

Related Works on Personalized Healthcare using Artificial Intelligence

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Abstract

This report summarizes recent research and developments in the field of AI-based personalized healthcare. It highlights the key contributions, methodologies, and challenges faced by existing systems.

1 Introduction

The use of Artificial Intelligence (AI) in healthcare has opened new avenues for personalized treatment. This report reviews existing studies and methods used in AI-driven healthcare solutions.

2 Related Works

2.1 A Primer on Reinforcement Learning in Medicine for Clinicians

Article Reference: [1]

Overview

Reinforcement Learning (RL) is a machine learning approach that enhances clinical decision-making by addressing uncertainties and optimizing sequential treatment strategies. This review introduces RL to clinicians, emphasizing how it leverages patient data to generate personalized treatment plans that improve outcomes and resource efficiency. It also explores foundational RL concepts, applications, challenges, and future directions.

Categories of RL

- **Model-based RL:** Learns a model of the environment to simulate outcomes and make decisions. Example: AlphaZero.
- **Model-free RL:** Learns policies directly from experience without modeling the environment. Includes:

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- *Value-based methods*: e.g., Q-learning, SARSA
 - *Policy-based methods*: e.g., REINFORCE
 - *Hybrid methods*: e.g., Actor-Critic

RL shifts AI in healthcare from prediction to actionable, real-time decision-making.

Applications in Healthcare RL has demonstrated potential in:

- Creating personalized treatment plans (e.g., chemotherapy, sedation, insulin dosing)
- Optimizing resource allocation in critical care (e.g., ventilator weaning, sepsis treatment)
- Enhancing adaptive interventions using offline RL and simulation environments

Evaluation Challenges Evaluation is constrained by safety, ethical, and logistical concerns. RL often relies on:

- Simulated environments
- Off-Policy Evaluation (OPE) methods like FQE and Doubly Robust methods

Implementation Issues Practical deployment of RL in healthcare is hindered by:

- Challenges in reward function design
- High-dimensional state and action spaces
- Necessity for domain expertise in clinical evaluation

Future Directions Future developments may include:

- Integration with Large Language Models (LLMs)
- Privacy-preserving learning (e.g., Federated Learning)
- Real-time adaptive interventions and decision support

Real-World Examples Examples include:

- DeepMind’s AlphaZero and AI Clinician for sepsis treatment
- RL-based models for sedation weaning, cancer therapy, and insulin control
- Clinical trials like REINFORCE and glycemic control interventions

3 Conclusion

Personalized healthcare using AI continues to evolve, offering significant potential to improve patient care. However, integration into real-world clinical settings remains an ongoing challenge.

References

- [1] Pushkala Jayaraman, Jacob Desman, Moein Sabounchi, Girish N. Nadkarni, and Ankit Sakhuji. A primer on reinforcement learning in medicine for clinicians. November 2025.