ResearchMate Final Report ■

Topic: Machine Learning in Healthcare ■

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Machine Learning in Healthcare: A Review of Recent Research

This report summarizes recent research on machine learning (ML) applications in healthcare, focusing on cybersecurity, personalized medicine, public health, and disease prediction.

1. Cybersecurity in Healthcare

1.1 Mapping the Cyberthreat Landscape:

Piazza and Vasudevan (2025) utilized a multimethod approach—combining social network analysis, natural language processing (NLP), and machine learning—to analyze data from the Global Database of Events, Language, and Tone (GDELT). Their research mapped the cyberthreat landscape in healthcare, concentrating on attacks targeting hospitals. The study revealed a significant increase in attacks from 2017 to 2023, with hospitals exhibiting heightened vulnerability to sophisticated attacks such as cyberterrorism, advanced persistent threats (APTs), and distributed denial-of-service (DDoS) attacks. This underscores the critical need for enhanced cybersecurity measures and policy interventions within the healthcare sector.

2. Personalized Medicine

2.1 Generative AI in Personalized Medicine:

Mishra et al. (2025) conducted a systematic review examining the role of generative artificial intelligence (AI) in personalized medicine. Their review, encompassing 27 studies, primarily focused on the application of generative adversarial networks (GANs) and variational autoencoders (VAEs). These models demonstrated considerable potential in drug response prediction, treatment effect estimation, biomarker discovery, and patient stratification. However, the authors highlight the need for further research to address challenges related to model validation, interpretability, and bias mitigation.

3. Public Health

3.1 Public Perception of Healthcare Systems:

Bi et al. (2025) investigated public perception of the Chinese healthcare system, specifically focusing on satisfaction with healthcare security. Using data from the 2021 China General Social Survey, the researchers employed machine learning methods (neural networks, random forests, and logistic regression) to predict satisfaction levels. Their findings revealed that social equity and trust positively correlated with satisfaction, while medical expenses negatively impacted satisfaction. This research emphasizes the importance of addressing social determinants of health and financial burdens to improve public satisfaction with healthcare systems.

4. Disease Prediction

4.1 Predicting PD-L1 Expression in NSCLC:

Peng et al. (2025) developed a positron emission tomography/computed tomography (PET/CT)-based radiomics model for predicting programmed cell death ligand 1 (PD-L1) expression in non-small cell lung cancer (NSCLC) patients. Utilizing machine learning algorithms (Bayesian methods, logistic regression, random forest, and support vector machines), they created a model effectively predicting PD-L1 expression, thereby assisting in the selection of appropriate immunotherapy treatments. Furthermore, they identified independent predictors of progression-free survival and overall survival in PD-L1-positive patients.

4.2 Biomarker Discovery for Heart Failure Subtypes:

An unnamed study (PMID: 40375290) explored the use of proteomics and machine learning to identify blood-based biomarkers for the early diagnosis of heart failure subtypes (HFpEF and HFrEF). The study aimed to improve diagnostic accuracy beyond existing methods by combining biomarkers with B-type natriuretic peptide (BNP). While details on the specific ML methods and results are limited in the provided abstract, the research highlights the potential of proteomics and ML for improved early diagnosis and personalized treatment of heart failure.

5. Summary Table

| Study | Focus Area | ML Methods Used | Key Findings |

|---|---|---|---|

| Piazza & Vasudevan (2025) | Healthcare Cybersecurity | Social network analysis, NLP, Machine learning | Increased cyberattacks on hospitals; vulnerability to sophisticated attacks (e.g., cyberterrorism, APTs, DDoS). |

| Mishra et al. (2025) | Personalized Medicine | GANs, VAEs | Generative AI shows potential for drug response prediction, treatment effect estimation, biomarker discovery, and patient stratification. Further research needed on validation, interpretability, and bias. |

| Bi et al. (2025) | Public Health | Neural networks, Random forests, Logistic Regression | Social equity and trust positively influence satisfaction; medical expenses negatively impact satisfaction. |

| Peng et al. (2025) | Disease Prediction | Bayesian methods, Logistic Regression, Random Forest, SVM | PET/CT radiomics model predicts PD-L1 expression; identifies independent predictors of progression-free and overall survival in PD-L1-positive NSCLC patients. |

| PMID: 40375290 | Disease Prediction | Unspecified | Proteomics and ML offer potential for improved early diagnosis of heart failure subtypes. |

References

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