

## Design patterns selection: An automatic two-phase method

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### Description

Over many years of research and practices in software development, hundreds of software design patterns have been invented and published. Now, a question which naturally arises is how software developers select the right design patterns from all relevant patterns to solve design problems in the software design phase. To address this issue, in this paper, we propose a two-phase method to select a right design pattern. The proposed method is based on a text classification approach that aims to show an appropriate way to suggest the right design pattern(s) to developers for solving each given design problem. There are two advantages of the proposed method in comparison to previous works. First, there is no need for semi-formal specifications of design patterns and second, the suitable design patterns are suggested with their degree of similarity to the design problem. To evaluate the proposed method, we apply it on real problems and several case studies. The experimental results show that the proposed method is promising and effective.

## CCIC: Clustering analysis classes to identify software components

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### Context

Component identification during software design phase denotes a process of partitioning the functionalities of a system into distinct components. Several component identification methods have been proposed that cannot be customized to software architect's preferences.

### Objectives

In this paper, we propose a clustering-based method by the name of CCIC (*Clustering analysis Classes to Identify software Components*) to identify logical components from analysis classes according to software architect's preferences.

### Method

CCIC uses a customized HEA (*Hierarchical Evolutionary Algorithm*) to automatically classify analysis classes into appropriate logical components and avoid the problem of searching for the proper number of components. Furthermore, it allows software architects to determine the constraints in their deployment and implementation framework.

### Results

A series of experiments were conducted for four real-world case studies according to various proposed weighting schemes.

### Conclusion

According to experimental results, it is concluded that CCIC can identify more cohesive and independent components with respect to software architect's preferences in comparison with the existing component identification methods such as *FCA*-based and *CRUD*-based methods.

## SCI-GA: Software Component Identification using Genetic Algorithm.

Authors

Seyed Mohammad Hossein Hasheminejad, Saeed Jalili

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Description

Identifying software components is a crucial task in software development. There are a number of methods to identify components in the literature; however, the majority of these methods rely on clustering techniques with expert judgment. In contrast to the previous methods, which have used classical clustering techniques, this paper maps the components identification problem to an optimization problem. We propose a novel GA-based algorithm (Genetic Algorithm) as a powerful optimization search algorithm, called SCI-GA (Software Component Identification using Genetic Algorithm), to identify components from analysis models. SCI-GA uses software cohesion, coupling, and complexity measurements to define its fitness function. For performance evaluation, we evaluated SCI-GA using three real-world cases. The results reveal that SCI-GA can identify correct suboptimal software components, and performs far better than alternative heuristics like k-means and FCA-Based methods.

## Source code and design conformance, design pattern detection from source code by classification approach

Authors

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Description

Nowadays, software designers attempt to employ design patterns in software design phase, but design patterns may be not used in the implementation phase. Therefore, one of the challenging issues is conformance checking of source code and design, i.e., design patterns. In addition, after developing a system, usually its documents are not maintained, so, identifying design pattern from source code can help to achieve the design of an existing system as a reverse engineering task. The variant implementations (i.e., different source codes) of a design pattern make hard to detect the design pattern instances from the source code. To address this issue, in this paper, we propose a new method which aims to map the design pattern detection problem into a learning problem. The proposed design pattern detector is made by learning from the information extracted from design pattern instances which normally include variant implementations. To evaluate the proposed method, we applied it on open source codes to detect six different design patterns. The experimental results show that the proposed method is promising and effective.

## An Evolutionary Approach to Identify Logical Components

Authors	Seyed Mohammad Hossein Hasheminejad, Saeed Jalili
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### Context

Identifying suitable components during the software design phase is an important way to obtain more maintainable software. Many methods including Graph Partitioning, Clustering-based, CRUD-based, and FCA-based methods have been proposed to identify components at an early stage of software design. However, most of these methods use classical clustering techniques, which rely on expert judgment.

### Objective

In this paper, we propose a novel method for component identification, called SBLCI (Search-Based Logical Component Identification), which is based on GA (genetic algorithm), and complies with an iterative scheme to obtain logical components.

### Method

SBLCI identifies logical components of a system from its analysis models using a customized GA, which considers cohesion and coupling metrics as its fitness function, and has four novel guided GA operators based on the cohesive component concept. In addition, SBLCI has an iterative scheme in which it initially identifies high-level components in the first iteration. Then, in the next iterations, it identifies low-level sub-components for each identified component in previous iterations.

### Results

We evaluated the effectiveness of SBLCI with three real-world cases. Results revealed that SBLCI is a better alternative for identifying logical components and sub-components in comparison with existing component identification methods.

## Automated software design using ant colony optimization with semantic network support

Authors

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Journal of Systems and Software

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Description

Software design is an important task that needs to be well performed. In this paper, a method for automated software design using search-based software engineering approach is proposed. This approach can solve software engineering problems using search algorithms. Ant colony optimization is used as the meta-heuristic search algorithm in both single-objective and multi-objective modes. Input data are the analysis phase artifacts and the output is in the form of early life cycle class diagram. To provide human designer's background knowledge, a semantic network is used that is built upon the textual documents of analysis phase plus other resources like WordNet. This semantic network is used to name the output classes, and also to determine structural relations between classes. The proposed method is evaluated by some case studies and results are reported. The evaluation results show that using background knowledge beside optimization algorithm helps to achieve better results.

# Traffic accident severity prediction using a novel multi-objective genetic algorithm

Authors

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Description

Prediction of traffic accident severity is a motor vehicle traffic challenge due to its impact on saving human lives. There are several researches in the literature to predict traffic accident severity based on artificial neural networks (ANNs), support vector machines (SVMs), decision trees (DTs) and other classification methods. In fact, the main disadvantage of ANNs and SVMs is lack of interpretation for human and the main disadvantage of classical DTs such as C4.5, ID3 and CART is their low accuracy. To address these drawbacks, in this paper we propose a novel rule-based method to predict traffic accident severity according to user's preferences instead of conventional DTs. In the proposed method, we customised a multi-objective genetic algorithm, i.e. Non-Dominated Sorting Genetic Algorithm (NSGA-II), to optimise and identify rules according to *Support*, *Confidence* and *Comprehensibility* metrics. The goal of the proposed method is providing facilities to make use of the knowledge of users, including traffic police, roads and transportation engineers and trade-off among all the conflicting objectives. The proposed method is evaluated by a traffic accident data set including 14211 accidents in rural and urban roads in Tehran Province of Iran for a period of 5 years (2008–2013). The evaluation results revealed that the proposed method outperforms the classification methods such as ANN, SVM, and conventional DTs according to classification metrics like accuracy (88.2%), and performance metrics of rules like support and confidence (0.79 and 0.74, respectively).

# FDiBC: A Novel Fraud Detection Method in Bank Club based on Sliding Time and Scores Window

Authors

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Journal

Journal of AI and Data Mining

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Publisher

Shahrood University of Technology

Description

One of the recent strategies for increasing the customer's loyalty in banking industry is the use of customers' club system. In this system, customers receive scores on the basis of financial and club activities they are performing, and due to the achieved points, they get credits from the bank. In addition, by the advent of new technologies, fraud is growing in banking domain as well. Therefore, given the importance of financial activities in the customers' club system, providing an efficient and applicable method for detecting fraud is highly important in these types of systems. In this paper, we propose a novel sliding time and scores window-based method, called FDiBC (Fraud Detection in Bank Club), to detect fraud in bank club. In FDiBC, firstly, based on each score obtained by customer members of bank club, 14 features are derived, then, based on all the scores of each customer member, five sliding time and scores window-based feature vectors are proposed. For generating training and test data set from the obtained scores of fraudster and common customers in the customers' club system of a bank, a positive and a negative label are used, respectively. After generating training data set, learning is performed through two approaches: 1) clustering and binary classification with OCSVM method for positive data, i.e. fraudster customers, and 2) multi-class classification including SVM, C4.5, KNN, and Naïve Bayes methods. The results reveal that FDiBC has the ability to detect fraud with 78% accuracy and thus can be used in practice.

## A hybrid clustering and classification approach for predicting crash injury severity on rural roads

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Description

As a threat for transportation system, traffic crashes have a wide range of social consequences for governments. Traffic crashes are increasing in developing countries and Iran as a developing country is not immune from this risk. There are several researches in the literature to predict traffic crash severity based on artificial neural networks (ANNs), support vector machines and decision trees. This paper attempts to investigate the crash injury severity of rural roads by using a hybrid clustering and classification approach to compare the performance of classification algorithms before and after applying the clustering. In this paper, a novel rule-based genetic algorithm (GA) is proposed to predict crash injury severity, which is evaluated by performance criteria in comparison with classification algorithms like ANN. The results obtained from analysis of 13,673 crashes (5600 property damage, 778 fatal crashes, 4690 slight injuries and 2605 severe injuries) on rural roads in Tehran Province of Iran during 2011–2013 revealed that the proposed GA method outperforms other classification algorithms based on classification metrics like precision (86%), recall (88%) and accuracy (87%). Moreover, the proposed GA method has the highest level of interpretation, is easy to understand and provides feedback to analysts.

# ATM management prediction using Artificial Intelligence techniques: A survey

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Description

Forecasting cash management, security, ease of use, and so on are important in the use of Automated Teller Machine (ATM). For this purpose, in this paper, we have discussed issues such as forecasting cash demand, fraud detection, ATM failure, user interface, replenishment strategy, ATM location, customer behavior, etc. Artificial Intelligence (AI) techniques are discussed for the detection of fraud, failure, replenishment and crash prediction. A number of statistical methods used to evaluate these forecasts are also covered in this paper. Moreover, we review AI techniques such as neural networks, regressions, support vector machines and their results in the form graphs in different sections. The literature covered in this paper is related to the past ten years (2006–2016). The approaches studied in this paper are compared in terms of data sets and prediction performance, accuracy and so on. We also provide a list of data sets available for the scientific community to conduct research in this field. Finally, open issues and future works in each of these items are presented.