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Artificial Intelligence used in Pharmaceutical and Healthcare Industry: A Review

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Abstract: *The pharmaceutical and healthcare sectors have transformed thanks to AI, which has sped up innovation and efficiency in many areas. By anticipating prospective medication candidates and modeling their interactions with biological systems, AI quickens the procedure for finding and creating novel medications. Through tailored treatment, early illness diagnosis, and increased diagnostic precision, AI-driven data analysis improves patient care. Robotic surgery technologies driven by AI increase operation accuracy. Predictive analytics reduces medicine shortages and waste in the pharmaceutical supply chain. AI is essential in medication safety monitoring because it can spot possible problems. Virtual health assistants powered by AI offer round-the-clock assistance and information, while chatbots simplify arranging appointments and making medical questions. However, data privacy, legal compliance, and ethical issues still need to be addressed. The increasing convergence of AI and these industries has enormous potential to transform healthcare delivery and pharmaceutical innovation.*

Keywords: Artificial intelligence, healthcare, pharmaceuticals, drug discovery, disease diagnostic, epidemic.

BIBLIOGRAPHY

[1]. Kolluri S, Lin J, Liu R, Zhang Y, Zhang W. Machine learning and artificial intelligence in pharmaceutical research and development: a review. The AAPS Journal. 2022 Feb;24:1-0.

[2]. DiMasi JA, Grabowski HG, Hansen RW. Innovation in the pharmaceutical industry: new estimates of R&D costs. Journal of health economics. 2016 May 1;47:20-33.

[3]. Wong CH, Siah KW, Lo AW. Estimation of clinical trial success rates and related parameters. Biostatistics. 2019 Apr 1;20(2):273-86.

[4]. Russell, Norvig Artificial intelligence: a modern approach (4th edition), 2021; Pearson Series in Artificial Intelligence

[5]. Paul D, Sanap G, Shenoy S, Kalyane D, Kalia K, Tekade RK. Artificial intelligence in drug discovery and development. Drug discovery today. 2021 Jan;26(1):80.

[6]. Mishra V. Artificial intelligence: the beginning of a new era in the pharmacy profession. Asian Journal of Pharmaceutics (AJP). 2018 May 30;12(02).

[7]. Mak KK, Pichika MR. Artificial intelligence in drug development: present status and prospects. Drug discovery today. 2019 Mar 1;24(3):773-80.

[8]. Sellwood MA, Ahmed M, Segler MH, Brown N. Artificial intelligence in drug discovery. Future medicinal chemistry. 2018 Sep;10(17):2025-8.

[9]. Zhu H. Big data and artificial intelligence modeling for drug discovery. Annual review of pharmacology and toxicology. 2020 Jan 6;60:573-89.

[10]. Ciallella HL, Zhu H. Advancing computational toxicology in the big data era by artificial intelligence: data-driven and mechanism-driven modeling for chemical toxicity. Chemical research in toxicology. 2019 Mar 14;32(4):536-47.

[11]. Brown N. In silico medicinal chemistry: computational methods to support drug design. Royal Society of Chemistry; 2015 Oct 30.

[12]. Pereira JC, Caffarena ER, Dos Santos CN. Boosting docking-based virtual screening with deep learning. Journal of chemical information and modeling. 2016 Dec 27;56(12):2495-506.

[13]. Augsburger LL, Hoag SW. 1 Advances in Capsule. Pharmaceutical Dosage Forms: Capsules. 2017 Oct 30:1.

[14]. Mehta CH, Narayan R, Nayak UY. Computational modeling for formulation design. Drug Discovery Today. 2019 Mar 1;24(3):781-8.

[15]. Zhao C, Jain A, Hailemariam L, Suresh P, Akkisetty P, Joglekar G, Venkatasubramanian V, Reklaitis GV, Morris K, Basu P. Toward intelligent decision support for pharmaceutical product development. Journal of Pharmaceutical Innovation. 2006 Sep;1:23-35.

[16]. Rantanen J, Khinast J. The future of pharmaceutical manufacturing sciences. Journal of pharmaceutical sciences. 2015 Nov 1;104(11):3612-38.

[17]. Ketterhagen, W.R. et al. (2009) Process modeling in the pharmaceutical industry using the discrete element method. J. Pharm. Sci. 98, 442–470

[18]. Damiati SA. Digital pharmaceutical sciences. AAPS PharmSciTech. 2020 Jul 26;21(6):206.

[19]. Borkotoky S, Joshi A, Kaushik V, Jha AN. Machine Learning and Artificial Intelligence in Therapeutics and Drug Development Life Cycle. IntechOpen; 2022 May 13.

[20]. Gupta R, Srivastava D, Sahu M, Tiwari S, Ambasta RK, Kumar P. Artificial intelligence to deep learning: machine intelligence approach for drug discovery. Molecular diversity. 2021 Aug;25:1315-60.

[21]. Heidari S, Alborzi M, Radfar R, Afsharkazemi MA, RajabzadehGhatari A. Big data clustering with varied density based on MapReduce. Journal of Big Data. 2019 Dec;6:1-6.

[22]. Javornik M, Nadoh N, Lange D. Data is the new oil. Towards user-centric transport in Europe: Springer; 2019. p. 295–308.

[23]. Bhattamisra SK, Banerjee P, Gupta P, Mayuren J, Patra S, Candasamy M. Artificial Intelligence in Pharmaceutical and Healthcare Research. Big Data and Cognitive Computing. 2023 Jan 11;7(1):10.

[24]. Menschner, P.; Prinz, A.; Koene, P.; Köbler, F.; Altmann, M.; Krcmar, H.; Leimeister, J.M. Reaching into patients' homes Participatory designed AAL services: The case of a patient-centered nutrition tracking service. Electron. Mark. 2011, 21, 63–76.

[25]. Okoli C, Schabram K. A guide to conducting a systematic literature review of information systems research.

[26]. Paré G, Trudel MC, Jaana M, Kitsiou S. Synthesizing information systems knowledge: A typology of literature reviews. Information & Management. 2015 Mar 1;52(2):183-99.

[27]. A deep learning approach for atrial fibrillation signals classification based on convolutional and modified Elman neural network, Future Generation Computer Systems,Volume 102,2020,Pages 670-679,https://doi.org/10.1016/j.future.2019.09.012.

[28]. Ransohoff DF, Feinstein AR. Problems of spectrum and bias in evaluating the efficacy of diagnostic tests. New England Journal of Medicine. 1978 Oct 26;299(17):926-30.

[29]. Jutel, A. Sociology of diagnosis: A preliminary review. Social. Health Illn. 2009, 31, 278–299. .

[30]. Chang, C.L.; Hsu, M.Y. The study applies artificial intelligence and logistic regression for assistance in the differential diagnosis of pancreatic cancer. Expert Syst. Appl. 2009, 36, 10663–10672.

[31]. Appari, Ajit & Johnson, M. & Anthony, Denise. (2009). HIPAA Compliance: An Institutional Theory Perspective HIPAA Compliance: An Institutional Theory Perspective. 15th Americas Conference on Information Systems 2009, AMCIS 2009. 3. 252.

[32]. Spohrer, Jim &Banavar, Guruduth. (2015). Cognition as a Service: An Industry Perspective. Ai Magazine. 36. 71-86. 10.1609/aimag.v36i4.2618.

[33]. Nasirian F, Ahmadian M, Lee OK. AI-based voice assistant systems: Evaluating from the interaction and trust perspectives.

[34]. Dellermann D, Lipusch N, Ebel P, Leimeister JM. Design principles for a hybrid intelligence decision support system for business model validation. Electronic markets. 2019 Sep;29:423-41.

[35]. Kersting K. Machine learning and artificial intelligence: two fellow travelers on the quest for intelligent behavior in machines. Frontiers in Big Data. 2018 Nov 19;1:6.

[36]. Rauschert S, Raubenheimer K, Melton PE, Huang RC. Machine learning and clinical epigenetics: a review of challenges for diagnosis and classification. Clinical epigenetics. 2020 Dec;12(1):1-1.
[37]. Bosse S, Maniry D, Müller KR, Wiegand T, Samek W. Deep neural networks for no-reference and full-reference image quality assessment. IEEE Transactions on image processing. 2017 Oct 10;27(1):206-19.
[38]. Qaisar SM, Khan SI, Srinivasan K, Krichen M. Arrhythmia classification using multi-rate processing metaheuristic optimization and variational mode decomposition. Journal of King Saud University-Computer and Information Sciences. 2023 Jan 1;35(1):26-37.
[39]. Hrizi O, Gasmi K, Ben Ltaifa I, Alshammari H, Karamti H, Krichen M, Ben Ammar L, Mahmood MA. Tuberculosis disease diagnosis based on an optimized machine learning model. Journal of Healthcare Engineering. 2022 Mar 21;2022.
[40]. Ramesh AN, Kambhampati C, Monson JR, Drew PJ. Artificial intelligence in medicine. Annals of the Royal College of Surgeons of England. 2004 Sep;86(5):334.
[41]. Haghighat F. Predicting the trend of indicators related to Covid-19 using the combined MLP-MC model. Chaos, Solitons & Fractals. 2021 Nov 1;152:111399.
[42]. Yao X, Zhu Z, Kang C, Wang SH, Gorriz JM, Zhang YD. AdaD-FNN for chest CT-based COVID-19 diagnosis. IEEE Transactions on Emerging Topics in Computational Intelligence. 2022 Jun 1;7(1):5-14.
[43]. Roy S, Bhunia GS, Shit PK. Spatial prediction of COVID-19 epidemic using ARIMA techniques in India. Modeling earth systems and environment. 2021 Jun;7:1385-91.
[44]. Yang X, Wang Y, Byrne R, Schneider G, Yang S. Concepts of artificial intelligence for computer-assisted drug discovery. Chemical reviews. 2019 Jul 11;119(18):10520-94.
[45]. Lusci A, Pollastri G, Baldi P. Deep architectures and deep learning in chemoinformatics: the prediction of aqueous solubility for drug-like molecules. Journal of chemical information and modeling. 2013 Jul 22;53(7):1563-75.
[46]. Lounkine E, Keiser MJ, Whitebread S, Mikhailov D, Hamon J, Jenkins JL, Lavan P, Weber E, Doak AK, Côté S, Shoichet BK. Large-scale prediction and testing of drug activity on side-effect targets. Nature. 2012 Jun 21;486(7403):361-7.
[47]. Feng Q, Dueva E, Cherkasov A, Ester M. Padme: A deep learning-based framework for drug-target interaction prediction. arXiv preprint arXiv:1807.09741. 2018 Jul 25.
[48]. Lysenko A, Sharma A, Boroevich KA, Tsunoda T. An integrative machine learning approach for prediction of toxicity-related drug safety. Life science alliance. 2018 Dec 1;1(6).
[49]. Gayvert KM, Madhukar NS, Elemento O. A Data-Driven Approach to Predicting Successes and Failures of Clinical Trials. Cell Chem Biol. 2016 Oct 20;23(10):1294-1301. doi: 10.1016/j.chembiol.2016.07.023. Epub 2016 Sep 15. PMID: 27642066; PMCID: PMC5074862.
[50]. Ray, Upasana & Chouhan, Usha & Verma, Neha. (2020). Comparative study of machine learning approaches for classification and prediction of selective caspase-3 antagonist for Zika virus drugs. Neural Computing and Applications. 32. 10.1007/s00521-019-04626-7.
[51]. Ykema BL, Hoefnagel SJ, Rigter LS, Kodach LL, Meijer GA, van Leeuwen FE, Khan HN, Snaebjornsson P, Aleman BM, Broeks A, Meijer SL. Gene expression profiles of esophageal squamous cell cancers in Hodgkin lymphoma survivors versus sporadic cases. Plos one. 2020 Dec 21;15(12):e0243178.
[52]. Aldaej A, Ahanger TA, Uddin MY, Ullah I. Secure Dengue Epidemic Prediction System: Healthcare Perspective. Computers, Materials & Continua. 2022 Oct 1;73(1).
[53]. Luetkemeyer AF, Kendall MA, Wu X, Lourenço MC, Jentsch U, Swindells S, Qasba SS, Sanchez J, Havlir DV, Grinsztejn B, Sanne IM. Evaluation of two-line probe assays for rapid detection of Mycobacterium tuberculosis, tuberculosis (TB) drug resistance, and non-TB Mycobacteria in HIV-infected individuals with suspected TB. Journal of clinical microbiology. 2014 Apr;52(4):1052-9.
[54]. Domingo C, Charrel RN, Schmidt-Chanasit J, Zeller H, Reusken C. Yellow fever in the diagnostics laboratory. Emerging microbes & infections. 2018 Dec 1;7(1):1-5.

[55]. Saberi-Karimian M, Khorasanchi Z, Ghazizadeh H, Tayefi M, Saffar S, Ferns GA, Ghayour-Mobarhan M. Potential value and impact of data mining and machine learning in clinical diagnostics. Critical reviews in clinical laboratory sciences. 2021 May 19;58(4):275-96.

[56]. Xie S, Yu Z, Lv Z. Multi-Disease Prediction Based on Deep Learning: A Survey. CMES-Computer Modeling in Engineering & Sciences. 2021 Aug 1;128(2).

[57]. Ahmedt-Aristizabal D, Armin MA, Denman S, Fookes C, Petersson L. Graph-based deep learning for medical diagnosis and analysis: past, present and future. Sensors. 2021 Jul 12;21(14):4758.

[58]. Sharma, Moolchand& Kochhar, Akanksha & Gupta, Deepak & Zubi, Jafar. (2021). Hybrid Intelligent System for Medical Diagnosis in Health Care. 10.1007/978-981-16-2972-3_2.

[59]. Shahrabi J, Hadavandi E, Asadi S. Developing a hybrid intelligent model for forecasting problems: A case study of tourism demand time series. Knowledge-Based Systems. 2013 May 1;43:112-22.

[60]. Baruque B, Corchado E, Mata A, Corchado JM. A forecasting solution to the oil spill problem based on a hybrid intelligent system. Information Sciences. 2010 May 15;180(10):2029-43.

[61]. Ramesh AN, Kambhampati C, Monson JR, Drew PJ. Artificial intelligence in medicine. Annals of the Royal College of Surgeons of England. 2004 Sep;86(5):334.

[62]. L. O. Chua and L. Yang, "Cellular neural networks: theory," in IEEE Transactions on Circuits and Systems, vol. 35, no. 10, pp. 1257-1272, Oct. 1988, doi 10.1109/31.7600.

[63]. Mandal L, Jana ND. Prediction of Active Drug Molecule using Back-Propagation Neural Network. In2019 8th International Conference System Modeling and Advancement in Research Trends (SMART) 2019 Nov 22 (pp. 22-26). IEEE.

[64]. Chan S, Siegel EL. Will machine learning end the viability of radiology as a thriving medical specialty? Br J Radiol. 2019 Feb;92(1094):20180416. doi: 10.1259/bjr.20180416. Epub 2018 Nov 1. PMID: 30325645; PMCID: PMC6404816.

[65]. Davenport T, Kalakota R. The potential for artificial intelligence in healthcare. Future Healthc J. 2019 Jun;6(2):94-98. doi 10.7861/futurehosp.6-2-94. PMID: 31363513; PMCID: PMC6616181.

[66]. Hanson III CW, Marshall BE. Artificial intelligence applications in the intensive care unit. Critical care medicine. 2001 Feb 1;29(2):427-35.