How Does AI Enable Point-of-Care Testing?

Rasit Dinc

Rasit Dinc Digital Health & AI Research

Published: September 25, 2015 | AI in Laboratory Medicine

DOI: 10.5281/zenodo.17999295

Abstract

Point-of-care testing (POCT) is revolutionizing healthcare by bringing diagnostics closer to the patient. This decentralized approach allows for rapid testin...

How Does AI Enable Point-of-Care Testing?

Author: Rasit Dinc

Introduction

Point-of-care testing (POCT) is revolutionizing healthcare by bringing diagnostics closer to the patient. This decentralized approach allows for rapid testing and timely clinical decision-making, which is especially critical in remote areas, emergency situations, and for managing chronic diseases. However, the reliability and scalability of POCT can be hindered by factors such as user variability and difficulties in data integration [1, 2]. The integration of artificial intelligence (AI) is emerging as a powerful solution to overcome these challenges, enhancing the accuracy, efficiency, and accessibility of POCT [2].

Enhancing Diagnostic Accuracy and Efficiency

AI, particularly machine learning (ML) and deep learning (DL) algorithms, significantly improves the diagnostic accuracy of POCT devices. For instance, in lateral flow immunoassays (LFIAs), which are commonly used for rapid tests like those for HIV, AI-powered deep-learning algorithms have been shown to increase sensitivity and specificity, reducing the number of false positives and negatives that can occur with human visual interpretation [1]. By building extensive image libraries, AI models can learn to interpret faint test lines and other nuances that might be missed by the human eye, leading to more reliable results [1].

Similarly, in bright-field microscopy, AI is being used to automate the detection of parasites like *Plasmodium* (malaria) and *Schistosoma* eggs. Automated systems equipped with convolutional neural networks (CNNs) can analyze blood smears or urine samples and identify parasites with high sensitivity and specificity, even in cases of low parasitemia [1]. This not only

improves the accuracy of diagnosis but also reduces the reliance on highly skilled microscopists, who may not be available in resource-limited settings [1].

Revolutionizing Hematology and Other Applications

AI is also making significant strides in the field of hematology. AI-powered POC hematology analyzers can perform complete blood counts (CBCs) with high accuracy, using machine vision and computer vision algorithms to differentiate between cell types and identify abnormalities [1]. These devices can be operated with minimal training, making them ideal for use in a variety of healthcare settings. Furthermore, AI algorithms are being developed to detect anemia and hemoglobin variants from electrophoresis images, providing a rapid and accurate method for diagnosing these conditions at the point of care [1].

Beyond these specific applications, AI-powered POCT offers a range of benefits. As highlighted by Pillay et al. (2025), AI-powered POCT provides significant advantages over traditional methods, including higher accuracy, faster results, and improved workflow efficiency [2]. AI can also help to standardize quality control, monitor device performance, and facilitate the seamless integration of POCT data into electronic health records (EHRs) [2].

Challenges and Future Directions

Despite the immense potential of AI in POCT, there are challenges that need to be addressed. These include issues related to data privacy, the transparency of AI algorithms, and the need for robust training and validation of AI models [2]. Ensuring that AI-powered POCT is deployed ethically and equitably is also a critical consideration, particularly in low-resource settings [2].

Looking ahead, the convergence of AI with other technologies like the Internet of Things (IoT) and blockchain holds the promise of creating even more powerful and secure POCT solutions [2]. These integrated systems could enable predictive diagnostics, personalized medicine, and real-time monitoring of disease outbreaks, further transforming the landscape of healthcare delivery [2].

Conclusion

Artificial intelligence is poised to play a pivotal role in the future of point-of-care testing. By enhancing diagnostic accuracy, improving workflow efficiency, and increasing accessibility, AI is helping to overcome the limitations of traditional POCT methods. While challenges remain, the continued development and thoughtful implementation of AI-powered POCT have the potential to democratize diagnostics, improve patient outcomes, and drive a new era of proactive, patient-centered healthcare.

References

[1] Khan, A. I., Khan, M., & Khan, R. (2023). Artificial Intelligence in Point-of-Care Testing. *Annals of Laboratory Medicine*, *43*(5), 401–407.

https://doi.org/10.3343/alm.2023.43.5.401

[2] Pillay, T. S., Khan, A. I., & Yenice, S. (2025). Artificial intelligence (AI) in point-of-care testing. *Clinica Chimica Acta*, *574*, 120341. https://doi.org/10.1016/j.cca.2025.120341
