Chapter 23
Revolutionizing Early Diagnosis on a Multifaceted Approach to Chronic Kidney Disease Detection

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ABSTRACT

A growing number of people throughout the world are suffering from chronic kidney disease (CKD), which is a major public health issue. Detection and prediction of CKD are crucial for healthcare providers to intervene timely and effectively in the fight against the disease. A number of medical fields have seen encouraging results from combining AI technologies with fuzzy logic and expert systems in recent years. The purpose of this study is to develop a CKD prediction model using an expert system that combines AI and fuzzy logic. By combining nephrologists' extensive knowledge with fuzzy logic and AI algorithms, the suggested expert system can improve prediction accuracy. A number of clinical and laboratory variables are integrated into the system. These include age, blood pressure, serum creatinine, and urine protein levels, among others. Fuzzy logic takes into account the inherent imprecision and ambiguity of medical data.

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INTRODUCTION

Chronic Kidney Disease (CKD) poses a significant global health challenge, necessitating innovative approaches to early detection for improved patient outcomes. With the rising prevalence of chronic diseases, timely identification and intervention have become paramount. This research explores cutting-edge technologies, including biomarker research, artificial intelligence, telehealth, and smart wearables, revolutionizing CKD diagnosis. By investigating the potential of these advancements, this paper aims to illuminate their roles in enhancing early detection precision, paving the way for more effective and accessible strategies in managing CKD on a global scale. This research endeavours to advance early detection methods for Chronic Kidney Disease (CKD) through a multifaceted approach. First, an extensive review and analysis of existing Machine Learning methods, specifically tailored for large datasets, will be conducted. Subsequently, the study aims to design, develop, and evaluate a smart diagnostic prototype biosensing system for early identification of kidney function loss. Leveraging innovative approaches, the research further delves into the detection of CKD by analyzing and quantifying a key biochemical marker, creatinine, sourced from diverse data channels. Lastly, Artificial Intelligence techniques will be developed and applied to distinct image datasets, contributing to enhanced precision in CKD detection. This comprehensive investigation aspires to propel advancements in early CKD diagnosis, fostering improved healthcare outcomes.

REVIEW OF LITERATURE

Chronic Kidney Disease (CKD) is a global health concern characterized by the gradual loss of kidney function, affecting millions of individuals worldwide. Early detection is critical to mitigate the progression of CKD and improve patient outcomes. In this context, integrating innovative technologies, particularly Machine Learning (ML), biosensing systems, and Artificial Intelligence (AI), has garnered significant attention in recent literature. This groundbreaking review, authored by Johnson et al. (2018), thoroughly explores the application of Machine Learning (ML) in the early detection of chronic kidney disease. Delving into various ML algorithms and their efficacy in analyzing extensive datasets, the study lays the foundation for a paradigm shift in CKD diagnostics. The review synthesizes evidence showcasing ML's potential to predict and identify early stages of CKD with heightened accuracy, propelling research in the field.

Patel et al. (2018) offer a comprehensive overview of biosensing technologies in the context of nephrology, with a focus on CKD. The review explores the evolution of biosensing prototypes, highlighting their capability for real-time monitoring of key biomarkers associated with kidney function. The study emphasizes the transformative potential of biosensing in ushering in proactive and patient-centric approaches to managing CKD. Garcia et al. (2018) delve into innovations in biochemical marker analysis, specifically focusing on quantifying creatinine levels. The study explores diverse data sources, including serum samples and electronic health records, showcasing a multifaceted approach to CKD diagnosis. This literature reflects the growing trend towards precision medicine in nephrology, emphasizing a more granular understanding of CKD through biochemical markers.

Kim et al. (2018) pioneered the integration of artificial intelligence (AI) into diagnostic imaging for the early detection of CKD. The research showcases the efficacy of AI-driven image analysis in identifying subtle structural abnormalities indicative of early-stage CKD. This literature piece marks a pivotal

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