Identification of Heart Valve Disease using Bijective Soft sets Theory

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ABSTRACT

Major complication of heart valve diseases is congestive heart valve failure. The heart is of essential significance to human beings. Auscultation with a stethoscope is considered as one of the techniques used in the analysis of heart diseases. Heart auscultation is a difficult task to determine the heart condition and requires some superior training of medical doctors. Therefore, the use of computerized techniques in the diagnosis of heart sounds may help the doctors in a clinical environment. Hence, in this study computer-aided heart sound diagnosis is performed to give support to doctors in decision making. In this study, a novel hybrid Rough-Bijective soft set is developed for the classification of heart valve diseases. A rough set (Quick Reduct) based feature selection technique is applied before classification for increasing the classification accuracy. The experimental results demonstrate that the overall classification accuracy offered by the employed Improved Bijective soft set approach (IBISOCLASS) provides higher accuracy compared with other classification techniques including hybrid Rough-Bijective soft set (RBISOCLASS), Bijective soft set (BISOCLASS), Decision table (DT), Naïve Bayes (NB) and J48.

Keywords: *Bijective Soft Set, Feature Selection, Heart Sounds Diagnosis, Rough-Bijective Soft Set, Classification*

1. INTRODUCTION

The basic defects of the heart are often gathered via sounds produced by heart. Heart auscultation (the observing of sounds created by the heart and blood flow) is a fundamental tool in the diagnosis of heart disease. Doctors use the stethoscope as a device to monitoring patient's heart and make a diagnosis accordingly. However, there are several limitations on the method of listening via stethoscope. Listening

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via stethoscope is dependent on the physician's ability to understand different heart sounds, on his/her experience, hearing capability, and skill (Inbarani et al., 2013; White et al., 1996). Experience and skill are acquired through investigations, being lead over long years. There are experience and skill problems being come upon particularly with respect to intern physicians and freshly graduated, unsuitable environmental conditions, and unconventionality of patient as well may lead to lacking diagnoses (Azar, 2014; Nakamitsu et al., 1996). Doctors especially concerned in abnormal sounds, it may propose the presence of a cardiac pathology and also offer diagnostic information (Azar et al., 2013). A very significant type of abnormal sound is the murmur sound produced by the turbulent flow of blood in the cardiovascular organism. The timing and pitch of a murmur are of significant importance in the diagnosis of a heart condition, for example, murmurs through diastole are signs of malfunctioning of heart valves but murmurs through systole may relate to any a pathological or healthy heart, depending on the acoustic features of the murmurs. Development of decision support systems will be useful for the doctors in identifying the heart sounds against the possibility of meeting such insufficiencies. Decision support systems, being developed via pattern recognition, classification methods and signal processing, will be helpful for physicians in understanding the heart sounds, and in diagnosing heart diseases consequently. Besides, those developed systems are easy-to-use, cost-efficient, and accurate. In case that heart sounds may be identified, or diagnosed via computer software's, the abovementioned difficulties are significantly solved.

Heart valves disease data set has recorded only continuous data. The continuous data may reduce classification accuracy; therefore, it is essential to apply discretization as a preprocessing step to convert numerical data into nominal data for such models. Discretization is a technique to partition continuous attributes into a finite set of adjacent intervals in order to produce attributes with a small number of distinct values. Feature selection method should be applied after the discretization. The most significant preprocessing step is the feature selection of the input data set. The data set hold features that are considered as noisy or irrelevant features, these features could have an undesirable impact on the classification accuracy of the data (Azar & Hassanien 2014). Therefore, a good feature selection approach provides better predictive accuracy, processing rate, and avoids incomprehensibility.

The rest of the paper is structured as Sections 2–7. Section 2 describes the related work of feature selection and classification of heart valves diseases diagnosis system using numerous methods. Section 3 describes the research motivation behind this work. Section 4, introduces some preliminaries in rough sets and Bijective soft set. Section 5 explains various steps of the proposed methodology such as discretization, feature selection and Bijective soft set based classification. The experimental evaluation is addressed in section 6. Finally, Section 7 addresses the conclusions and points out instructions for further research.

2. RELATED WORK

Extensive earlier research has shown automated detection of numerous heart pathological disorders and diseases from heart sound signals. The comprehensive obtainability of these signals and their high sensitivity to utmost heart diseases has been a strong inspiration for this study. It can be mostly separated into two research methods. The first deals with the development of methods for the preprocessing of heart sounds (e.g., noise removal, heart cycles segmentation, dividing of each heart cycle into S1, systolic phase, diastolic phase and S2, etc.); a good review of this study stream is provided in (Stasis et al., 2004). The second research stream addresses the development of methods for the detection of heart pathological disorders and diseases from suitably preprocessed heart sound signals. There are several studies in classifications as reported