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APPLICATION OF MACHINE LEARNING IN HEALTHCARE SECTOR: DETECTION OF CHRONIC KIDNEY DISEASE

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ABSTRACT

Chronic Kidney Disease (CKD) poses a significant public health concern due to its increasing prevalence and impact on patient outcomes and healthcare systems. This research paper provides a comprehensive investigation into CKD, focusing on risk factors, diagnostic methods, and management strategies. CKD is characterized by the progressive loss of kidney function, often resulting from conditions such as diabetes, hypertension, and primary renal disorder. As CDK advances, it leads to complications, including kidney failure, necessitating costly interventions like dialysis or transplantation. CKD is seen to be more common in women (14%) as compared to men (12%). However, the risk factors of CKD, such as diabetes, high blood pressure, and age can be similar for both men and women. However, some specific causes of CKD, like certain autoimmune diseases, may have a higher prevalence in women. The development of CKD is influenced by a combination of factors, and gender is just one of them. This study examines the multifaceted etiology of CKD, encompassing genetic, lifestyle, and environmental factors.

Keywords: Machine learning, Chronic Kidney Disease, SVM, Random Forest,

I. INTRODUCTION

Chronic Kidney Disease (CDK) stands as a formidable enigma in the realm of healthcare. It silently advances, often unnoticed until it reaches a critical gesture, placing both patients and healthcare systems in a precarious position. This pervasive condition affects millions across the globe, spanning a broad spectrum of severity, from early-stage renal dysfunction to the dire need for dialysis or transplantation.

The kidneys, these unassuming bean-shaped organs, orchestrate an intricate symphony within the human body. Their role encompasses the filtration of waste products, regulation of blood pressure, and the synthesis of vital hormones. When the delicate equilibrium of kidney function is perturbed by an array of underlying factors, CKD emerges as an inexorable and progressive ailment.

In this research paper, we embark on a journey through the intricate landscape of CKD. Our goal is to unravel the latest breakthroughs in diagnosis, prediction, and management. We underscore the paramount significance of early detection while highlighting the pivotal role played by machine learning and data-driven methodologies. Moreover, we delve into the web of risk factors and coexisting conditions that frequently accompany CKD and explore promising therapeutic strategies to enhance patient well-being.

The evolving medical landscape is increasingly turning to advanced technologies and data analytics to illuminate the path toward a deeper comprehension of CKD. As we advance, we must acknowledge not only the clinical dimensions but also the innovative solutions and the fusion of interdisciplinary insights.

Our objective is to cast a light on a future where CKD is not only better understood by machine learning but also more effectively managed, possibly bringing a better quality of life to the countless individuals who grapple with its challenges worldwide.

II. METHODOLOGY

Chronic kidney disease is a long-term medical condition where the kidney progressively loses their ability to function actively. It can lead to a range of health complications as kidneys struggle to filter waste and excess fluids from the blood. Early detection and management are essential for future kidney failure and damage. The following research is based on the detection of chronic kidney disease, it will be beneficial to the patients facing this disease. Performing this experiment we have a certain dataset, dataset contains patient data like sugar level, red blood cells, blood pressure, pus blood cells, and coronary-artery disease. Using this attribute will use some of the attributes. Analyzing these attributes of the target will analyze and detect the disease. Here we have used the machine learning platform which is a very big known and big platform. Machine learning has

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been applied to chronic kidney disease in various ways to aid in diagnosis, prediction, and management. we have used three methods of machine learning random forest, Support Vector machine method K-Nearest Neighbors.

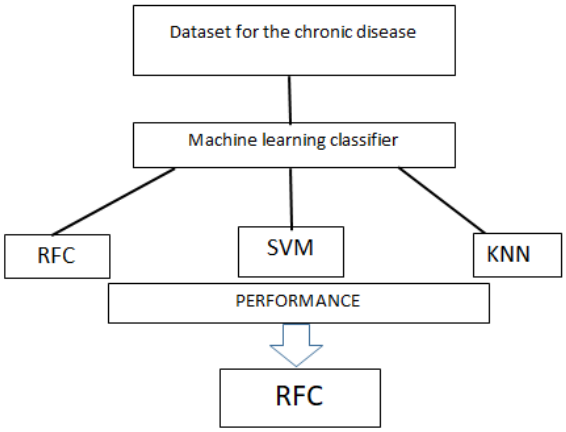


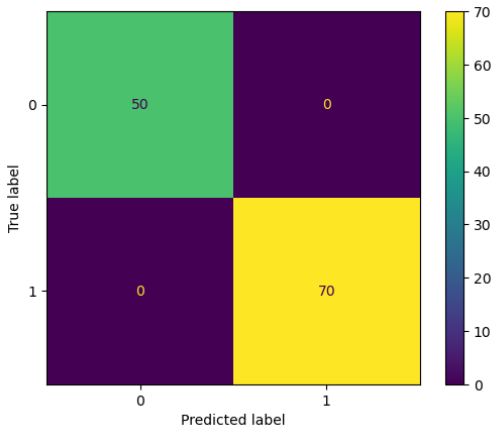
Fig 1: Performance Evaluation

III. MODELING AND ANALYSIS

Are the following machine learning methods(algorithm) we are going to use in this following experiment for the detection of chronic kidney disease.

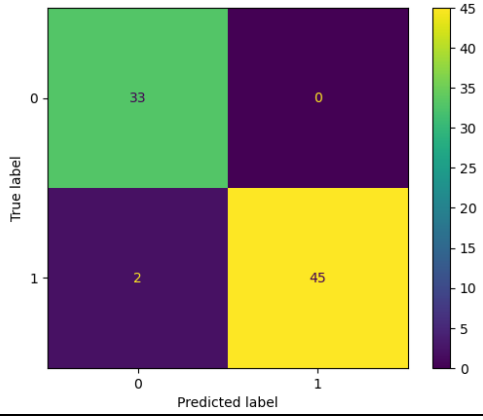
Random Forest Methods (RFM):

Random Forest is a machine learning method used for both classification and prediction tasks. It combines the prediction more accurately and robustly.



Support Vector Machine Method (SVM):

Support Vector Machine is also a machine learning method that finds the hyperplane that best separates data points belonging to different classes.



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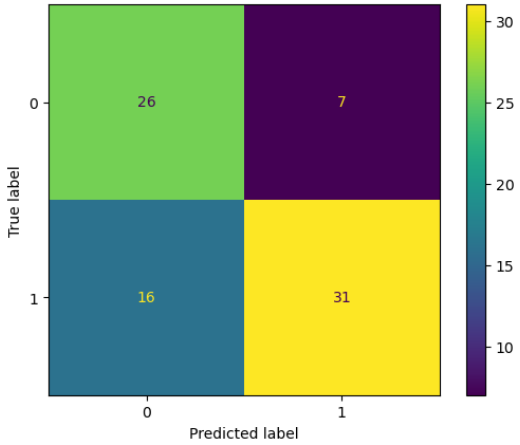
K-Nearest Neighbors:

This is also a machine learning method, it is a simple yet effective approach that makes predictions based on the majority class or average of the k-nearest data points in the feature space.



IV. RESULTS AND DISCUSSION

The results of the research work were very superlative and remarkable based on the prediction of the chronic kidney disease that we have conducted in this study here we have used three methods random forest, support vector machine, and k-nearest neighbor. Three of the classifiers perform excellently. For the most accurate performance, we get a random forest classifier next to that we have to get an accurate prediction of the support vector machine and then the k-nearest neighbor classifier. The result of the accurate prediction of the disease would be very best for the patients facing the disease.

Table 1: Comparison of the classifier

Classifier	precision		accuracy		support	
	0	1	0	1	0	1
Random forest classifier	0.99%	0.99%	0.99%	0.99%	50%	70%
Support vector machine classifier	0.94%	0.99%	0.97%	0.98%	33%	47%
Decision tree classifier	0.62%	0.82%	0.69%	0.73%	33%	47%

V. CONCLUSION

The conclusion of this research paper has delved into the utilization of machine learning techniques, specifically support vector machine (SVM), k-nearest neighbors (KNN), and Random Forest, as powerful tools for chronic kidney disease (CKD)detection. The study has highlighted the potential of this algorithm to enhance CKD diagnosis accuracy and efficiency, ultimately leading to early detection and improved patient outcomes. The finding of this research underscores the valuable role that machine learning can play in CKD diagnosis. However, it's important to recognize that the choice of dataset, feature engineering, and model fine-tuning significantly influence the success of these algorithms in real-world clinical settings and require rigorous validation and customization to ensure their practical applicability.

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