Artificial Intelligence as a Promising Tool for Evaluating COVID-19 Severity

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Dear Editor,

The COVID-19 pandemic has posed unprecedented challenges to global healthcare systems, especially in the timely assessment of disease severity and resource allocation (1). Traditional clinical and imaging markers, although useful, often lack the sensitivity and speed necessary for early and accurate patient classification. In this context, artificial intelligence (AI) has emerged as a transformative tool in assessing COVID-19 severity, aiding diagnosis, prognosis, and clinical decision-making (2).

AI, particularly through machine learning (ML) and deep learning (DL) algorithms, can process extensive volumes of clinical, imaging, and laboratory data with remarkable speed and accuracy (3). For instance, convolutional neural networks (CNNs) have shown high accuracy in detecting COVID-19-related abnormalities in chest CT and X-ray images, often outperforming conventional radiological assessments in identifying ground-glass opacities and fixation patterns (4). CNNs with three layers use medical datasets to recognizing images for good identification, and python language for training the proposed deep transfer learning models (5). We should be mentioned CheXNet, the largest publicly available chest X-ray dataset that can detect 14 diseases hinging on X-ray images (6). So this ML based models can compete with radiologists in analyzing radiology images by extra tools, for example using natural language processing (NLP) for high level transforming like IBM Watson Health (7).

Additionally, AI models that integrate vital signs, oxygen saturation, comorbidities, and biomarkers such as D-dimer and C-reactive protein have shown promise in predicting disease progression and risk of ICU admission (8). SOFA (Sequential Organ Failure Assessment) is a clinical scoring system used to evaluate the function of vital organs in critically ill patients in the ICU. It measures the severity of organ failure based on the respiratory, cardiovascular, hepatic, renal, hematologic, neurologic. Each organ is scored from 0 to 4 (normal to most severe dysfunction), and the total score 0 to 24 that shown the degree of multi-organ failure. DEEP SOFA is a cutting-edge deep learning-based model that help more accurate organ failure prediction, improved ICU management, integration of multi-source data, personalized treatment and can be used by trained nurses and doctors (9).

One notable application is the development of AI-based triage tools in emergency department, that can quickly identify high-risk patients and prioritize care, particularly when healthcare resources are limited (10). To illustrate this, knowledge-augmented temporal model for emergency care (KATE) is an advanced ML model for prediction and making better decisions than humans. KATE with some steps such as multimodal data integration, feature extraction, hybrid neural network, outcome prediction and explainable AI with some better primary result use in sophisticated but small hospitals (11). In addition, AI-based predictive models are used to predict the need for ventilatory support and the likelihood of recovery or mortality, improving individualized patient management (12).

Despite these advances, challenges remain. Algorithm transparency, data privacy, and the need for external validation across diverse populations are important concerns (13). Most AI models are developed using retrospective datasets, often with regional biases, which limits their generalizability (14). Furthermore, integrating AI into routine clinical workflows needs interdisciplinary collaboration and strong regulatory frameworks (15).

However, the pandemic has catalyzed the acceptance and adoption of AI in clinical medicine. Future strategies should concentrate on creating ethically sound, clinically validated, and interpretable AI systems tailored for pandemic response (16). Integrating real-time data from wearable devices, electronic health records, and cloud-based platforms can increase the capacity of AI to provide timely and accurate assessments of COVID-19 severity (17).

In conclusion, AI shows a powerful complement to the fight against COVID-19, providing tools to accurately evaluate severity and optimize resources. Continued investment in AI research and its responsible implementation critical to strengthening global preparedness for current and future pandemics.

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Conflict of Interest

None.

References

1. Arshid MA, Mumtaz M, Nazir R. Unforeseen challenges to global health system, in particular context to COVID-19 pandemic and health care personnel. Arab Journal of Basic and Applied Sciences. 2021;28(1):145-53.
2. Ellahham S. Artificial intelligence in the diagnosis and management of COVID-19: A narrative review. Journal of Medical Artificial Intelligence. 2021;4.
3. Topol EJ. High-performance medicine: the convergence of human and artificial intelligence. Nature medicine. 2019;25(1):44-56.
4. Hameed BZ, Prerepa G, Patil V, Shekhar P, Zahid Raza S, Karimi H, et al. Engineering and clinical use of artificial intelligence (AI) with machine learning and data science advancements: Radiology leading the way for future. Therapeutic Advances in Urology. 2021;13:17562872211044880.
5. Narin A, Kaya C, Pamuk Z. Automatic detection of coronavirus disease (covid-19) using x-ray images and deep convolutional neural networks. Pattern Analysis and Applications. 2021;24:1207-20.
6. Rajpurkar P, Irvin J, Zhu K, Yang B, Mehta H, Duan T, et al. Chexnet: Radiologist-level pneumonia detection on chest x-rays with deep learning. arXiv preprint arXiv:171105225. 2017.
7. Norouzi K, Ghodsi A, Argani P, Andi PA, Hassani H. Innovative artificial intelligence tools: exploring the future of healthcare through IBM Watson's potential applications. Sensor Networks for Smart Hospitals: Elsevier; 2025. p. 573-88.
8. Stylianides C, Nicolaou A, Sulaiman WA, Alexandropoulou C-A, Panagiotopoulos I, Karathanasopoulou K, et al. AI Advances in ICU with an Emphasis on Sepsis Prediction: An Overview. Machine Learning and Knowledge Extraction. 2025;7(1):6.
9. Shickel B, Loftus TJ, Adhikari L, Ozrazgat-Baslanti T, Bihorac A, Rashidi P. DeepSOFA: a continuous acuity score for critically ill patients using clinically interpretable deep learning. Scientific reports. 2019;9(1):1879.
10. Aleksandra S, Robert K, Klaudia K, Dawid L, Mariusz S. Artificial intelligence in optimizing the functioning of emergency departments; a systematic review of current solutions. Archives of Academic Emergency Medicine. 2024;12(1):e22.
11. Ivanov O, Wolf L, Brecher D, Lewis E, Masek K, Montgomery K, et al. Improving ED emergency severity index acuity assignment using machine learning and clinical natural language processing. Journal of Emergency Nursing. 2021;47(2):265-78. e7.
12. Stivi T, Padawer D, Dirini N, Nachshon A, Batzofin BM, Ledot S. Using artificial intelligence to predict mechanical ventilation weaning success in patients with respiratory failure, including those with acute respiratory distress syndrome. Journal of Clinical Medicine. 2024;13(5):1505.

13. Daneshjou R, Smith MP, Sun MD, Rotemberg V, Zou J. Lack of transparency and potential bias in artificial intelligence data sets and algorithms: a scoping review. JAMA dermatology. 2021;157(11):1362-9.

14. Cha D, Pae C, Lee SA, Na G, Hur YK, Lee HY, et al. Differential biases and variabilities of deep learning–based artificial intelligence and human experts in clinical diagnosis: Retrospective cohort and survey study. JMIR Medical Informatics. 2021;9(12):e33049.

15. Olusegun J, Oluwaseyi J, Brightwood S, Temitope OM. INTEGRATION OF AI WITH ELECTRONIC HEALTH RECORDS: ENHANCING CLINICAL WORKFLOWS. 2024.

16. Balasubramanian S, Shukla V, Islam N, Upadhyay A, Duong L. Applying artificial intelligence in healthcare: lessons from the COVID-19 pandemic. International Journal of Production Research. 2025;63(2):594-627.

17. Ahmed S, Yong J, Shrestha A. The integral role of intelligent IoT system, cloud computing, artificial intelligence, and 5G in the user-level self-monitoring of COVID-19. Electronics. 2023;12(8):1912.