LITERATURE SURVEY

TITLE: Identifying Important Attributes for Early Detection of Chronic Kidney Disease

AUTHOR: Ananda Nadarajah Nishanth; Tharmarajah Thiruvaran

YEAR: 2019

CONTEXT:

Individuals with chronic kidney disease (CKD) are often not aware that the medical tests they take for other purposes may contain useful information about CKD, and that this information is sometimes not used effectively to tackle the identification of the disease. Therefore, attributes of different medical tests are investigated to identify which attributes may contain useful information about CKD. A database with several attributes of healthy subjects and subjects with CKD are analyzed using different techniques. Common spatial pattern (CSP) filter and linear discriminant analysis are first used to identify the dominant attributes that could contribute in detecting CKD. Here, the CSP filter is applied to optimize a separation between CKD and nonCKD subjects. Then, classification methods are also used to identify the dominant attributes. These analyses suggest that hemoglobin, albumin, specific gravity, hypertension, and diabetes mellitus, together with serum creatinine, are the most important attributes in the early detection of CKD. Further, it suggests that in the absence of information on hypertension and diabetes mellitus, random blood glucose and blood pressure attributes may be used.

TITLE: Detection of Chronic Kidney Disease: A NN-GA-Based Approach

AUTHOR: Sirshendu Hore, Sankhadeep Chatterjee, Rahul Kr. Shaw, Nilanjan Dey & Jitendra Virmani

YEAR: 2018

CONTEXT:

In the present work, a genetic algorithm (GA) trained neural network (NN)-based model has been proposed to detect chronic kidney disease (CKD) which has become one of the newest threats to the developing and undeveloped countries. Studies and surveys in different parts of India have suggested that CKD is becoming a major concern day by day. The financial burden of the treatment and future consequences of CKD could be unaffordable to many, if not detected at an earlier stage. Motivated by this, the NN-GA model has been proposed which significantly overcomes the problem of using local search-based learning algorithms to train NNs. The input weight vector of the NN is gradually optimized by using GA to train the NN. The model has been compared with well-known classifiers like Random Forest, Multilayer

Perception Feedforward Network (MLP-FFN), and also with NN. The performance of the classifiers has been measured in terms of accuracy, precision, recall, and *F*-Measure. The experimental results suggest that NN-GA-based model is capable of detecting CKD more efficiently than any other existing model.

TITLE: Emerging Biomarkers for Early Detection of Chronic Kidney Disease

AUTHOR: Maja Mizdrak

YEAR: 2022

CONTEXT:

Chronic kidney disease (CKD) is a major and serious global health problem that leads to kidney damage as well as multiple systemic diseases. Early diagnosis and treatment are two major measures to prevent further deterioration of kidney function and to delay adverse outcomes. However, the paucity of early, predictive and noninvasive biomarkers has undermined our ability to promptly detect and treat this common clinical condition which affects more than 10% of the population worldwide. Despite all limitations, kidney function is still measured by serum creatinine, cystatin C, and albuminuria, as well as estimating glomerular filtration rate using different equations. This review aims to provide comprehensive insight into diagnostic methods available for early detection of CKD. In the review, we discuss the following topics: (i) markers of glomerular injury; (ii) markers of tubulointerstitial injury; (iii) the role of omics; (iv) the role of microbiota; (v) and finally, the role of microRNA in the early detection of CKD. Despite all novel findings, none of these biomarkers have met the criteria of an ideal early marker. Since the central role in CKD progression is the proximal tubule (PT), most data from the literature have analyzed biomarkers of PT injury, such as KIM-1 (kidney injury molecule-1), NGAL (neutrophil gelatinase-associated lipocalin), and L-FABP (liver fatty acid-binding protein).

TITLE: Role of abnormal energy metabolism in the progression of chronic kidney disease and drug intervention

AUTHOR: Xuyan Liu, Yan Sun

YEAR: 2022

CONTEXT:

Chronic kidney disease (CKD) is a severe clinical syndrome with significant socioeconomic impact worldwide. Orderly energy metabolism is essential for normal kidney function and energy metabolism disorders are increasingly recognized as an important player in CKD. Energy metabolism disorders are characterized by ATP deficits and reactive oxygen species increase. Oxygen and mitochondria are essential for ATP production, hypoxia and mitochondrial dysfunction both affect the energy production process. Renin-angiotensin and adenine signaling pathway also play important regulatory roles in energy metabolism. In addition, disturbance of energy metabolism is a key factor in the development of hereditary nephropathy such as autosomal dominant polycystic kidney disease. Currently, drugs with clinically clear renal function protection, such as Angiotensin II Type 1 receptor blockers and fenofibrate, have been proven to improve energy metabolism disorders. The sodium-glucose co-transporter inhibitors 2 that can mediate glucose metabolism disorders not only delay the progress of diabetic nephropathy, but also have significant protective effects in non-diabetic nephropathy. Hypoxia-inducible factor enhances ATP production to the kidney by improving renal oxygen supply and increasing glycolysis, and the mitochondria targeted peptides (SS-31) plays a protective role by stabilizing the mitochondrial inner membrane. Moreover, several drugs are being studied and are predicted to have potential renal protective properties. We propose that the regulation of energy metabolism represents a promising strategy to delay the progression of CKD.

TITLE: A Machine Learning Methodology for Diagnosing Chronic Kidney Disease

AUTHOR: Jiongming Qin; Lin Chen; Yuhua Liu; Chuanjun Liu; Changhao Feng; Bin Chen

YEAR: 2019

CONTEXT:

Chronic kidney disease (CKD) is a global health problem with high morbidity and mortality rate, and it induces other diseases. Since there are no obvious symptoms during the early stages of CKD, patients often fail to notice the disease. Early detection of CKD enables patients to receive timely treatment to ameliorate the

progression of this disease. Machine learning models can effectively aid clinicians achieve this goal due to their fast and accurate recognition performance. In this study, we propose a machine learning methodology for diagnosing CKD. The CKD data set was obtained from the University of California Irvine (UCI) machine learning repository, which has a large number of missing values. KNN imputation was used to fill in the missing values, which selects several complete samples with the most similar measurements to process the missing data for each incomplete sample. Missing values are usually seen in real-life medical situations because patients may miss some measurements for various reasons. After effectively filling out the incomplete data set, six machine learning algorithms (logistic regression, random forest, support vector machine, k-nearest neighbor, naive Bayes classifier and feed forward neural network) were used to establish models. Among these machine learning models, random forest achieved the best performance with 99.75% diagnosis accuracy. By analyzing the misjudgments generated by the established models, we proposed an integrated model that combines logistic regression and random forest by using perceptron, which could achieve an average accuracy of 99.83% after ten times of simulation. Hence, we speculated that this methodology could be applicable to more complicated clinical data for disease diagnosis.