

Artificial Intelligence in Biomarker Discovery for Early Disease Diagnosis

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ABSTRACT

The healthcare sector is on the verge of making remarkable advancements with the help of artificial intelligence (AI), allowing us to enhance patient care and gain deeper insights into medical practices. Early disease detection is critical for increasing patient survival, lowering treatment costs, and facilitating timely clinical intervention. Traditional biomarker finding methods, on the other hand, are frequently slow, expensive, and limited when dealing with complicated and high-dimensional biological data. This chapter investigates AI-enabled biomarker discovery and disease detection, their revolutionary impact against the difficulties of conventional methods. Large-scale biomedical datasets were analysed using machine learning and deep learning approaches, which included genomic, proteomic, metabolomics, and clinical data. The methods for distinguishing early illness states from healthy persons included data pre-processing, feature extraction, dimensionality reduction, model training, and validation. AI models were taught to spot delicate biological patterns and interactions that are difficult to detect using traditional methods. The main findings show that AI-based models improve the accuracy, sensitivity, and speed of biomarker discovery when compared to traditional approaches. Several possible biomarkers were discovered at early disease stages, allowing for earlier prediction and diagnosis. The study also shown increased model robustness and reproducibility across numerous datasets. The importance of this research stems from its ability to speed biomarker development, aid in early disease identification, and improve tailored medication. of efficient and sustainable healthcare systems. Future research should concentrate on clinical validation, ethical data use, model transparency, and the incorporation of AI technologies into ordinary healthcare workflows to assure reliability, safety, and wider adoption across varied patient groups worldwide.

Keywords: Biomarker Discovery, early detection, AI-driven model, healthcare, biomedical datasets

