Chapter 12
Empowering Healthcare With AI-Driven Transformer Models

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ABSTRACT

The BERT and GPT transformer models are leading the way in artificial intelligence (AI) in healthcare. Personalized medicine and clinical decision-making can be simplified with these models because they excel at handling natural language and unstructured data. Healthcare generates enormous amounts of data every day, including electronic health records (EHRs), imaging, and biomedical literature. It is difficult for clinicians and researchers to extract actionable insights from this unstructured information due to its unstructured nature. The transformer model can process and analyze this data efficiently because it has self-attention mechanisms and context understanding. In drug discovery, transformers analyze vast biomedical datasets to speed repurposing. They enable multi-modal assessments through text, image, and genomic data integration in diagnostics. Through AI-driven solutions, transformers will revolutionize healthcare by improving patient care, reducing workloads, and accelerating innovation.

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I. INTRODUCTION

This study explores how AI and data-driven techniques can transform personalized healthcare. By using deep neural networks, it predicts disease outcomes while ensuring clarity and trust through SHAP-based explanations. The focus is on how AI helps doctors deliver tailored treatments, uncover important health insights, and stay within ethical boundaries. As healthcare continues to evolve, the results show a promising future where care becomes more accurate, efficient, and focused on each patient's needs. This work sets the stage for smarter healthcare systems that improve treatment results, support medical research, and make care better for everyone (Mendhe et al., 2024).

AI is rapidly transforming healthcare by improving diagnostics, treatment methods, and overall system efficiency. This paper explores the growing role of AI in healthcare, particularly in crafting personalized treatment plans. It addresses the current challenges within the industry and presents AI as a key solution to enhance care delivery. A comprehensive literature review outlines existing knowledge and sets the stage for future exploration.

The paper highlights how AI supports tailored decision-making for patients and provides deeper insights for medical professionals. It concludes by examining emerging AI trends and their potential to reshape healthcare, improve patient outcomes, and drive innovation forward (Arshi et al., 2023).

This study explores the transformative potential of AI- powered predictive modeling in advancing personalized medicine and accelerating drug discovery. By leveraging advanced machine learning techniques and extensive biomedical data, the research focuses on identifying promising drug candidates and tailoring treatments to individual patient needs. The findings reveal that AI significantly enhances predictions of drug-target interactions, detects potential side effects, and identifies key biomarkers for patient segmentation. Compared to traditional methods, AI models offer improved processing speed and prediction accuracy—demonstrating a 20% accuracy boost. These advancements could reshape the pharmaceutical landscape by reducing development time and costs while improving treatment outcomes (Kalyani et al., 2024).

Precision medicine represents a major advancement in healthcare, focusing on tailoring treatments based on each patient's genetic makeup, clinical history, and lifestyle. This study delves into the combined use of genomics, clinical decision support systems (CDSS), and advanced technologies like machine learning and deep learning. The integration of these tools offers a powerful way to deliver more accurate, efficient, and personalized medical care. By applying this data-driven approach, healthcare professionals can create highly targeted treatment plans, reducing side effects and improving patient outcomes. This research highlights a transformative