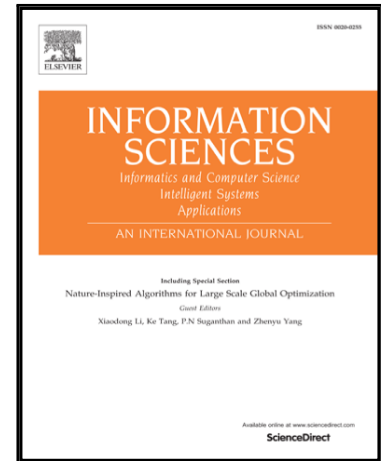


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Relational regularized risk prediction of acute coronary syndrome using electronic health records

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Abstract

In this paper, we attempt to utilize the information that is inherent in electronic health records (EHR) to predict clinical risks of acute coronary syndrome (ACS) patients. Because EHR data are typically highly-dimensional and non-linear, we propose a novel relational regularization-based feature selection method to identify informative risk factors from EHR data, on which a sparse ACS risk prediction model can be built. Specifically, we formulate our objective function by imposing two types of correlational characteristics, i.e., feature-feature relations and sample-sample relations, along with an l_2 -norm regularization term, to extract significant risk factors from EHR data. With the dimension-reduced EHR data, we train a Softmax Regression model to predict clinical risks of ACS patients. To validate the effectiveness of the proposed method, a case study was conducted on a real ACS clinical data-set that was collected from a Chinese hospital. The experimental results demonstrate the efficacy of the proposed method for improving the performance of ACS risk prediction via relational regularized risk factor selection by a comparison with state-of-the-art methods.

Key words: Clinical risk prediction, Electronic Health Record, Acute Coronary Syndrome, Risk factor selection, Relational regularization

1. Introduction

Acute coronary syndrome (ACS) refers to a group of conditions, in which part of the heart muscle is unable to function properly or dies that are due to decreased blood flow in the coronary arteries [1]. ACS often causes severe chest pain or discomfort, and as such, it is a medical emergency that requires prompt diagnosis and care. Recent studies have shown that ACS is the leading cause of death worldwide [8, 6]. In China, the mortality rate of ACS patients who survive initial hospitalization is approximately 5% to 6% in the year after acute myocardial infarction (MI), and the rate of recurrent MI ranges from 8% to 10% [6]. A fundamental tenet of preventive medicine is to initiate interventions appropriate to the level of risk for the individual [20, 32]. Therefore, risk stratification, or formal prediction of an ACS patient's clinical risk at the time of presentation, as recommended by American College of Cardiology (ACC), American Heart Association (AHH) and European Society of Cardiology (ESC) guidelines, is an inextricable component of preventive care of ACS patients.

Several well-known risk stratification tools, such as Thrombolysis in Myocardial Infarction (TI-MI) [3] and the Global Registry of Acute Coronary Events (GRACE) [8], have been

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