, 2011, doi: 10.1007/s11423-010-9177-y.

[37] J. Bowyer, “Evaluating blended learning: Bringing the elements together,” *Res. Matters A Cambridge Assess. Publ.*, no. 23, pp. 17–26, 2017, [Online]. Available: http://www.cambridgeassessment.org.uk/research-matters/.

[38] K. D. Strang, “Do the Critical Success Factors From Learning Analytics Predict Student Outcomes?,” *J. Educ. Technol. Syst.*, vol. 44, no. 3, pp. 273–299, 2016, doi: 10.1177/0047239515615850.

[39] A. Al-Azawei and M. A. A. Al-Masoudy, “Predicting learners’ performance in Virtual Learning Environment (VLE) based on demographic, behavioral and engagement antecedents,” *Int. J. Emerg. Technol. Learn.*, vol. 15, no. 9, pp. 60–75, 2020, doi: 10.3991/ijet.v15i09.12691.

[40] S. Hussain, N. A. Dahan, F. M. Ba-Alwib, and N. Ribata, “Educational data mining and analysis of students’ academic performance using WEKA,” *Indones. J. Electr. Eng. Comput. Sci.*, vol. 9, no. 2, pp. 447–459, 2018, doi: 10.11591/ijeecs.v9.i2.pp447-459.

[41] J. Valverde-Berrocoso, M. del Carmen Garrido-Arroyo, C. Burgos-Videla, and M. B. Morales-Cevallos, “Trends in educational research about e-Learning: A systematic literature review (2009-2018),” *Sustain.*, vol. 12, no. 12, 2020, doi: 10.3390/su12125153.

[42] K. Stepanyan, A. Littlejohn, and A. Margaryan, "Sustainable e-Learning: Toward a coherent body of knowledge," *Educ. Technol. Soc.*, vol. 16, no. 2, pp. 91–102, 2013.

[43] C. A. Ionescu *et al.*, "Sustainability analysis of the e-learning education system during pandemic period—covid-19 in Romania," *Sustain.*, vol. 12, no. 21, pp. 1–22, 2020, doi: 10.3390/su12219030.

[44] Albert Sangra, Dimitrios Vlachopoulos, and Nati Cabrera, "Building an inclusive definition of e-learning: An approach to the conceptual framework," *Int. Rev. Res. Open Distance Learn.*, vol. 13, pp. 145–159, 2012.

[45] P. Alves, L. Miranda, and C. Morais, "The Influence of Virtual Learning Environments in Students' Performance," *Univers. J. Educ. Res.*, vol. 5, no. 3, pp. 517–527, 2017, doi: 10.13189/ujer.2017.050325.

[46] Á. F. Agudo-Peregrina, S. Iglesias-Pradas, M. Á. Conde-González, and Á. Hernández-García, "Can we predict success from log data in VLEs? Classification of interactions for learning analytics and their relation with performance in VLE-supported F2F and *online* learning," *Comput. Human Behav.*, vol. 31, no. 1, pp. 542–550, 2014, doi: 10.1016/j.chb.2013.05.031.

[47] S. Valsamidis, I. Kazanidis, I. Petasakis, S. Kontogiannis, and E. Kolokitha, "E-Learning Activity Analysis," *Procedia Econ. Financ.*, vol. 9, no. Ebeec 2013, pp. 511–518, 2014, doi: 10.1016/s2212-5671(14)00052-5.

[48] I. Zitter, E. De Bruijn, P. R. J. Simons, and T. J. T. Cate, "Adding a design perspective to study learning environments in higher professional education," *High. Educ.*, vol. 61, no. 4, pp. 371–386, 2011, doi: 10.1007/s10734-010-9336-4.

[49] F. Dalipi, A. S. Imran, and Z. Kastrati, "MOOC Dropout Prediction Using Machine Learning Techniques : Review and Research Challenges," in *IEEE Global Engineering Education Conference (EDUCON)*, 2018, pp. 1007–1014.

[50] J. Pearl, "Causality: Models, Reasoning and Inference," *Econ. Theory*, vol. 19, pp. 675–685, 2003.

[51] H. Wang, X. Hao, W. Jiao, and X. Jia, "Causal Association Analysis Algorithm for MOOC Learning Behavior and Learning Effect," in *Proceedings - 2016 IEEE 14th International Conference on Dependable, Autonomic and Secure Computing, DASC 2016, 2016 IEEE 14th International Conference on Pervasive Intelligence and Computing, PICom 2016, 2016 IEEE 2nd International Conference on Big Data*, 2016, pp. 202–206, doi: 10.1109/DASC-PICom-DataCom-CyberSciTec.2016.53.

[52] C. J. Togerson and D. J. Togerson, "The need for RCTs in British Educational Research," *Br. J. Educ. Stud.*, vol. 49, no. 3, pp. 316–328, 2001.

[53] S. Asadianfam, M. Shamsi, and S. Asadianfam, "Predicting academic major of students using bayesian networks to the case of iran," *Int. J. Comput. Technol.*, vol. 2, no. 3, pp. 47–53, 2015, doi: 10.5121/ijcax.2015.2304.

[54] D. Niedermayer, "Applications of Bayesian Networks," *Innovations in Bayesian Networks*, 2003. .

[55] A. E. Punt and R. Hilborn, "Bayesian Stock Assessment Methods in Fisheries-User's Manual," 2001.

[56] M. R. Firdaus, S. I. Halim, and Dewi, "Penerapan Metode Hill Climbing Search untuk Pencarian Lokasi Terdekat pada Aplikasi Toko Virtual Berbasis Android," 2014.

[57] B. N. Pambudi, I. Hidayah, and S. Fauziati, "DETEKSI TRANSAKSI KEUANGAN MENCURIGAKAN SEBAGAI DUKUNGAN ANTI PENCUCIAN UANG MENGGUNAKAN KOMBINASI TUNED SUPPORT VECTOR MACHINE, RANDOM UNDER SAMPLING DAN MODIFIED APPROACH OF PRINCIPAL COMPONENT ANALYSIS," 2020.

[58] W. P. Chawla, Nitesh V.; Bowyer, Kevin W.; Hall, Lawrence O.; Kegelmeyer, "SMOTE : Synthetic Minority Over-Sampling Techique," *J. Artif. Intell. Res.*, vol. 16, pp. 321–357, 2002.

[59] N. V Chawla, "Imbalanced Datasets: From Sampling to Classifiers," in *Imbalanced Learning: Foundations, Algorithms, and Applications*, no. June, 2013, pp. 43–59.

[60] H.-C. Chen, E. Prasetyo, Prayitno, S. S. Kusumawardani, S.-S. Tseng, and T.-L. Kung, "Learning Performance Prediction with Imbalanced Virtual Learning Environment Students' INteractions Data," in *International Conference on Innovative Mobile and Internet Services in Ubiquitous Computing*, 2021, pp. 330–340.

[61] T. Parlar and S. A. Ozel, "A new feature selection method for sentiment analysis of Turkish reviews," 2016, doi: 10.1109/INISTA.2016.7571833.

[62] M. A. Hall, "Correlation-based Feature Selection for Machine Learning," 1999.

[63] Y. Jiao and P. Du, "Performance measures in evaluating machine learning based bioinformatics predictors for classifications," *Quant. Biol.*, vol. 4, no. 4, pp. 320–330, 2016, doi: 10.1007/s40484-016-0081-2.

[64] M. A. Nanda, K. B. Seminar, D. Nandika, and A. Maddu, "A comparison study of kernel functions in the support vector machine and its application for termite detection," *Information*, vol. 9, no. 1, 2018, doi: 10.3390/info9010005.

[65] J. Kuzilek, M. Hlosta, and Z. Zdrahal, "Data Descriptor: Open University Learning Analytics dataset," 2017.

[66] S. A. Putri, "Integrasi Teknik Smote Bagging Dengan Information," *J. Ilmu Pengetah. dan Teknol. Komput.*, vol. 2, no. 2, pp. 22–31, 2017.

[67] S. Pan and X. Zhu, "Graph classification with imbalanced class distributions and noise," in *Proceedings of the Twenty-Third international joint conference on Artificial Intelligence*, 2013, no. August.

[68] R. Duangsoithong and T. Windeatt, "Correlation-based and causal feature selection analysis for ensemble classifiers," \, vol. 5998 LNAI, pp. 25–36, 2010, doi: 10.1007/978-3-642-12159-3_3.

[69] A. Nandeshwar, T. Menzies, and A. Nelson, "Learning patterns of university student retention," *Expert Syst. Appl.*, vol. 38, no. 12, pp. 14984–14996, 2011, doi: 10.1016/j.eswa.2011.05.048.

[70] N. I. Pradasari and R. L. Atimi, "Pemodelan Bayesian Network untuk Prediksi Penyakit Saluran Pernapasan," *Petir J. Pengkaj. dan Penerapan Tek. Inform.*, vol. 12, no. 2, pp. 292–302, 2019, doi: 10.33322/petir.v12i2.637.

[71] I. Borrella, S. Caballero-Caballero, and E. Ponce-Cueto, "Predict and intervene: Addressing the dropout problem in a MOOC-based program," *Proc. 6th 2019 ACM Conf. Learn. Scale, L@S 2019*, no. June, 2019, doi: 10.1145/3330430.3333634.