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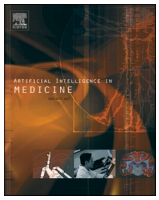

Research paper

Cardiovascular disease detection from high utility rare rule mining

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ABSTRACT

We propose a method to search rare cardiovascular disease symptom rules from historical health examination records according to its hazard ratio utility and further detect the disease given new medical record data. Further, we aim to assist both medical experts and patients by alerting the current symptoms and preparing the early treatments. In general, the proposed method first deals with the uncertainty of age and other continuous features using a fuzzy set. Next, we define the hazard ratio utility of each item set to assist the mining process. Based on the utility, we discover the rare cardiovascular disease patterns employing High Utility Rare Itemset Mining. At last, we add a prediction step to check the given health record data whether diagnosed cardiovascular. Subsequently, we can obtain rare symptoms of cardiovascular disease, which are later applied to detect the new related record data. The rare symptoms that are confirmed by their utility risk for cardiovascular disease can assist the medical experts' decision better than the common symptoms as it is often hard to be recognized at a glance. The proposed method evaluated on a public cardiovascular dataset. The experimental results showed that the generated rare cardiovascular disease patterns successfully applied to detect the cardiovascular given the symptoms data.

1. Introduction

Cardiovascular disease is a group of heart and blood vessel illnesses, i.e., coronary heart, cerebrovascular, rheumatic heart, and etc. World Health Organization (WHO) has been reported that the death patients from heart and blood vessel illness hits over 17.9 million in each year around the world.[1] According to the global health data tools in http://ghdx.healthdata.org/gbd-results-tool, we discovered that the death percentage from cardiovascular diseases in Indonesia continuously increased for each year. Let us see on the 2015 year data where the death percentage reached out 36.83 % and jumped to 38.18 % in 2019. Accordingly, we are surprised that the death percentage in Indonesia is 5 % higher than its global percentage. In additions, Maharani et al. [1] investigated that most Indonesian people will have a high risk to suffer from cardiovascular disease in the next few years. Hereby, we attempt to propose a method to detect whether people showing symptoms of cardiovascular disease given their medical examination records by developing an algorithm called *Cardio_Mine_Detect*. The main purpose of this study is to assist both medical experts and patients alerting the current medical issues and preparing the early treatments. Also, we believe this study supporting the one of Sustainable Development Goals (SDGs) on the health section [2].

In this study, the proposed algorithm has two stages for extracting the rare symptoms of cardiovascular disease rules from the historical medical examinations data and utilizes it to detect the cardiovascular disease given the new medical check-up data. According to the proposed algorithm, we expect to provide the detection results accurately along with its symptoms in rules form. Before we go further, we want to discuss relevant studies on medical issues using data mining. Ou-Yang et al. [3] proposed an algorithm to deal with subsumption and circular rules to obtain better conclusive of cerebrovascular disease rules based on association rule mining (ARM). Borah and Nath [4]

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