

Chapter 12

Artificial Bee Colony–Based Associative Classifier for Healthcare Data Diagnosis

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ABSTRACT

Data mining is likely to explore hidden patterns from the huge quantity of data and provides a way of analyzing and categorizing the data. Associative classification (AC) is an integration of two data mining tasks, association rule mining, and classification which is used to classify the unknown data. Though association rule mining techniques are successfully utilized to construct classifiers, it lacks in generating a small set of significant class association rules (CARs) to build an accurate associative classifier. In this work, an attempt is made to generate significant CARs using Artificial Bee Colony (ABC) algorithm, an optimization technique to construct an efficient associative classifier. Associative classifier, thus built using ABC discovered CARs achieve high prognostic accurateness and interestingness value. Promising results were provided by the ABC based AC when experiments were conducted using health care datasets from the UCI machine learning repository.

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INTRODUCTION

Health care applications necessitate an efficient and accurate diagnostic system. Generally, physicians rely on the diagnostic system for providing treatments to the patients. An efficient diagnostic system provides a way to analyze and categorize the data. It helps in exploring interesting patterns/associations between the symptoms and diseases. It provides realistic decision-making in the disease diagnosis task. In recent times, it is proven that data mining techniques have gained significance in providing useful suggestions and predictions based on the existing data. Hence, data mining techniques are best suited to build an efficient diagnostic system. Broadly, data mining techniques are categorized into two, descriptive and predictive. Association rule mining is one of the descriptive data mining techniques, commonly used to find interesting patterns/associations in the form of If-then rules. The relationships/affinities among the attributes of the dataset are acquired from the generated rules. Classification is one of the predictive data mining techniques used to compute a model from the historical data to predict some response of interest. Thus, a health care diagnostic system using the knowledge of domain experts becomes essential for extracting interesting patterns and providing reasonable decision-making. In this work, an attempt is made to construct a health care diagnostic system by building a classification system using Class Association Rules (CARs) or simply class rules.

Associative Classification (AC) is one of the data mining techniques which integrate the concept of association and classification (Liu, Hsu, Ma, & Ma, 1998). The role of the association in AC is to extract a large number of interesting rules representing the relationship among the attributes whereas the classification is predefined with the class label for predicting the unknown data. Thus, the AC system is constructed using the generated CARs. Construction of AC involves two tasks, such as class rule generation and classification. In the 'rule generation' phase, all possible CARs i.e. class rules are discovered from the dataset and they are taken into classifier construction. AC is one of the classifiers extensively used in healthcare applications, because of its high precision classification. Inherently, healthcare data diagnosis desires high precision, so AC is more suitable for healthcare applications. Though AC is a competent classifier, its classification ability is often affected by the generation of many insignificant class rules in the 'rule generation' phase. Further, the number and significance of the generated class rules deteriorate the efficiency of the AC. To address this issue, in the literature, many evolutionary algorithms like (Shahzad & Baig, 2011), PSO (Mangat & Vig, 2014), Firefly algorithm (Nandhini, Rajalakshmi, & Sivanandam, 2017) are adopted within AC to generate significant class rules. A new approach has been proposed in this work to build an efficient classification system by generating a very few significant class rules using Artificial Bee Colony (ABC) algorithm within AC.

ABC is a meta-heuristic population-based algorithm motivated by the intelligent foraging behavior of honey bees (D Karaboga, 2005). It is highly used for optimizing solutions for mathematical problems. Three main components involved in this algorithm are employed bee, unemployed bee, and food sources. The foraging behavior aids to find the significant class rules among the generated rules. In this work, an attempt is made to generate very few significant Class Association Rules (CARs) using ABC algorithm to construct an efficient associative classifier. Incorporating ABC in AC considerably increases the performance of the classifier. ABC based AC (ABC-AC) achieves high prognostic accurateness and interestingness value. The generation of very few significant class rules using the ABC algorithm improves the interpretability of the result and provides more insight cognition into the classifier structure and the decision-making process. Promising results in terms of classifier accuracy are obtained by the ABC-AC when experiments were conducted using five health care datasets such as Breast cancer,

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