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An Analysis of Collaborative Intelligent Decision Support System for Estimated Glomerular Chronic Kidney Disease

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Abstract

Computational Collaborative Healthcare data analytics is a method of methodical data analysis that allows healthcare specialists to discovery opportunities used for development in health system management processing the various information are stored. This proposed approach entails three parts comparable to preprocessing, attribute selection, classification algorithms. The goal of this work is to plan a machine-based diagnostic approach using machine learning technique. This method is developed to mining the risk factors of chronic kidney diseases. In this work, Random forest, SVM C5.0, Decision Tree, C4.5 and ANN algorithms were used to identify an early diagnosis of CKD patients. This work comparing other algorithms the best for Random forest algorithm with good accuracy and less time complexity.

Keywords: Computational collaborative healthcare data analysis • Intelligent decision support system • Computational chronic kidney • Data mining, Random forest • Support vector machine • Artificial neural network C5.0 • Decision tree, C4.5 and Machine learning

Introduction

In data mining is an analyzing or discovering good knowledge to develop the meaningful collection of data from huge amount of data using the knowledge. The health specifying care is the solicitation of information using machine learning algorithms. To developing also exploring healthcare data_records analytical surroundings are using various methods to superior raise the value of health related problem to prediction

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Factors of CKD

The following are some of the factors which lead to CKD, the main cause is diabetes and others are hypertension, smoke, fatness, heart illness, family record, alcohol, and age problem.

Symptoms

Some of the warning sign are listed down, that could be variations to urinary function, plasma in the urine, bulge & pain, severe tiredness and weakness.

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Types: acute and chronic

- Acute_Prerenal_Kidney_Failure APKF
- Acute_Intrinsic_Kidney_Failure AIKF
- Chronic_Prerenal_Kidney_Failure CPKF
- Chronic_Intrinsic_Kidney_Failure CIKF

CKD is a worldwide health crisis. In 2019, World Health Organization agreeing to fifty eight million deaths and 35 million recognized to chronic kidney disease. The world level 850 million people now predictable to have kidney diseases from many causes, CKD causes at least 2.4 million deaths world wide-reaching per year sixth fastest growing cause of disease and death. Dialysis is a fashion of life for many patients pain with kidney sicknesses in the India. The medical record of Government of TamilNadu, India, Every one year 2.2 Lakh fresh patients of affected by final point renal disease or end stage renal disease. According to GBD learning, kidney disease was hierarchical 27th 1990, but rose to 18th in 2010 and 9th in 2019. Focuses on the development and application of machine learning algorithms for classical methods using other machine learning approaches to achieve high accuracy (Figure 1).

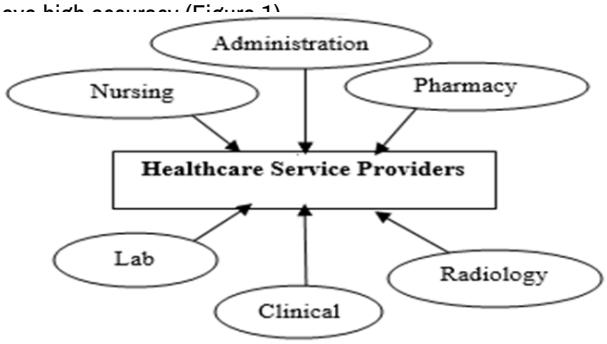

Figure 1. Affecting factors of the healthcare data analytics.

Figure 1 represents the various factors are affecting the patient data are evaluated with healthcare data analytics.

Literature Review

In this collected works review mentions to a serious summary. The analyses have been done in various topic of an outline. The root of the fundamental information, everybody to building an advanced knowledge and thought for advance study perseverance [4, 5].

Dowluru., SVGK.K., et al. [6] used to affected by the patients and relate machine learning techniques to properly categorized records. Kidney nugget creation is one of the greatest collective due to altering human hierarchical generation methods. This paper is showed with statistically and data mining methods on kidney gravels and diseases. An efficient analysis and metadata using data about data scrutiny takes similarly too formed in the current task. To predicted good accuracy with C4.5, SVM. Logistic method has also the good accuracy results. Bhaskar, N., and Suchetha, M., [7] the main aim of this work have been studying sensor devices to enhance the classification accuracy of the model. The future ideal effectively secret the model with an accuracy of deep learning algorithm CNN is high. Lakshmanaprabu, S.K., et al. [6] present suggested context assembles the patient data using internet of things. Particle-swarm-optimization is high accuracy and less time. Shankar, K., et al. [2] have proposed to classify CKD in the direction of indicate top structures aimed at the cataloging procedure. The compared by surviving determining classify the utmost correctness such as good accuracy of Deep Neural Network. Zhang, H., et al. [7]. Suggested model based on the performance of all model is equivalent to respectively other; both of them reach a great accurateness performance.

Findings

From this review, it is concrete that healthcare decision support clinical performance can be assessed by covering; machine learning techniques can be valued by various algorithms. In this survey, our research work ordered as three parts. It deal with huge datasets, using R programming language is used. This research work presents algorithm on the classification structure by various machine learning algorithm is resulted with good accuracy. In future the proposed research work has been successfully implemented in R with GUI environment.

Data Set Description

Data collection

The chronic kidney data set files are composed from UCI Machine Learning Repository and it predicts CKD based on the given attributes. The dataset has thirty-two attributes that predict the CKD. To build on both numerical and nominal data types. Initially, data size is 4050 records 33 features are preprocessing; attribute variety techniques, cataloguing or classification algorithms toward spread over chronic kidney data using performance evaluation (Table 1).

S. No	Attribute Name	Attribute Type	Attribute Code	Possible_Values
1.	Age	Numeric	age	E, VG, G, F, P
2.	Age Group	Numeric	ageg	E, VG, G, F, P
3.	Sex	Nominal	Sex	E, VG, G, F, P
4.	Systolic Blood Pressure	Numeric	sysbp	E, VG, G, F, P
5.	Diastolic Blood Pressure	Numeric	diabp	E, VG, G, F, P
6.	Specific Gravity	Numeric	sap	E, VG, G, F, P
7.	Albumin	Numeric	alb	E, VG, G, F, P
8.	Sugar	Numeric	sug	E, VG, G, F, P
9.	Red Blood Cell	Nominal	rbc	E, VG, G, F, P
10.	Pus Cell	Nominal	pcell	E, VG, G, F, P
11.	Pus Cell Clumps	Nominal	pcellc	E, VG, G, F, P
12.	Bacteria	Numeric	bac	E, VG, G, F, P
13.	Blood Glucose Random	Numeric	bgr	E, VG, G, F, P

14.	Blood Urea	Numeric	blu	E, VG, G, F, P
15.	Serum Creatine	Numeric	sercr	E, VG, G, F, P
16.	Sodium	Numeric	sdi	E, VG, G, F, P
17.	Potassium	Numeric	pota	E, VG, G, F, P
18.	Hemoglobin	Numeric	hg	E, VG, G, F, P
19.	Packed_Cell_ Volume	Numeric	p_c_v	E, VG, G, F, P
20.	White_Blood_ Cell_Count	Numeric	w_b_c_c	E, VG, G, F, P
21.	Red_Blood_C ell_Count	Numeric	r_b_c_c	E, VG, G, F, P
22.	Hypertension	Nominal	hyptn	E, VG, G, F, P
23.	Diabetes Mellitus	Numeric	diam	E, VG, G, F, P
24.	Appetite	Nominal	app	E, VG, G, F, P
25.	Pedal Edema	Nominal	peed	E, VG, G, F, P
26.	Low Density Lipoprotein	Numeric	ldl	E, VG, G, F, P
27.	smoking status	Numeric	smo	E, VG, G, F, P
28.	Alcohol Drinking	Numeric	alc	E, VG, G, F, P
29.	Anemia	Nominal	ane	E, VG, G, F, P
30.	Coronary Artery Disease	Nominal	Coad	E, VG, G, F, P
31.	Estimated Glomerular Filtration Rate	Numeric	egfr	E, VG, G, F, P
32.	CKD Level	Numeric or Nominal	ckd	E, VG, G, F, P
33.	Class	Numeric or Nominal	Class	E, VG, G, F, P

Table I. Dataset description format - attributes of chronic kidney disease dataset.

Methodology

The first objective is an early diagnosis of CKD patients with risk level by analyzing Chronic Kidney Disease dataset. This objective plays a valuable role in current research since many patients suffer from this disease around the world (Figure 2).

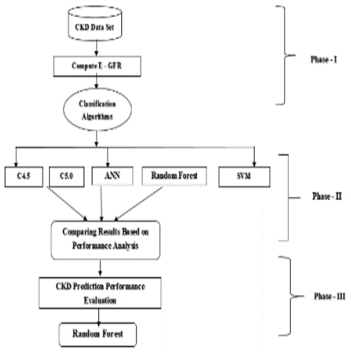

Figure 2. Methodology framework process of CKD.

Figure 2 represents the various parts are represented the patient data is evaluated with the collaborative healthcare data analytics block diagram of CKD.

Phase-part 1: Preprocessing phase.

- Dataset Description
- Removing Missing Values
- Cataloging and Categorization Methods

Phase-part 2: Classification algorithms

- - C4.5, C5.0, ANN, Random Forest and SVM **Phase-**

Part3: CKD prediction performance evaluation.

Categorization

- Input: Chronic Kidney Disease data
- Output: Categorized value
- Step 1: Choose the attributes for categorization.
- Step 2: Compute the condition for the particular attributes.
- Step 3: Conditional values results to be changed into the categorical values.
- Step 4: Repeat steps 2-3 until all the conditions are changed fbe particular attributes
- Step 5: Repeat steps 1-4 until all relevant attributes have been used.
- Step 6: Finally write the attributes in new csv file.

The procedure for categorization process is used to convert numerical values into categorical value format (Table 2).

Main Testing	Prediction	
	Excellent	**Normal**
All attributes measure level compare to	Very Good	Mild
	Good	Moderate
Estimated Glomerular Filtration Rate value(egfr)	Fair	Severe
	Poor or Failure	End-stage

Table 2. Testing performance for chronic kidney disease identification.

Results

Random forest algorithm

It is an important classification algorithm for random forest. These algorithms are handling continued values or categorical values. It is a supervised classification learning algorithm that works on randomly creating and merging numerous decision trees into one forestry.

Advantages:

- Decreases the variance and increases the accuracy
- Solve both classifications as well as regression problems
- Categorical and continuous variables
- Automatically handling missing values
- Handling non-linear efficiently
- Very stable
- Low noise

Disadvantage: Complication and extended training period.

Conclusions

In conclusion, chronic kidney disease study to approach emerging endorsements for machine learning techniques in healthcare has become a real world emerging for obtaining accurate results of medical diagnosis, using the machine learning techniques involved the collaborative healthcare is developing interested in a hopeful field for successful outcomes with reducing costs. Thus, system can improve the efficiency of mining risk factors of chronic kidney disease, the structure consuming machine learning methods over large volume of dataset for making better decision and prediction. The random forest feature selection is the good method for feature selection, which takes less time compares to the other feature selection methods. The reports are tested using machine learning algorithms, to predict the chronic kidney disease. Random forest decision tree classification algorithm is high accuracy resulted and less time complexity in 98.97% cataloguing accuracy.

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