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Resurgery clusters in Intensive Medicine

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Abstract

The field of critical care medicine is confronted every day with cases of surgical interventions. When Data Mining is properly applied in this field, it is possible through predictive models to identify if a patient, should or should not have surgery again upon the same problem. The goal of this work is to apply clustering techniques in collected data in order to categorize re-interventions in intensive care. By knowing the common characteristics of the re-intervention patients it will be possible to help the physician to predict a future resurgery. For this study various attributes were used related to the patient's health problems like heart problems or organ failure. For this study it was also considered important aspects such as age and what type of surgery the patient was submitted. Classes were created with the patients' age and the number of days after the first surgery. Another class was created where the type of surgery that the patient was operated upon was identified. This study comprised Davies Bouldin values between -0.977 and -0.416. The used variables, in addition to being provided by Hospital de Santo António in Porto, they are provided from the electronic medical record.

Keywords: Clustering, Data Mining, Intensive Care Units, INTCare, Re-intervention, Intervention;

1. Introduction

This study is inserted in the INTCare project. This study intends to use clustering techniques to characterize the resurgery patients. This is a pioneering approach because nothing has been done previously related to this work in intensive care. This work is different from all the other previously performed, since it addresses cases where patients needed further surgery (again to the same problem). This study aims to improve the performance of Intensive Care

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Units (ICUs) assisting health professionals in their decision-making regarding their patients. The dataset used in this project was provided by ICU of Centro Hospitalar do Porto. A resurgery is performed when a patient needs to be operated upon again to a given problem. This has only recently been analyzed as a problem, which means that there is not an extensive work in this area. The goal of this work is to identify health problems and characteristics of resurgery patients in order to prevent these cases from happening again. This study presents some interesting results with the best value of Davies-Bouldin being -0.416. The negative value provides the fact that the tool used to assess this value always deliver results with negative value. This work is divided in five sections. The first one, Introduction, where the basic ideas for this work are presented, the second is the Background, where the problem will be defined and the theory behind the work, the third is the description of the study, d the methods and tools used are described, and understanding the data. In the fourth chapter, named Discussion, some views on the results of this study are presented. Finally, in the last chapter are presented some conclusions and and the future work.

2. Background

2.1. Intensive Care and INTCare

In the 90s, experts realized that the available knowledge was not enough to solve complex real-life problems [1]. The change was then induced, where the main focus was the collection of knowledge directly from data, using intelligent data analysis. After 90 years, the approach has gained more interest, especially in the medical field due to the large volume and complexity of clinical data [2]. Intensive Medicine is categorized as a multidisciplinary field of medical science that specifically addresses the prevention, diagnosis and treatment of potentially reversible acute disease conditions in patients presenting imminent bankruptcy or established in one or more vital functions [3]. First, they have to make a diagnosis and design their treatment plans to improve the patients conditions [4]. However, doctors in intensive care units have to make decisions that are even more challenging, such as life support treatments. In this field appeared INTCare. The INTCare main goal is the development of an intelligent system able to predict clinical events [2] and can be accessed anytime and anywhere. Currently, INTCare is a pervasive intelligent decision support system based in a fully automated knowledge discovery process and in. It also uses the agent paradigm[5, 6]. The values automatically collected are validated by the nurses in order to ensure their quality [7].

2.2. Interventions and re-interventions

In the past, surgical interventions were seen as the last resort for certain diseases. However, due to the evolution of science, surgery also started to be used as a treatment. With the development of new techniques and the evolution of knowledge, surgical methods have been given preference, driven by advances in anesthesia, antisepsis, radiology and blood transfusion and the use of bone transplants or prostheses [8]. Surgical procedures are part of their everyday life in health according to WHO, in a survey conducted in 56 countries In 2004, the percentage of surgeries was 20% [9]. Another study [10] showed that only in industrialized countries the rate of complications of surgeries was 3% to 6%, the mortality rate between 0.4% and 0.8%. Three-quarters of surgical procedures are performed in only one third of the world population[9]. According Cunha[11], surgical intervention can be divided into three phases: preoperative, intraoperative, and postoperative. In this case the incidence of trauma and complications are high and where there is a huge backlog of untreated surgical diseases[12]. In a study provided by Lafortune et al [13] it is possible to observe that the most frequent intervention in Portugal is to cataracts. A resurgery occurs when a particular patient in this section need re-intervention to a given problem. Regarding resurgery made, in intensive medicine, is not possible to obtain any statistics since this is an area which is still under investigation.

It should be stated that this problem was recently studied, since this is an aspect that only recently begun to be given as a problem. In practical terms, there is no DM practical work related to surgical re-interventions, however it was already developed data mining work in the medical field, for example work related with surgical interventions, however, related surgical re-intervention is a pioneering study as it addresses cases where patients have been intervened and requires a new intervention. Some work in this area were already developed in ICUs [14,15,16]. Other works also were developed in data mining area, however not being included in the area of intensive care [17].